CLEANUP ACTION PLAN

West of 4th Site

Prepared for: West of 4th PLP Group

Project No. AS050067U • February 10, 2025 DRAFT

Aspect
A Geosyntec Company

earth + water

CLEANUP ACTION PLAN

West of 4th Site

Prepared for: West of 4th PLP Group

Project No. AS050067U • February 10, 2025 DRAFT

Jeremy Porter, PE
Aspect Consulting
Jeremy.porter@aspectconsulting.com

Janet Knox, LG
Mott MacDonald
Janet.knox@mottmac.com

Jeff Kaspar, LHG
Farallon Consulting
jkaspar@farallonconsulting.com

William Carroll, LHG
Pacific Crest Environmental
w.carroll@pcenv.com

V:\050067 Art Brass Plating\Cleanup Action Plan\Feb 2025 draft\DCAP_REVISED_Draft_2025.2.10.docx

Contents

List of Tables

List of Figures

List of Appendices

Acronyms

AO	Agreed Order
ABP	Art Brass Plating
ARAR	applicable or relevant and appropriate requirement
Aspect	Aspect Consulting, a Geosyntec Company
AS	air sparging
BE	Burlington Environmental, LLC
BDC	Blaser Die Casting
bgs	below ground surface
CI	Capital Industries
cis-DCE	cis-1,2-dichloroethene
COC	constituent of concern
CUL	cleanup level
CVOC	chlorinated volatile organic compounds
DCA	disproportionate cost analysis
dCAP	draft Cleanup Action Plan
DCE	dichloroethene
E4	East of 4th
EAnB	Enhanced Anaerobic Bioremediation
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
HCIM	Hydraulic Containment Interim Measure
IPIM	Inhalation Pathway Interim Measure
ISCO	In Situ Chemical Oxidation
ISCR	In Situ Chemical Reduction
ISS	In Situ Stabilization

LDW	Lower Duwamish Waterway
LDW Site	Lower Duwamish Waterway Superfund Site
LEL	lower explosive limit
MM	Mott MacDonald
mg/L	milligrams per liter
µg/L	micrograms per liter
MTCA	Model Toxics Control Act
NA	Natural Attenuation
OSHA	Occupational Safety and Health Act
Pacific Crest	Pacific Crest Environmental
PCE	tetrachloroethene
PCUL	preliminary cleanup level
PFS-N	Pacific Food Systems, North Building
PGG	Pacific Groundwater Group
PLP	potentially liable person
PSC	Phillips Services Corporation Environmental Services, LLC
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
REL	remediation level
RI	Remedial Investigation
SCAP	Source Control Action Plan
SCM	Site Conceptual Model
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SU1	Site Unit 1
SU2	Site Unit 2
SVE	soil vapor extraction
SWAC	surface area-weighted average concentration
TASCO	The Amalgamated Sugar Company

TCE	trichloroethene
TOC	total organic carbon
TSDF	Treatment, Storage, and Disposal Facility
UIC	underground injection control
VC	vinyl chloride
VI	vapor intrusion
VIAMM	vapor intrusion assessment monitoring and mitigation
W4	West of 4th
WAC	Washington Administrative Code

Executive Summary

This draft Cleanup Action Plan (dCAP) defines the cleanup action selected by the Washington State Department of Ecology (Ecology) for the West of 4th (W4) Site (Site). The W4 Site dCAP has been prepared on behalf of potentially liable persons (PLPs) [Art Brass Plating (ABP), Blaser Die Casting (BDC), Capital Industries (CI), and Clean Earth/Burlington Environmental, LLC (Clean Earth/BE)] identified by Ecology in Agreed Order (AO) No. DE10402 for the W4 Site. The AO requires the PLPs (referred to collectively as the W4 Group) to complete a Feasibility Study (FS) and prepare a dCAP for the W4 Site.

The W4 Site is located in the Georgetown neighborhood of Seattle, Washington, between 4th Avenue South and the Lower Duwamish Waterway (LDW). For the purposes of the FS, the W4 Site was divided into two site units, Site Unit 1 (SU1; ABP and Clean Earth/BE) and Site Unit 2 (SU2; BDC, CI, and Clean Earth/BE), as described in the AO.

Summary of Site Conditions

W4 Site constituents of concern (COCs) include the chlorinated volatile organic compound (CVOC) trichloroethene (TCE) and associated degradation products (primarily vinyl chloride [VC]), and metals used in electroplating (primarily nickel; only a COC at the ABP Property). Sources of contamination include releases from the ABP Property at 5516 3rd Avenue South, the BDC Property at 5700 3rd Avenue South, and the CI Property at 5801 3rd Avenue South. Other sources include groundwater containing TCE and VC that has migrated into the W4 Site from the upgradient Clean Earth/BE facility.

Groundwater is relatively shallow, with a depth to water between 4 and 10 feet below ground surface (bgs). At SU1, a plume of TCE-contaminated groundwater extends from the ABP Property southwest to the LDW. The plume migrates laterally and downward until approximately 1st Avenue South, at which point advective flow transitions upward and the plume becomes shallower as it approaches the LDW. At SU2, plumes of TCE-contaminated groundwater extend from the BDC Property and the CI Property to the southwest, but the plumes but do not reach the LDW. Plume boundaries in SU1 and SU2 are defined for TCE.

Interim Remedial Actions

Interim remedial actions that have been implemented at the W4 Site include the following:

- Source control through operation of a soil vapor extraction (SVE) and air sparging (AS) system to remove chlorinated COCs from soil and groundwater at and around the ABP Property.

- Implementation of a Vapor Intrusion Assessment, Monitoring, and Mitigation Plan (VIAMMP) for permanent structures within the footprint of contaminated shallow soil and groundwater.
- An In Situ Chemical Reduction and Enhanced Anaerobic Bioremediation (ISCR/EAnB) Pilot Study to evaluate in situ treatment of CVOCs in groundwater in the South Fidalgo Street area near the LDW.
- A Metals Immobilization Pilot Study at the ABP Property to evaluate in situ treatment methods for immobilizing elevated metals in groundwater through pH adjustment.
- Source control through excavation and groundwater extraction at the BDC Property.
- Excavation of contaminated soil at CI Plant 2.
- An In Situ Chemical Oxidation (ISCO) Pilot Study at CI Plant 4 to evaluate whether the technology was feasible to remediate shallow soil contamination and reduce CVOC concentrations in groundwater in the Water Table Interval (depths ranging from 0 to 20 feet bgs) to shorten the cleanup time frame for groundwater.

Remedial actions upgradient of the W4 Site include source control measures at the Clean Earth/BE facility.

Cleanup Objectives

Cleanup levels (CULs) for COCs are based on potential exposure pathways. Potentially affected media include soil, groundwater, surface water, and air. Potential receptors include aquatic organisms in the LDW and humans (including workers, residents, recreational beach users, and fishers/shellfish harvesters) via direct contact with soil or groundwater, inhalation of dust or air, or ingestion of contaminated aquatic organisms.

Remedial Action Objectives (RAOs) are generally stated as follows:

- Achieve CULs at the standard point of compliance for soil, groundwater, air, and surface water, if practicable within a reasonable time frame.
- Use engineered and institutional controls to protect potential receptors from contaminants exceeding CULs for potentially complete exposure pathways.

Remediation levels (RELs) for CVOCs in groundwater were developed in the SU1 FS to help determine when and where active treatment may be appropriate. RELs are defined in Washington State's Model Toxics Control Act (MTCA) as a concentration (or other method of identification) of a hazardous substance in soil, water, air, or sediment above which a particular cleanup action component will be required as part of a cleanup action at a site (WAC 173-340-355). RELs for groundwater near the LDW, including in porewater (Porewater RELs), were further refined in the SU1 FS Addendum.

Remedial Alternatives

Remedial alternatives for the W4 Site were developed and evaluated as described below.

SU1

The SU1 FS evaluated nine alternatives that provided a broad range of treatment and containment options. Based on Ecology comments on the SU1 FS and subsequent data collection, including pilot studies, groundwater and porewater monitoring, and the collection of water level data to evaluate groundwater flow variability, the SU1 FS Addendum developed and evaluated two new alternatives, Alternatives 2A and 2B. These are summarized as follows:

- Alternative 2A:
    - ABP source area: pH neutralization
    - Downgradient TCE Plume: ISCR/EAnB in South Fidalgo Street
    - Contingency Actions: ISCR in the ABP source area to further reduce TCE concentrations, and ISCR/EAnB near the shoreline to address VC in porewater
- Alternative 2B:
    - ABP source area: pH neutralization
    - Downgradient TCE Plume: ISCR/EAnB in South Fidalgo Street and ISCR/EAnB along the LDW shoreline

Both SU1 FS Addendum alternatives also incorporate engineered and institutional controls and natural attenuation (NA) in conjunction with active treatment to provide protection during the restoration period and ultimately achieve CULs across the W4 Site. Based on the evaluation in the SU1 FS Addendum and Ecology approval, the selected alternative for SU1 is Alternative 2A.

SU2

The SU2 FS identified and evaluated six remedial alternatives (Alternatives 1, 2A, 2B, 3A, 3B, and 4) that provided a broad range of treatment and containment options.

Alternative 1 was the recommended cleanup action for SU2 based on the analysis and considerations presented in the FS Report, but the FS Report acknowledged uncertainties regarding implementation of the alternative because certain technologies had not been pilot tested (e.g., ISCO and SVE). In accordance with the AO Amendment and based on comments received from Ecology after their review of the FS, the SU2 FS Addendum proposed a seventh alternative, which is a modified version of the preferred remedial alternative selected in the FS.

Alternative 1R comprises NA of CVOCs in SU2 groundwater, targeted soil remediation of CVOCs at CI Plant 4 by SVE, and engineered and institutional controls.

Alternative 1R was modified to include SVE treatment rather than ISCO at CI Plant 4 due to pilot testing results that indicated ISCO was not a feasible remediation technology at CI Plant 4. SVE was originally a component of Alternative 4. Alternative 1R also includes NA with a long-term groundwater monitoring program to confirm that natural attenuation continues to be sufficiently protective of the LDW and associated receptors

within the plume areas, and to evaluate whether a future contingency action is necessary. The selected cleanup alternative also includes engineered and institutional controls to protect human health and the environment until the cleanup standards are achieved.

Cleanup Action Overview

The selected cleanup action for the W4 Site reflects the combination of preferred alternatives from the SU1 FS Addendum and SU2 FS Addendum, and consists of the following components:

- pH neutralization to address plating metals and CVOCs in groundwater in the vicinity of the ABP Property;
- Injection-based treatment using ISCR/EAnB reagents to address CVOCs in groundwater in South Fidalgo Street in SU1;
- SVE to address CVOCs in soil at CI Plant 4;
- Institutional and engineering controls as appropriate throughout the W4 Site;
- NA for CVOCs and plating metals in groundwater throughout the W4 Site;
- Compliance groundwater monitoring site-wide; and
- Contingency actions where necessary at the W4 Site.

This Executive Summary should only be used in the context of the full report.

1 Introduction

This document is the draft Cleanup Action Plan (dCAP) for the West of 4th (W4) Site (Site). The general location of the Site is in the Georgetown neighborhood of Seattle as shown in Figure 1-1. A dCAP is required as part of the site cleanup process. The purpose of the dCAP is to identify the proposed cleanup action for the Site and to provide an explanatory document for public review.

The W4 Site dCAP has been prepared on behalf of potentially liable persons (PLPs) [Art Brass Plating (ABP), Blaser Die Casting (BDC), Capital Industries (CI), and Clean Earth/Burlington Environmental, LLC (Clean Earth/BE)[1]] identified by the Washington State Department of Ecology (Ecology) in Agreed Order (AO) No. DE10402 for the W4 Site[2]. The AO requires the PLPs (the W4 Group) to complete a Feasibility Study (FS) and prepare a dCAP for the W4 Site.

The W4 Site is being cleaned up under the authority of the Washington State Model Toxics Control Act (MTCA), Chapter 70A.305 of the Revised Code of Washington (RCW), the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC), Hazardous Waste Management Act Chapter 70A.300 RCW, and Dangerous Waste Regulations Chapter 173-303 WAC. This dCAP describes the Ecology-selected cleanup action for the entire W4 Site in accordance with WAC 173-340-380(1)(a).

Ecology has made a preliminary determination that a cleanup conducted in conformance with this dCAP will comply with the requirements for selection of a remedy under WAC 173-340-360. For Clean Earth/BE exclusively, the dCAP also satisfies the requirements of WAC 173-303-646 through -64630.

1.1 Site Description

The W4 Site is located in the Georgetown neighborhood of Seattle. The W4 Site extends from 4th Avenue South to the Lower Duwamish Waterway (LDW), a distance of about 2,200 feet, and is generally flat with a gradual slope to the west. The W4 Site includes a

[1] Burlington Environmental, LLC and Phillips Services Corporation Environmental Services, LLC (PSC) are wholly owned subsidiaries of Clean Earth Environmental Solutions, Inc. (Clean Earth). Clean Earth/BE is a nationwide hazardous waste treatment, storage, and disposal company. Hazardous waste spills and leaks at the Georgetown facility resulted in soil and groundwater contamination. We refer to Clean Earth/BE in this document because the company uses the name Clean Earth in public, but the facility was permitted in 1991 as BE. PSC closed the operating portion of its Georgetown facility effective December 2003. Clean Earth is currently conducting cleanup action activities at its Georgetown facility and east of 4th Avenue South under a separate RCRA Permit for corrective action only.

[2] The W4 Site is described in AO No. DE10402 as generally bounded by 4th Avenue South to the east; the Duwamish Waterway to the west; South Lucile Street to the north; and Slip 2 of the Duwamish Waterway to the south and, within those boundaries, is defined as "the extent of contamination caused by the release of hazardous substances from the PLPs' respective properties."

mixture of commercial, industrial, and residential land uses. The W4 Site is defined by the extent of groundwater contamination caused by historical releases at several facilities.

Three PLP properties located in the W4 Site area have been identified as sources of releases of contamination

- ABP Property located at 5516 3rd Avenue South;
- BDC Property located at 5700 3rd Avenue South; and
- CI Property located at 5801 3rd Avenue South.

The Clean Earth/BE facility is located at 734 Lucile Street, east of 4th Avenue South. Clean Earth/BE is included as a PLP for the W4 Site due to the migration of constituents of concern (COCs) [and subsequent comingling] in groundwater from east of 4th Avenue South into the W4 Site.

For the purposes of the FS, the W4 Site was divided into two site units, Site Unit 1 (SU1; ABP and Clean Earth/BE) and Site Unit 2 (SU2; BDC, CI and Clean Earth/BE), as described in the AO. Figure 1-2 shows the locations of the four PLP properties and the SU1 and SU2 boundaries.

1.2 Previous Studies

The 4 PLPs completed separate Remedial Investigation (RI) reports to characterize W4 Site conditions and collect the information needed to prepare the FS, as documented in the following:

- *Final Comprehensive Remedial Investigation Report for Philip Services Corporation's Georgetown Facility, Philip Services Corporation* (BE RI; PSC, 2003)
- *Remedial Investigation Report, Art Brass Plating* (ABP RI Report; Aspect, 2012)
- *Revised Draft Remedial Investigation Report, Capital Industries* (CI RI Report; Farallon, 2012)
- *Revised Remedial Investigation, Blaser Die Casting* (BDC RI Report; PGG, 2012)

The RI stage was completed in 2012 and Ecology placed the PLPs under AO No. DE10402, which required the PLPs to jointly complete an FS and prepare a dCAP for the W4 Site.

Between 2014 and 2016, the W4 Group submitted numerous technical memorandums to Ecology as required by the AO. The "Site Conceptual Model Technical Memo*"* (SCM; Aspect, 2014) identifies the sources of COCs, nature and extent of contamination, and known and potential exposure pathways and receptors. A summary of Site COCs is provided in Section 4.

The SU1 and SU2 FS reports (Aspect, 2016 and PGG, 2016, respectively) were accepted by Ecology in a letter dated October 25, 2016 (Ecology, 2016). The FS developed cleanup alternatives for the W4 Site and evaluated them with respect to criteria specified

in MTCA. Based on subsequent discussions with Ecology, additional actions were implemented, including two pilot studies in SU1 and two in SU2 to further evaluate certain remedial technologies that were identified in the FS.

Two focused FS Addenda reports were submitted [one for SU1 and one for SU2], re-evaluating potential remedies based on the information collected in the pilot studies. This work was described in AO Amendment No. 1, dated November 20, 2017 (AO Amendment No. 1). In correspondence dated December 13, 2017, the W4 Group proposed conducting an extended analysis of tidal effects on groundwater flow near the LDW to fill data gaps in the hydrogeologic conceptual site model. The W4 Group modified the study based on Ecology's draft comment letter dated December 15, 2017. The refinement of the evaluation of remedial alternatives was also summarized in the W4 SU1 and SU2 FS Addendum reports (Aspect, 2023 and Farallon, 2023), which were approved by Ecology in a letter dated September 7, 2023 (Ecology, 2023). A "preferred alternative" was identified for each SU and for an area at the SU boundary. The FS and FS Addenda went through the MTCA-required public comment period in July 2023.

This dCAP details the "preferred alternative" as the Ecology-selected cleanup action for the W4 Site.

1.3 Regulatory Framework

A combination of state and federal regulations governs the cleanup of the W4 Site. MTCA is the controlling state regulation for cleanup of the W4 Site. However, the Hazardous Waste Management Act (Chapter 70A.300 RCW), Dangerous Waste Regulations (Chapter 173-303 WAC), and federal Resource Conservation and Recovery Act (RCRA) regulations also apply to the W4 Site due to the Clean Earth/BE facility. The facility is located east of the 4th Avenue South and is a RCRA-permitted dangerous waste treatment, storage, and disposal facility (TSDF). Ecology is the lead agency overseeing compliance with both sets of regulations as they apply to the W4 Site.

"Clean Earth/BE facility" refers to the former RCRA dangerous waste operations located at Parcel Number 1722800206 and 5084400124 at 734 South Lucile Street in Seattle, Washington.[3]

MTCA requires all W4 PLPs to perform cleanup actions to address releases that occurred at "any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located." The definition of the Site is incorporated in AO No. DE 10402 in Section IV. S. This dCAP therefore only uses the term "facility" in its hazardous waste context. Therefore, this dCAP is intended to meet

- Corrective action-related requirements in BE's RCRA permit, and
- Requirements of MTCA cleanup regulations.

[3] "Facility" is defined under the Hazardous Waste Management Act in RCW 70A.300.010(8) as meaning "all contiguous land and structures, other than appurtenances, and improvements on the land used for recycling, storing, treating, incinerating, or disposing of hazardous waste."

MTCA requires that cleanup actions comply with all applicable local, state, and federal laws; and requirements that are legally applicable and determined by Ecology to be relevant and appropriate for the Site (WAC 173-340-710). This is discussed further in Section 5, Applicable or Relevant and Appropriate Requirements.

1.4 Purpose and Content

The purpose of the dCAP is to identify the proposed cleanup action for the W4 Site and to provide an explanatory document for public review. This dCAP is organized as follows:

- **Section 2** describes the W4 Site and summarizes current site conditions.
- **Section 3** summarizes interim actions conducted at the E4 and W4 Sites[4] to date.
- **Section 4** identifies cleanup standards, remediation levels, and remedial action objectives.
- **Section 5** identifies state and federal laws and other regulatory requirements potentially applicable to the cleanup.
- **Section 6 s**ummarizes the cleanup action alternatives considered in the remedy selection process, the evaluation of alternatives, and the rationale for selection of the preferred alternative.
- **Section 7** describes the selected cleanup action for the W4 Site.
- **Section 8** presents the schedule for implementing the dCAP.
- **Section 9** describes the public participation plan for the dCAP.

[4] For the purposes of administering cleanup of the Clean Earth/BE site, in 2005 it was divided into two areas designated as the "East of 4th Avenue South Area" (E4 Site) and the "West of 4th Avenue South Area" (i.e., W4 Site).

2 Summary of Site Conditions

2.1 Environmental Setting

The environmental setting for the W4 Site has been discussed in detail in the RI reports prepared by ABP (Aspect, 2012), BDC (PGG, 2012), CI (Farallon, 2012), and Clean Earth/BE (PSC, 2003) as well as the Site Conceptual Model Technical Memorandum (Aspect, 2014).

The hydrogeologic units encountered in borings completed at the W4 Site include Younger Alluvium and Older Alluvium. The upper portion of the Younger Alluvium has been modified and is referred to as the Fill Unit. A description of these units is provided below.

- **Fill Unit** consists of heterogeneous layers of gravelly sand, silt, and silty sand with scattered bits of inert debris, such as glass shards or brick fragments. This unit extends up to a depth of 8 feet below ground surface (bgs); however, the boundary between the Fill Unit and the Younger Alluvium is difficult to distinguish.

- **Younger Alluvium (Qyal)** represents channel and overbank/floodplain deposits from the Duwamish River (Booth and Herman, 1998). At the W4 Site, the Younger Alluvium consists of two subunits: a sandy silt or silty sand unit overlying slightly silty fine-medium sand unit. Wood and organic debris are also present. This unit is typically found within a few feet above or below the current sea level and extends to a depth of approximately 25 to 30 feet bgs. Moving westward towards the LDW, the Younger Alluvium extends to a depth of approximately 55 feet bgs.

- **Older Alluvium (Qoal)** represents materials deposited in an estuarine and deltaic environment. The Older Alluvium consists of interbedded sequences of silty fine sand and sandy silt. A silt aquitard, likely a subunit of the Older Alluvium, and bedrock have been identified in deeper borings east of 4th Avenue South (PSC, 2003). These additional units were not encountered in the borings located at the W4 Site. Based on a review of the Duwamish Valley cross sections available in Booth and Herman (1998), it is expected that the silt aquitard and bedrock are present at a depth greater than 150 feet bgs.

The lithologic units discussed above correspond to the hydrogeologic units encountered at the W4 Site. The PLPs use a standardized nomenclature for groundwater monitoring and sampling intervals which are:

- **Water Table Interval.** This interval includes monitoring wells screened above 20 feet bgs and reconnaissance groundwater samples collected above 20 feet bgs.

- **Shallow Interval.** This interval includes monitoring wells screened below 20 feet and above 40 feet bgs, and reconnaissance groundwater samples collected between 21 feet and 40 feet bgs.

- **Intermediate Interval.** This interval includes monitoring wells and reconnaissance groundwater samples screened below 40 feet bgs.

2.1.1 Groundwater Flow and Tidal Variability

Saturated conditions are first encountered in the Water Table Interval between 4 feet bgs and 10 feet bgs. Groundwater flow at the W4 Site is to the west and southwest. Little seasonal variability in flow direction is observed. Vertical gradients between the Water Table Interval and Shallow Intervals are typically downward. Vertical gradients between the Shallow and Intermediate Intervals fluctuate between upward and downward, except in the well clusters close to the LDW located west of East Marginal Way. Upward gradients were typical in these well pairs.

Tidal studies are detailed in RI reports from ABP (Aspect, 2012) and CI (Farallon, 2012) and as part of the Amended FS by the W4 Group (Pacific Crest, 2020). Tidal fluctuations in the LDW are a significant contributing factor to the hydrogeologic complexity of the portion of the W4 Site located between East Marginal Way and the LDW. Water level elevations in wells located between 800 and 1,200 feet of the LDW are influenced by tidal fluctuations in the LDW. The semi-diurnal tidal pattern can be observed in the hydrographs for wells close to the LDW and tidal influence on groundwater decreases with distance from the shoreline of the LDW.

Tidal studies illustrate that, despite the fluctuations in groundwater elevations induced by LDW tides and seasonal variations, flow paths in the study area are relatively stable over extended periods of time. In the portion of the W4 Site where groundwater is tidally influenced, groundwater flow direction and gradient change on an almost continuous short-term, small-scale basis that is implicitly incorporated into the groundwater flow directions determined and the resulting TCE plume configurations observed. Particle track analysis conducted in 2020 indicates that the tidally induced changes in groundwater flow direction and groundwater gradient combine to result in a groundwater flow direction that is relatively insensitive to precipitation events and tidal fluctuations (Pacific Crest, 2020). The particle track analysis is consistent with the gradient weighted groundwater flow directions. The particle flow triangulated from well sets also appears to remain stable for extended time periods.

2.2 Site History and Source Areas

This section provides a summary of the sources of COCs from the four PLP properties. Figure 1-2 illustrates the location of these properties.

Art Brass Plating

The ABP Property is located at 5516 3rd Avenue South. Since 1983, the ABP has conducted industrial operations on its property exclusively for metal plating and related work (e.g., metal polishing and powder coating). Metal plating has included nickel, chrome, brass (an alloy of copper and zinc), copper, and gold. The chlorinated solvent trichloroethene (TCE) was formerly used at the ABP Property for vapor degreasing from approximately 1983 to February 2004. Since 1983, the vapor degreaser has been located at its current location just south of the polishing area, labeled “Former TCE Degreaser No. 1” on Figure 2-1. A second vapor degreaser, located in what is now the Time-Saver

Room, was temporarily used between 1988 and 1993, labeled "Former TCE Degreaser No. 2" on Figure 2-1.

The RI indicated that releases of chlorinated solvents and plating metals from the ABP operations at the property likely affected soil and groundwater. The RI data confirmed that downgradient migration of TCE and its degradation products dichloroethene (DCE) and vinyl chloride (VC) occurred via groundwater flow in the Shallow and Intermediate Intervals (downgradient TCE Plume). These data also indicate the historical release(s) of plating solutions resulted in depressed pH and elevated concentrations of cadmium, copper, nickel, and zinc in soil and groundwater beneath, and in close proximity to, the ABP Property. Interim actions completed by ABP are described in Section 3.1.

Blaser Die Casting

The BDC Property is located at 5700 3rd Avenue South and has been located there since 1962, performing die casting until 2010. The building was converted to a storage and distribution facility. BDC's processes did not change substantively from 1962 until 2010. The review of site processes, materials, waste oil testing, and interviews of key employees provided no records that TCE was ever used by BDC or that TCE was ever used at the property. Nevertheless, a release of TCE occurred sometime before 1996 when a building addition was constructed at BDC. The building is currently used as warehouse and temporary storage space. Soil and groundwater data indicated a TCE release to soils that were beneath the southwest corner of the BDC addition (Figure 2-2). BDC completed a soil source control action and full soil cleanup at the building in January 2008, described in more detail in Section 3.2.1.

Capital Industries

The CI Property consists of multiple buildings (referred to as Plants 1 through 5 typically) located at 5801 3rd Avenue South. Former CI operations that may have resulted in releases of TCE and/or tetrachloroethene (PCE) to soil and groundwater include use of a vapor degreaser formerly located in CI Plant 4, and use of a solvent-based parts cleaner formerly located in CI Plant 2. There is no documented record of a release of solvents from either location. Nevertheless, concentrations of PCE and/or TCE have been confirmed present in soil, groundwater, and/or soil gas at the CI Property. A site plan of the CI Property is provided on Figure 2-3.

Plant 4

The nature and extent of TCE, PCE, and related chlorinated volatile organic compounds (CVOCs) in soil and groundwater in the Water Table Interval suggest that a release(s) of TCE and/or PCE may have occurred from degreasing operations that formerly took place in the CI Plant 4 building. Sufficient sampling was performed during the RI to estimate the distribution of CVOCs in the affected media. No interim action was performed during the RI due to the relatively low concentrations and limited distribution of CVOCs in soil, groundwater, and soil gas. However, vapor intrusion (VI) mitigation measures were enacted for the east-adjacent Pacific Food Systems North building until cleanup of the source(s) at CI Plant 4 can be completed.

Plant 2

The nature and extent of CVOCs in groundwater in the Water Table Interval suggest that a release(s) of TCE may have occurred from a parts cleaner formerly located at the southwest corner of CI Plant 2, and from the former storage of chemicals at the CI Plant 2 Canopy. The results of pre-RI investigations, soil gas monitoring, and soil sampling conducted during the excavation and reconstruction of the CI Plant 2 building following a fire that destroyed the building, and during the RI, did not detect residual concentrations of CVOCs in soil that suggested an extensive release of CVOCs at the CI Plant 2 building or the CI Plant 2 Canopy. Nevertheless, the Water Table Interval groundwater reconnaissance and monitoring well data indicate a source of CVOCs is likely present. Interim actions at CI Plant 2 are described in Section 3.2.2.

Clean Earth/BE

Clean Earth/BE operated the former hazardous waste management facility at 734 South Lucile Street, east of 4th Avenue South (Figure 1-2). The dangerous waste facility consisted of two adjacent and contiguous parcels of property, the original permitted parcel consisted of approximately 2 acres located at 734 Lucile Street and an unpermitted parcel of approximately 4 acres (the former Amalgamated Sugar Company or “TASCO” property) located at 5400 Denver Avenue. Clean Earth/BE closed the operating portion of the facility effective December 2003.

During the RI, Clean Earth/BE performed soil, soil gas, and groundwater sampling on and in the vicinity of the Clean Earth/BE facility. Concentrations of hazardous substances exceeding applicable cleanup levels (CULs) were detected on and to the north and east of the Clean Earth/BE facility. Hazardous substances associated with the Clean Earth/BE facility operations have also contaminated groundwater. Hazardous substances in groundwater have migrated in the direction of regional groundwater flow, which is generally westerly-to-southwesterly. This has resulted in contaminated groundwater located east and west of 4th Avenue South.

For the purposes of administering cleanup of the Clean Earth/BE site, in 2005 it was divided into two areas designated as the "East of 4th Avenue South Area" (E4 Site) and the "West of 4th Avenue South Area" (i.e., W4 Site). The eastern area of the Clean Earth/BE site, E4 Site, is being addressed under a May 2010 Cleanup Action Plan (Ecology, 2010) and AO DE7347. Remedial Investigations in the western area of the Clean Earth/BE site, west of 4th Avenue South, were completed under BE Permit WAD 00081 2909, ABP AO DE5296, CI AO DE5348, and BDC Enforcement Order DE5479. The FS and dCAP for the portions of the Clean Earth/BE site located west of 4th Avenue South are being addressed under AO DE10402. Clean Earth/BE's corrective action obligations with respect to its dangerous waste facility are enforceable conditions of its June 2010 dangerous waste permit, WAD 00081 2909, under the authority of Chapter 70.105 RCW, and its implementing regulations, Chapter 173-303 WAC.

2.3 Nature and Extent of Contamination

The nature and extent of contamination at the W4 Site has been discussed in detail in the RI reports prepared for ABP (Aspect, 2012) and BE (PSC, 2003) and the SCM Memo (Aspect, 2014), the SU1 (Aspect, 2016) and SU2 FS (PGG, 2016) reports, and the SU1 (Aspect, 2023) and SU2 (Farallon, 2023) FS Addendum reports. The locations of SU1

and SU2 and the PLP properties are illustrated on Figure 1-2. This section focuses on key COCs - TCE, VC, and select plating metals (nickel, copper, and zinc) - and key contaminated media. Please refer to the above-referenced documents for detailed information.

2.3.1 TCE

- **Soil:** TCE concentrations exceeding the MTCA Method B direct contact cleanup level may be present under the ABP Property[5].

- **Groundwater:** Chlorinated solvent releases in groundwater migrate to the west and southwest, and vertically from the various PLP source areas, consistent with horizontal and vertical gradients at the W4 Site. In SU1, the CVOC plume migrates upward west of 1st Avenue South to the southwest and extends to the LDW. At SU2, the existing site characterization data indicates that the CVOC plume (as defined by groundwater exceedances of the surface water CULs) does not reach the LDW. Plume boundaries in SU1 and SU2 are defined for TCE, as shown on Figure 2-4.

2.3.2 VC

- **Groundwater:** A VC plume in groundwater is comingled throughout the W4 Site in the Shallow and Intermediate Intervals, as illustrated in Figure 2-5. Concentrations of VC that are migrating from the E4 Site into the W4 Site become comingled with VC associated with releases that occurred at ABP, CI, and BDC. Near the center of the W4 Site, an area of elevated VC concentrations in the Shallow and Intermediate Intervals at and downgradient of 1st Avenue South is referred to as the Site Unit Boundary Area.

2.3.3 Plating Metals

- **Groundwater:** In SU1, plating metals copper, nickel, and zinc in groundwater exceed cleanup standards for protection of surface water. The horizontal extent of plating metals impacts appears limited to a distance of approximately 400 feet downgradient of the ABP Property. Copper and zinc are limited to the Water Table Interval and nickel extends to the Shallow Interval. Nickel has the greatest area and magnitude of exceedances, and the maximum extent of plating metals in groundwater is represented as the extent of nickel in groundwater, as shown on Figure 2-6.

2.4 Human Health and Environmental Concerns

The following provides a summary of the potential receptors and exposure pathways, detailed in the SCM Memo (Aspect, 2014).

[5] No TCE concentrations have been detected in soil above the direct contact cleanup level since implementation of the ABP interim actions. However, a historical exceedance is located under the ABP Property that is inaccessible to drilling, so the potential for exceedances in this area remains as of 2024. The location is under the building where drilling would penetrate a secondary containment floor coating in an active plating area.

2.4.1 Potential Receptors

The W4 Site includes upland and aquatic areas. Potential receptors[6] in the upland areas include:

- Aboveground workers (e.g., employees at commercial facilities);
- Belowground workers (e.g., construction workers conducting digging or trenching operations); and
- Residents.

Potential receptors in aquatic areas include:

- Recreational beach users;
- Recreational fishing/shellfish harvesters;
- Subsistence fishing/shellfish harvesters; and
- Aquatic organisms

2.4.2 Potential Exposure Pathways

Potentially impacted media at the W4 Site include soil, groundwater, air, and surface water. Potential exposure pathways for each medium are identified below. Site use includes a mixture of industrial, commercial, and residential uses.

Soil

Potential direct exposure pathways for soil contamination include:

- Direct contact
- Dust inhalation

Although existing surface materials (asphalt and concrete) prevent contaminated soils from being inhaled or contacted, this is a potential future exposure pathway in the event that coverings are removed or belowground work is conducted.

Soil contamination may also contribute to contamination in other media through intermedia transport, as follows:

- Air contamination, via the soil-to-air migration pathway (i.e., volatilization)
- Groundwater contamination, via the soil-to-groundwater migration pathway (i.e., leaching)

Potential groundwater and air exposure pathways are discussed below.

Groundwater

Potential direct exposure pathways for groundwater contamination include:

- Incidental direct contact

[6] Terrestrial ecologic receptor risk was eliminated under the criteria set forth in WAC 173-340-7491 during completion of the RIs.

This pathway is considered a potential current and/or future exposure pathway only for below-ground workers. Above-ground residents and workers are not expected to contact groundwater, which is located 4 to 10 feet bgs.

As described in the FS documents with Ecology concurrence, W4 Site groundwater will not be a source of drinking water in the foreseeable future.

Groundwater contamination may also contribute to contamination in other media, as follows:

- Air contamination, via the groundwater-to-air migration pathway (i.e., volatilization)
- Surface water contamination, via the groundwater-to-surface water migration pathway (i.e., discharge to surface water)

Air

CVOCs in contaminated soil and groundwater may volatilize into soil gas, which in turn may migrate into indoor or outdoor air (i.e., VI). Potential exposure pathways for CVOCs in air include:

- Inhalation of outdoor air
- Inhalation of indoor air

Surface Water

The nearest surface water receptor, the LDW, is a brackish water body that is not a potential drinking water source. Potential exposure pathways for contaminated surface water include:

- Incidental direct contact to humans
- Direct contact by aquatic organisms
- Aquatic or terrestrial organism ingestion of contaminated aquatic organisms
- Human ingestion of contaminated aquatic organisms

3 Interim Remedial Actions

Interim remedial actions were completed at PLP source areas to reduce threats to human health and the environment by eliminating or reducing pathways for exposure.

3.1 Vapor Intrusion Mitigation Program

The PLPs have performed VI assessment and mitigation for properties as detailed below. The following outlines the program and PLP responsibilities.

3.1.1 Background

In 2002, Clean Earth/BE developed and began implementing an Inhalation Pathway Interim Measure (IPIM) Program to assess and mitigate VI of COCs associated with releases at the former Clean Earth/BE facility in accordance with the corrective action requirements of Clean Earth/BE's RCRA Permit. The IPIM Program included the combined E4 and W4 Site areas. Between 2003 and 2007, Clean Earth/BE conducted an extensive VI program that included

- Advancing reconnaissance borings to collect groundwater samples for laboratory analysis, for the purpose of comparing analytical results of groundwater samples to analytical results of indoor air samples;
- Assessing the potential for VI at residential and commercial buildings using quarterly groundwater data;
- Collecting indoor air, ambient air, and subslab soil gas samples for laboratory analysis at 24 building locations;
- Installing 30 subslab and/or submembrane depressurization systems;
- Inspecting the subslab depressurization and submembrane depressurization systems on an annual basis; and
- Conducting repairs and monitoring of the systems on an as needed basis.

In 2007, VI assessment and mitigation responsibilities in the W4 Site area were divided between ABP, BDC, and CI. Clean Earth/BE's involvement in VI activities ceased. The framework for W4 VI assessment and mitigation was summarized in the Interim VI Plan (Arrow Environmental, et al., 2007) prepared on behalf of ABP, BDC, CI, and Clean Earth/BE.

In 2015, the VI mitigation program was outlined in the joint W4 deliverable, Revised Vapor Intrusion Assessment, Monitoring, and Mitigation Plan (VIAMM Plan; Farallon, 2015). The VIAMM Plan provides an overview of the tiered process used to assess potential VI issues and the VI mitigation process. The VIAMM Plan included a tabulated listing of the buildings where Tier 1 through Tier 4 VI assessment and mitigation measures have been implemented. The following provides a summary of recent VI program activities in the W4 Site.

3.1.2 SU1 Vapor Mitigation Program

In SU1, vapor mitigation remains active at the ABP Property and two properties west of ABP (218 and 220 South Findlay Street). Groundwater monitoring data are reviewed consistent with the tiered decision process described in the VIAMM Plan to confirm that vapor mitigation is being implemented where appropriate.

3.1.3 SU2 Vapor Mitigation Program

This section describes the VI mitigation measures at SU2 that were implemented in accordance with the requirements the VIAMM Plan. Multiple buildings were assessed during the RI phase of work and mitigation measures were implemented where necessary.

VI mitigation measures were implemented at the following locations in SU2:

- Pacific Food Systems, Inc. North Building at 5815 4th Avenue South (PFS-N). A subslab depressurization system (SSDS) was installed in March 2015 to mitigate VI issues associated with releases of PCE and/or TCE at the adjacent CI Plant 4 building.
- 5900 1st Avenue South building. This building has also been referenced previously as the Olympic Medical Building and more recently, the Natus building based on the tenants occupying this warehouse and office building. A SSDS was installed in January 2009 to mitigate VI issues associated with the commingled BDC/CI Plant 2 TCE plumes underlying the building.

The SSDS at the PFS-N building was shut down following air sampling in August and September 2023. Products containing CVOCs are used in the PFS-N building and the evaluation of sources from beneath the building slab versus sources from the products being used for equipment cleaning and maintenance indicated that VI mitigation measures were no longer necessary. The sampling activities were conducted in accordance with the technical memorandum regarding Work Plan for Vapor Intrusion Mitigation System Shut Down prepared by Landau Associates, Inc., which was submitted to Ecology on July 25, 2023.

The SSDS at the 5900 1st Avenue South building was shut down on July 7, 2022. An agency-review draft report documenting the results of the confirmation sampling was submitted to Ecology in October 2022. The report recommends permanent shutdown and decommissioning of the SSDS based on the confirmation sampling results indicating that no further mitigation measures are necessary. The building is currently vacant.

On December 20, 2019, on behalf of BDC, MM/PGG submitted a Tier 5 Vapor Intrusion System Shutdown Technical Memorandum to Ecology to perform VI system shutdown for the six buildings located at 227, 217, and 215 South Orcas Street, and 128, 132, and 134 South Mead Street. Ecology approved BDC's Tier 5 shutdown and monitoring plan on January 10, 2020 (Ecology, 2020). BDC satisfied the requirements for system shutdown in accordance with Tier V and the approved plan and reported the findings to Ecology on September 29, 2023. On January 26, 2024, Ecology issued an approval letter authorizing the final steps in system removal. Ecology notified the building owners and tenants in writing and, as the final step, BDC representatives have contacted them

regarding a preference for either mitigation fan removal or to keep the system intact. Final system shutdowns are scheduled for early 2025.

3.2 SU1 Interim Actions

Chlorinated solvents in SU1 groundwater in the Water Table Interval exceeded screening levels for the VI pathway. Because of the concern for this pathway, two interim actions were implemented by ABP prior to the completion of the ABP RI Report: (1) a VI mitigation program (as discussed in the previous section); and (2) source control interim action. Additionally, injections were completed as pilot studies to evaluate in situ treatment of COCs. The source control interim actions and pilot study injections are summarized below. These interim actions are described in more detail in Section 3 of the FS (Aspect, 2016).

3.2.1 ABP Source Control Interim Action

In September 2008, ABP installed an air sparging/soil vapor extraction (AS/SVE) system to remove CVOCs from soil and groundwater at and around the ABP Property. The system included 28 AS wells, 13 SVE wells, and 10 SVE trenches. Extracted vapors were treated with granular activated carbon.

The objectives of the AS/SVE system were to prevent VI at the ABP Property and the adjacent 220 Findlay office building, and reduce soil and groundwater concentrations of TCE, cis-1,2-DCE (cisDCE), and VC to levels that significantly reduce the restoration time frame and are protective of the indoor air pathway.

The SVE system operated continuously (except for periodic shutdowns for monitoring and maintenance) since startup in 2008 until 2011. In late 2011, the AS portion of the system was shut down to conduct a rebound analysis for CVOCs in groundwater. Between October 2012 and October 2015, the AS operated on an approximate six-month on-off pulsing schedule, and in October 2015, the AS system was shut down indefinitely to conduct an extended CVOC rebound analysis. The system removed approximately 87 pounds of TCE from the subsurface, and groundwater concentrations of TCE have declined 90 to 99 percent at wells in and around the treatment area.

After AS shutdown, TCE concentrations rebounded in several source area wells, most notably at Water Table Interval monitoring wells downgradient of Former TCE Degreaser No. 1 (Figure 2-1). TCE concentrations at these wells show seasonal variability but have overall been relatively stable since 2017. Based on the results of the AS system rebound analysis, the AS system was shut down permanently with Ecology concurrence in September 2017.

The interim action reduced CVOC concentrations in groundwater downgradient of the ABP Property. In 2020, Ecology approved a transition of the existing SVE system to vapor mitigation. In 2022, vapor mitigation equipment was installed in accordance with the Ecology-approved mitigation plan (Aspect, 2022a).

3.2.2 ISCR/EAnB Pilot Study

The ISCR/EAnB Pilot Study was implemented between 2018 and 2021 to evaluate in situ treatment of CVOCs (primarily TCE, cis-DCE, and VC) in groundwater in the South Fidalgo Street (Fidalgo Street) area near the LDW. Injection of a combined zero-valent iron-based reagent (PeroxyChem EHC®-Liquid powder solution) and organic carbon

(PeroxyChem ELS®-microemulsion) were completed in October 2018 to stimulate both in-situ chemical reduction (ISCR) and enhanced anaerobic bioremediation (EAnB) of CVOCs.

The ISCR/EAnB Pilot Study demonstrated that ISCR and EAnB are suitable technologies for treating CVOCs in groundwater. The scope included monitoring well installation, direct-push injection of the reagent, monitoring of injection pressure and flow rates, contingency monitoring of soil gas, and performance monitoring of groundwater for 5 years. Performance monitoring data have shown effective and sustained treatment, with greater than 90 percent reduction in total CVOCs as of the monitoring event in September 2021. Treatment appears to be a combination of biotic and abiotic mechanisms.

Secondary effects from the treatment including pH change, methane generation, and water quality impacts were limited and manageable. Groundwater pH can decrease due to the fermentation of organic carbon and generation of volatile fatty acids, which can be toxic to biological processes below pH 5. The pH initially decreased to 5.08, but after Month 1 post-injection, the pH began to rebound and continued to increase successive monitoring events, demonstrating the ability of the aquifer to buffer this temporary effect.

Methane generation and accumulation was another secondary effect of the ISCR/EAnB Pilot Study. Methanogenesis occurs under the same highly reducing anaerobic conditions which are favorable for reductive dichlorination. Dissolved methane concentrations in groundwater reached and exceeded solubility in groundwater (20 milligrams per liter [mg/L]) at Month 6 post-injection, and subsequently soil gas concentrations beneath Fidalgo Street began to increase above the methane lower explosive limit (LEL) of 5 percent. Contingency actions were immediately implemented, including weekly indoor air monitoring in the buildings on the north and south sides of Fidalgo Street and installation and monitoring of additional soil gas probes in Fidalgo Street until methane concentrations decreased below the LEL. No methane was detected in the indoor air of either building adjacent to the increased concentrations beneath Fidalgo Street during the monitoring period (Aspect, 2022b).

The final secondary effect of the ISCR/EAnB Pilot Study was water quality impacts due to mobilization of redox-sensitive metals (dissolved arsenic, barium, and manganese) or transport of the fluorescent tracer. There were minimal, temporary increases of less than one order of magnitude of these redox sensitive metals at downgradient monitoring well MW-24-30, which did not trigger any contingency action. The fluorescent tracer was not detected at MW-24-30.

The ISCR/EAnB Pilot Study verified the technology applicability for treating CVOCs in groundwater near the LDW and for inclusion in the cleanup action (Aspect, 2022b). The ISCR/EAnB Pilot Study results will also inform the remedial design of the selected cleanup action described in Section 7.2.

3.2.3 Metals Immobilization Pilot Study

The Metals Immobilization Pilot Study evaluated in situ treatment methods for immobilizing elevated metals (primarily nickel) in groundwater at the ABP Property through pH adjustment. The initial injection was performed at the ABP Property in September 2018, with a follow-up injection in August 2019.

The Metals Immobilization Pilot Study demonstrated that pH adjustment is a suitable technology for treating dissolved metals in groundwater at the ABP Property. The scope included bench testing of potential amendments, initial field injection of a sodium bicarbonate reagent, and follow-up injection of an adapted reagent that combined sodium bicarbonate and sodium hydroxide.

The initial field injection consisted of injecting 1.0 Molar sodium bicarbonate solution into two injection wells located adjacent to the ABP Property. This injection was performed in September 2018 and groundwater was monitored for 6 months following the injection. The results of this injection showed modest treatment of metals, but effectiveness was limited by density-driven flow of the reagent below the targeted treatment zone.

To mitigate the density effects, a follow-up injection of a lower-density solution (0.1 Molar sodium bicarbonate and 0.1 Molar sodium hydroxide) was performed in August 2019 and monitored for 6 months following injection. The results of the second injection showed greater than 90 percent reduction in nickel concentrations that were sustained for at least six months, indicating that the modified reagent solution was effective at immobilizing metals.

The Metals Immobilization Pilot Study verified the technology applicability for treating groundwater at the ABP Property and for inclusion in the cleanup action (Aspect, 2022c). The Metals Immobilization Pilot Study results will also inform the remedial design of the selected cleanup action described in Section 7.1.

3.3 SU2 Interim Actions

Several interim actions have been completed or are underway in source areas contributing to groundwater contamination in SU2 and down-gradient locations with VI concerns. These interim actions, which are presented in more detail in the SU2 FS, are summarized herein, and consist of

- An interim excavation action in the BDC Source Area (PGG, 2012);
- Excavation at CI Plant 2 following a 2004 fire (Farallon, 2012); and
- An in situ chemical oxidation (ISCO) pilot study at CI Plant 4, which was also intended to reduce CVOC concentrations in groundwater.

Assessment and implementation of VI mitigation measures at multiple structures in SU2 were previously discussed in Section 3.1. The interim actions directly related to this dCAP are summarized in the following sections.

3.3.1 BDC Source Control Interim Actions

BDC completed a soil source control action and groundwater extraction at the BDC building in January 2008 (PGG, 2008). The source control action included the following work:

- Excavating and disposing 1,200 tons of chlorinated solvent contaminated soil.
- Removing 7,250 gallons of groundwater and rainwater from the excavation at and beneath the southwest corner of the BDC building.

- Excavating soil from the source area under the southwest corner of the BDC building to just below the water table (about ~8 feet bgs). The excavation was extended laterally until confirmation samples indicated that the source was removed.
- Installing a passive vapor control system and installation of a vapor barrier in the excavated area.
- Collecting 54 final confirmation soil samples and 17 preliminary confirmation soil samples from the walls of the excavation from depths between 1.5 and 7.5 feet bgs.
- Analyzing 54 final confirmation soil samples and 17 preliminary soil samples by U.S. Environmental Protection Agency (EPA) Method 8260 for chlorinated ethenes and 4 soil samples for 1,4-dioxane[7].

The Source Control Action Plan (SCAP) was submitted to Ecology for review and provided protocols for determining excavation extent based on sample density, cleanup confirmation, and practicability criteria. In executing the SCAP, multiple phases of excavation occurred based on confirmation samples. Lateral excavation ceased when analytical results of confirmation samples were below MTCA Method A or B CULs. The actual spacing of the 65 confirmation samples was 1 sample per 10 feet of excavation, exceeding the sample density proposed in the SCAP.

As a result of the source control soil excavation and groundwater removal, concentrations in the groundwater water table zone immediately decreased over an order of magnitude.

3.3.2 Soil Excavation at CI Plant 2

Soil beneath CI Plant 2 was excavated for the foundation and utility trenches for reconstruction of CI Plant 2 in 2004 following the destruction of the building by a fire. The new construction work served as an interim action removing the source of TCE contamination that had affected groundwater quality.

Soil sampling was conducted during the CI Remedial Investigation (Farallon, 2012) and supplemental sampling was conducted to resolve data gaps and more definitively confirm that no further soil remediation work would be required at CI Plant 2 prior to completing the FS (Farallon, 2016) in areas of CI Plant 2 where historical information indicated the potential for sources of COCs or utilities that could convey COCs beneath the Plant existed. The results of the soil sampling indicated that concentrations of COCs are less than the preliminary cleanup levels (PCULs) established at that time and no further remedial actions are necessary for soil cleanup. The fire, soil excavation, and reconstruction activities remediated soil with the potential for impacting groundwater. Natural attenuation of the residual CVOC plume from CI Plant 2 and BDC sources will be monitored as part of the cleanup action cited in this dCAP.

[7] 1,4-dioxane was not detected in any of the four soil samples from the source area during excavation. 1,4-dioxane analyses were preferentially conducted on soil samples with elevated TCE concentrations to ensure that 1,4-dioxane would be detected if present in the Blaser source area.

3.3.3 CI Plant 4 ISCO Pilot Study

This section describes the ISCO Pilot Study conducted by CI at Plant 4 after preparation of the SU2 FS. The ISCO Pilot Study was intended to both evaluate whether the technology was feasible to remediate shallow soil contamination and also reduce CVOC concentrations in groundwater in the Water Table Interval (depths ranging from 0 to 20 feet bgs) to shorten the cleanup timeframe for groundwater. The 2015 RI data gap resolution work also included supplemental soil investigation at CI Plant 4. The results of the soil sampling indicated that there are areas where PCE and/or TCE exceeded the PCULs established at that time for protection of groundwater. The depth of soil contamination ranged from approximately 1 to 6 feet below the ground surface. ISCO was identified as the preferred technology presented in the SU2 FS as a component of SU2 Alternative 1 for treatment of PCE and TCE source areas in soil and for groundwater treatment at CI Plant 4.

In 2018, ISCO injections were conducted as a component of the ISCO Pilot Study to evaluate the technology. Potassium permanganate ($KMnO_4$) was injected into the subsurface at CI Plant 4 to evaluate whether shallow soil and groundwater within the Water Table Interval could likely be remediated by ISCO. The results indicated that ISCO, or other injection-based technologies, are not appropriate for cleanup of shallow soil (Farallon, 2019).

Groundwater data collected from existing and temporary observation wells during the ISCO Pilot Study indicated that CVOC concentrations in the Water Table Interval at CI Plant 4 were less than the PCULs. Ecology indicated that active treatment of groundwater at CI Plant 4 would not be a requirement of the dCAP, provided that an alternative technology could be applied to treat soil contamination that represented current and future risk to groundwater. SVE was selected as the preferred technology to eliminate the remaining shallow soil contamination at CI Plant 4 and also mitigate potential VI issues at the adjacent PFS-N building. SVE pilot testing was conducted in accordance with an Ecology-approved work plan and confirmed to be an appropriate remedy that was subsequently included in the FS Addendum (Farallon, 2023).

3.4 E4 Site Interim Actions and Pre-FS Interim Actions

Clean Earth/BE is included as a PLP for the W4 Site as a result of the migration of COCs and subsequent comingling in groundwater from the E4 to the W4 Site. Since 2002, Clean Earth/BE has conducted extensive interim cleanup actions in the E4 Site area, as summarized in this section. Clean Earth/BE's contribution to the VI mitigation program was discussed in Section 3.1.Other interim measures that pre-date the W4 Group are summarized below.

In 2003, Clean Earth/BE implemented an interim measure in the E4 Site area for groundwater control. The Hydraulic Containment Interim Measure (HCIM) is summarized below.

- Between 2003 and 2004, Clean Earth/BE installed a subsurface barrier wall that surrounds the Clean Earth/BE source area and is keyed into the aquitard underlying the facility, and installed a groundwater recovery system within the barrier wall that is designed to maintain an inward groundwater gradient.

- Since 2004, Clean Earth/BE has operated the groundwater recovery system to maintain an inward hydraulic gradient in groundwater. The effectiveness of the HCIM system is monitored using groundwater analytical data from samples collected quarterly from monitoring wells surrounding and inside the Clean Earth/BE facility.

4 Cleanup Objectives

This section describes W4 Site cleanup objectives, including cleanup standards, remediation levels, and remedial action objectives. As defined in WAC 173-340-200, a cleanup standard consists of a cleanup level for a hazardous substance present at a site, combined with the location where the cleanup level must be met (point of compliance), and other regulatory requirements that apply to the site ("applicable state and federal laws"). Pursuant to WAC 173-340-355, a remediation level is a concentration (or other method of identification) of a hazardous substance above which a particular cleanup action component will be required as part of a cleanup action. The remedial action objectives (RAOs) are specific goals to be achieved by remedial alternatives that meet cleanup standards and provide adequate protection of human health and the environment under a specified land use.

4.1 Cleanup Levels and Constituents of Concern

The W4 joint deliverable, "Revised Preliminary Site Cleanup Standards" outlined the preliminary cleanup standards for the W4 Site (Farallon, 2014). That deliverable tabulated PCULs based on chemical-specific Site ARARs (see Section 5) that are protective of the potential exposure pathways summarized in Section 2.4. For a given media (soil, groundwater, air and surface water) and location (e.g., shallow versus deeper groundwater), the lowest potentially applicable cleanup level is carried forward as the CUL. At the W4 Site, groundwater discharges to surface water, so evaluation of groundwater cleanup standards accounted for protection of surface water (WAC 173-340-720).

Since 2014, surface water criteria for protection of human health have been updated (EPA, 2022). Groundwater and air criteria for the protection of indoor air have been updated as well in accordance with Washington State's Guidance for Evaluating Vapor Intrusion in Washington State (Ecology, 2022b) and Ecology's Cleanup Level and Risk Calculation (CLARC) database. Updated CULs are presented in Table 4-1, where applicable.

W4 Site COCs that were carried through the FS process can be categorized as follows[8]:

CVOCs

- PCE
- TCE

[8] Ecology initially identified 1,4-dioxane as a groundwater COC for the W4 Site in the AO and iron as a groundwater COC during the RI process; however, with Ecology concurrence, they are not carried forward as site COCs (Aspect, 2023; Farallon, 2023). The concentrations of 1,4-dioxane in groundwater samples collected in the W4 Site (maximum of 150 micrograms per liter [µg/L]) are below the CUL for 1,4-dioxane (20,000 µg/L). The presence of 1,4-dioxane at concentrations below the CUL in SU1 groundwater appears to be due to migration of groundwater originating from the E4 Site and is being addressed by Clean Earth/BE under AO DE 7347. Freshwater criteria were previously listed for iron; however, the LDW is a tidally influenced marine environment and freshwater criteria are not applicable. Iron does not have criteria for marine waters.

- cis-DCE
- trans-1,2-Dichloroethene
- 1,1-Dichloroethene
- VC

Plating Metals

- Cadmium
- Copper
- Nickel
- Zinc

Non-plating Metals[9] (aka Redox-Sensitive Metals)

- Arsenic
- Manganese

4.2 Points of Compliance

The following points of compliance have been identified:

- **Soil[10]**
    - Protection of Groundwater Quality: throughout the W4 Site
    - Protection of Direct Contact: throughout the W4 Site to a depth of 15 feet bgs
- **Groundwater:** Standard point of compliance defined as "…throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site." WAC 173-340-720(8)(b).
    - Protection of Surface Water and Direct Contact: throughout the W4 Site
    - Protection of Air: at Water Table Interval throughout the W4 Site

4.3 Remediation Levels

Remediation levels (RELs) are concentrations (or other method of identification) of a hazardous substance used to identify where a particular cleanup action component is

[9] Elevated concentrations of the non-plating metals in groundwater are due to microbial degradation of organic materials in the aquifer matrix that has resulted in generally anaerobic conditions. Anaerobic conditions favor the dissolution of the non-plating metal COCs from the native aquifer materials. (Ecology, 2022a; USGS, 2019)

[10] Cleanup actions may also be considered to meet cleanup objectives if they satisfy the requirements of WAC 173-340-740(6)(f).

required as part of a cleanup action at a site (WAC 173-340-200). RELs for TCE and VC in LDW porewater were established in Section 4.3 of the SU1 FS Addendum (Aspect, 2023). Porewater REL development is described in Appendix D of the SU1 FS Addendum. The Porewater RELs represent treatment goals that would protect exposure pathways until CULs can be achieved throughout the W4 Site. The Porewater RELs for the W4 Site are as follows:

- TCE: 3.2 micrograms per liter (µg/L)
- VC: 0.82 µg/L

As described in Appendix D of the SU1 FS Addendum, achievement of Porewater RELs is evaluated on a surface area-weighted average concentration (SWAC) basis because the risk driver for this analysis is human consumption of shellfish exposed to contaminated porewater. Because porewater sampling is a complex undertaking and frequent porewater studies are impracticable, groundwater monitoring upgradient of the LDW will be used for remedial design and as a preliminary indication of remediation performance, with follow-up porewater monitoring to verify protectiveness.

Where Porewater RELs are exceeded, RELs for treating groundwater discharging to porewater will be determined by calculating CVOC concentrations in groundwater along treatment transects or in porewater on a SWAC basis, as described in Appendix D of the SU1 FS Addendum and applying the estimated reduction of CVOCs in groundwater needed to achieve Porewater RELs. Based on the 2020 porewater data, the goal of treatment upgradient of the SU1 porewater area exceeding Porewater RELs is to reduce the average concentration of CVOCs in groundwater by at least 83 percent.

4.4 Remedial Action Objectives

RAOs for the W4 Site are to reduce concentrations in each medium to the relevant CULs for a given pathway, and to prevent unacceptable exposure to concentrations exceeding CULs. Specific RAOs include:

- **RAO 1:** Reduce soil COC concentrations posing a potentially unacceptable direct contact health risk to acceptable levels. Or, if this is not practicable, reduce risks associated with contacting surface or subsurface soils to acceptable levels through the use of institutional controls or engineered barriers.
- **RAO 2:** Reduce soil and shallow groundwater CVOC concentrations posing a potentially unacceptable VI health risk to acceptable levels. Or, if this is not practicable, reduce risks associated with inhaling contaminated indoor air to acceptable levels through the use of institutional controls or engineered controls.
- **RAO 3:** Within a reasonable time frame, reduce soil and groundwater COC concentrations posing a potentially unacceptable health risk to human and ecological surface water receptors to acceptable levels. Or, if this is not practicable, reduce the health risks associated with COC exposure to acceptable levels through the use of institutional controls or engineered barriers.
- **RAO 4:** Reduce COC concentrations in groundwater discharging to surface water to CULs.

5 Applicable or Relevant and Appropriate Requirements

MTCA requires that cleanup actions comply with applicable state and federal laws (WAC 173-340-360[2] [a] [iii]), which include legally applicable requirements, as well as requirements that the department determines are relevant and appropriate. Applicable or relevant and appropriate requirements (ARARs) for cleanup actions often include various construction-related permits, air emission requirements, water discharge requirements, off-site disposal requirements, and other issues related to impacts in and around the site. ARARs can be categorized as follows:

- **Chemical-specific ARARs** are laws and requirements that establish health- or risk-based numerical values or methodologies for developing such values. These ARARs are used to establish the acceptable concentration of a chemical that may remain in or be discharged to the environment. As such, chemical-specific ARARs are considered in developing cleanup standards (Section 4).
- **Action-specific ARARs** are performance, design, or other requirements that may place controls or restrictions on a particular remedial action.
- **Location-specific ARARs** are requirements that are triggered based on the location of the remedial action to be undertaken.

MTCA authorizes Ecology to adopt cleanup standards for groundwater, soil, surface water, and air at sites where hazardous substances are present, and establishes processes for identifying, investigating, and cleaning up these sites.

Other ARARs for the W4 Site cleanup actions include:

- The federal Clean Water Act (33 United States Code [USC] Section 1251) and the Washington Water Pollution Control Act (Chapter 90.48 RCW; Chapter 173 201A WAC; Chapter 173-200 WAC). These ARARs apply to discharge of treated groundwater into the waters of the Duwamish.
- The RCRA and the Washington Hazardous Waste Management Act (Chapter 70.105 RCW; Chapter 173 303 WAC). These ARARs apply to the generation, transportation, treatment, storage, and disposal of hazardous materials generated at the W4 Site.
- Sediment Management Standards (Chapter 173-204 WAC).
- Washington State Shoreline Management Act (SMA). All work within the LDW shoreline jurisdiction must be compliant with the SMA (RCW 90.58) and the City of Seattle's Shoreline Master Program (SMP), including required evaluations to assess potential for presence and discovery of historic, archaeological, or cultural resources at the Site. Appropriate measures will be taken to evaluate the potential for presence of these resources.

- Federal and state Clean Air Acts (42 USC 7401 et seq.; 40 CFR 50; RCW 70.94; WAC 173-400, 403) and the Puget Sound Clean Air Agency (PSCAA; https://pscleanair.gov/). This ARAR potentially applies to the emission of volatile contaminants during soil vapor extraction.

- The State Environmental Policy Act (SEPA) (RCW 43.21C; WAC 197-11). A SEPA checklist will be completed, and a Threshold Determination will be issued by the Responsible Official, along with any additional required analysis. This analysis will include an evaluation to assess potential for presence and discovery of historic, archaeological, or cultural resources at the Site. Appropriate measures will be taken to evaluate the potential for presence of these resources.

- The Occupational Safety and Health Act (OSHA) (Part 1910 of Title 29 of the Code of Federal Regulations [29 CFR 1910]); General Occupational Health Standards (Chapter 296-62 WAC); and Safety Standards for Construction Work (Chapter 296-155 WAC). These ARARs apply to the health and safety of all parties on-site during remediation. Construction work will be conducted under site-specific health and safety plans in compliance with applicable safety regulations.

- Minimum Standards for Construction and Maintenance and Decommissioning of Wells (Chapter 173-160 WAC). This ARAR applies to monitoring well infrastructure required by the cleanup action. Construction of monitoring or remediation wells will be conducted by a Washington State licensed driller.

- Underground Injection Control Program (UIC, Chapter 173-218 WAC). This ARAR applied to the completed pilot tests and will also apply to the injection-based remediation at the W4 Site. Injection-based remedial actions must comply with the substantive requirements of the UIC program and UIC wells must be registered; however, a permit is not required for formal cleanup sites.

- Permits from local municipalities as required for activities at the W4 Site. Examples include King County and City of Seattle permits for sewer discharges, and City of Seattle grading permits, street-use permits, or shoreline permits.

Remedial design and implementation of the cleanup action will comply with the substantive requirements of these ARARs.

6 Remedial Alternatives

This section provides an overview of the remedial alternatives that were evaluated for SU1 and SU2 during the FS.

6.1 SU1

6.1.1 Alternative Descriptions

The SU1 FS identified and evaluated nine remedial alternatives (Alternatives 1 through 9) to achieve W4 Site RAOs for COCs. The FS Report included a technology screening evaluation, alternative cost estimate, and disproportionate cost analysis in accordance with MTCA (WAC 173-340-360). Table 4-1 summarizes the nine cleanup alternatives evaluated in the FS.

The SU1 FS alternatives were as follows:

- **Alternative 1**: pH neutralization and monitored natural attenuation (NA) at the ABP source area, and NA for the downgradient TCE Plume (pH/NA/NA);
- **Alternative 2**: pH neutralization and NA at the ABP source area, and ISCR along Fidalgo Street for the downgradient TCE Plume (pH/NA/ISCR @ Fidalgo);
- **Alternative 3**: pH neutralization and EAnB in the ABP source area, and EAnB along Fidalgo Street for the downgradient TCE Plume (pH/EAnB/EAnB @ Fidalgo);
- **Alternative 4**: pH neutralization and ISCR in the ABP source area, and ISCR along Fidalgo Street for the downgradient TCE Plume (pH/ISCR/ISCR @ Fidalgo);
- **Alternative 5**: pH neutralization and ISCR in the ABP source area, and EAnB along Fidalgo Street for the downgradient TCE Plume (pH/ISCR/EAnB @ Fidalgo);
- **Alternative 6**: pH neutralization and ISCR in the ABP source area, and ISCR along Fidalgo Street and EMW for the downgradient TCE Plume (pH/ISCR/ISCR @ Fidalgo, and EMW);
- **Alternative 7**: pH neutralization and ISCR in the ABP source area, and ISCR along Fidalgo Street, EMW, and 1st Avenue South for the downgradient TCE Plume (pH/ISCR/ISCR @ Fidalgo, EMW, and 1st Avenue);
- **Alternative 8**: ISCO and groundwater pump-and-treat (P&T) at the ABP source area, and ISCR along Fidalgo Street for the downgradient TCE Plume (ISCO/P&T/ISCR @ Fidalgo); and
- **Alternative 9**: Excavation/off-site disposal and in situ stabilization (ISS) at the ABP source area, and ISCR over the areal extent of the downgradient TCE Plume (Excavation/ISS/ISCR).

Each of these alternatives also includes some degree of engineered and institutional controls, as well as NA.

Alternative 1 was the recommended cleanup action for SU1 based on the analysis and considerations presented in the FS Report, but the FS Report acknowledged uncertainties regarding implementation of the alternative. In accordance with AO Amendment No. 1, the SU1 FS Addendum was prepared to refine the evaluation of remedial alternatives in the FS to address Ecology comments on the SU1 FS and within the context of data collected in SU1 since 2016, including pilot studies, groundwater and porewater monitoring, and the collection of water level data to evaluate groundwater flow variability. The SU1 FS Addendum evaluated the alternative recommended in the SU1 FS (FS Alternative 1) and the alternative identified by Ecology in a comment letter for further consideration (FS Alternative 5). Those alternatives were modified, based on the results of the pilot studies and monitoring conducted during the FS, as follows:

- The SU1 FS Alternative 1 was modified to include treatment in Fidalgo Street, based on the efficacy of the ISCR/EAnB Pilot Study and recent groundwater and porewater monitoring.
- SU1 FS Alternative 5 was modified, as discussed with Ecology in FS Addendum coordination calls, to replace the air sparge curtain along the LDW with treatment using ISCR and EAnB, based on the efficacy of the ISCR/EAnB Pilot Study.
- Both alternatives were modified to include combined ISCR/EAnB, rather than one or the other of these technologies. The technology selected for the pilot study, which resulted in effective CVOC treatment, combined ISCR and EAnB.

The modifications to these alternatives resulted in two new alternatives, which were renamed Alternatives 2A and 2B because they most closely resembled SU1 FS Alternative 2. These are summarized as follows:

- Alternative 2A:
    - ABP source area: pH neutralization
    - Downgradient TCE Plume: ISCR/ EAnB in Fidalgo Street
    - Contingency Actions: ISCR in the ABP source area to further reduce TCE concentrations, and ISCR/EAnB near the shoreline to address VC in porewater
- Alternative 2B:
    - ABP source area: pH neutralization
    - Downgradient TCE Plume: ISCR/EAnB in Fidalgo Street and ISCR/EAnB along the LDW shoreline

Both FS Addendum alternatives also incorporate engineered and institutional controls and NA in conjunction with active treatment to ensure protectiveness during the restoration period and ultimately achieve CULs across the W4 Site.

6.1.2 Summary of Alternative Evaluation

A total of 11 remedial alternatives were evaluated in the SU1 FS and SU1 FS Addendum. The remedial alternatives were evaluated against the following MTCA criteria in accordance with WAC 173-340-360(2):

Threshold Criteria

- Protection of human health and the environment
- Compliance with cleanup standards and applicable state and federal laws
- Provision for compliance monitoring

Other Criteria

- Use of permanent solutions to the maximum extent practicable
- Provision for a reasonable restoration time frame
- Consideration of public concerns

It was determined that all eleven alternatives would meet the requirements of the "threshold criteria."

A disproportionate cost analysis (DCA) was conducted to assess the extent to which the remedial alternatives would use permanent solutions to the maximum extent practicable. The DCA quantified the environmental benefits of each alternative, and then compared incremental benefits versus costs between alternatives. Costs are disproportionate to benefits if the incremental cost of a more permanent alternative over that of a lower-cost alternative exceeds the incremental benefits achieved by the more permanent alternative.

Based on the results of the DCA, Alternative 2A was the most cost effective of the eleven remedial alternatives. Tabulated DCA comparison of alternatives provided in Appendix C. Therefore, this alternative was deemed to satisfy the MTCA requirement for an alternative to be permanent to the maximum extent practicable.

All alternatives, including the most permanent alternative (Alternative 9) would have extended restoration timeframes. Some incremental benefit in restoration time frame can be achieved through implementation of additional treatment measures, but these measures are costly relative to the incremental reduction in restoration time frame. For the selected alternative (2A), the time to achieve VI-based CULs for groundwater is estimated at 25 years, the time to achieve surface water-based CULs discharging to the LDW is estimated at 50 years, and the time to achieve surface water-based CULs for groundwater everywhere is estimated to be close to 280 years. It is anticipated that Porewater RELs could be achieved within 13 years under Alternative 2A. EPA is overseeing the design of the cleanup plan for the Lower Duwamish Waterway Superfund Site (LDW Site), and the estimated cleanup time for Alternative 2A is significantly faster than the time predicted for the LDW Site cleanup to achieve its target levels (at least 20

years)[11]. Selected Alternative 2A provides for a reasonable restoration time frame. If performance monitoring data indicate the time to achieve Porewater RELs is longer than expected and not adequately protective, contingency actions would be implemented as described in Section 7.7.

6.2 SU2

6.2.1 Alternative Descriptions

The SU2 FS identified and evaluated six remedial alternatives (Alternatives 1, 2A, 2B, 3A, 3B, and 4) that provided a broad range of treatment and containment options.

The SU2 FS alternatives were as follows:

- **Alternative 1:** Alternative 1 focused on NA of CVOCs in groundwater with targeted soil remediation by ISCO in selected source area hot spots at CI Plant 4.
- **Alternative 2A:** Alternative 2A focused on targeted CVOC remediation by EAnB in selected source area hot spots and downgradient groundwater locations near CI Plant 4, Plant 2, BDC source area, and the commingled plume; and targeted soil remediation by ISCO in selected CVOC source area hot spots at CI Plant 4.
- **Alternative 2B:** All elements of Alternative 2B were the same as Alternative 2A, with the exception of an additional EAnB treatment line along 1st Avenue intercepting the downgradient extent of the commingled CVOC plume in the vicinity of CI 14-35 and CI-15-60, and elevated cis-DCE and VC in the vicinity of the CG-141 Site Boundary Area, and the application of excavation at CI Plant 4.
- **Alternative 3A:** Alternative 3A focused on targeted groundwater remediation by ISCO in selected source area CVOC hot spots at CI Plant 4, ISCR in selected CVOC source area hot spots at CI Plant 4, CI Plant 2, BDC source area, and commingled CVOC plumes and downgradient groundwater locations.
- **Alternative 3B:** All elements of Alternative 3B were the same as Alternative 3A, with the exception of an additional line treatment line along 1st Avenue intercepting the downgradient extent of the commingled CVOC plume in the vicinity of CI 14-35 and CI-15-60, and elevated cis-DCE and VC in the vicinity of CG-141 at the Site Boundary Area.
- **Alternative 4:** Alternative 4 was similar to Alternative 1 but evaluated AS/SVE as technologies for soil and groundwater treatment of CVOCs at CI Plant 4.

[11] According to the LDW Site ROD (EPA, 2014), protective levels are anticipated to be achieved within 17 years of beginning construction, assuming that construction will take 7 years. This time frame is consistent with Ecology guidance that sediment cleanups will generally achieve protective levels within 10 years of completing construction (Ecology, 2021). Construction of the LDW Site remedy for the upper reach is currently scheduled to begin in 2025. For the lower reach (the area where the groundwater plume discharges), this time frame will be significantly longer as design and construction are not currently scheduled.

Cleanup elements in the BDC source area, CI Plant 2, and downgradient groundwater areas were the same as in Alternative 1.

Each of these alternatives also includes some degree of engineered and institutional controls, as well as NA.

Alternative 1 was the recommended cleanup action for SU2 based on the analysis and considerations presented in the FS Report, but the FS Report acknowledged uncertainties regarding implementation of the alternative due to certain technologies had not been pilot tested including ISCO and SVE. Ecology's review of the FS resulted in creation of a seventh alternative, Alternative 1R, that was Ecology's preferred alternative. Alternative 1R, which is a modified version of Alternative 1, is summarized below.

In accordance with the AO Amendment No. 1 and based on comments received from Ecology, the SU2 FS Addendum proposed a selected alternative, which is a modification of the preferred remedial alternative selected in the FS. Alternative 1R comprises NA of CVOCs in SU2 groundwater, targeted soil remediation of CVOCs at CI Plant 4 by SVE, and engineered and institutional controls.

Alternative 1R was modified to include SVE treatment rather than ISCO at CI Plant 4 due to pilot testing results described in Section 3.2.4 that indicated ISCO was not a feasible remediation technology at CI Plant 4. SVE was originally a component of Alternative 4. SVE pilot testing was conducted in accordance with an Ecology-approved work plan and confirmed to be an appropriate remedy that was subsequently included in Alternative 1R (Farallon, 2023). Alternative 1R also includes NA with a long-term groundwater monitoring program to confirm that natural attenuation continues to be sufficiently protective of the LDW, associated receptors within the plume areas, and evaluate whether a future contingency action is necessary. The selected cleanup alternative also includes engineered and institutional controls to protect human health and the environment until the cleanup standards are achieved.

6.2.2 Summary of Alternative Evaluation

A total of seven remedial alternatives were evaluated in the SU2 FS and SU2 FS Addendum. The remedial alternatives were evaluated against the MTCA criteria in accordance with WAC 173-340-360(2) that are cited in Section 6.1.2.

It was determined that all seven alternatives would meet the requirements of the "threshold criteria."

A DCA was conducted to assess the extent to which the remedial alternatives would use permanent solutions to the maximum extent practicable. The DCA quantified the environmental benefits of each alternative, and then compared incremental benefits versus costs between alternatives. Costs are disproportionate to benefits if the incremental cost of a more permanent alternative over that of a lower-cost alternative exceeds the incremental benefits achieved by the more permanent alternative.

The SU2 FS included evaluation of six alternatives that met the threshold requirements above. The final ranking scores based on the cost to benefit ratio analysis ranged from 2.8 to 13.9. Alternative 1 was selected based on it having the lowest overall cost to benefit ranking score of 2.8. As discussed in the previous section, Alternative 1 was modified

replacing ISCO with SVE at CI Plant 4 due to pilot testing results confirming that ISCO was not a feasible cleanup technology. Alternative 1R was not re-evaluated to compare the cost to benefit ranking scores with the other five remedial alternatives from the SU2 FS. Ecology concurred that the change from ISCO to SVE at CI Plant 4 would not substantively affect the costs and benefits for Alternative 1R in a manner that could result in the cost to benefit ranking score exceeding the next lowest remedial alternative ranking score of 3.9 for Alternative 4 (Farallon, 2023). Tabulated DCA comparison of alternatives provided in Appendix C.

Based on the results of the DCA, Alternative 1R was the alternative with the greatest benefit in relation to its cost. Therefore, this alternative was deemed to satisfy the MTCA requirement for an alternative to be permanent to the maximum extent practicable.

All alternatives summarized herein have extended restoration timeframes. Some incremental benefit in restoration time frame can be achieved through implementation of additional treatment measures; however, the lower potential risks to human health and the environment and diffuse plume distributions outside the PLP source areas in SU-2 do not support the relatively costly implementation of the additional treatment measures that the FS evaluation work had shown would have a nominal decrease in the restoration time frame. For the selected alternative (1R), the time to achieve GW-based CULs is estimated at: 9-99 years in the vicinity of the BDC/CI Plant 2 plume; and 0-71 years in the CI Plant 4 vicinity.

7 Selected Cleanup Action

This section describes the selected cleanup action for the W4 Site, consisting of the following components:

- pH neutralization for groundwater in the vicinity of the ABP Property;
- Injection-based treatment using ISCR/EAnB reagents for groundwater in Fidalgo Street in SU1;
- SVE at CI Plant 4;
- Institutional and engineering controls as appropriate throughout the W4 Site;
- NA for groundwater throughout the W4 Site;
- Compliance groundwater monitoring site-wide; and
- Contingency actions where necessary at the W4 Site.

7.1 ABP Property pH Neutralization (SU1)

The selected cleanup action for addressing metals impacts at the ABP Property is pH neutralization. Groundwater with a pH less than 6 at the Water Table Interval beneath and immediately downgradient of the ABP Property will be neutralized to immobilize dissolved plating metals. Raising the groundwater pH to more-neutral conditions (i.e., around pH 7) induces precipitation of metals from groundwater and sorption to soil. The effectiveness of pH adjustment for immobilizing plating metals at the ABP Property was demonstrated through pilot testing (Aspect, 2022c).

The conceptual design presented herein will be refined during remedial design. Conceptual injection layouts are shown on Figure 7-1. The pH neutralization solution (likely 0.1 molar sodium bicarbonate and 0.05 molar sodium hydroxide) will be delivered through new permanent injection wells, existing SVE or monitoring wells, and temporary direct-push injection points. Injection points would be installed to a total depth of approximately 20 feet, and reagent would be injected into the 10- to 20-foot depth interval (Water Table Interval). For temporary injection point application, the reagent solution would be pumped from the tank into a piping manifold connected to injection points. Instrumentation would be provided for monitoring and controlling solution flow rates to different segments of the injection-well system.

Remedial design of the initial injection event will be detailed in an Engineering Design Report (EDR) for review and approval by Ecology. The final design for full-scale application will evaluate and consider local pH conditions and will focus reagent application on areas and depth intervals of lowest pH. The remedial design will include injection layouts, injection chemistry, and performance-based specifications for contractor implementation. Registration of injections wells with Ecology's UIC program, traffic control plans, City of Seattle permitting, and utility locating will also be completed prior to injections.

The overall objectives of pH neutralization are to immobilize plating metals, prevent migration of plating metals to the LDW above surface water CULs, and achieve a pH range that is conducive to natural attenuation of TCE. The EDR will identify a performance monitoring program to evaluate when these objectives are achieved.

7.2 Fidalgo Street ISCR/EAnB Application (SU1)

The selected cleanup action for the downgradient TCE Plume is ISCR/EAnB application. The downgradient TCE Plume along Fidalgo Street will be treated by reducing groundwater concentrations of CVOCs approaching the LDW and achieving Porewater RELs. Groundwater concentrations of CVOCs will be reduced by injection-based remediation using ISCR and EAnB technologies. The ISCR/EAnB Pilot Study demonstrated that ISCR/EAnB substantially reduces CVOC concentrations in and downgradient of the treatment area (Aspect, 2022b).

The conceptual design presented herein will be refined during remedial design. The remedial injections will include design, permitting, contracting and field work to inject reagents and treat CVOCs in groundwater. Conceptual injection layouts are shown on Figure 7-2. The remedial injections will utilize reagent chemistries that target chemically and biologically mediated treatment of CVOCs in groundwater. The chemistry consists of ISCR using a zero-valent iron-based amendment (EHC-Liquid power) and EAnB with a soluble and/or semi-soluble carbon-containing amendment (ELS-emulsion). The reagent mixture would contain approximately 13,000 mg/L total organic carbon. ISCR and EAnB will be implemented via pressurized direct-push injection. Transects would consist of two offset rows of injection points spaced approximately 6 feet on-center. Methane in soil gas will be monitored during the treatment period, and accumulation of methane beneath nearby structures would be mitigated using passive venting wells.

The lateral and vertical extent of treatment will target the area of the plume requiring treatment to achieve Porewater RELs. The estimated lateral extent is based on historical groundwater and porewater data, and the vertical extent of treatment is assumed to be from 20 to 30 ft bgs based on the pilot study recommendations. A baseline investigation would be conducted along potential treatment transects as part of the design. CVOC concentrations along each transect would be evaluated through a combination of monitoring wells, to be used as future performance monitoring points, and direct-push sampling to refine the lateral and vertical extent of CVOCs. The area targeted for treatment would be determined by the area required to reduce the average concentration in groundwater upgradient of the porewater study area by at least 75 percent.

Remedial design of the initial injection event will be detailed in an EDR for review by Ecology. The EDR will include injection layouts, injection chemistry, and performance-based specifications for contractor implementation. Registration of injections wells with Ecology's UIC program, traffic control plans, City of Seattle permitting, and utility locating will also be completed prior to injections.

As explained in more detail in the CVOC Pilot Study Completion Report (Aspect, 2022b), more than one injection will likely be needed to maintain treatment during the time period until upgradient groundwater has sufficiently attenuated such that additional active treatment is no longer needed to meet Porewater RELs. Subsequent injections would be located along the same transects and likely require less reagent to achieve

objectives. The frequency of injections to maintain treatment is expected to decrease with time. Performance monitoring to be outlined in the EDR will be used to determine the frequency and scale of additional injection events.

7.3 Capital Industries Plant 4 SVE (SU2)

The selected cleanup action for CI Plant 4 includes NA of CVOCs in groundwater, targeted CVOC soil remediation at CI Plant 4 by SVE, and engineered and institutional controls at the source and downgradient plume areas. The details of the SVE application are provided below. The compliance monitoring associated with the remaining SU2 sources is described in Section 7.6.2.

7.3.1 Description of the Cleanup Action

The selected cleanup action includes installation of an SVE remediation system to remediate concentrations of PCE and TCE in shallow, near surface soil. SVE is the process of inducing a pressure and concentration gradient in the subsurface to cause VOCs to desorb from the soil and flow with the vapor stream to a common collection point for discharge to the atmosphere. Extracted soil vapors may be treated at the surface prior to disposal into the atmosphere. SVE is a proven technology for treatment of soil with concentrations of CVOCs exceeding CULs and is considered an effective and implementable technology at CI Plant 4.

The SVE system will be designed to provide the maximum treatment radius practical to remove PCE and TCE present in soil and soil vapor in the vadose zone. The preliminary SVE design is based on a treatment radius of 25 feet from each SVE well based on the SVE pilot test results. The SVE pilot test results indicated that the proposed SVE system will likely remove concentrations of PCE and TCE present in soil and soil vapor throughout CI Plant 4. Engineering drawings of the SVE system are included in Appendix A. A description of the key elements of the SVE system and operations follows.

The SVE system will consist of nine SVE wells installed at locations shown on Sheet EN2.00 of Appendix A. Vacuum for the SVE system will be applied using a Rotron DR808 regenerative blower, which will produce a flow of 320 standard cubic feet per minute at 32 inches of water vacuum. A moisture separator will be installed in the intake pipe to the blower to protect the blower from potential water damage.

The extracted vapor from the SVE system will be monitored and sampled to confirm that concentrations of PCE and TCE are within the air discharge limits established by the Puget Sound Clean Air Agency. It is not anticipated that the vapors will exceed the discharge limits based on the results of the pilot study. Air will be discharged via a 4-inch-diameter stack not less than 6 inches above the roof and not less than 10 feet from any operable openings or air intake. Monitoring and sampling of the vapor emissions will continue monthly following start-up of the SVE system. The schedule will be modified thereafter, as needed, based on the initial sampling results.

The permitting process and contractual arrangements with the selected contractor to conduct installation of the SVE system will be completed following finalization of the CAP. Approximately 15 to 20 days will be required to install the SVE system following completion of permitting.

Regular system monitoring will be conducted during the initial start-up period to make sure the SVE system operates as designed. The initial start-up will occur after SVE system installation. Following start-up and evaluation to assess performance of the SVE system, system operations and maintenance site visits will be performed monthly for the duration of system operations until performance soil gas removal results indicate that the CULs for soil have likely been achieved. An Operations and Maintenance Manual will be prepared following the installation and will include at a minimum:

- As-built drawings;
- Details regarding all SVE system components;
- Start-up and shutdown protocols;
- Details regarding compliance monitoring including but not limited monitoring and sampling frequency, locations, and analysis;
- Safety and emergency protocols;
- Data evaluation criteria; and
- Termination of operation/decommissioning criteria.

Details regarding the cleanup action activities conducted each quarter will be documented in the required quarterly progress reports.

SVE performance monitoring data for PCE and TCE mass removal will be evaluated to determine when the CULs in soil have likely been achieved. Soil sampling will likely be conducted at locations and depths where soil results prior to the cleanup indicated that CVOCs concentrations exceeded the CULs. If soil confirmation data indicate isolated exceedances, statistical methods may be used to further evaluate those data to determine whether the cleanup standards have been achieved or whether further action is necessary. If the current soil results indicate that CVOCs are less than the CULs, the soil samples will be considered confirmation soil samples and SVE system will be decommissioned. If additional cleanup is required, the SVE system operations and/or the SVE system components will be evaluated to determine whether the technology can be better optimized to achieve the cleanup standards. SVE operations would continue for a time frame to be determined based on the performance monitoring results. Additional soil sampling or statistical analyses will be conducted as necessary to confirm the cleanup standards have been achieved.

7.4 Natural Attenuation (SU1 and SU2)

The selected cleanup action for the W4 Site includes NA to address the residual impacts to groundwater that exceed applicable groundwater CULs. This process relies on the attenuation of COCs in groundwater by natural processes including biodegradation, abiotic degradation, adsorption, and dilution. Natural attenuation of metals may occur through immobilization via sorption or precipitation. Natural attenuation of some metals may be enhanced by conditions that result in a change in the valence state of the metal, such as an increase in redox potential in some near shore environments. NA includes a source control component followed by long-term groundwater monitoring to document remediation progress and verify plume stability.

NA will address the following areas of contamination in SU1:

- Plating metals in groundwater at the ABP source area following pH neutralization;
- CVOCs in groundwater at the ABP source area following the interim AS/SVE removal action; and
- CVOCs in groundwater outside areas outside the Fidalgo Street ISCR/EAnB application area.

NA will address the following areas of contamination in SU2:

- CVOCs in groundwater in the BDC source area and the CI Plant 2 area;
- CVOCs in the CI Plant 4 area following SVE implementation; and
- CVOCs in groundwater outside the SU2 source areas at the BDC and CI properties.

The details of long-term monitoring, including monitoring locations and frequencies, are provided in Section 7.6.

7.5 Institutional and Engineered Controls (SU1 and SU2)

Engineered and institutional controls would be maintained until RAOs are achieved and compliance monitoring indicates they are no longer necessary. This includes:

- Maintaining and operating existing vapor mitigation systems at the ABP Property, 218 and 220 Findlay Street.
- Maintaining hard surfaces at the ABP Property as an effective cap to mitigate contact with contaminated media until concentrations in soil are demonstrated to be protective of direct contact.
- Maintaining hard surfaces at the CI Property as an effective cap to mitigate contact with contaminated media until concentrations in soil are demonstrated to be protective of direct contact.
- Placing an environmental covenant on the ABP Property.
- Placing an environmental covenant for CI Plant 4, if soil exceeding CULs remains following the cleanup action.
- Providing notifications to area underground utility providers of the presence of CVOC in water table groundwater until CULs are achieved. Notification procedures will be presented to and approved by Ecology.

The existing VIAMM Plan identifies a tiered approach to assessing buildings for VI and conducting monitoring and mitigation as needed (Farallon, 2015). This plan will continue to be implemented until CVOC concentrations in groundwater are protective of air.

Environmental Covenants, if needed, will be implemented following approval by Ecology and completion of administrative and recording requirements according to RCW 64.70 and 65.04.

7.6 Compliance Monitoring

The selected cleanup action will include periodic compliance monitoring (protection, performance, and confirmation monitoring) of the remedial action, in accordance with WAC 173-340-410, as follows:

- **Protection Monitoring** is conducted to ensure human health and the environment are protected during construction and operation of the cleanup action.
- **Performance Monitoring** confirms that the cleanup action has attained cleanup standards, remediation levels, or other performance standards such as permit requirements.
- **Confirmation Monitoring** confirms the long-term effectiveness of the cleanup action once cleanup standards and remediation levels or other performance standards have been attained.

Compliance monitoring for active treatment technologies and for NA are discussed separately, below.

7.6.1 Active Treatment Technologies

Implementation of active treatment technologies – pH neutralization, ISCR/EAnB, and SVE – will include protection and performance monitoring. Protection monitoring will be provided as part of EDR health and safety plans prepared for specific cleanup components and updated accordingly throughout the cleanup action. Performance monitoring for active treatment technologies will be conducted as generally described in Sections 7.1, 7.2, and 7.3 above, and specific monitoring programs will be defined in their respective EDRs. The performance monitoring program described in the EDRs will include criteria for when active treatment can cease and transition to NA. It is expected that CULs will ultimately be achieved by NA, and that confirmation monitoring will be performed as part of NA monitoring (see Section 7.6.2).

7.6.2 Natural Attenuation Monitoring

This section describes long-term performance and confirmation monitoring to evaluate NA performance and ultimately confirm compliance with cleanup standards. This program will be described in a Long-Term Groundwater Monitoring Plan that will include a sampling and analysis plan and quality assurance project plan.

The compliance groundwater monitoring program for NA presents the methods that the W4 PLPs will use at the W4 Site for performance and confirmation groundwater sampling and the decision criteria for the transition from performance sampling to confirmation sampling. For the purposes of groundwater monitoring, the W4 Site has been subdivided into four groundwater plume areas, as illustrated on Figure 7-3, to allow the PLPs flexibility in allocating sampling resources in an efficient manner: SU1, SU2 BDC/CI Plant 2, SU2 CI Plant 4, and Site Unit Boundary Area.

Performance sampling will consist of collecting groundwater samples for laboratory analysis at the selected sample frequency (1 year, 2 years, or 5 years) and comparing the laboratory analytical results to their respective site-specific CULs to assess compliance with the RAOs. During performance monitoring, the compliance monitoring program will be reviewed at 5-year intervals to evaluate changes[12] in sampling locations and frequency to achieve the RAOs. Once the performance groundwater monitoring data indicate that the applicable RAOs have been met throughout the sampling subarea, final confirmation monitoring will be implemented. Confirmation monitoring will consist of four quarterly sampling events using the set of performance monitoring wells approved during the most recent 5-year review cycle. Following concurrence from Ecology that the RAOs have been achieved, all monitoring wells will be decommissioned[13]. The compliance monitoring program meets the MTCA requirement (WAC 173-340-410) to provide compliance monitoring to verify cleanup.

7.6.2.1 SU1 Monitoring

Existing natural attenuation processes will address residual contamination of CVOCs and metals in groundwater in SU1 not addressed by active treatment. The effectiveness of the natural attenuation will be monitored by conducting long-term compliance monitoring until CULs are met.

Groundwater. The compliance groundwater monitoring plan for SU1 is provided in Table B-1 of Appendix B and on Figure 7-4[14], and includes monitoring of the following:

- Plume centerline and boundary wells, to confirm the plumes are stable or shrinking;
- Wells with CVOCs at the water table to evaluate the VI pathway;
- Wells along the LDW shoreline, to evaluate the groundwater-to-surface water pathway.

Initial sampling frequencies will be annual monitoring for VI and shoreline wells and biennial monitoring at plume centerline and boundary wells. Sampling frequency will be evaluated during the 5-year review cycle. Sampling frequency will decrease at wells exhibiting consistent stable or declining trends. For the purposes of this plan, we have assumed that wells will be sampled every 5 years after Year 10. If increasing trends are observed, sampling frequency may remain the same or be increased.

Porewater. Porewater sampling will be conducted to confirm Porewater RELs are achieved after treatment objectives are achieved at shoreline wells. Porewater sampling

[12] Changes to the sampling locations may include replacing wells or, upon Ecology approval, removing those wells from the program for which sampling results have met the RAOs for at least four consecutive sampling events.

[13] Performance wells may be selected for decommissioning during the 5-year review process. This process would be on a well-by-well basis as long as remedy performance and confirmation monitoring can be achieved with the remaining well network.

[14] Table B-1 and Figure 7-4 also identify wells to be maintained for potential performance monitoring of active treatment technologies. The EDRs will identify monitoring frequencies for those wells and may identify additional performance monitoring locations.

will be conducted in the zone of groundwater discharge, as identified in prior porewater studies, offshore of locations exhibiting groundwater concentrations above the Porewater REL. The timing of porewater sampling will depend on performance monitoring of the Fidalgo Street ISCR/EAnB Injections, and specific sampling plan will be described in a future work plan.

Soil. Confirmation soil monitoring will be performed to evaluate achievement of CULs for direct contact in the vadose zone at the ABP Property in the future when the potential area of impact beneath the current plating operations area is accessible by a drill rig. Achievement of soil CULs protective of groundwater will be evaluated via groundwater monitoring for empirical demonstration.

7.6.2.2 SU2 Monitoring

RAOs for groundwater will be met by the permanent destruction of CVOCs through ongoing natural attenuation processes demonstrated to be occurring in all groundwater intervals during the RI/FS work (Farallon, 2023). NA will be demonstrated through ongoing compliance groundwater monitoring throughout the duration of the cleanup action until the cleanup standards are achieved or the SU2 plumes are no longer stable to decreasing, presenting sufficient risk to human health and/or the environment, triggering a need for contingency action(s) or other measures to meet the RAOs.

The compliance groundwater monitoring for SU2 has been divided according to sources for the two distinct CVOC plumes, which include the commingled CVOC plumes originating from BDC and CI Plant 2 (Figure 7-5) and a separate smaller CVOC plume associated with CI Plant 4 (Figure 7-6). The compliance monitoring program includes wells that will be monitored more frequently to ensure that downgradient receptors, the LDW and Slip 2, remain protected (for contingency action evaluation); and wells proximate to the former source areas, plume center, and boundaries to monitor natural attenuation rates/plume stability for comparison with the modeling results and restoration timeframes presented in the SU2 FS documents. The compliance groundwater monitoring program for each area is summarized below and presented in Table B-2.

Commingled SU2 BDC/CI Plant 2 Area

The compliance monitoring program for the BDC/CI Plant 2 area will be conducted to evaluate the effects of the historical source area remediation actions, monitor natural attenuation of residual CVOCs within the plume area (Figure 7-5), confirm plume stability, refine restoration timeframe estimates, and assess whether a contingency action at Slip 2 is warranted. Key indicator monitoring wells in all three groundwater intervals that have been historically used to evaluate the plume stability and natural attenuation potential during the RI/FS will be included in the long-term compliance monitoring for this area.

The BDC/CI Plant 2 area compliance monitoring details follow:

- Annual contingency action and NA performance evaluation monitoring will be conducted at the CI-13 well cluster, including CI-13-WT, CI-13-40, and CI-13-60, located upgradient of Slip 2.
- Every 5 years, NA and plume stability performance monitoring will be conducted at key monitoring wells within the plume boundaries downgradient of BDC and

CI Plant 2 and reviewed thereafter to evaluate potential changes in sampling frequency. The monitoring wells are CI-10-WT, CI-12-35, CI-10-35, CI-14-35, CI-10-65, and CI-14-70.

- Every 5 years, former source area performance monitoring will be conducted at key monitoring wells closer to the former source areas at BDC and CI Plant 2 to monitor natural attenuation of the residual CVOCs and refine restoration time frames. The monitoring wells are BDC-6-WT, MW-2, BDC-6-30, CG-137-40, BDC-6-60, and CI-137-50.

The compliance groundwater sampling program for this area will be reviewed every 5 years to evaluate whether changes in sampling locations and frequency are required to achieve the RAOs.

SU2 CI Plant 4 Area

The compliance monitoring program for the CI Plant 4 area will evaluate the effects of the soil remediation work on groundwater quality, monitor natural attenuation of residual CVOCs within the plume area (Figure 7-6), and refine restoration timeframe estimates. The CVOCs associated with historical releases at CI Plant 4 are limited to the Water Table Interval and potentially the Shallow Interval based on detections of cis-1,2-dichloroethene and VC present in the Shallow Interval. However, these CVOCs have also been detected in the Shallow Interval upgradient of CI Plant 4 and may potentially be associated with the E4 Site. The Intermediate Interval in the CI Plant 4 area includes low detections of VC only and are not associated with releases at CI Plant 4 and will be included in the long-term compliance monitoring program for CI Plant 4.

The CI Plant 4 area compliance monitoring details follow:

- Annual SVE and NA performance monitoring will include Water Table Interval monitoring wells CI-MW-6 and CI-MW-7 for each year of SVE operation. Following confirmation of soil cleanup at CI Plant 4, the frequency of monitoring will be reduced to once every 5 years until the CULs are achieved; and
- Monitoring wells CI-7-40, CI-9-WT, and CI-9-40 will be sampled at a frequency of once every 5 years until CULs are achieved.

The compliance groundwater sampling program for this area will be reviewed every 5 years to evaluate whether changes in sampling locations and frequency are required to achieve the RAOs.

7.6.2.3 Site Unit Boundary Area

The compliance monitoring program for the Site Unit Boundary Area is being conducted to monitor the natural attenuation, plume stability, and refine restoration timeframe estimates associated with an unidentified source of elevated VC in the Shallow and Intermediate Intervals that poses a potential risk to the LDW (Figure 7-7). The compliance monitoring results will be used to assess whether a contingency action to protect the LDW receptors will be necessary in the future.

Site Unit Boundary Area compliance monitoring will be conducted as follows:

- Annual monitoring for CVOCs will be conducted at monitoring wells CI-19-30, MW-23-30. MW-23-30 is also a monitoring well used for the SU1 cleanup and will be retained for sampling for the SU1 cleanup. The data will also be used to evaluate the Site Boundary Area status.
- Every 5 years, performance monitoring will be conducted at key monitoring wells where elevated concentrations of VC have been identified and along the periphery of the plume to monitor natural attenuation and restoration time frames at each location. The monitoring wells that will be sampled include CG-141-40, CG-141-50, CI-15-40, CI-15-60, CG-140-40, and CI-12-35. MW-23-50 will also be sampled at a 5-year frequency based on historical monitoring data that has indicated that all CVOCs have been less than the CULs.

The compliance groundwater sampling program for this area will be reviewed every 5 years to evaluate whether changes in sampling locations and frequency are required to achieve the RAOs.

7.7 Contingency Actions

Contingency actions may be implemented if a cleanup action is insufficiently protective or if RAOs for achieving CULs within a reasonable restoration time frame are not met. The potential pathway of greatest concern is achieving Porewater RELs in groundwater discharging to the LDW. Therefore, a contingency action for addressing CVOCs discharging to the LDW is included as part of this cleanup action plan. The contingency actions outlined in this section would be considered for three areas: the Fidalgo shoreline (downgradient of the SU1 TCE plume), the Slip 2 shoreline (downgradient of the SU2 TCE plume), and the Site Unit Boundary Area shoreline.

A contingency action technology that is currently anticipated to be most applicable involves injection-based treatment of the CVOCs using EAnB and/or ISCR. These technologies were selected based on the results of pilot testing s at SU1 (Aspect, 2022b). However, groundwater conditions at the shoreline are different than in the pilot test area due to tidal influence and the presence of a more degraded plume dominated by vinyl chloride. Furthermore, application results in SU1 will continue to be evaluated and the evolution of alternative technologies will be monitored to confirm that an appropriate technology is selected prior to implementing a contingency action. Therefore, if a contingency action is determined to be needed, the appropriate technology and implementation approach would be re-evaluated at that time, and it is possible that further pilot testing would be needed.

The contingency action process described below includes evaluation of triggers for contingency action, a baseline investigation, pilot study design and implementation, and full-scale design and implementation.

7.7.1 Triggers for Contingency Action

Implementing a contingency action for groundwater treatment would be based on compliance monitoring data (Section 7.6) from monitoring wells next to the LDW. Based on nature and extent of CVOCs, we identified the following contingency action areas and their associated monitoring wells (shown on Figure 7-3):

- Fidalgo Shoreline
    - Monitoring wells proximate to the Fidalgo Shoreline MW-22-30, MW-23-30, CG-151-25
- Slip 2 Shoreline
    - Monitoring wells proximate to Slip 2, CI-13-WT, CI-13-30, and CI-13-60
- Site Unit Boundary Area Shoreline
    - Monitoring well CI-19-30 located proximate to the LDW

Performance monitoring data from the monitoring wells identified above will be used to evaluate CVOC trends to determine whether a contingency action may be necessary and if treatment is recommended. Evaluation and implementation of contingency actions will include:

- Review groundwater performance monitoring trends at the selected monitoring wells and estimate the time frame to achieve Porewater RELs.
- Use the groundwater performance monitoring data to evaluate current temporal trends and determine if a statistically significant increasing trend is occurring that may pose an unacceptable risk to the surface water receptor. An increasing trend/risk evaluation will consist of a review of monitoring data and the conceptual model, including attenuation, to assess the origin of the increase and if the increase is likely to be sustained or transient.

A phased contingency action approach will be conducted if the performance monitoring data indicate the following:

1. A statistically significant increasing trend in CVOC concentrations is occurring and sustained in groundwater at the shoreline, and concentrations of CVOCs at the shoreline pose a risk[15] to the LDW; or
2. The time frame to achieve Porewater RELs is more than 20 years after initiating the selected cleanup action.

The phased approach, discussed in the following sections, includes porewater investigation, baseline investigation and remedy selection, and remedy design/implementation.

7.7.2 Phase 1: Porewater Investigation

Porewater sampling would be conducted to evaluate whether Porewater RELs have been achieved or are likely to be achieved within an acceptable time frame. Porewater sampling would be focused offshore on shoreline monitoring well(s) that have exhibited conditions that triggered the contingency action.

A work plan for conducting porewater evaluation work, including the number and location of samples, would be prepared by the PLPs and reviewed by Ecology. Upon

[15] The FS determined the primary exposure risk is for humans consuming clams harvested from the Lower Duwamish Waterway (Aspect, 2023). Evaluation of risk would include estimating porewater concentrations and evaluating potential consumption scenarios.

Ecology's approval of the work plan, the porewater sampling would be conducted and the results evaluated to determine if Phase 2 is required. Collection and analysis of porewater samples would be conducted in the groundwater plume discharge area. Surface area-weighted average concentrations of porewater within the groundwater discharge area would be calculated as described in Appendix D of the SU1 FS Addendum (Aspect, 2023) in accordance with Ecology guidance (Ecology, 2021), or most current applicable methodology. If the calculated surface area-weighted average concentration in the site groundwater discharge area is less than the porewater REL for VC of 0.82, protection of human health is indicated, and no further action would be taken. If the surface area-weighted average porewater concentration in the site groundwater discharge area exceeds the porewater REL and the investigation is considered accurate and complete, Phase 2 of the contingency plan would be implemented.

7.7.3 Phase 2: Baseline Investigation and Remedy Selection

A baseline shoreline investigation would be conducted to refine the lateral and vertical extent of a treatment area that would be targeted. CVOC concentrations in groundwater upgradient of the shoreline would be evaluated through a combination of monitoring wells (to be used as future performance monitoring points) and direct-push sampling to refine the lateral and vertical extent of CVOCs. Contingent on private property access, the investigation would be as close to the shoreline as practicable, upgradient of the porewater results exceeding RELs as defined in Phase 1. The treatment area would be defined by the investigation results and the area required to achieve Porewater RELs following the REL approach described in Section 4.3.

Following the baseline investigation, the collective data would be used to identify a feasible and practicable appropriate remedial approach based on the specific contaminants, their spatial distribution, and treatment objectives. Potential remedial actions would be re-screened for feasibility consistent with MTCA remedy selection and evaluation (WAC 173-340-350 and -360). A pilot study may be conducted as part of remedy evaluation to assess reagent effectiveness and potential for secondary water quality impacts in the area targeted for treatment. If treatment effectiveness near the shoreline is limited due to tidal effects and geochemical conditions, or if secondary water quality impacts from treatment are a concern, the implementation of shoreline treatment would be reconsidered in consultation with Ecology. If the remedy evaluation indicates additional action is appropriate, Phase 3 of the contingency plan would be implemented.

7.7.4 Phase 3: Full-Scale Implementation

If a contingency remedy is required following completion of Phase 1 and Phase 2, a work plan for full-scale implementation of the selected remedy would be prepared for Ecology review and approval. Full-scale implementation would include any design modifications based on the results of pilot studies completed during Phase 2. The lateral and vertical extent of treatment would target the area of the plume requiring treatment to achieve Porewater RELs.

8 Schedule and Reporting

The Consent Decree will include the Schedule of Deliverables for preparing and submitting documents necessary to conduct the cleanup action. Documents will include EDRs for three active treatment areas, a Long-Term Monitoring Plan, and periodic monitoring reports.

Groundwater NA compliance monitoring and interim action maintenance activities will continue until respective CULs are achieved throughout the W4 Site.

9 Public Participation

The Public Participation Plan describes how Ecology involves the public in investigating contamination and selecting cleanup activities during the corrective action process.

The public is encouraged to:

- Learn about and get involved in decision-making opportunities.
- Provide input during the investigation and cleanup of contamination.

Public participation activities are coordinated between the four liable parties and Ecology. The cleanup and the outreach comply with Washington State's Dangerous Waste Regulations and Model Toxics Control Act (MTCA) requirements. We will hold public comment periods and other public outreach during the cleanup process.

A public comment period for this dCAP is currently anticipated for April 21 through May 23, 2025. After the comment period ends, all comments received will be reviewed and considered. The documents may change based on public comments, after which the document will become final.

10 References

Arrow Environmental, Aspect Consulting, Pacific Groundwater Group, and Farallon (Arrow Environmental, et. al), 2007, Draft Interim Vapor Intrusion Plan, West of 4th Avenue South Investigation Area, Seattle, Washington, PSC, May 1, 2007.

Aspect Consulting, LLC (Aspect), 2012, Remedial Investigation Report, Art Brass Plating, Agency Review Draft, September 27, 2012.

Aspect Consulting, LLC (Aspect), 2014, Site Conceptual Model Technical Memorandum (Revised), W4 Joint Deliverable, December 15, 2014.

Aspect Consulting, LLC (Aspect), 2016, Feasibility Study, W4 Group – Site Unit 1, Final, August 11, 2016.

Aspect Consulting, LLC (Aspect), 2022a, Vapor Intrusion Mitigation Plan, Art Brass Plating Facility, W4 Site – Site Unit 1, September 16, 2022.

Aspect Consulting, LLC (Aspect), 2022b, CVOC Pilot Study Completion Report, West of 4th – Site Unit 1, December 2022.

Aspect Consulting, LLC (Aspect), 2022c, In Situ Metals Immobilization Pilot Study Completion Report, West of 4th – Site Unit 1, December 2022.

Aspect Consulting, LLC (Aspect), 2023, Feasibility Study Addendum, W4 Group – Site Unit 1, Final, September 2023.

Booth and Herman, 1998, Duwamish Basin Groundwater Pathways Conceptual Model Report, Duwamish Industrial Area Hydrogeologic Pathways Project, Prepared for City of Seattle Office of Economic Development and King County Office of Budget and Strategic Planning, University of Washington and Hart Crowser, Seattle, Washington.

Environmental Protection Agency (EPA), 2014, Record of Decision (ROD), Lower Duwamish Waterway Site, EPA, Region 10, November 2014.

Environmental Protection Agency (EPA), 2022, Restoring Protective Human Health Criteria in Washington, Document ID 2022-25150, November 2022.

Farallon, 2012, Revised Draft Remedial Investigation Report, Capital Industries, October 2012.

Farallon, 2014, Revised Preliminary Site Cleanup Standards, W4 Joint Deliverable, September 12, 2014.

Farallon, 2015, Revised Vapor Intrusion Assessment, Monitoring, and Mitigation Plan, W4 Joint Deliverable, February 2, 2015.

Farallon, 2016, Remedial Investigation Data Gap Resolution Summary Report, August 11, 2016.

Farallon, 2019, Final Capital Industries Plant 4 Interim Action – Stage 1 In-Situ Chemical Oxidation Report, February 22, 2019.

Farallon, 2023, Feasibility Study Addendum, West of 4th, Site Unit 2, Final, October 5, 2023.

Pacific Crest Environmental (Pacific Crest), 2020, Groundwater Elevation Data Collection Study, West of 4th Site, April 15, 2020.

Pacific Groundwater Group (PGG), 2008, Blaser Source Control Report, 5700 3rd Avenue South, Seattle, Washington, January 23, 2008.

Pacific Groundwater Group (PGG), 2012, Blaser Die Casting, Revised Remedial Investigation Report, August 2, 2012.

Pacific Groundwater Group (PGG), 2016, West of Fourth Site Unit 2, Feasibility Study, Seattle, Washington, August 11, 2016.

PSC Environmental Services, LLC (PSC), 2003, Final Comprehensive Remedial Investigation Report for Philip Services Corporation's Georgetown Facility, Philip Services Corporation, November 14, 2003.

United States Geological Survey, 2019, Oxidation/Reduction (Redox), Water Resources Mission Area, February 27, 2019. https://www.usgs.gov/mission-areas/water-resources/science/oxidationreduction-redox

Washington State Department of Ecology (Ecology), 2010, Final Cleanup Action Plan, PSC Georgetown Facility, Seattle, Washington, prepared by Washington State Department of Ecology, Version 00, April 28, 2010.

Washington State Department of Ecology (Ecology), 2016, Ecology letter regarding Revised Feasibility Study Report for Site Units 1 and 2, October 25, 2016.

Washington State Department of Ecology (Ecology), 2020, Ecology letter regarding Tier 5 Vapor Intrusion Mitigation System Shutdown at Six Buildings, January 21, 2020.

Washington State Department of Ecology (Ecology), 2021, Sediment Cleanup User's Manual SCUM, December 2021.

Washington State Department of Ecology (Ecology), 2022a, Natural Background Groundwater Arsenic Concentrations in Washington State, Study Results, Toxics Cleanup Program, Publication No. 14-09-044, January 2022.

Washington State Department of Ecology (Ecology), 2022b, Guidance for Evaluating Vapor Intrusion in Washington State: Investigation and Remedial Action, March 2022.

Washington State Department of Ecology (Ecology), 2023, Ecology letter regarding FS & FS Report Addenda Comment period, September 7, 2023.

TABLES

Table 4-1. Summary of Cleanup Levels

Project No. AS050067U, West of 4th Site, Site Unit 1, Seattle, Washington

		Cleanup Levels									
		Soil			Groundwater			Air		Surface Water	
Constituent of Concern	Carcinogen or Non-Carcinogen	Puget Sound Background Concentrations for Metals[1]	Soil Cleanup Level Protective of Direct Contact Pathway (Unrestricted Land Use)[2]	Soil Cleanup Level Protective of Groundwater concentrations, Protective of Surface Water Quality (Vadose Zone) [3]	Groundwater Screening Level Protective of Air Quality Water Table Zone (Unrestricted Land Use)[4]	Groundwater Screening Level Protective of Air Quality Water Table Zone (Commercial Worker)[4]	Groundwater Cleanup Level Protective of Surface Water[6]	Air Cleanup Level Protective of Inhalation Pathway (Unrestricted Land Use)[4]	Air Cleanup Level Protective of Inhalation Pathway (Commercial Worker)[4]	Surface Water Cleanup Level Protective of Human Health[7]	Surface Water Cleanup Level Protective of Aquatic Life
		(Milligrams/kilogram)			(Micrograms/liter)			(Micrograms/cubic meter)		(Micrograms/liter)	
Tetrachloroethene	Carcinogen	--	480	0.03	25	120	2.9	9.6	45	2.9	--
Trichloroethene	Carcinogen	--	12	0.004	1.4	12	0.7	0.33	2.9	0.7	194 [11]
cis-1,2-Dichloroethene	Non-Carcinogen	--	160	--	180	1600	--	18	160	--	--
trans-1,2-Dichloroethene	Non-Carcinogen	--	1,600	5.2	610	650	1,000	18	160	1,000	--
1,1-Dichloroethene	Non-Carcinogen	--	4,000	26	130	1,100	4,000	91	780	4,000	--
Vinyl chloride	Carcinogen	--	0.67	0.001	0.33	1.6	0.18	0.28	1.3	0.18	210 [11]
Arsenic	Carcinogen	**7.3**	67	4.7	Not Applicable	Not Applicable	8 [9]	Not Applicable	Not Applicable	0.14	36 [12]
Cadmium	Non-Carcinogen	0.77	80	**1.1**	Not Applicable	Not Applicable	7.9	Not Applicable	Not Applicable	--	7.9 [12]
Copper	Non-Carcinogen	**36**	3,200	1.4	Not Applicable	Not Applicable	3.1	Not Applicable	Not Applicable	--	3.1 [12]
Manganese	Non-Carcinogen	1,200	3,700	130	Not Applicable	Not Applicable	100	Not Applicable	Not Applicable	100 [10]	--
Nickel	Non-Carcinogen	48	1,600	11	Not Applicable	Not Applicable	8.2	Not Applicable	Not Applicable	100	8.2 [12]
Zinc	Non-Carcinogen	85	24,000	100	Not Applicable	Not Applicable	81	Not Applicable	Not Applicable	1,000	81 [8]

NOTES:

Cleanup levels presented represent the most stringent cleanup levels for the constituent of concern listed in the media indicated.

-- indicates no value is available. In the case of ARARs, the reference sources do not publish values for the noted chemicals. In the case of calculated values, one or more input parameters are not available.

"Not Applicable" is used where the constituent of concern will not affect the media of potential concern due to an incomplete pathway.

[1] Background metals values from Ecology Publication No. 94-115, Natural Background Soil Metals Concentrations in Washington State. Updated for arsenic, cadmium, and iron provided by Ecology 5/25/2022 for inclusion in this table .

[2] Cleanup level is based on standard Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method B (unrestricted land use) values from the Cleanup and Risk Calculations tables (CLARC, database dated August 2023).

[3] Soil cleanup levels for protection of surface water quality are based on vadose conditions. Achievement of soil cleanup levels protective of groundwater would be evaluated via groundwater monitoring for empirical demonstration. Values are calculated using MTCA Equation 747-1 where the groundwater cleanup level protective of surface water in this table was used as Cw.

[4] Cleanup levels protective of the air pathway for unrestricted land use (residential and commercial sites) as listed in CLARC (database dated August 2023).

[6] Human health and marine aquatic ecologic receptors were considered. The more stringent value of the two surface water receptors, as listed in this table, has been listed for the Groundwater Cleanup Level Protective of Surface Water.

[7] Criteria in this column are based on EPA's Partial Approval/Partial Disapproval of Washington's Human Health Water Quality Criteria and Implementation Tools (November 15, 2016), unless otherwise noted below.

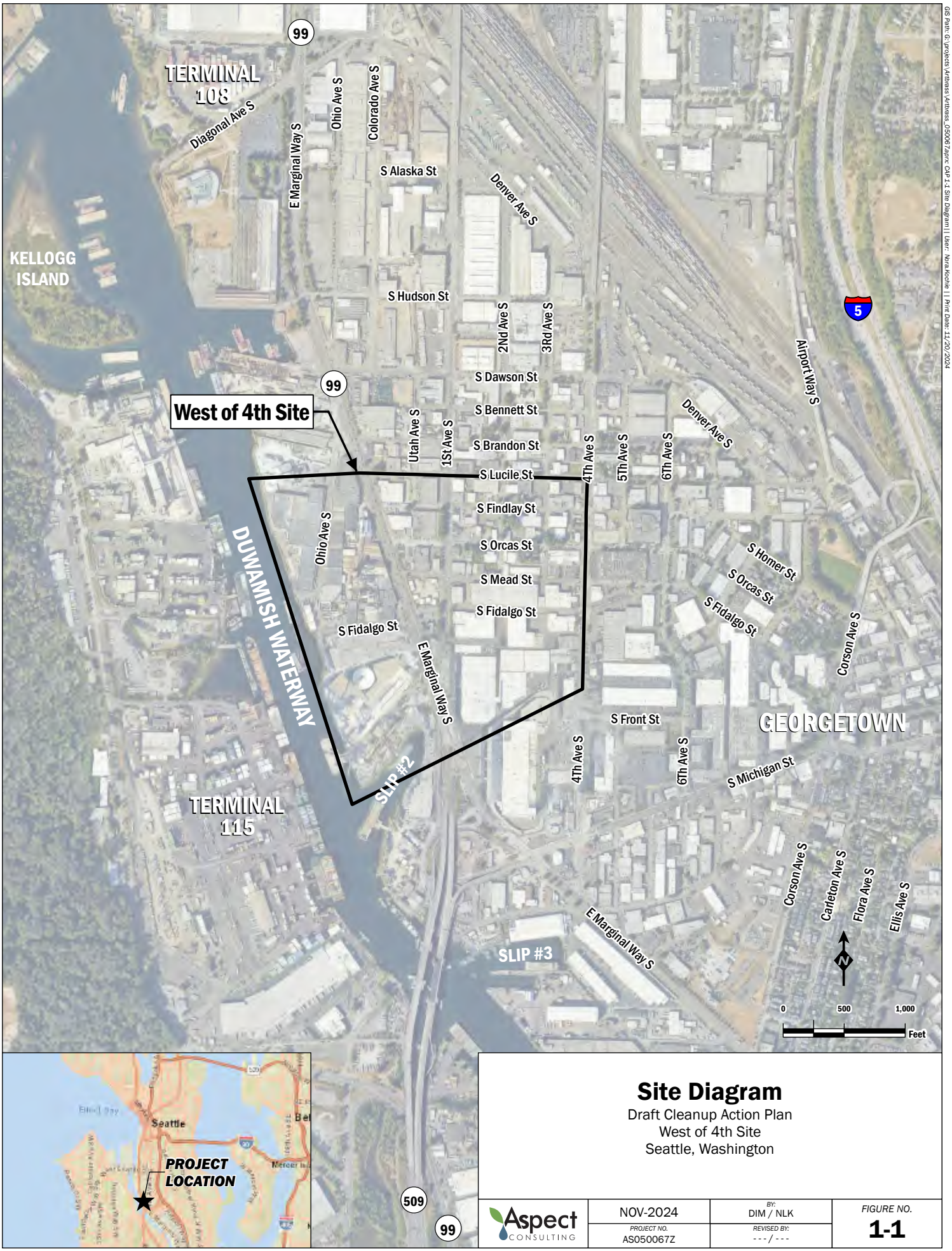
[9] Arsenic Cleanup level of 8 ug/L based on background concentrations for Puget Sound Basin (Ecology Publication Number 14-09-044).

[10] CWA Section 304, National Recommended Water Quality Criteria, Human Health based on consumption of organisms. Provided by Ecology 5/25/2022 for inclusion in this table.

[11] Aquatic Life, literature value provided by Ecology 5/25/2022 for inclusion in this table

[12] National Recommended Water Quality Criteria published by EPA under 304 of the Federal Clean Water Act - Aquatic Life Criteria Table

FIGURES



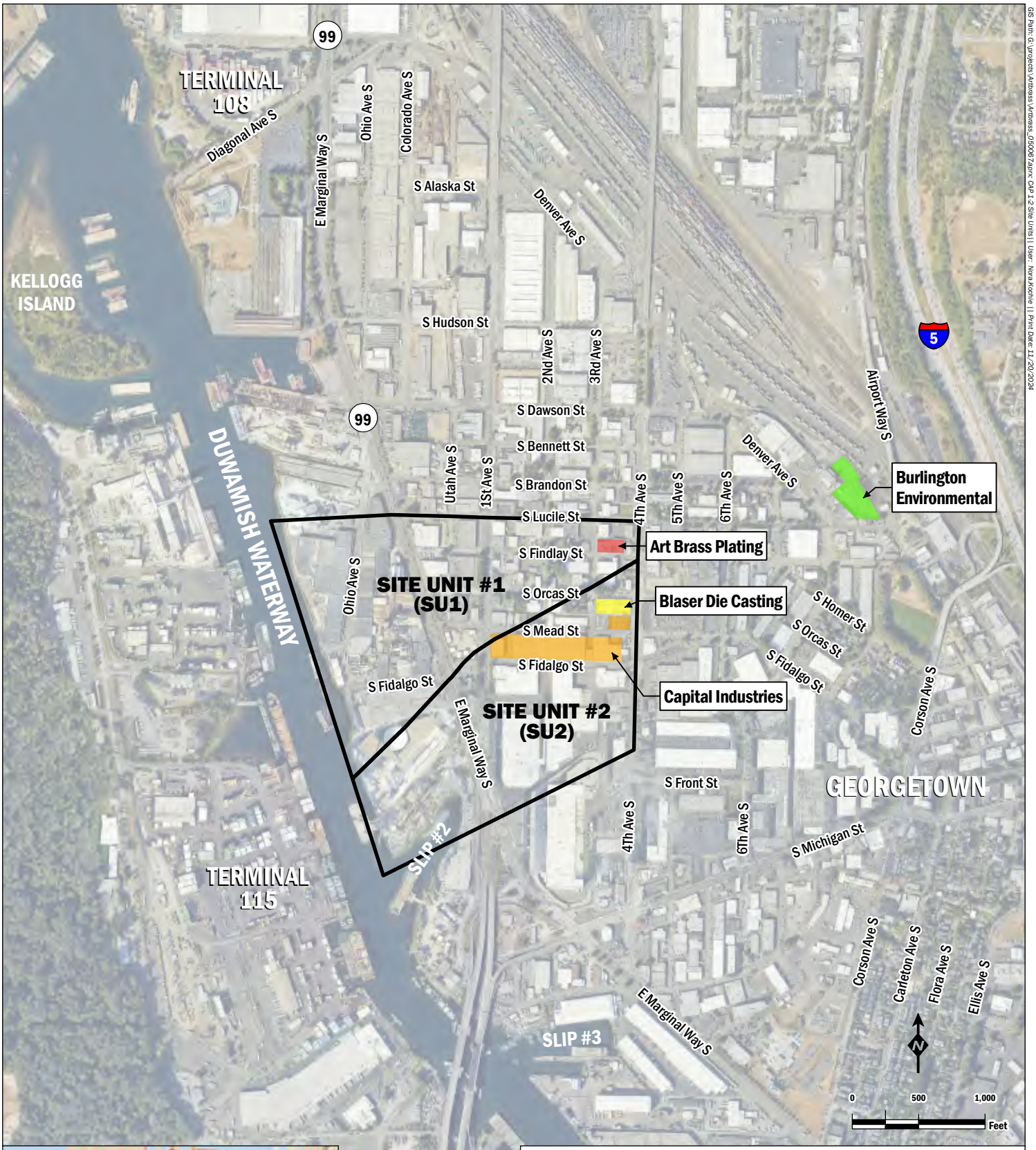
Site Diagram

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

Aspect CONSULTING	NOV-2024	BY: DIM / NLK	FIGURE NO. 1-1
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

Data source credits: None | | Basemap Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA, City of Seattle, County of King, Bureau of Land Management, Esri, HERE, Garmin, NGA, USGS, NPS

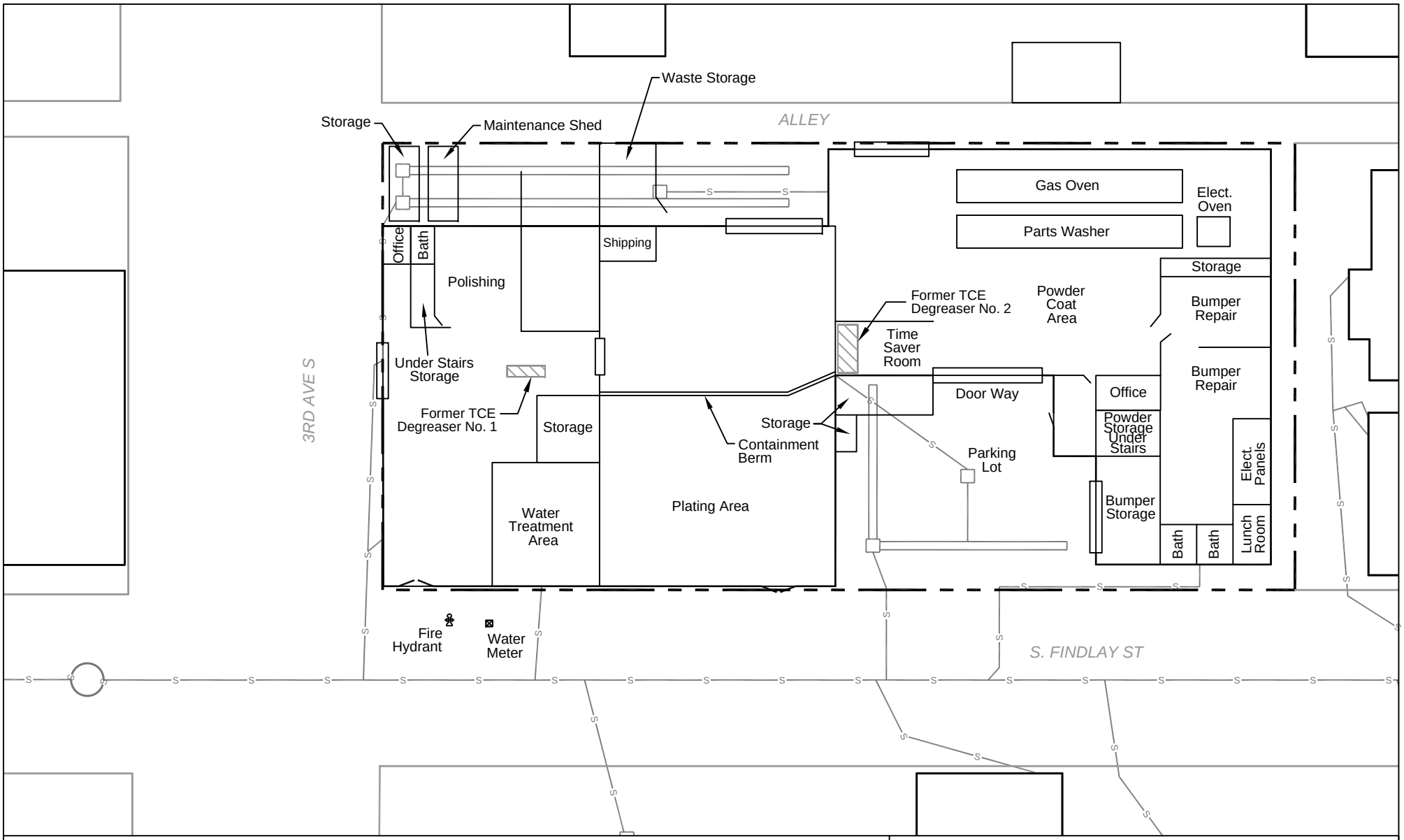
GIS Path: G:\projects\Artnass\Artnass_050067\aprx\ CAP 1-1 Site Diagram | User: 'Nora.Kochle' | Print Date: 11/20/2024



Site Unit Location Plan

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

Aspect CONSULTING	NOV-2024	BY: DIM / NLK	FIGURE NO. 1-2
	PROJECT NO. AS050067Z	REVISED BY: ---/---	



Legend

- Approximate Property Boundary
- Catch Basin
- Sewer Line (Combined)
- Vapor Degreaser Location
- Corrugated Metal Pipe (Sewer Retention)

N

0 30 60

Feet

Art Brass Plating Property Map

Draft Cleanup Action Plan

West of 4th Site

Seattle, Washington

DRAFT

Aspect CONSULTING	JAN-2024	BY: JJP/LAL	FIGURE NO. 2-1
	PROJECT NO. AS050067Z	REV BY: SCC / NLK	

K:\JANET\JK0504 BlaserDieCasting\GIS\mxds\SiteDiagram_2014.mxd

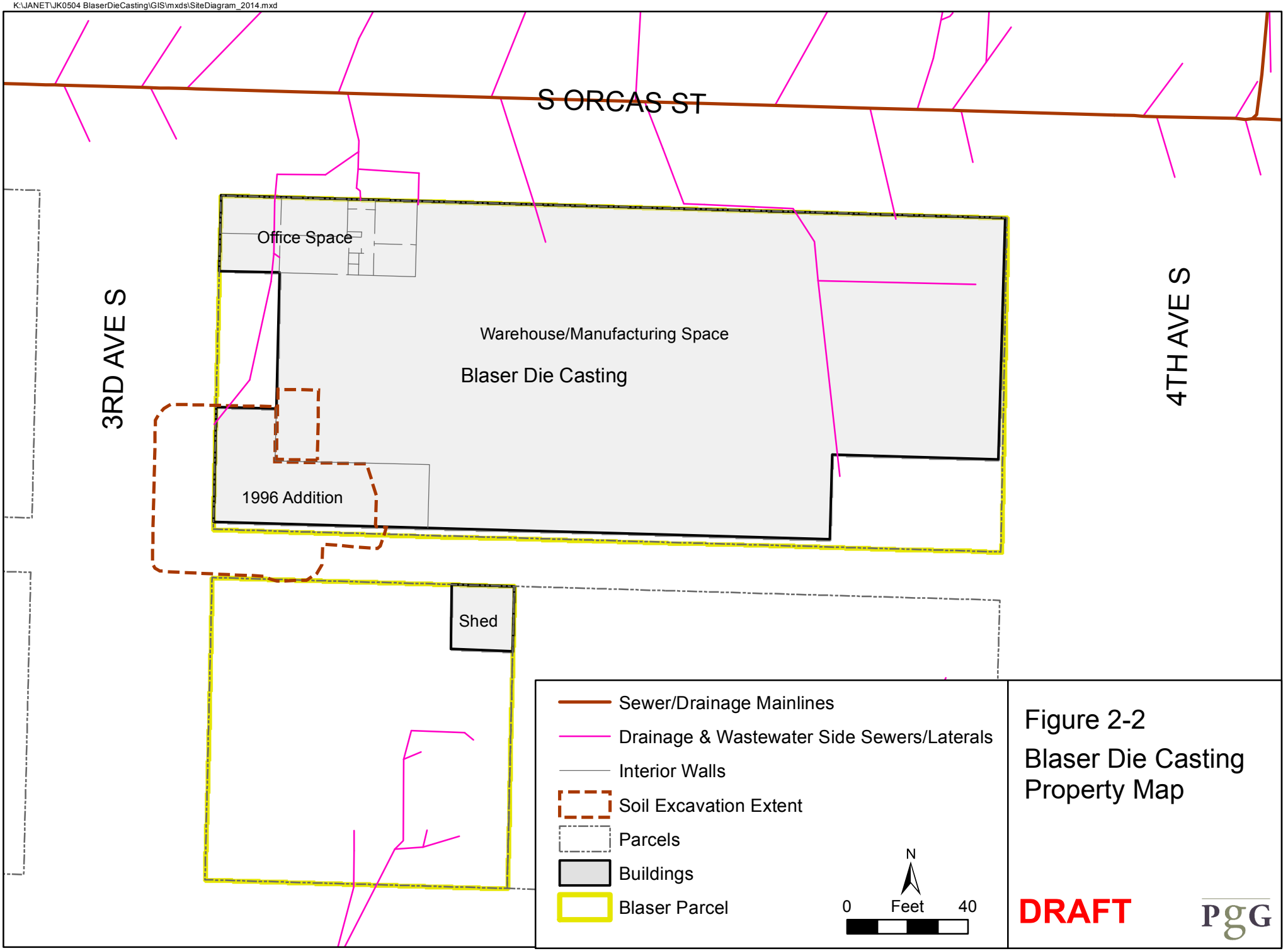


Figure 2-2

Blaser Die Casting Property Map

DRAFT

PgG

LEGEND

- WATER TABLE INTERVAL MONITORING WELL
- SHALLOW INTERVAL MONITORING WELL
- INTERMEDIATE INTERVAL MONITORING WELL
- PLANT 4 CURRENT INTERIOR FEATURE
- SITE UNIT BOUNDARY
- BUILDING
- CAPITAL PROPERTY BOUNDARY

DRAFT

NOTES:
1. ALL LOCATIONS ARE APPROXIMATE.
2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

N

0 40 80
SCALE IN FEET

FARALLON CONSULTING
Your Challenges. Our Priority. | farallonconsulting.com

Washington
Issaquah | Bellingham | Seattle

Oregon
Portland | Baker City

California
Oakland | Irvine

FIGURE 2-3

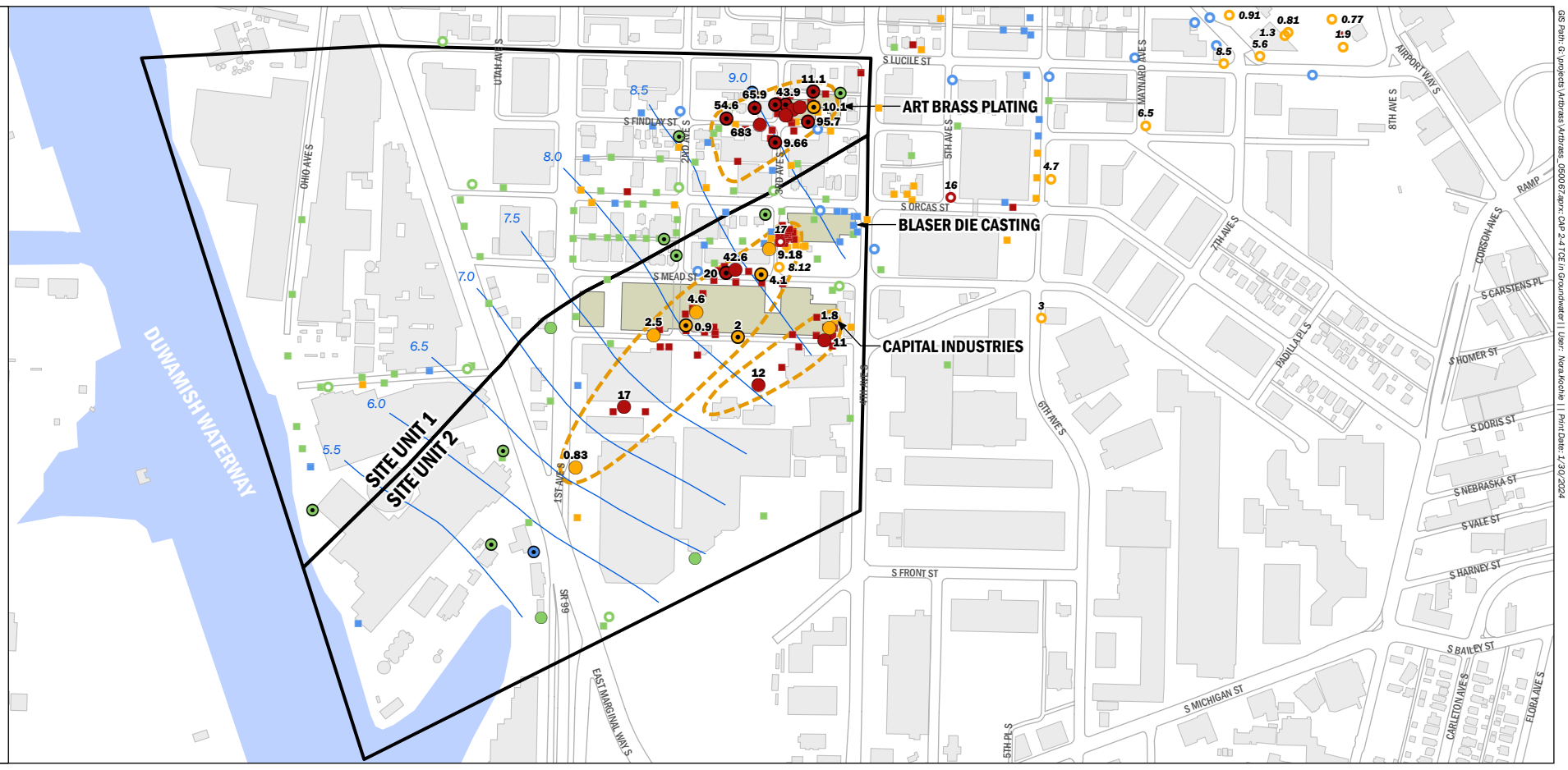
CAPITAL INDUSTRIES PROPERTY MAP
WEST OF FOURTH AVENUE SOUTH
SEATTLE, WASHINGTON

FARALLON PN: 457-008

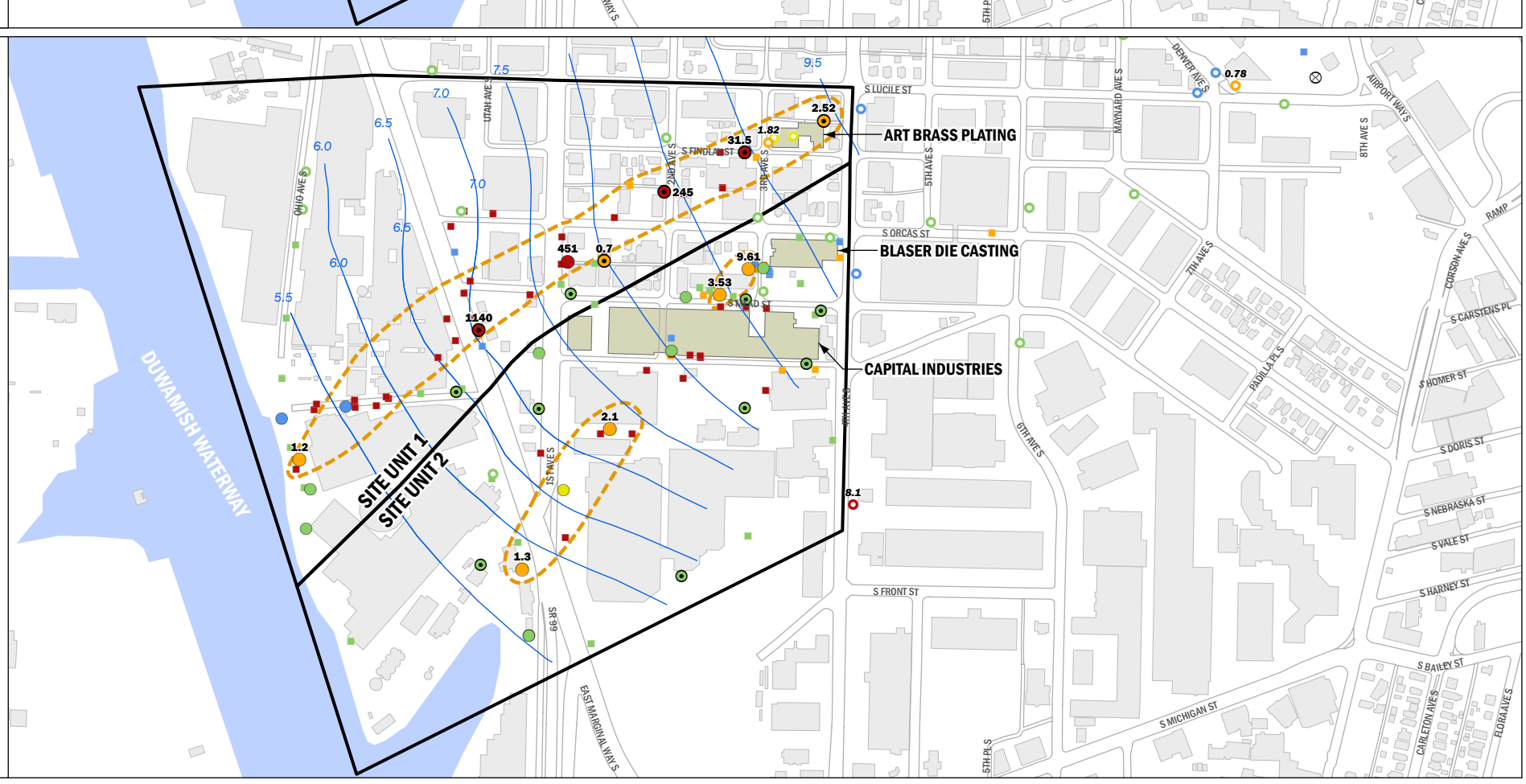
Drawn By: aguse | Checked By: SJ | Date: 2/12/2024 | Disc Reference:

Document Path: \\192.168.0.248\gis\Projects\457 CapitalIndust\017 Cleanup Action\Mapfiles\Figure-2-3_PropertyMap_v2.mxd

WATER TABLE INTERVAL



SHALLOW INTERVAL



INTERMEDIATE INTERVAL

The Groundwater Cleanup Level (CUL) Protective of Surface Water Quality for Trichloroethene (TCE) is 0.86µg/L.

TCE in Groundwater

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect Consulting	JAN-2024	BY: DIM / NLK	FIGURE NO. 2-4
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

Groundwater Sample Locations:

- Well with data from 2022
- Well with data from 2020 to 2021 (most recent if multiple samples)
- Well with data pre-dating 2020
- Probe sample data* (reflecting the maximum concentration detected in the given interval)
  * Note: Probe data are from 2000 to 2012*
- Well Not Sampled for Given Analyte/Interval

Sample Location Symbol Color:

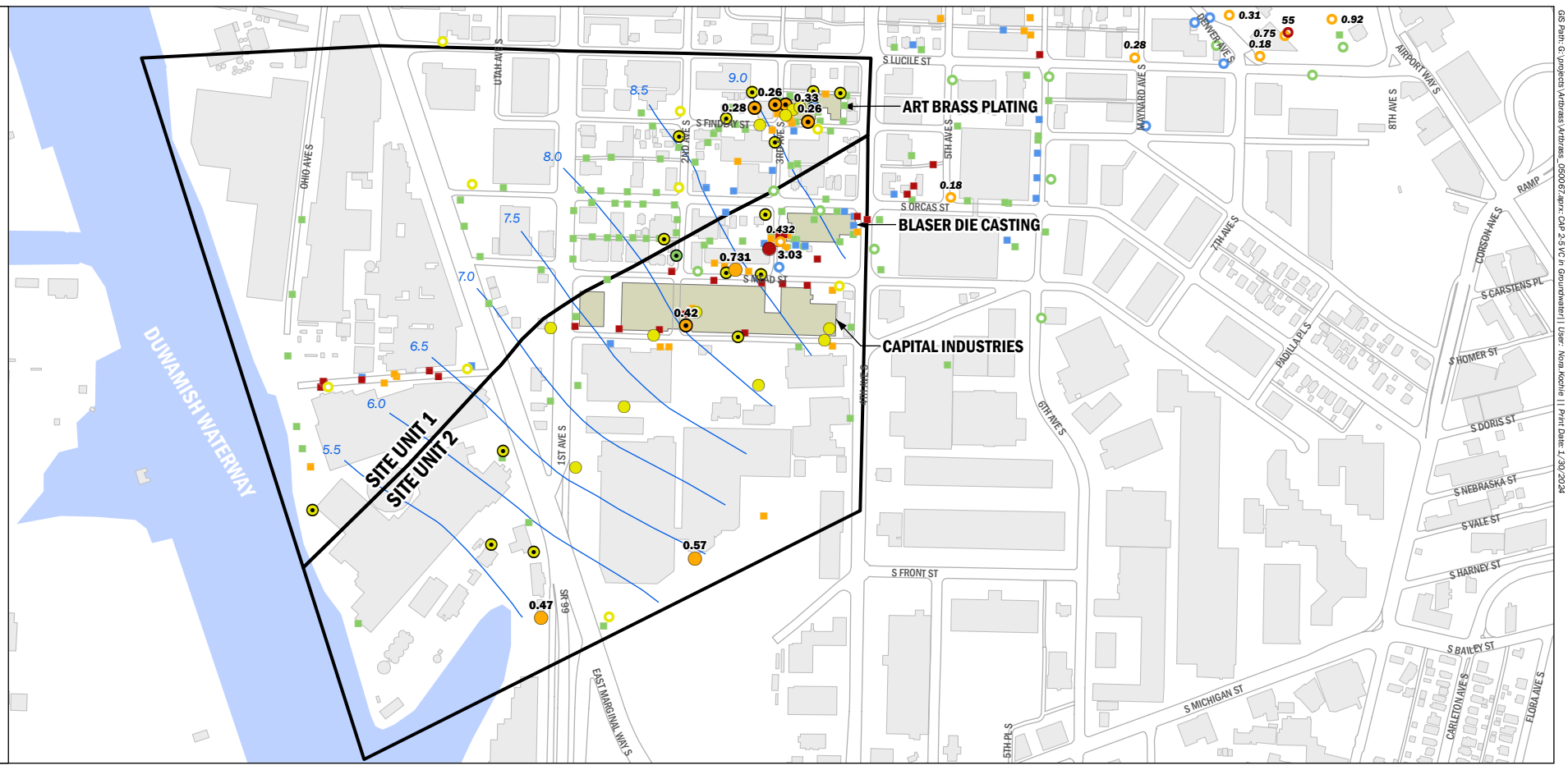
- Detected at >10x CUL
- Detected above CUL
- Detected below CUL
- Not detected (reporting limit above CUL)
- Not detected

- Half-foot groundwater elevation contours from August, 2012 site-wide monitoring event (NAVD88 Vertical Datum)
- TCE isoconcentration line at 0.86 µg/L cleanup level

Well locations with CUL exceedances are labeled with the exceeding concentration: 55 ← *Trichloroethene (TCE) Concentration (in µg/L)*

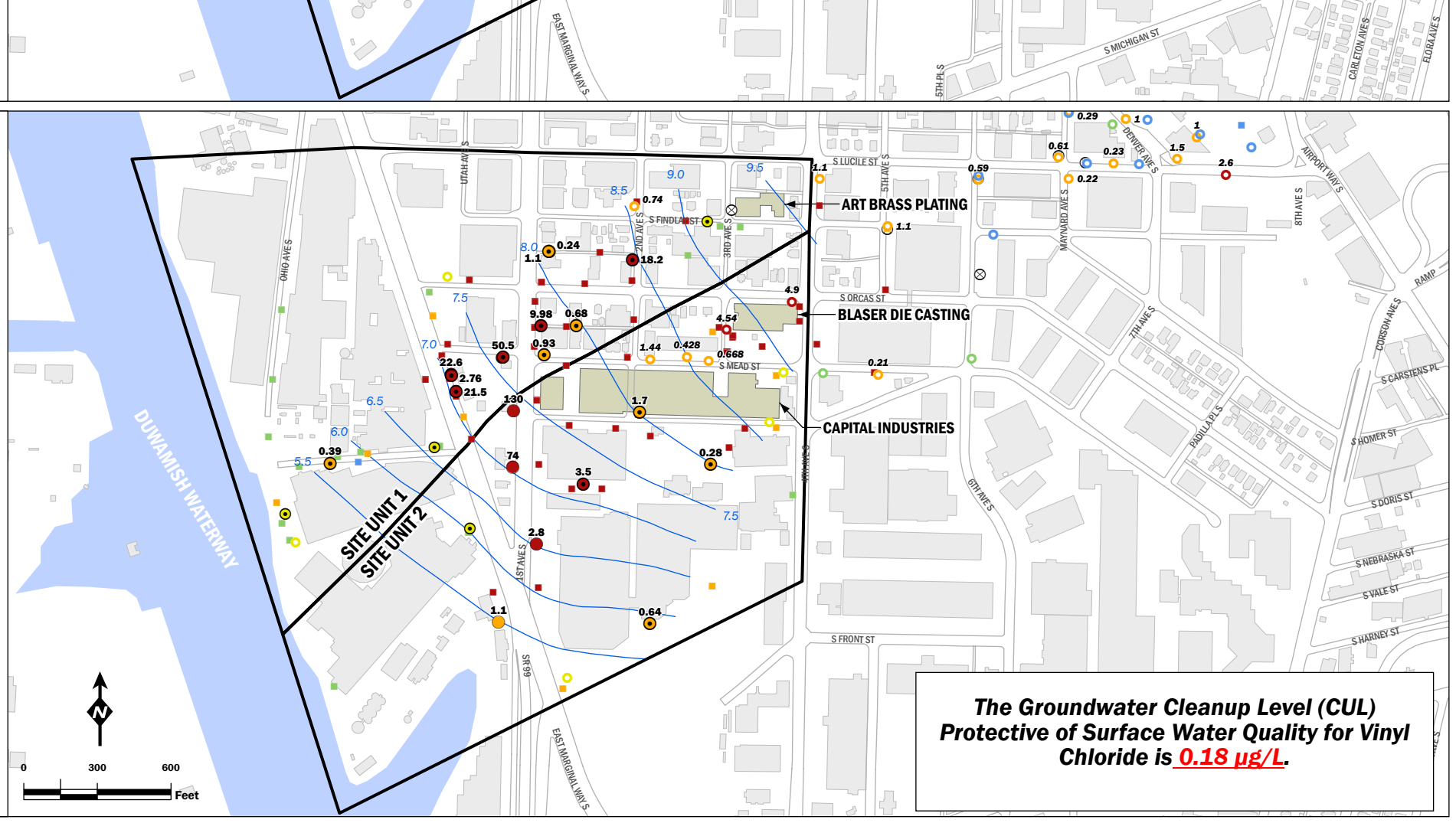
GIS Path: G:\projects\Artbrass\Artbrass_050067.aprx; CAP 2-4 TCE in Groundwater || User: Nora.Kochie || Print Date: 1/30/2024

WATER TABLE INTERVAL



SHALLOW INTERVAL

INTERMEDIATE INTERVAL



The Groundwater Cleanup Level (CUL) Protective of Surface Water Quality for Vinyl Chloride is 0.18 µg/L.

VC in Groundwater

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect Consulting	JAN-2024	BY: DIM / NLK	FIGURE NO. 2-5
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

Groundwater Sample Locations:

- Well with data from 2022
- Well with data from 2020 to 2021 (most recent if multiple samples)
- Well with data pre-dating 2020
- Probe sample data* (reflecting the maximum concentration detected in the given interval)
  ** Note: Probe data are from 2000 to 2012*
- Well Not Sampled for Given Analyte/Interval

Sample Location Symbol Color:

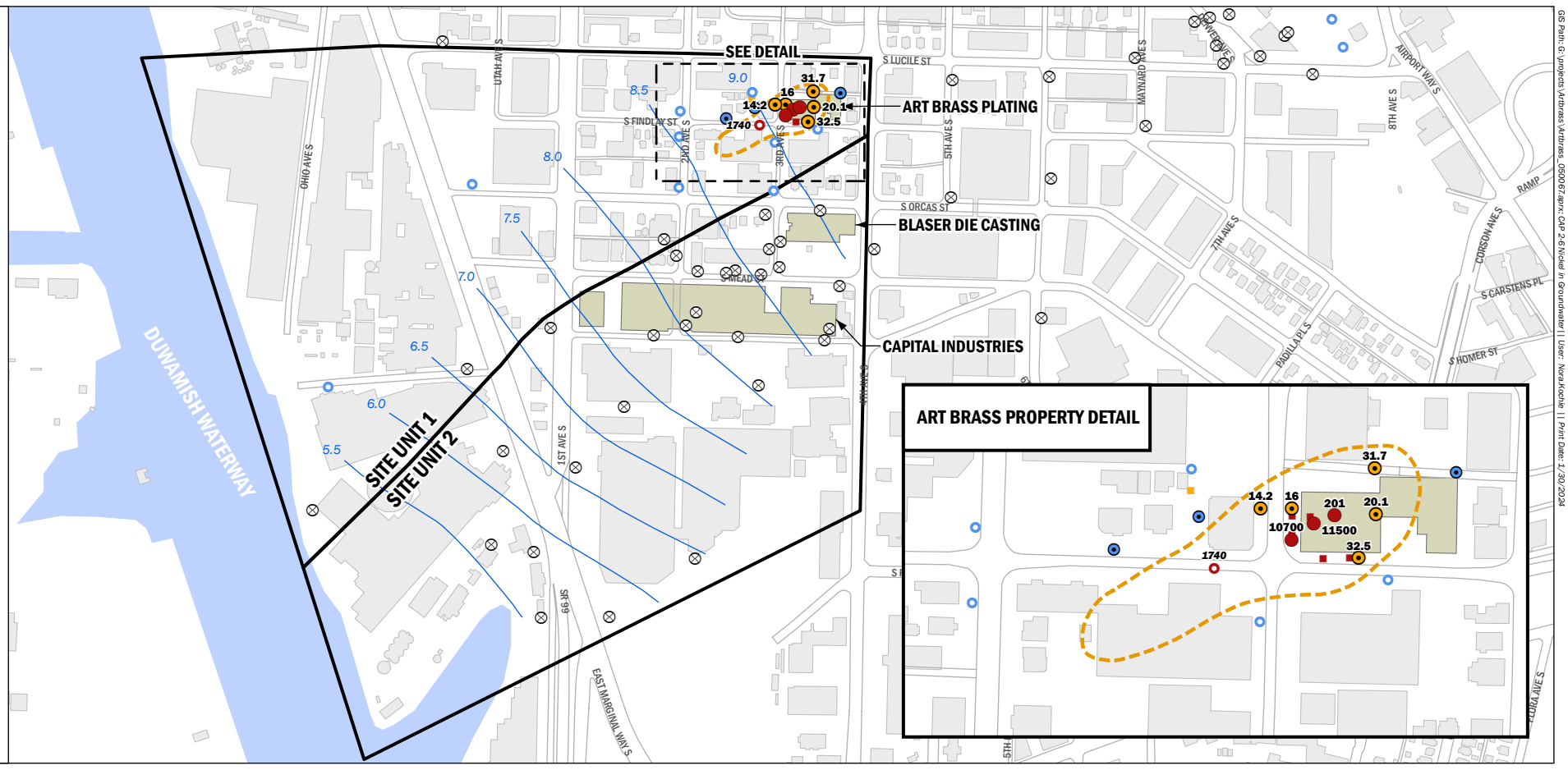
- Detected at >10x CUL
- Detected above CUL
- Detected below CUL
- Not detected (reporting limit above CUL)
- Not detected

Half-foot groundwater elevation contours from August, 2012 site-wide monitoring event (NAVD88 Vertical Datum)

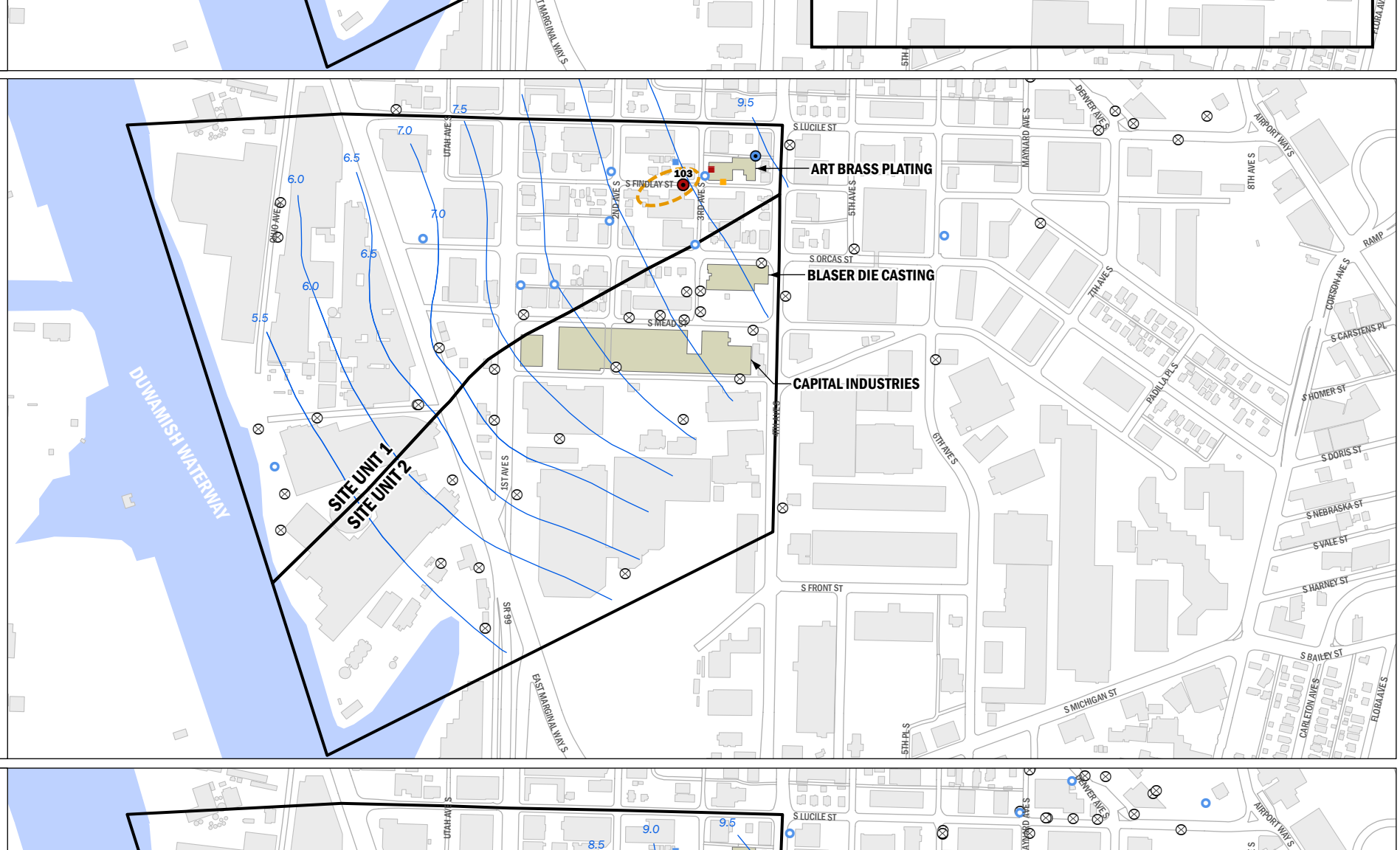
Well locations with CUL exceedances are labeled with the exceeding concentration: 55 ← *Vinyl Chloride Concentration (in µg/L)*

GIS Path: G:\projects\Artbrass\Artbrass_050067.aprx; CAP 2-5 VC in Groundwater | User: Nora Kochle | | Print Date: 1/30/2024

WATER TABLE INTERVAL



SHALLOW INTERVAL



INTERMEDIATE INTERVAL

The Groundwater Cleanup Level (CUL) Protective of Surface Water Quality for Nickel is 8.2 µg/L.

Dissolved Nickel in Groundwater

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect CONSULTING	JAN-2024	BY: DIM / NLK	FIGURE NO. 2-6
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

Groundwater Sample Locations:

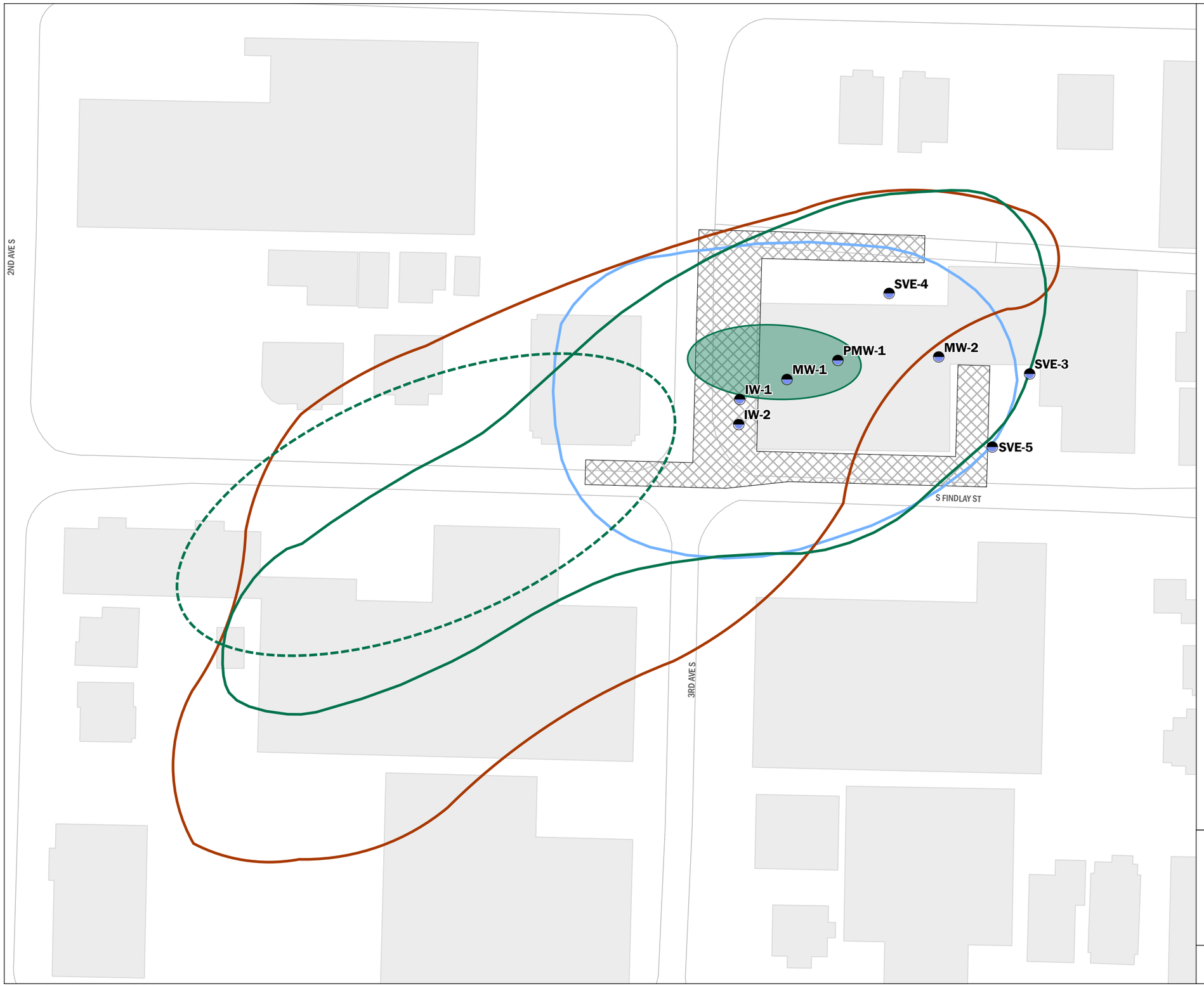
- Well with data from 2022
- Well with data from 2020 to 2021 (most recent if multiple samples)
- Well with data pre-dating 2020
- Probe sample data* (reflecting the maximum concentration detected in the given interval)
  ** Note: Probe data are from 2000 to 2012*
- Well Not Sampled for Given Analyte/Interval

Sample Location Symbol Color:

- Detected at >10x CUL
- Detected above CUL
- Detected below CUL
- Not detected (reporting limit above CUL)
- Not detected

- Half-foot groundwater elevation contours from August, 2012 site-wide monitoring event (NAVD88 Vertical Datum)
- Nickel isoconcentration line at 8.2 µg/L cleanup level

Well locations with CUL exceedances are labeled with the exceeding concentration: 55 ← *Nickel Concentration (in µg/L)*



- Existing pH Neutralization Solution Injection Well
- Area of pH Neutralization Direct-Push Injection
- Water Table Groundwater pH < 6
- TCE Isoconcentration Line at 1.4 µg/L Cleanup Level in Water Table Groundwater (for Protection of Air Quality)
- Nickel Isoconcentration Line at 8.2 µg/L Cleanup Level in Water Table Groundwater (for Protection of Surface Water)
- Nickel Isoconcentration Line at 8.2 µg/L Cleanup Level in Shallow Groundwater (for Protection of Surface Water)
- Nickel Isoconcentration Line at 48 mg/kg Cleanup Level in Soil Vadose Zone (for Protection of Surface Water Adjusted to Background)

N

0 50 100 Feet

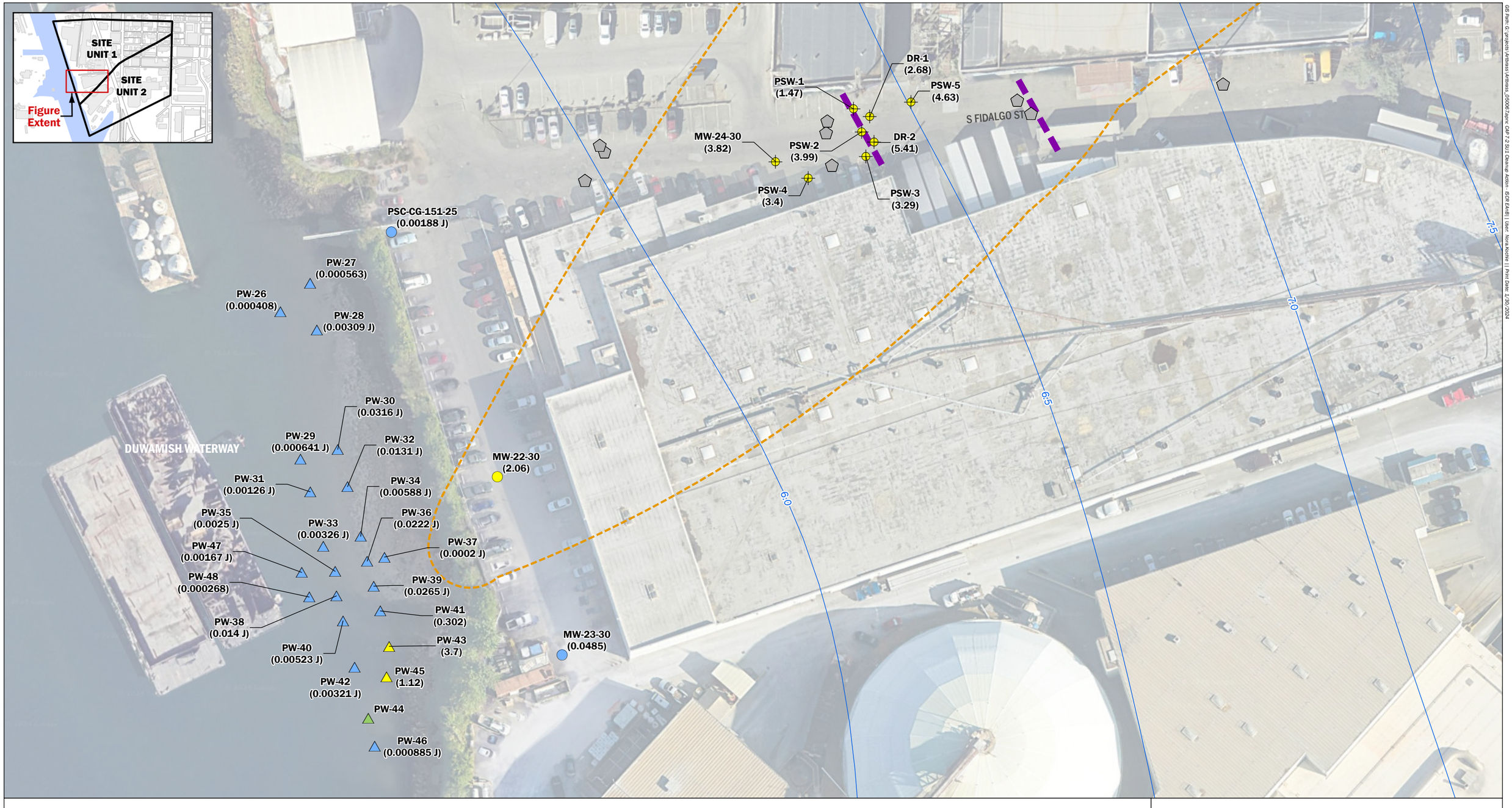
SU1 Cleanup Action: ABP Property pH Neutralization

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect CONSULTING	JAN-2024	BY: DIM / NLK	FIGURE NO. 7-1
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

Data source credits: None || Basemap Service Layer Credits: NA



Sample Locations:

- Porewater Sample Locations*
- Well (Groundwater Samples)*
- Probe Location (2002 & 2005)
- Pilot Study Wells

**Porewater data from August 2020. Well data from August 2020.*

Sample Location Symbol Color:

- Detected, Total Chlorinated Ethenes Cleanup Level Concentration Greater than 1 umol/L
- Detected
- Not detected
- 0.5 ft Groundwater Elevation Contours†

†Contours based on January 2011 Tidal Study (Aspect, 2012).

- TCE isoconcentration line at 0.7 ug/L cleanup level
- ISCR/EAnB Treatment Transect

Notes:
- *Total chlorinated ethenes data are from the Shallow Interval.*
- *Probe data collected between 2002 and 2005. Maximum concentration detected for Shallow Interval.*
- *Data from shoreline wells collected using the same method as porewater data (passive diffusion bag samplers).*
- *Data depicted for remaining wells collected as part of baseline groundwater monitoring for pilot study (10/4/2018, except MW-24-30 from 1/29/18).*

N

0 30 60 Feet

SU1 Cleanup Action: Fidalgo Street ISCR/EAnB Application

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect Consulting	JAN-2024	BY: DIM / NLK	FIGURE NO. 7-2
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

Groundwater Monitoring Area

- SU1 Area
- SU2 CI Plant 4 Area
- SU2 BDC and CI Plant 2 Area
- Site Unit Boundary Area

**Well data used in two compliance monitoring areas*

DUWAMISH WATERWAY

OHIO AVE S

UTAH AVE S

EAST MARGINAL WAY S

1ST AVE S

2ND AVE S

3RD AVE S

4TH AVE S

5TH AVE S

6TH AVE S

S LUCILE ST

S FINDLAY ST

S ORCAS ST

S MEAD ST

S FIDALGO ST

S FRONT ST

SR 99

Site Unit 1

Site Unit 2

MW-05
PSW-06
IW-01
MW-07
MW-01
MW-13
MW-12
MW-09
MW-02
MW-15
MW-03-50
MW-03-30
MW-04
MW-08
MW-14
MW-08-30
MW-03
PSW-07
MW-27
IW-02
PSW-08
MW-18-50
PZ-01
MW-16-40
MW-16-75
MW-17-40
MW-17-60
MW-25-50
MW-25-75
MW-20-40
MW-20-60
BDC-06-30
BDC-06-60
BDC-06-WT
MW-26-40
PSC-CG-141-50
PSC-CG-141-40
PSC-CG-137-40
PSC-CG-137-50
CI-MW-06
CI-MW-07
CI-07-40
PSW-01
PSW-05
MW-24-30
MW-24-50
PSC-CG-140-40
DR-01
DR-02
PSW-02
PSW-03
MW-24
PSW-04
PSC-CG-151-25
CI-15-40
CI-15-60
CI-10-35
CI-10-WT
CI-10-65
CI-09-40
CI-09-WT
MW-22-30
CI-12-35*
CI-14-35
CI-14-70
MW-23-30*
MW-23-50*
CI-19-30
CI-13-30
CI-13-WT
CI-13-60

N

0 250 500 Feet

Data source credits: None | | Basemap Service Layer Credits: NA

Compliance Monitoring Well Network

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect CONSULTING	FEB-2024	BY: DIM / NLK	FIGURE NO. 7-3
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

GIS Path: G:\projects\Ambiass\Ambiass_050067\gis\mxd_CAP 7-4_SU1 Compliance Monitoring Well Network1 | User: Nora Kluehe | | Print Date: 2/12/2024

Monitoring Wells

- Long-Term Performance & Confirmation Monitoring
- Wells Maintained for Short-Term Performance Monitoring
- Wells To Decommission

OHIO AVE S
S BRANDON ST
PSC-CG-139-40
PSC-CG-143-40
PSC-CG-143-WT
UTAH AVE S
S LUCILE ST
PSC-CG-135-50
PSC-CG-135-40
PSW-6
MW-3-50
MW-5
IW-1
MW-12
MW-6-30
MW-13
MW-7
MW-6
PMW-1
MW-2
PSC-CG-138-70
PSC-CG-138-40
PSC-CG-138-WT
MW-9
MW-1
2ND AVE S
S FINDLAY ST
MW-8-70
MW-4
MW-15
MW-8-30
MW-14
MW-8
MW-16
IW-2
PSC-CG-145-35
MW-27
MW-3
3RD AVE S
MW-3-30
MW-18-70
PZ-1
PSW-7
MW-16-40
PSW-8
MW-18-50
MW-16-75
PSC-CG-144-35
PSC-CG-142-40
PSC-CG-142-WT
MW-10
MW-11
MW-11-30
S ORCAS ST
EAST MARGINAL WAY S
4TH AVE S
MW-17-40
MW-19-40
MW-19-60
MW-17-60
MW-25-50
MW-20-60
MW-25-75
MW-20-40
S MEAD ST
MW-21-50
MW-21-75
MW-26-40
MW-26-55
S FIDALGO ST
DUWAMISH WATERWAY
AB-CG-140-70
PSC-CG-140-WT
PSW-1
DR-1
PSW-5
PSC-CG-140-40
MW-24-50
MW-24-30
PSW-2
PSC-CG-140-30
DR-2
PSC-CG-151-25
MW-24
PSW-4
PSW-3
MW-22-30
MW-22-50
MW-23-30
MW-23-50
1ST AVE S
Site Unit 1
Site Unit 2
N
0
200
400
Feet

Data source credits: None | | Basemap Service Layer Credits: NA

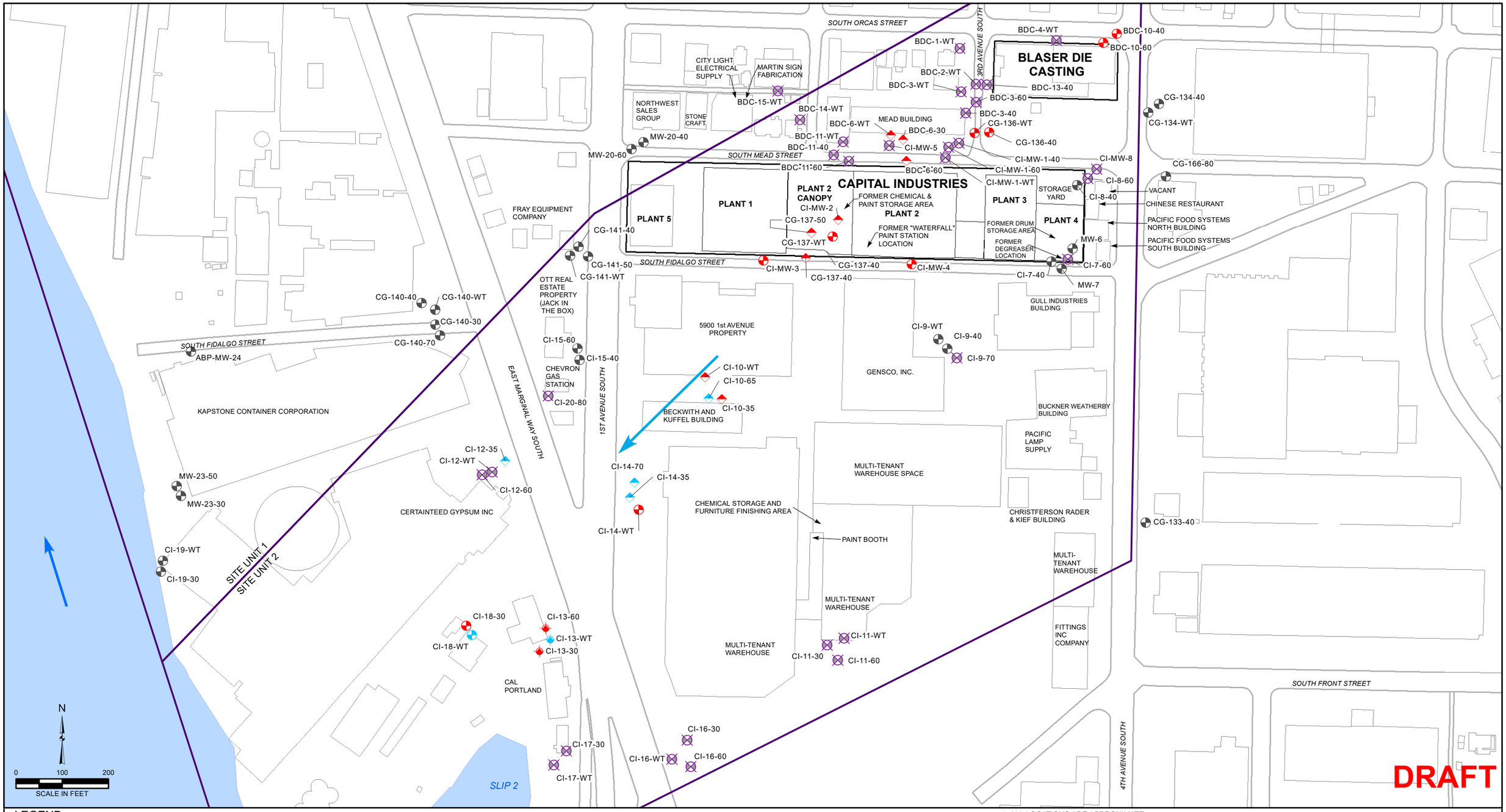
SU1 Compliance Monitoring Plan

Draft Cleanup Action Plan
West of 4th Site
Seattle, Washington

DRAFT

Aspect Consulting	JAN-2024	BY: DIM / NLK	FIGURE NO. 7-4
	PROJECT NO. AS050067Z	REVISED BY: ---/---	

GIS Path: G:\projects\Anthesis\Anthesis_050067\aprx\ CAP 7-3 SU1 Compliance Monitoring Plan.mxd | User: Nora Kourke | | Print Date: 1/26/2024



LEGEND

MONITORING FREQUENCY

- ANNUAL
- EVERY 5 YEARS
- NOT INCLUDED IN SAMPLING PROGRAM FOR THIS AREA
- WELL TO BE DECOMMISSIONED
- WHERE DETETECTED, COCS IN GROUNDWATER SAMPLES HAVE BEEN LESS THAN CUL PROTECTIVE OF SURFACE WATER (BETWEEN 2014 AND 2024).
- GROUNDWATER SAMPLE HAS HAD ONE OR MORE COCS THAT HAVE HAVE EXCEEDED CUL PROTECTIVE OF SURFACE WATER (BETWEEN 2014 AND 2024).
- APPROXIMATE AVERAGE DIRECTION OF GROUNDWATER FLOW FOR ALL THREE GROUNDWATER INTERVALS. THE FLOW DIRECTION IS VARIABLE WITH MORE NORTHERN AND SOUTHERN COMPONENTS OBSERVED BASED ON HISTORICAL MONITORING DATA.
- DUWAMISH RIVER FLOW DIRECTION

NOTES:

OVERLAPPING MONITORING WELL LOCATIONS HAVE BE SHIFTED FOR DISPLAY PURPOSES. MONITORING WELLS HAVE LABELS THAT INDICATE THEIR IDENTIFICATION AND SAMPLE DEPTH. SAMPLE DEPTH ARE MEASURED BELOW GROUND SURFACE OR AT THE WATER TABLE (WT).

CI-17-30
WELL ID | WELL DEPTH

TCE = TRICHLOROETHENE
CUL = CLEANUP LEVEL

1. ALL LOCATIONS ARE APPROXIMATE.
2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

FARALLON CONSULTING
Your Challenges. Our Priority. | farallonconsulting.com

Washington
Issaquah | Bellingham | Seattle

Oregon
Portland | Baker City

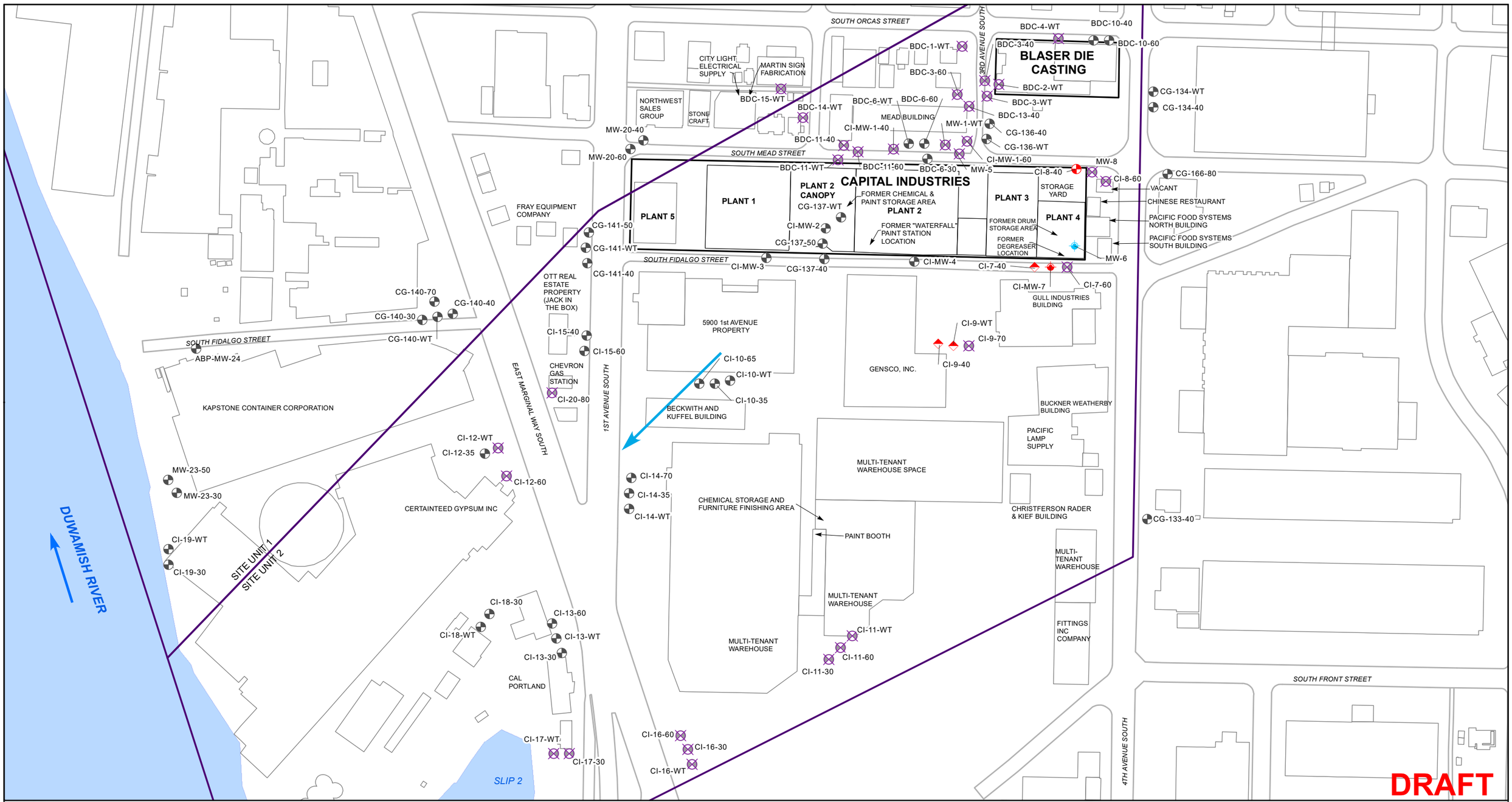
California
Oakland | Irvine

FIGURE 7-5

SU2 COMPLIANCE MONITORING PLAN
BDC AND CI PLANT 2 AREA
DRAFT CLEANUP ACTION PLAN
WEST OF 4th SITE
SEATTLE, WASHINGTON

FARALLON PN: 457-008

Drawn By: aguse | Checked By: SJ | Date: 3/5/2024 | Disc Reference: Q:\Projects\457 CapitalIndust\017 Cleanup Action\Mapfiles\Figure-7-5_GW_Monitoring_Plant2_v2.mxd



LEGEND

MONITORING FREQUENCY

- ANNUAL
- EVERY 5 YEARS
- NOT INCLUDED IN SAMPLING PROGRAM FOR THIS AREA
- WELL TO BE DECOMMISSIONED

- WHERE DETETECTED, COCS IN GROUNDWATER SAMPLES HAVE BEEN LESS THAN CUL PROTECTIVE OF SURFACE WATER (BETWEEN 2014 AND 2024).
- GROUNDWATER SAMPLE HAS HAD ONE OR MORE COCS THAT HAVE HAVE EXCEEDED CUL PROTECTIVE OF SURFACE WATER (BETWEEN 2014 AND 2024).
- APPROXIMATE AVERAGE DIRECTION OF GROUNDWATER FLOW FOR ALL THREE GROUNDWATER INTERVALS. THE FLOW DIRECTION IS VARIABLE WITH MORE NORTHERN AND SOUTHERN COMPONENTS OBSERVED BASED ON HISTORICAL MONITORING DATA.
- DUWAMISH RIVER FLOW DIRECTION

NOTES:
OVERLAPPING MONTIORING WELL LOCATIONS HAVE BE SHIFTED FOR DISPLAY PURPOSES.
MONITORING WELLS HAVE LABELS THAT INDICATE THEIR IDENTIFICATION AND SAMPLE DEPTH. SAMPLE DEPTH ARE MEASURED BELOW GROUND SURFACE OR AT THE WATER TABLE (WT).

CI-17-30
WELL ID WELL DEPTH

TCE = TRICHLOROETHENE
CUL = CLEANUP LEVEL

N

0 100 200
SCALE IN FEET

1. ALL LOCATIONS ARE APPROXIMATE
2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

FARALLON CONSULTING
Your Challenges. Our Priority. | farallonconsulting.com

Washington
Issaquah | Bellingham | Seattle

Oregon
Portland | Baker City

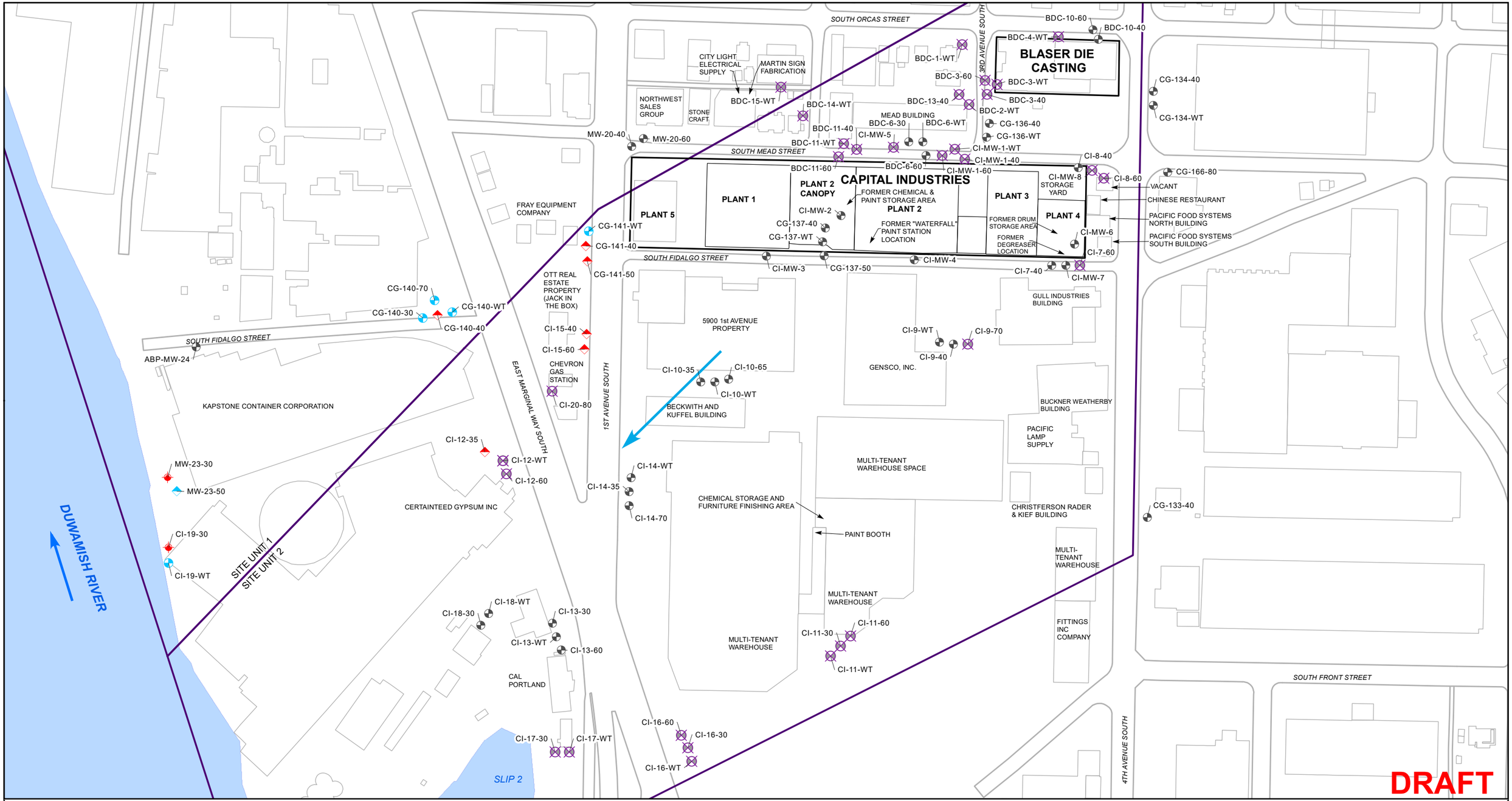
California
Oakland | Irvine

FIGURE 7-6

SU2 COMPLIANCE MONITORING PLAN
CI PLANT 4 AREA
DRAFT CLEANUP ACTION PLAN
WEST OF 4th SITE UNIT 2
SEATTLE, WASHINGTON

FARALLON PN: 457-008

Drawn By: aguse
Checked By: SJ
Date: 3/5/2024
Disc Reference:
Path: Q:\Projects\457 CapitalIndust\017 Cleanup Action\Mapfiles\Figure-7-6_GW_Monitoring_Plant4_v2.mxd



LEGEND

MONITORING FREQUENCY

- ANNUAL
- EVERY 5 YEARS
- NOT INCLUDED IN SAMPLING PROGRAM FOR THIS AREA
- WELL TO BE DECOMMISSIONED
- WHERE DETETECTED, COCS IN GROUNDWATER SAMPLES HAVE BEEN LESS THAN CUL PROTECTIVE OF SURFACE WATER (BETWEEN 2014 AND 2024).
- GROUNDWATER SAMPLE HAS HAD ONE OR MORE COCS THAT HAVE HAVE EXCEEDED CUL PROTECTIVE OF SURFACE WATER (BETWEEN 2014 AND 2024).

APPROXIMATE AVERAGE DIRECTION OF GROUNDWATER FLOW FOR ALL THREE GROUNDWATER INTERVALS. THE FLOW DIRECTION IS VARIABLE WITH MORE NORTHERN AND SOUTHERN COMPONENTS OBSERVED BASED ON HISTORICAL MONITORING DATA.

DUWAMISH RIVER FLOW DIRECTION

NOTES:
OVERLAPPING MONITORING WELL LOCATIONS HAVE BE SHIFTED FOR DISPLAY PURPOSES. MONITORING WELLS HAVE LABELS THAT INDICATE THEIR IDENTIFICATION AND SAMPLE DEPTH. SAMPLE DEPTH ARE MEASURED BELOW GROUND SURFACE OR AT THE WATER TABLE (WT).

CI-17-30
WELL ID WELL DEPTH

CLEAN UP LEVEL (CUL) FOR PROTECTION OF AIR QUALITY = 0.33 MICROGRAMS PER LITER CLEAN UP LEVEL FOR PROTECTION OF SURFACE WATER = 0.18 MICROGRAMS PER LITER

VC = VINYL CHLORIDE

N

0 100 200
SCALE IN FEET

1. ALL LOCATIONS ARE APPROXIMATE
2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

FARALLON CONSULTING
Your Challenges. Our Priority. | farallonconsulting.com

Washington
Issaquah | Bellingham | Seattle

Oregon
Portland | Baker City

California
Oakland | Irvine

FIGURE 7-7

SITE UNIT BOUNDARY AREA
COMPLIANCE MONITORING PLAN
DRAFT CLEANUP ACTION PLAN
WEST OF 4th SITE UNIT 2
SEATTLE, WASHINGTON

FARALLON PN: 457-008

Drawn By: aguse | Checked By: SJ | Date: 3/5/2024 | Disc Reference:
Path: Q:\Projects\457 CapitalIndust\017 Cleanup Action\Mapfiles\Figure-7-7_GW_Monitoring_SiteBoundary_v2.mxd

APPENDIX A

CI Plant 4 Soil Vapor Extraction Engineering Plans

CAPITAL INDUSTRIES, INC.
SOIL VAPOR EXTRACTION (SVE) SYSTEM
SEATTLE, WASHINGTON

5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

SITE VICINITY MAP

DRAWING INDEX

DIRECTORY

ENVIRONMENTAL CONSULTANT
FARALLON CONSULTING
975 5TH AVENUE NORTHWEST
ISSAQUAH, WASHINGTON 98027

PRIMARY CONTACT: JEFF KASPAR
PHONE: (425) 417-7238
EMAIL: JKASPAR@FARALLONCONSULTING.COM

ENGINEER CONTACT: LISA THOMPSON
PHONE: (425) 395-4636
EMAIL: LTHOMPSON@FARALLONCONSULTING.COM

LEAD AGENCY OVERSEEING CLEANUP
AGREED ORDER NO. DE 10402
15700 DAYTON AVENUE NORTH
SHORELINE, WASHINGON 98133

SITE MANAGER
ED JONES
UNIT MANAGER

OWNER
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

		RB	RM
		BY	APP.
12/13/2023	PRELIMINARY SVE DESIGN		
DATE	REVISION/DESCRIPTION		

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

COVER, VICINITY MAP, AND DRAWING INDEX

5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

FARALLON PROJECT NO.:
457-008

SHEET
EN0.00

ELECTRICAL ABBREVIATIONS

A/AMP	AMP
AC	ALTERNATING CURRENT
BD	BUS DUCT
C	CURRENT
CB	CIRCUIT BREAKER
CLG	CEILING
DC	DIRECT CURRENT
DIS	DISCONNECT
DP	DOUBLE POLE
DT	DOUBLE THROW
EG	ENCLOSED AND GASKETED
E(OH)	ELECTRICAL (OVERHEAD)
E(UG)	ELECTRICAL (UNDERGROUND)
EMER	EMERGENCY
EPO	EMERGENCY POWER OFF
EMT	ELECTRICAL METALLIC TUBING
EXP	EXPOSED
FBO	FURNISHED BY OTHERS
FLEX	FLEXIBLE METAL CONDUIT
FRN	DUAL ELEMENT FUSE
GEN	GENERATOR
GFIC	GROUND FAULT INTERRUPTER
GND	GROUND
GRC	GALVANIZED RIGID CONDUIT
HOA	HAND-OFF-AUTO SWITCH
IRD	INFRARED DETECTOR
HP	HORSE POWER
HZ	CYCLES PER SECOND
JB	JUNCTION BOX
LFMC	LIQUID TIGHT FLEXIBLE METAL CONDUIT
M	MOTOR/MOTOR STARTER COIL
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NON-FUSED
NO	NORMALLY OPEN
OL	OVERLOADS
PBS	PUSHBUTTON
PF	POWER FACTOR
PL	PILOT LIGHT
PLC	PROGRAMMABLE LOGIC CONTROLLER
RC	RIGID CONDUIT
RCPT	RECEPTACLE
SN	SOLID NEUTRAL
SP	SINGLE POLE
ST	SINGLE THROW
SW	SWITCH
TF/TRAN	TRANSFORMER
UF	UNDERFLOOR
UG	UNDERGROUND
V	VOLTS
VFD	VARIABLE FREQUENCY DRIVE
VP	VAPOR PROOF
WHT	WHITE
WP	WEATHER PROOF
XP	EXPLOSION PROOF

STANDARD ABBREVIATIONS

AF	AIR FILTER
AB	AGGREGATE BASE
AC	ASPHALTIC CONCRETE
APPROX	APPROXIMATELY
AF	AIR FILTER
AS	AIR SPARGE
BF	BLIND FLANGE
B.G.S.	BELOW GROUND SURFACE
BLDG	BUILDING
BOP	BOTTOM OF PIPE
BV	BALL VALVE
CAS	CENTRAL AREA AIR SPARGE
CONC	CONCRETE
CPLG	COUPLING
℄ /CL	CENTERLINE
CV	CONTROL VALVE/CHECK VALVE
DC	DOUBLE CONTAINED
Ø/DIA	DIAMETER
DWG	DRAWING
DP	DUAL PHASE
DPI	DIFFERENTIAL PRESSURE INDICATOR
EF	EACH FACE
EL/ELEV	ELEVATION
ELEC	ELECTRICAL
ELB	ELBOW
EPDM	ETHYLENE PROPYLENE RUBBER
EXIST/(E)	EXISTING
EXP	EXPANSION
EW	EACH WAY
EA	EACH
FC	FAIL CLOSE
FO	FAIL OPEN
FLXC	FLEXIBLE CONNECTION
FM	FLOW METER
FL	FLOW LINE
FT	FOOT
FUT	FUTURE
FIN GR	FINISHED GRADE
FE	FLANGED END
FNPT	FEMALE NATIONAL PIPE THREAD
GA	GAUGE
GAC	GRANULAR ACTIVATED CARBON
GALV	GALVANIZED
GI	GALVANIZED IRON
GPM	GALLONS PER MINUTE
GR	GRADE
GND	GROUND
GSKT	GASKET
GW	GROUNDWATER
GV	GATE VALVE
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
HP	HORSEPOWER/HIGH PRESSURE
HR	HOUR
HS	HOSE
HYD	HYDRANT
HOA	HAND OFF AUTOMATIC
ID	INSIDE DIAMETER
IN	INCHES
INV	INVERT
IPS	IRON PIPE SIZE
JT	JOINT
JB	JUNCTION BOX
KO	KNOCK OUT
LSHH	LEVEL SWITCH
M	MOTOR
MAX	MAXIMUM
MH	MANHOLE
MJ	MECHANICAL JOINT
MIN	MINUTE/MINIMUM
MISC	MISCELLANEOUS
MNPT	MALE NATIONAL PIPE THREAD
MP	METER PUMP
MON.PORT	MONITORING PORT
MW	MONITORING WELL
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO.	NUMBER
N	NEW
NTS	NOT TO SCALE
NPDES	NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM
OC	ON CENTER
OD	OUTSIDE DIAMETER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OVHD	OVERHEAD
#/LB	POUND
PB	PULL BOX
PBF	PROVIDED BY FARALLON
PC	PORTLAND CEMENT
PCC	PORTLAND CEMENT CONCRETE
PG	PRESSURE GAS
PL	PROPERTY LINE/PIPE LINE
PO	PUMP OUT
P	PRESSURE
PRV	PRESSURE RELEASE VALVE
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH, ABSOLUTE
PSIG	POUNDS PER SQUARE INCH, GAUGE
PTW	PRESSURE TREATMENT
PVC	POLYVINYL CHLORIDE
PV	PROCESS VARIABLE
PR	PAIR
PUE	PUBLIC UTILITY EASEMENT
R	RADIUS/RISER
RC	REINFORCED CONCRETE
REQ	REQUIRED
REF	REFERENCE
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHT	SHEET
SPEC	SPECIFICATION
SQ	SQUARE
STA	STATION
STD	STANDARD
STL	STEEL
SBO	SUPPLIED BY OWNER
ST	SAMPLE TAP
STR	STRAINER
SS	STAINLESS STEEL
STL	STEEL
SVE	SOIL VAPOR EXTRACTION
SW	SWITCH
TYP	TYPICAL
TOC	TOP OF CASING/CURB
TOS	TOP OF STEEL
TOW	TOP OF WALL
UBC	UNIFORM BUILDING CODE
UGPS	UNDERGROUND PULL SECTION
UTIL	UTILITY
V	VALVE/VENT/VOLTS
VAC	VACUUM
VAR	VARIES/VARIABLE
VERT	VERTICAL
VP	VAPOR
VRV	VACUUM RELIEF VALVE
W/	WITH
W/O	WITHOUT
WS	WATER SURFACE/WATER STOP

STANDARD SYMBOLS

- 1 / N5.00 — DETAIL OR SECTION NUMBER / DETAIL SHEET NUMBER
- MW-3 — MONITORING WELL
- MW-7 — SOIL VAPOR EXTRACTION WELL
- AS-1 — AIR SPARGE WELL
- AS-3 — ANGLED AIR SPARGE WELL
- EXCAVATION AREA
- PROPOSED HORIZONTAL SOIL VAPOR EXTRACTION (HSVE) TRENCHING

EXISTING TOPOGRAPHIC LEGEND

LEGEND

⊕	AREA DRAIN
ABAN/RET	ABANDONED/RETIRED
	ASPHALT (ASPH)
BLRD	BOLLARD
	BRICK SURFACE
	BUILDING LINE
BC	BUILDING CORNER
BR	BIKE RACK
	CANOPY
	CATCH BASIN (CB)
	CONCRETE SURFACE
CW/BW	CONCRETE/BRICK WALK
CRW/WRW	CONCRETE/WOOD RETAINING WALL
CC/XC	CONCRETE/EXTRUDED CURB
CP/IP	CONCRETE/IRON PIPE
	CHAIN LINK FENCE (CLF)
CTV	CABLE TV
COL	COLUMN
℄/M	CENTERLINE/MONUMENT LINE
CS/WS	CONCRETE/WOOD STAIRS
	H/C PARKING SPACE
CON	CONIFEROUS TREE
DEC	DECIDUOUS TREE
CMP	CORRUGATED METAL PIPE
C.O.C.	CENTER OF CHANNEL
DWY	DRIVEWAY
ECD	ELECTRICAL CONDUIT
ED	ELECTRICAL DUCT
EHH	ELECTRICAL HANDHOLE
EMH	ELECTRICAL MANHOLE
EM	ELECTRICAL METER
EV/ET	ELECTRICAL VAULT/TRANSFORMER
	FOUND SURVEY MONUMENT (AS NOTED)
	FIRE HYDRANT
	FIRE DEPT. CONNECTION (FDC)
FO	FIBER OPTICS
FOMH	FIBER OPTIC MANHOLE
FFE	FINISH FLOOR ELEVATION
GB	GRADE BREAK
G	GAS MAIN
GM	GAS METER
	GAS VALVE
GV	GAS VAULT
ICB	IRRIGATION CONTROL BOX
IV	IRRIGATION VALVE
IE	INVERT ELEVATION
	LIGHT POLE (DECORATIVE)
LSCAPE/PA	LANDSCAPE/PLANTER
	MANHOLE
US	MAILBOX (FEDERAL/PRIVATE)
MW	MONITOR WELL
OHP/OHT	OVERHEAD POWER/TELEPHONE
P.S.	PARKING SPACE(S)
PL	PROPERTY LINE (PL)
(P)	PAINTED UTILITY LOCATION
	PIPE FLOW DIRECTION
PE	POLYETHYLENE
	POST INDICATOR VALVE
PS/PSS	COMBINED/SANITARY SEWER
PSD	STORM DRAIN
	PRIVATE CATCH BASIN
	PEDESTRIAN PUSH BUTTON (PPB)
(R)	RECORD DATA
	GRAVEL SURFACE
	ROCKERY
RE	ROOF ELEVATION
SD	SERVICE DRAIN (STORM)
CO	CLEANOUT
SSS	SANITARY SIDE SEWER (RECORD)
	SIGN/STREET NAME SIGN
TP SB	TEST PIT/SOIL BORING
TC/SL	TRAFFIC CONTROL/STREET LIGHT HANDHOLE
	TRAFFIC CONTROL CABINET (TRSCC)
TCHD	TRENCH DRAIN
	TEMPORARY BENCHMARK (TBM)
TCD	TELEPHONE CONDUIT (BURIED)
TD	TELEPHONE DUCT
TV	TELEPHONE VAULT
TMH	TELEPHONE MANHOLE
TS	TELEPHONE SENTRY
	TRAFFIC FLOW DIRECTION
TRCD	TRAFFIC SIGNAL CONDUIT (BURIED)
TOE	TOE OF SLOPE
TOP	TOP OF BANK
WV	WATER VAULT
W	WATER MAIN
WM	WATER METER
	WATER VALVE
	WATER BLOWOFF VALVE
	WATER GATE VALVE/CHAMBER
VO/CO	VACATION/CONDEMNATION ORDINANCE
	WOOD FENCE (WF)
	OIL FILL CAP
	YARD LIGHT
	REBAR AND CAP

GENERAL NOTES

1. READ ALL NOTES AND REVIEW ENTIRE PLAN SET PRIOR TO COMMENCEMENT OF WORK ACTIVITIES.
2. ESTABLISH EXACT PROJECT BOUNDARIES PRIOR TO COMMENCEMENT OF WORK, AND RECONFIRM BOUNDARY LINES WHEN COORDINATING WITH NEIGHBORING PROPERTY OWNERS.
3. VERIFY SITE CONTROL POINTS PROVIDED ON PLANS. VERIFY DIMENSIONS AND ORIENTATION PRIOR TO STAKING OF SITE POINTS.
4. A COPY OF THE PROJECT DESIGN DRAWINGS AND SPECIFICATIONS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES.
5. COPIES OF ALL PERMITS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES. THE CONTRACTOR SHALL COMPLY WITH ALL PERMIT REQUIREMENTS.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL LOCATIONS, DIMENSIONS AND QUANTITIES.
7. UTILITIES SHOWN IN THIS DRAWING SET ARE BASED ON INFORMATION PROVIDED BY OTHERS. INFORMATION SHOWN SHALL BE CONSIDERED APPROXIMATE AND INCOMPLETE. CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO COMMENCEMENT OF WORK ACTIVITIES.
8. THE CONTRACTOR SHALL HAVE A PRIVATE UTILITY LOCATE SERVICE VERIFY ALL UTILITIES AND/OR OTHERWISE FIELD VERIFY EXACT LOCATIONS AND MARK THEIR LOCATIONS ON THE GROUND PRIOR TO STARTING CONSTRUCTION. FARALLON SHALL BE CONTACTED IMMEDIATELY IF A CONFLICT IS FOUND BETWEEN EXISTING UTILITIES AND THE PROJECT DESIGN.
9. ENGINEER SHALL BE NOTIFIED OF DISCREPANCIES BETWEEN CONTRACT DRAWINGS AND ACTUAL SITE CONDITIONS.
10. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR THE JOB SITE CONDITIONS AND ENSURE THE SAFETY OF ALL PERSONS AND PROPERTY FOR THE DURATION OF ON-SITE PROJECT WORK. THE CONTRACTOR SHALL PROTECT STRUCTURES, UTILITIES, AND PAVING FROM DAMAGE, DIRECT OR INDIRECT, RESULTING FROM THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY OVER THE DURATION OF ON-SITE ACTIVITIES AND NOT BE LIMITED TO NORMAL WORKING HOURS.
11. MAINTAIN FULL OPERATION OF PUBLIC ROADWAYS. KEEP CLEAN AND FREE OF DEBRIS, DIRT, AND OTHER PROJECT RELATED ITEMS. SWEEP AS NEEDED TO MEET PROJECT REQUIREMENTS. COORDINATE WITH OWNER AND PIERCE COUNTY ALL DISRUPTIONS TO SERVICES. REPAIR ALL DAMAGE TO MATCH EXISTING CONDITIONS.
12. GENERAL CONTRACTOR AND, IF SUBCONTRACTED, THE EARTHWORK SUBCONTRACTOR ARE RESPONSIBLE FOR ANY EARTHWORK QUANTITY ESTIMATES.
13. ON-SITE SOILS MAY ONLY BE USED IN ACCORDANCE WITH PROJECT REQUIREMENTS AND SUBJECT TO APPROVAL OF PROPER COMPLIANCE BY THE PROJECT ENGINEER.
14. REVIEW AND PROPERLY COORDINATE ALL WORK OF ALL DISCIPLINES PRIOR TO CONSTRUCTION, INCLUDING, BUT NOT LIMITED TO, IRRIGATION LINES, SLEEVES, AND UTILITY CONDUITS.
15. ALL EXCAVATIONS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPLICABLE U.S. DEPARTMENT OF LABOR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE WASHINGTON INDUSTRIAL SAFETY AND HEALTH ACT (WISHA) REGULATIONS. THE CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR THE SAFETY OF ALL CONSTRUCTION OPERATIONS.
16. NO TRENCHES SHALL BE LEFT OPEN WHEN WORK IS NOT IN PROGRESS. ALL OPEN EXCAVATIONS SHALL BE SECURELY FENCED AND COVERED IF SO REQUIRED.
17. THE CONTRACTOR SHALL DISPOSE OF MATERIALS REMOVED FROM THIS SITE AT APPROPRIATE AND PERMITTED RECEIVING FACILITIES.
18. CONFIRM ALL UTILITY ALIGNMENTS AND CROSSINGS PRIOR TO ORDERING MATERIALS AND PRIOR TO STAKING.
19. UPON COMPLETION OF SITE WORK, CLEAN ALL SITE SURFACES (PAVEMENTS, CURBS, STAIRS, WALKS, ETC.).
20. ROUTE DISCHARGE PIPING IN ACCORDANCE WITH ASTM E2121-13 SECTION 7.3.2.9 ROOF LINE, MINIMUM 10 FT AWAY FROM HVAC INTAKE AND AT LEAST 12 INCHES ABOVE THE SURFACE OF THE ROOF.

PIPING, ELECTRICAL AND EQUIPMENT SYMBOLS

- GATE VALVE
- GLOBE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DIAPHRAM OPERATED VALVE
- S — SOLENOID VALVE
- M — MOTOR OPERATED VALVE
- PRESSURE REGULATING VALVE
- D — DRAIN
- WELD CAP
- SCREWED CAP
- SCREWED PLUG
- FLANGE
- BLIND FLANGE
- REDUCER/INCREASER
- DIRECTION OF FLOW
- UNION
- FLEXIBLE PIPE COUPLING
- BLOWER OR FAN
- CENTRIFUGAL PUMP
- PITOT TUBE
- STRAINER
- TRAP
- AF — FILTER
- Ø — DIAMETER
- FEMALE ADAPTER
- S — SILENCER
- NEEDLE VALVE
- FLOW METER
- HOSE BIB
- SAMPLE TAP/MONITORING PORT
- HEAT EXCHANGER
- PRESSURE RELIEF OR AIR RELIEF
- VACUUM RELIEF
- NO — NORMALLY OPEN
- NC — NORMALLY CLOSED
- CONDUIT RUN EXPOSED
- CONDUIT RUN UNDERGROUND
- EXIST CONDUIT RUN UNDERGROUND
- MAGNETIC STARTER
- DUPLEX RECEPTICAL, 15A; WP-WEATHER PROOF
- ETM — ELAPSED TIME METER
- FUSE
- FUSED DISCONNECT
- CAMLOCK CONNECTION
- VERTICAL PIPERUN
- GROUND
- GROUND ROD (3/4" COPPER WELD)
- HEATER STRIP
- J — JUNCTION BOX, PB-PULLBOX
- KWH — KILOWATT HOUR METER
- M — MOTOR
- MOTOR OVERLOAD
- NON-FUSABLE DISCONNECT SWITCH
- PILOT LIGHT, R=RED, W=WHITE, G=GREEN
- SELECTOR SWITCH AO=AUTO OFF, HOA=HAND OFF AUTO
- SWITCH, 120-277V, 2-2POLE, 20A
- T — THERMOSTAT
- TD — TIME DELAY RELAY, CR=CONTROL RELAY
- TRANSFORMER
- UNDERGROUND PULLBOX
- W.P. — WEATHER PROTECTED
- 120/208V PANEL
- 277/480V PANEL
- *HIGH LIGHT STANDARD
- X — REVISION TO PLANS

INSTRUMENTATION ABBREVIATIONS AND SYMBOLS

INSTRUMENT LEGEND

FIRST LETTER INITIATING VARIABLE		SUCCEEDING LETTERS OUTPUT FUNCTIONS
A	ANALYSIS	ALARM
B	BURNER	
C	CONDUCTIVITY	CONTROL
D	DENSITY	DIFFERENTIAL
E	POTENTIAL (VOLTS)	PRIMARY ELEMENT
F	FLOW RATE	RATIO (FRACTION)
G	FIRE ALARM	GLASS (SIGHT GAUGE)
H	HAND (MANUALLY)	HIGH
I	CURRENT (AMPERES)	INDICATE
J	POWER	
K	TIME	
L	LEVEL	LEAK, LOW
M	MOISTURE/HUMIDITY	LIGHT (PILOT)
N	EQUIPMENT STATUS	
P	PRESSURE/VACUUM	POINT (TEST CONNECTION)
Q	QUANTITY	INTEGRATE (TOTALIZE)
R		RECORD/PRINT
S	SPEED	SWITCH
T	TEMPERATURE	TRANSMIT
U	MULTIVARIABLE	MULTIFUNCTION
V	VIBRATION/VOLUME	VALVE/DAMPER
W	WEIGHT/FORCE/TORQUE	
X	UNCLASSIFIED	UNCLASSIFIED
Y		RELAY/COMPUTE
Z	POSITION	DRIVE/ACTUATE

INSTRUMENT SYMBOLS

SYMBOL	DESCRIPTION
M	MOTOR
HOA	HAND-OFF-AUTO SELECTOR SWITCH
	LOCALLY MOUNTED INSTRUMENT
	CONTROL PANEL MOUNTED INSTRUMENT
I	INTERLOCK
-10	PLC SHUTDOWN ALARM

NO.	DESCRIPTION	DATE	BY	CKD.	APP.
	PRELIMINARY SVE DESIGN	12/13/2023	RB	LT	RM

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

GENERAL NOTES, LEGEND, SYMBOLS, AND ABBREVIATIONS

5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

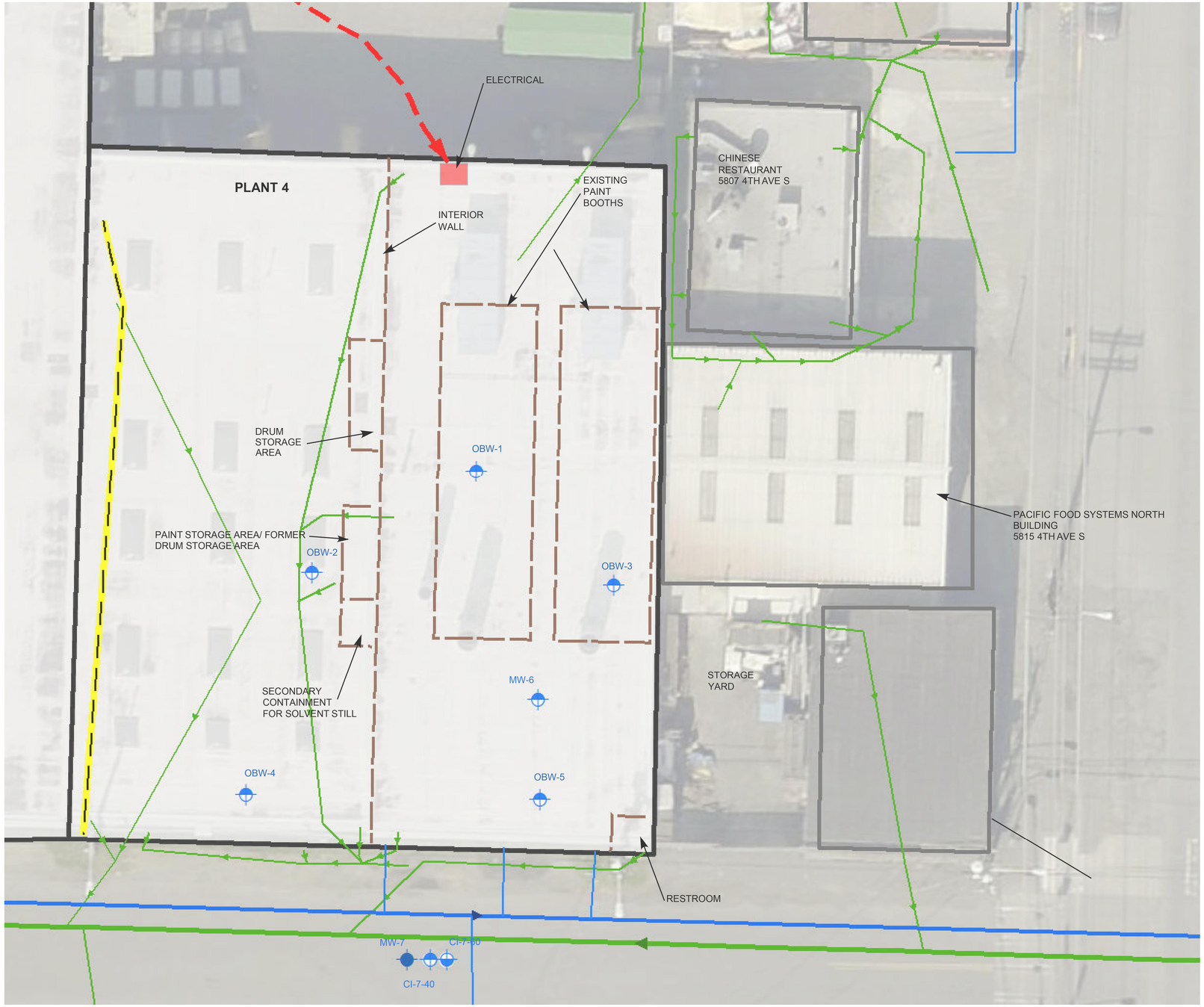
811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

FARALLON PROJECT NO.:
457-008

SHEET
EN0.10



LEGEND

- WATER TABLE INTERVAL MONITORING WELL
- SHALLOW INTERVAL MONITORING WELL
- INTERMEDIATE INTERVAL MONITORING WELL
- ELECTRICAL LINE
- OVERHEAD GAS LINE
- PLANT 4 CURRENT INTERIOR FEATURE
- HYDRANT
- WATER DISTRIBUTION MAIN
- WATER SERVICE LINE
- HYDRANT LATERAL
- COMBINED SANITARY SEWER/ STORMWATER MANHOLE
- COMBINED SANITARY SEWER/STORMWATER MAIN LINE AND FLOW DIRECTION
- SANITARY SEWER LATERAL AND FLOW DIRECTION
- STORMWATER CATCH BASIN
- STORMWATER SIDE SEWER/LATERAL

10 0 10
SCALE IN FEET

DATE	REVISION/DESCRIPTION	BY	CKD	APP.
12/13/2023	PRELIMINARY SVE DESIGN	RB	LT	RM

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

SITE PLAN -EXISTING CONDITIONS
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

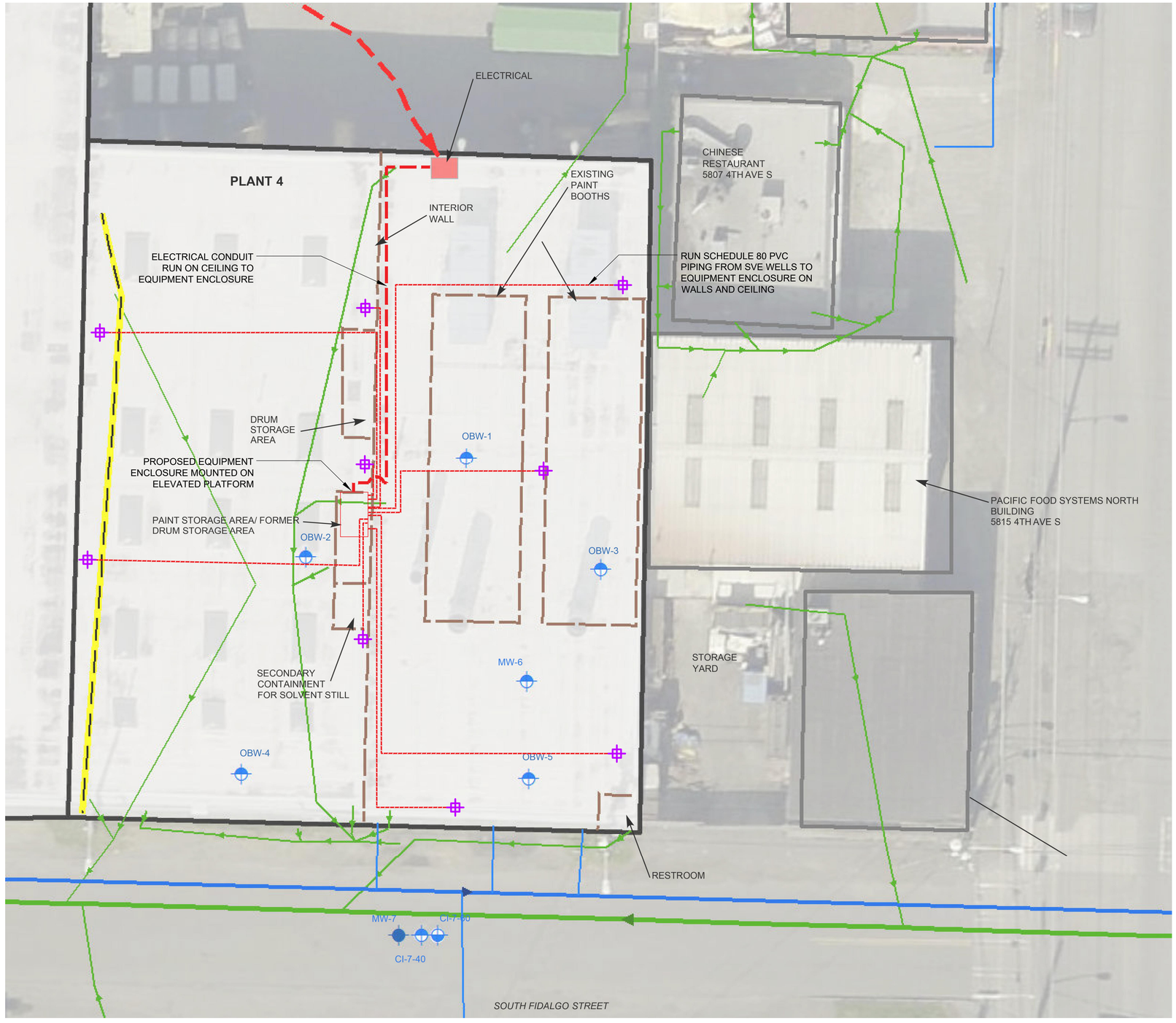
811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

FARALLON PROJECT NO.:
457-008

SHEET
EN1.00



LEGEND

- WATER TABLE INTERVAL MONITORING WELL
- SHALLOW INTERVAL MONITORING WELL
- INTERMEDIATE INTERVAL MONITORING WELL
- ELECTRICAL LINE
- OVERHEAD GAS LINE
- PLANT 4 CURRENT INTERIOR FEATURE
- HYDRANT
- WATER DISTRIBUTION MAIN
- WATER SERVICE LINE
- HYDRANT LATERAL
- COMBINED SANITARY SEWER/ STORMWATER MANHOLE
- COMBINED SANITARY SEWER/STORMWATER MAIN LINE AND FLOW DIRECTION
- SANITARY SEWER LATERAL AND FLOW DIRECTION
- STORMWATER CATCH BASIN
- STORMWATER SIDE SEWER/LATERAL
- PROPOSED SOIL VAPOR EXTRACTION WELL
- PROPOSED SVE PIPING RUN ALONG WALLS AND CEILING

10 0 10
SCALE IN FEET

APP.	RM
CKD.	LT
BY	RB
REVISION/DESCRIPTION	PRELIMINARY SVE DESIGN
DATE	12/13/2023

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

SITE PLAN WITH PROPOSED SYSTEM LAYOUT

5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

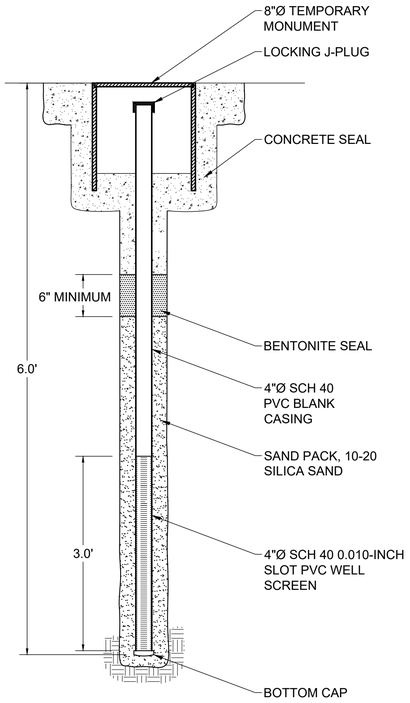
811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

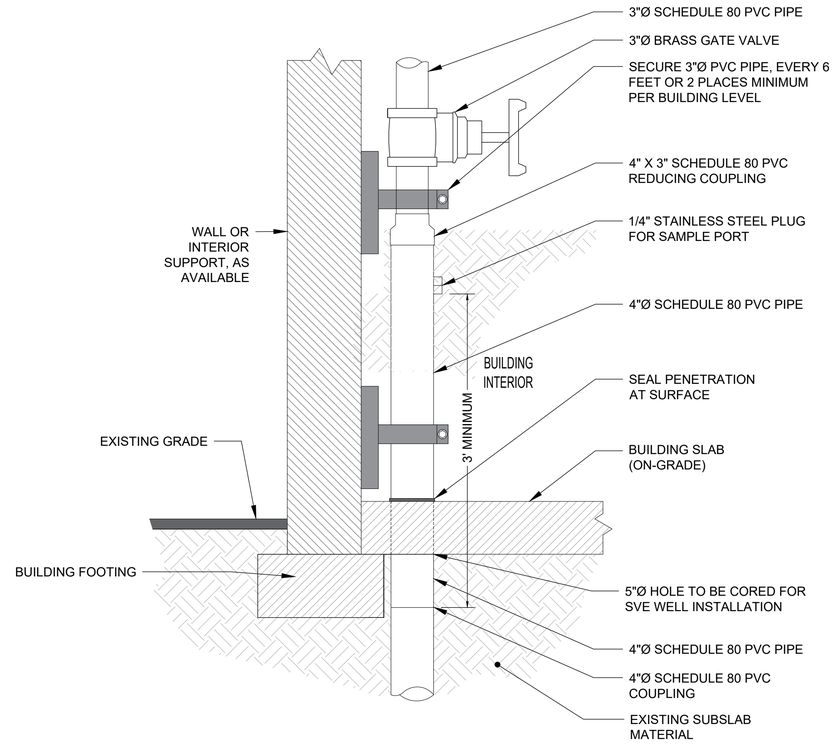
FARALLON PROJECT NO.:
457-008

SHEET
EN2.00

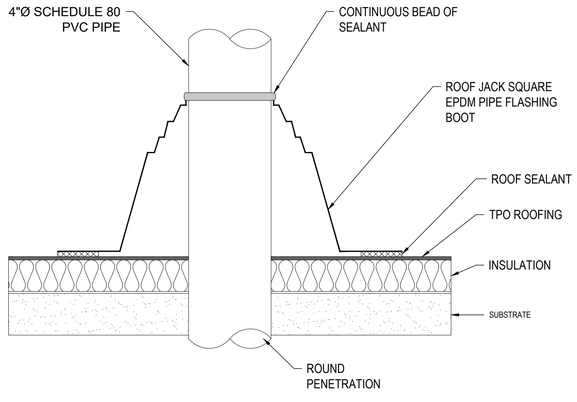


NOTES:
PVC = POLYVINYL CHLORIDE
SCH = SCHEDULE

1 EXTRACTION WELL
NTS



2 SVE PIPING
NTS



3 ROOF PENETRATION
NTS

REV	DATE	REVISION/DESCRIPTION	BY	CKD.	APP.
	12/13/2023	PRELIMINARY SVE DESIGN	RB	LT	RM

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

SVE WELL CONSTRUCTION AND WELLHEAD DETAILS

5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

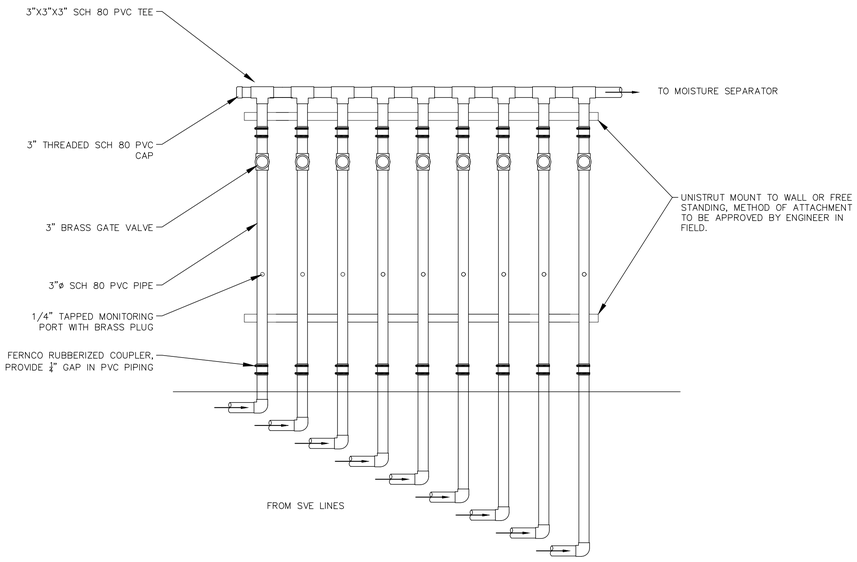
811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

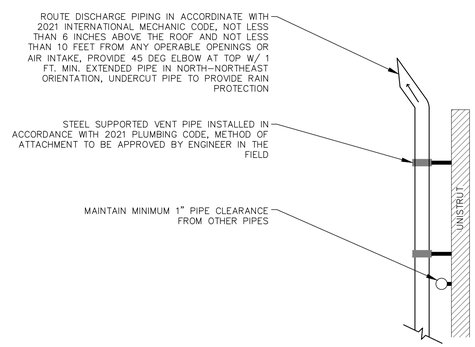
FARALLON PROJECT NO.:
457-008

SHEET
EN3.00

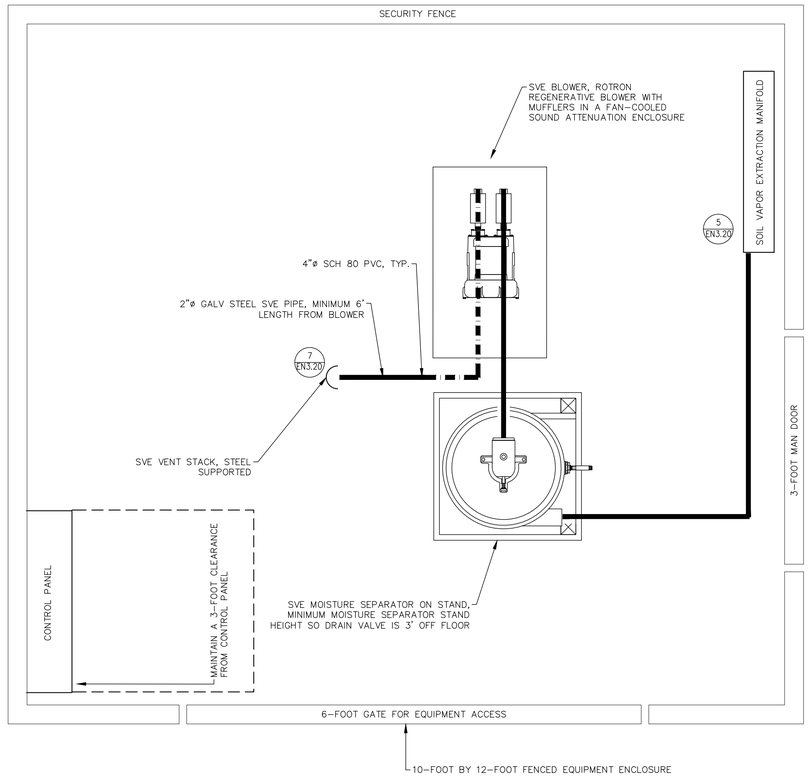


NOTES:
1. SPACE SVE RISER TO MINIMUM NECESSARY TO FABRICATE, OPERATE, AND MAINTAIN CONSIDERING THE SIZE OF TEES, NIPPLES, ELBOWS, AND VALVES.
2. CONTRACTOR SHALL USE AND INSTALL FITTINGS TO MANUFACTURER RECOMMENDATIONS FOR ASSOCIATED PIPE MATERIALS.

4 SOIL VAPOR EXTRACTION MANIFOLD DETAIL
NTS



5 VENT STACK
NTS



NOTES:
1. EQUIPMENT INSTALLED IN A MANNER THAT ALLOWS FOR ACCESS AROUND EQUIPMENT AND FOR MAINTENANCE OF ALL COMPONENTS IN PLACE. UNIONS, RUBBERIZED COUPLERS, AND OTHER QUICK DISCONNECT FITTINGS SHALL BE USED TO ALLOW FOR REMOVAL OF EQUIPMENT AND COMPONENTS.
2. THE DISCHARGE STACK WAS LOCATED A MINIMUM OF 10 FEET AWAY FROM ANY AIR INTAKE OR WINDOWS.

6 TYPICAL REMEDIATION ENCLOSURE LAYOUT
NTS

APP.	RM
CKD.	LT
BY	RB

REVISION/DESCRIPTION: PRELIMINARY SVE DESIGN
DATE: 12/13/2023

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

SVE MANIFOLD DETAILS AND REMEDIATION EQUIPMENT ENCLOSURE LAYOUT

5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

FARALLON PROJECT NO.:
457-008

SHEET
EN3.10

EQUIPMENT LIST

AF-2
2"ø FILTERED SILENCER AIR INLET SOLBERG MODEL NO. FS-231P-300 OR ENGINEER APPROVED EQUIVALENT WITH 2"ø BRASS GATE VALVE.

AF-3
4"ø INLINE AIR FILTER, ROTRON MODEL NO. 516465 OR ENGINEER APPROVED EQUIVALENT.

CP-101
BLOWER CONTROL PANEL. OWNER TO SUPPLY 30 AMP, THREE PHASE ELECTRICAL SERVICE. PROVIDE 5.0Hp VFD WITH AMPERAGE DISPLAY. PLACE VFD DISPLAY ON OUTSIDE OF CONTROL PANEL. PROVIDE ELAPSED TIME METER WITH DISPLAY ON OUTSIDE OF CONTROL PANEL.

MS-101
ROTRON CYCLONIC MOISTURE SEPARATOR MODEL NO. MS350BS EQUIPPED W/ SINGLE HIGH LEVEL SWITCH, VACUUM GAUGE, VACUUM RELIEF VALVE; ELEVATE UNIT 3' MINIMUM ABOVE CONCRETE FLOOR ON STAND TO BE APPROVED BY THE ENGINEER; PROVIDE FERNCO CONNECTIONS ON INLET AND DISCHARGE.

RGB-101
ROTRON REGENERATIVE BLOWER, MODEL NO. DR808D89MX 5.0 HP, 3PH. PLACE BLOWER WITHIN SOUND ENCLOSURE WITH COOLING FAN. INSTALL WITH OVERLOAD PROTECTION.

S-101
DISCHARGE SILENCER, ROTRON MODEL NO. 550888 OR ENGINEER APPROVED EQUIVALENT.

T-101
PROVIDE A SENSAPHONE SENTINEL MONITORING TELEMETRY SYSTEM. THE TELEMETRY SYSTEM SHALL BE INSTALLED WITHIN THE MAIN CONTROL PANEL OR A NEMA 4 ENCLOSURE TO PROVIDE WEATHER PROTECTION. THE TELEMETRY SHALL BE PROGRAMMED WITH ALARM CONDITIONS AND TRANSDUCER DATA, SYSTEM TO NOTIFY THE OPERATOR IF AN ALARM CONDITION EXISTS.

TI-1
TEMPERATURE INDICATOR RANGE AND UNITS: 50-500 °F

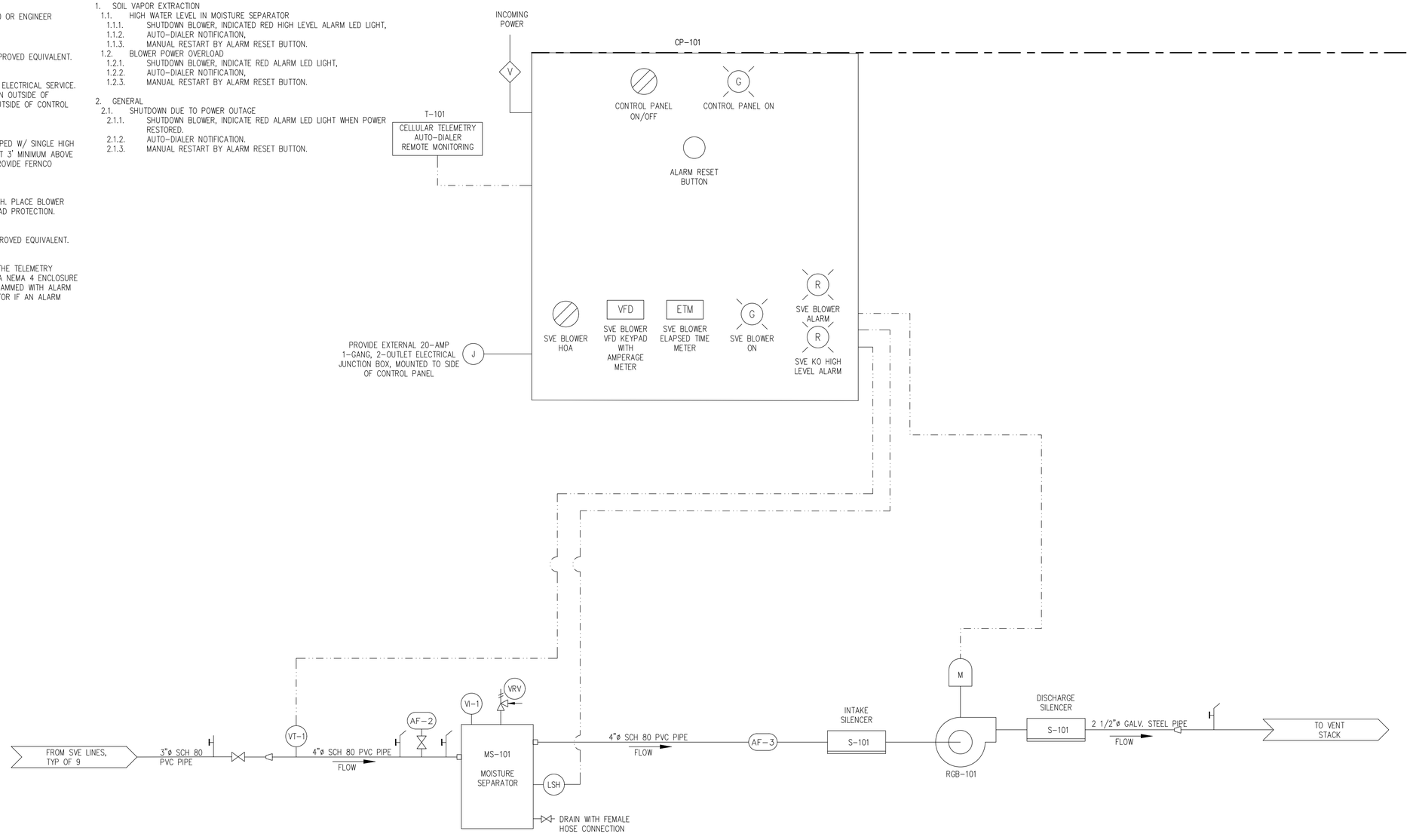
TT-1
TEMPERATURE TRANSMITTER RANGE AND UNITS: -30-140 °F

VI-1
VACUUM INDICATOR RANGE AND UNITS: -100-0 IOW

VT-1
VACUUM TRANSDUCER RANGE AND UNITS: -5-0 PSI

CONTROL LOGIC:

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



DATE	REVISION/DESCRIPTION	BY	CKD	APP.
12/13/2023	PRELIMINARY SVE DESIGN	RB	LT	RM

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

PROCESS AND INSTRUMENTATION DIAGRAM
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

FARALLON PROJECT NO.:
457-008

SHEET
EN4.00

PART 1 GENERAL

SYSTEM DESCRIPTION

A. FURNISH, DELIVER, INSTALL, TEST, AND START-UP OF SVE SYSTEM AND EQUIPMENT AS SHOWN ON THE DRAWINGS, AS SPECIFIED HEREIN, AND AS REQUIRED TO PROVIDE A COMPLETE AND FULLY FUNCTIONAL TREATMENT SYSTEM. MAJOR COMPONENTS INCLUDE THE SYSTEM BLOWER AND MOTOR, MOISTURE SEPARATOR, CONTROL PANEL, AIR FILTERS, ASSOCIATED PIPING, VACUUM GAUGES, VALVES, FITTINGS, AND MONITORING PORTS.

SUBMITTALS

A. SUBMIT DATA AND/OR MANUFACTURER CUT SHEETS TO DEMONSTRATE CONFORMANCE TO SPECIFICATION REQUIREMENTS.
B. PRODUCT DATA: SUBMIT MANUFACTURER'S PRODUCT DATA AND INSTALLATION INSTRUCTIONS FOR EACH MATERIAL, COMPONENT, AND/OR PRODUCT USED.
C. OPERATION AND MAINTENANCE DATA: SUBMIT MANUFACTURER'S OPERATION AND MAINTENANCE INSTRUCTIONS, INCLUDING A MAINTENANCE SCHEDULE.
D. SUBMIT FINAL AS-BUILT DRAWINGS.

QUALIFICATIONS

A. TREATMENT EQUIPMENT FURNISHED UNDER THIS SECTION SHALL BE OF MANUFACTURERS WHO HAVE BEEN REGULARLY ENGAGED IN DESIGN AND MANUFACTURE OF THE MATERIAL AND EQUIPMENT FOR AT LEAST 5 YEARS.

DELIVERY, STORAGE, AND HANDLING

A. EQUIPMENT AND MATERIALS FURNISHED UNDER THIS SECTION SHALL BE PREPARED AND PROTECTED FOR SHIPMENT, SHIPPED, AND STORED UNTIL INSTALLATION PER MANUFACTURERS' INSTRUCTIONS.

QUALITY ASSURANCE

A. COMPLY WITH GOVERNING CODES AND REGULATIONS. PROVIDE PRODUCTS OF ACCEPTABLE MANUFACTURERS, WHICH HAVE BEEN IN SATISFACTORY USE IN SIMILAR SERVICE FOR 3 YEARS. USE EXPERIENCED INSTALLERS. DELIVER, HANDLE, AND STORE MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

GUARANTEE AND WARRANTY

B. SUPPLIERS OF EQUIPMENT SHALL GUARANTEE PERFORMANCE AT DESIGN CONDITIONS.
C. SUPPLIERS OF EQUIPMENT AND MATERIAL SHALL WARRANT THEM FREE OF DEFECTS IN MATERIAL AND WORKMANSHIP FOR AT LEAST 12 MONTHS FROM INITIAL ACCEPTANCE.

END OF SECTION

PART 2 EARTHWORK

SUMMARY

PERFORM EXCAVATION, FILLING, COMPACTION, AND GRADING OPERATIONS AS REQUIRED FOR BELOW-GRADE IMPROVEMENTS. PROVIDE TRENCHING AND BACKFILL FOR UNDERGROUND WORK AND UTILITIES.
A. PROVIDE SUBBASE MATERIALS, SELECT BACKFILL, COMMON BORROW, AND STRUCTURAL FILL MATERIALS FOR PAVEMENTS, AND RESTORATION AS INDICATED ON THE DRAWINGS.
B. PROVIDE SUITABLE FILL FROM OFF THE SITE IF ON-SITE QUANTITIES ARE INSUFFICIENT OR UNACCEPTABLE, AND LEGALLY DISPOSE OF EXCESS FILL OFF THE SITE OR ON-SITE AREAS APPROVED BY THE OWNER.

SUBMITTALS

A. PRODUCT DATA: SUBMIT MANUFACTURER'S PRODUCT DATA AND INSTALLATION INSTRUCTIONS FOR EACH MATERIAL AND PRODUCT USED.
B. TEST REPORTS: SUBMIT FOR APPROVAL ALL TEST REPORTS, LISTS OF MATERIALS AND GRADATION PROPOSED FOR USE.

MATERIALS

A. BORROW SOIL: SATISFACTORY ON-SITE SOIL OR SOIL IMPORTED FROM OFF THE SITE FOR USE AS FILL OR BACKFILL PER WSDOT STANDARD SPECIFICATION 9-03.14(1)
B. BACKFILL FOR PIPE ZONE BEDDING: IN ACCORDANCE WITH WSDOT STANDARD SPECIFICATION 9-03.12(3)
C. CRUSHED SURFACING TOP COURSE (CSTC): IN ACCORDANCE WITH WSDOT STANDARD SPECIFICATION 9-03.9(3)
D. HOT MIX ASPHALT (HMA) SHALL BE HMA CL. 1/2 IN. PG 64-22 OR AS APPROVED BY THE ENGINEER. HMA SHALL BE INSTALLED IN ACCORDANCE WITH WSDOT STANDARD SPECIFICATION SECTION 5-04.
E. CONCRETE SHALL BE 3000 PSI OR AS APPROVED BY THE ENGINEER.

EXECUTION

A. MAINTAIN STABILITY OF EXCAVATIONS; COORDINATE SHORING AND BRACING AS REQUIRED BY JURISDICTIONAL AUTHORITIES. PREVENT OR INHIBIT SURFACE AND SUBSURFACE WATER FROM ACCUMULATING IN EXCAVATIONS. STOCKPILE SATISFACTORY MATERIALS FOR REUSE AND ALLOW FOR PROPER DRAINAGE.
B. COMPACT MATERIALS AT THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D 1557 BY AERATION OR WETTING TO THE FOLLOWING PERCENTAGES OF MAXIMUM DRY DENSITY:
   1. UNPAVED AREAS: TOP 6 INCHES OF SUBGRADE AND EACH FILL LAYER TO 90 PERCENT MAXIMUM DRY DENSITY AS DETERMINED BY ASTM 0698.
C. PLACE ACCEPTABLE MATERIALS IN LIFTS NO MORE THAN 8" FOR MATERIALS COMPACTED BY HEAVY EQUIPMENT AND NOT MORE THAN 4" DEEP FOR MATERIALS COMPACTED BY HAND EQUIPMENT TO SUBGRADES INDICATED AS FOLLOWS:
   1. GRADE TO WITHIN ½" ABOVE OR BELOW REQUIRED SUBGRADE AND WITHIN A TOLERANCE OF ½" IN 10'.
   2. PROTECT NEWLY GRADED AREAS FROM TRAFFIC AND EROSION. RECOMPACT AND REGRADE SETTLED, DISTURBED, AND DAMAGED AREAS AS NECESSARY TO RESTORE QUALITY, APPEARANCE, AND CONDITION OF WORK.
   3. CONTROL EROSION TO PREVENT RUNOFF INTO SEWERS OR DAMAGE TO SLOPED OR SURFACED AREAS IN COMPLIANCE WITH THE PROJECT TEMPORARY EROSION AND SEDIMENT CONTROL PLAN AND LOCAL REGULATIONS.
   4. CONTROL DUST TO PREVENT HAZARDS TO ADJACENT PROPERTIES AND VEHICLES. IMMEDIATELY REPAIR OR REMEDY DAMAGE CAUSED BY DUST INCLUDING AIR FILTERS IN EQUIPMENT AND VEHICLES. CLEAN SOILED SURFACES.
   5. DISPOSE OF WASTE AND UNSUITABLE MATERIALS OFF THE SITE IN A LEGAL MANNER.
D. ALL PIPING/TUBING SHALL BE SLOPED A MINIMUM OF ⅜% (6"/100') DOWN TOWARDS EACH WELLHEAD OR SUMP AT THE MANIFOLD FROM THE MINIMUM COVER DEPTH OF 12 INCHES AT REMEDIATION COMPOUND.
E. SURROUND THE PIPE(S) WITH 6 TO 8 INCHES OF BACKFILL. BACKFILL SHALL BE FREE OF ROCKS WITH A PARTICLE SIZE OF ½ INCH OR LESS.

END OF SECTION

PART 3 PRODUCTS

GENERAL

A. EQUIPMENT AND MATERIALS FURNISHED UNDER THIS SECTION SHALL BE NEW.

SERVICE CONDITIONS

A. LOCATION: SEATTLE, WASHINGTONINSTALLATION: OUTDOORS
B. AMBIENT AIR TEMPERATURE RANGE: 15 TO 100 DEGREES FAHRENHEIT.
C. RELATIVE HUMIDITY OF AMBIENT AIR: 40 TO 100 PERCENT

PERFORMANCE REQUIREMENTS

A. MATERIAL AND EQUIPMENT SHALL MEET THE FOLLOWING PERFORMANCE REQUIREMENTS WHEN OPERATING AT SERVICE CONDITIONS LISTED IN THIS SECTION.
B. MATERIAL AND EQUIPMENT SHALL NOT CORRODE, DEFORM, CRACK, BECOME BRITTLE, OR OTHERWISE BECOME UNSERVICEABLE.
C. MATERIAL AND EQUIPMENT SHALL NOT LEAK.
D. MATERIAL AND EQUIPMENT SHALL BE CHEMICALLY RESISTANT FOR INTENDED USE.

EQUIPMENT AND SOUND ENCLOSURE

A. PROVIDE SOUND ATTENUATING ENCLOSURES TO REDUCE NOISE GENERATED BY SVE BLOWER BY A MINIMUM OF 10 DECIBELS.
B. THE SOUND ATTENUATING ENCLOSURES SHALL HAVE VENTILATION FAN(S) AND LOUVER OPENINGS TO ALLOW FOR AIR EXCHANGE INSIDE ENCLOSURE. THE ENCLOSURES SHALL BE INSTALLED TO PROVIDE RECOMMENDED CLEARANCE FOR VENTILATION FROM OTHER EQUIPMENT PER MANUFACTURES SPECIFICATIONS.
C. THE SOUND ATTENUATION ENCLOSURES SHALL HAVE ACCESS PANELS TO ALLOW FOR MAINTENANCE OF EQUIPMENT INSIDE OF ENCLOSURE. THE ENCLOSURE SHALL BE INSTALLED WITH ACCESS PANEL(S) UNBLOCKED BY OTHER EQUIPMENT.
D. THE SOUND ATTENUATION ENCLOSURE SHALL BE MOUNTED TO THE FLOOR PER MANUFACTURES SPECIFICATIONS.

SVE BLOWER

A. PROVIDE ONE (1) ROTRON REGENERATIVE BLOWER CAPABLE OF 230 SCFM AT 52 IOW.
B. PROVIDE TWO (2) MUFFLERS AT THE INLET AND OUTLET OF THE BLOWER, MUFFLER INNER DIAMETER SHALL MATCH THE BLOWER INLET AND OUTLET DIAMETER.
C. THE BLOWER SHALL BE MOUNTED TO THE PLATFORM PER MANUFACTURES SPECIFICATIONS.

MOISTURE SEPARATOR

A. PROVIDE ONE (1) MOISTURE SEPARATOR. SHALL HAVE HIGH WATER LEVEL SWITCH, CHEMICAL RESISTANCE FLOAT BALL, VACUUM RELIEF VALVE, VACUUM GAUGE (0 TO 100 INCHES OF WATER COLUMN), AND WITHSTAND 12 INCHES OF MERCURY VACUUM.
B. THE MOISTURE SEPARATOR SHALL BE DESIGNED FOR THE SVE SYSTEM CAPABLE OF CONTINUOUS OPERATION WITH A PRESSURE DROP OF LESS THAN 6 INCHES OF WATER COLUMN AT THE RATED FLOW OF APPROXIMATELY 300 SCFM. IT MUST HAVE A LIQUID CAPACITY OF 40 GALLONS BELOW THE WATER LEVEL SHUTOFF SWITCH.
C. THE MOISTURE SEPARATOR SHALL INCORPORATE CYCLONIC SEPARATION TO REMOVE ENTRAINED WATER.

ELECTRICAL CONTROL PANEL

A. PROVIDE ONE (1) EQUIPMENT CONTROL PANEL WITH THE FOLLOWING: SYSTEM OPERATING LED LIGHT, CONTROL POWER ON/OFF SWITCH, BLOWER HOA SWITCH, BLOWER ALARM LED LIGHT, HIGH WATER KNOCKOUT ALARM LED LIGHT, BLOWER TOTAL RUN TIME ELAPSE METER, BLOWER VFD WITH AMPERAGE METER.
B. PROVIDE ONE (1) SENTINEL MONITORING TELEMETRY SYSTEM (AUTO-DIALER) WITH CELLULAR MODEM.

PIPE, FITTINGS, AND SPECIALTIES

A. PVC PIPE - BELOW GRADE PIPING SHALL BE SCHEDULE 40, AND ABOVE GRADE PIPING SHALL BE SCHEDULE 80, MINIMUM CELL CLASSIFICATION 12545-C, IN ACCORDANCE WITH THE PLANS AND CONFORMING TO ASTM D1785.

1. **PVC JOINTS** - THE PIPING SYSTEM SHALL BE JOINED PRIMARILY BY SOCKET-WELD CONNECTIONS, EXCEPT WHERE CONNECTING TO UNIONS, VALVES, AND EQUIPMENT WITH THREADED OR FLANGED CONNECTIONS THAT MAY REQUIRE FUTURE DISASSEMBLY. CONNECTIONS AT THOSE POINTS SHALL BE THREADED AND BACK-WELDED.
2. **PVC FITTINGS** - THE SCHEDULE RATING FOR THE FITTINGS SHALL NOT BE LESS THAN THAT FOR THE ASSOCIATED PIPE. FITTINGS SHALL BE ASTM D 1784, PVC CONFORMING TO THE REQUIREMENTS OF ASTM D 2466, SOCKET TYPE, OR ASTM D 2467, SOCKET TYPE. THE THREAD LUBRICANT PROPOSED BY THE CONTRACTOR SHALL BE PROVIDED TO THE ENGINEER FOR APPROVAL. ALL THREADED FITTINGS WILL SUBJECT TO ZERO-TOLERANCE FOR EVEN MINOR LEAKS, DUE TO THE NATURE OF THE PROCESS SYSTEM.
   a. **PVC SOLVENT CEMENT** - SOCKET CONNECTIONS SHALL BE JOINED WITH PVC SOLVENT CEMENT CONFORMING TO ASTM D 2564. MANUFACTURE AND VISCOSITY SHALL BE AS RECOMMENDED BY THE PIPE AND FITTING MANUFACTURER TO ENSURE COMPATIBILITY. JOINTS SHALL BE PREPARED WITH PRIMERS CONFORMING TO ASTM F 656 PRIOR TO CEMENTING AND ASSEMBLY.

B. GALVANIZED STEEL PIPE - GALVANIZED STEEL PIPE SHALL BE SCHEDULE 40 IN ACCORDANCE WITH THE PLANS AND CONFORMING TO ASTM A-53 SPECIFICATIONS.

1. **GALVANIZED STEEL FITTINGS** - THE SCHEDULE RATING FOR FITTINGS SHALL NOT BE LESS THAN THAT FOR THE ASSOCIATED PIPE. FITTINGS SHALL BE THREADED AND MEET ASME B16.3 SPECIFICATIONS FOR GALVANIZED PIPE FITTINGS. THE TREAD LUBRICANT/SEALANT PROPOSED BY THE CONTRACTOR SHALL BE PROVIDED TO THE ENGINEER FOR APPROVAL. ALL THREADED FITTINGS WILL SUBJECT TO ZERO-TOLERANCE FOR MINOR LEAKS DUE TO THE NATURE OF THE PROCESS SYSTEM.

C. PEX PIPE - PEX PIPE SHALL BE IN ACCORDANCE WITH THE PLANS AND CONFORMING TO AWWA C900 SPECIFICATIONS.

1. **PEX FITTINGS** - PEX FITTINGS SHALL BE METAL INSERTS SHALL MEET THE REQUIREMENTS OF ASTM F1807.
   a. **PEX CRIMP FITTINGS** - PEX CRIMP FITTINGS FOR USE WITH COPPER CRIMP RINGS SHALL MEET THE REQUIREMENTS OF ASTM F1807.
   b. **PEX COLD EXPANSION FITTINGS** - PEX COLD EXPANSION FITTING SHALL MEET THE REQUIREMENTS OF ASTM F1960 FOR PEX REINFORCEMENT RINGS AND ASTM 2080 FOR METAL COMPRESSION SLEEVES.

D. DURAPIPE

1. **DURAPIPE FITTINGS** - DURAPIPE FITTINGS SHALL MEET THE REQUIREMENTS OF BS 4346 PART 1.

PART 3 PRODUCTS (CONT'D)

E. VALVES

1. SVE AIR FLOW CONTROL VALVES SHALL BE MATCHING 3-INCH-DIAMETER BRASS GATE VALVES.
2. MOISTURE SEPARATOR DRAIN VALVE SHALL BE 1-INCH-DIAMETER BRASS BALL VALVE.

F. METERS, GAGES, INSTRUMENTS

1. ALL MONITORING PORTS SHALL BE ¼-INCH NPT BRASS BALL VALVE WITH BRASS THREAD TO BARBED TUBING ADAPTOR.
2. VACUUM INDICATORS SHALL HAVE A MINIMUM RANGE OF 0 TO 100" WC WITH 4" WC INCREMENTS.

G. SUPPORT AND ANCHORS

1. ABOVEGROUND PIPING SHALL BE SUPPORTED WITH UNISTRUT AND PIPE SUPPORTS AT ADEQUATE SPACING TO PREVENT PIPE SAG.
2. THE BLOWER AND MOISTURE SEPARATOR MOUNT SHOULD BE MOUNTED AND ANCHORED PER MANUFACTURE'S SPECIFICATIONS.

END OF SECTION

PART 4 EXECUTION

INSTALLATION

A. INSTALL MATERIALS AND SYSTEMS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND APPROVED SUBMITTALS. INSTALL MATERIALS IN PROPER RELATION WITH ADJACENT CONSTRUCTION AND WITH UNIFORM APPEARANCE FOR EXPOSED WORK. COORDINATE WITH WORK OF OTHER SECTIONS. COMPLY WITH APPLICABLE REGULATIONS AND CODE REQUIREMENTS. PROVIDE PROPER CLEARANCES FOR SERVICING.
B. CLEARLY LABEL AND TAG ALL COMPONENTS.
C. RESTORE DAMAGED FINISHES. CLEAN AND PROTECT WORK FROM DAMAGE.
D. SVE BLOWER
   1. INSTALL THE BLOWER MOTOR ASSEMBLIES IN COMPLIANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, THE REFERENCED CODES, THE DRAWINGS, AND AS SPECIFIED BELOW.
E. WATER KNOCKOUT MOISTURE SEPARATOR
   1. ELEVATED PER DRAWINGS AND SPECIFICATIONS.
   2. PROVIDE TWO (2) FERNCO RUBBER COUPLERS WITH STAINLESS STEEL SLEEVES AT THE INLET AND OUTLET.
F. ELECTRICAL CONTROL PANELS
   1. ALL ELECTRICAL WIRING AND CONTROLS SHALL BE INSTALLED BY A LICENSED ELECTRICIAN QUALIFIED IN SYSTEM CONTROL WIRING. INSTALL IN ACCESSIBLE LOCATION. PROVIDE WIRING DIAGRAMS.

TESTING

A. FUNCTIONAL TESTS
   1. SVE BLOWER, AND ALARM CONDITIONS SHALL BE STARTED AND TESTED IN THE PRESENCE OF THE ENGINEER.
   2. PERFORM EQUIPMENT FUNCTIONAL TESTS PER MANUFACTURER'S RECOMMENDED PROCEDURES IN THE PRESENCE OF THE DESIGN ENGINEER.
   3. PRESSURE TEST ALL PIPING IN THE PRESENCE OF THE ENGINEER. ALL SYSTEM PIPING SHALL BE PRESSURE TESTED UNDER THE FOLLOWING CONDITIONS.
      a. VACUUM PIPING - PIPING FOR SVE SYSTEM SHALL MAINTAIN A VACUUM OF 6 PSIG AND LOSE NO MORE THAN 0.10 PSIG IN 20 MINUTES.

B. PERFORMANCE TESTS

1. THE CONTRACTOR SHALL PERFORM A 48-HOUR COMPLETED SYSTEM PERFORMANCE TEST TO DEMONSTRATE INTEGRATED SYSTEM EQUIPMENT FUNCTIONS. PERFORM TEST IN ACCORDANCE WITH EQUIPMENT MANUFACTURER RECOMMENDATIONS AND IN ACCORDANCE WITH PLAN APPROVED BY THE ENGINEER. CONTRACTOR SHALL PROVIDE A QUALIFIED ELECTRICIAN TO BE PRESENT DURING ALL TESTING.

END OF SECTION

DATE	REVISION/DESCRIPTION	BY	CKD.	APP.
12/13/2023	PRELIMINARY SVE DESIGN	RB	LT	RM

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, Washington 98027
(425) 295-0800
farallonconsulting.com

PREPARED FOR:
CAPITAL INDUSTRIES, INC.
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON 98108

SPECIFICATIONS
5801 3RD AVENUE SOUTH
SEATTLE, WASHINGTON

811 Know what's below. Call before you dig.

PROJECT LOCATION (S,T,R):
PORTION OF THE SW 1/4 OF SEC. 20, TWP. 24N, RNG. 04E, W.M.

JURISDICTION FILE NO.:

FARALLON PROJECT NO.:
457-008

SHEET
EN5.00

APPENDIX B

Compliance Monitoring Plan Tables

Table B-1 - SU1 Compliance Monitoring Plan

Project No. AS050067U, West of 4th Site, Site Unit 1, Seattle, Washington

Well Location	Long-Term Compliance Monitoring Purpose					Frequency			Potential Performance Monitoring (Frequency TBD in Design)	Decommission	Access Considerations
	Plume conditions			Exposure Pathway		Annual	Biennial	Every 5 Years			
	Source Area/Centerline	CVOC Plume Boundary	Metal Plume Boundary	Vapor Intrusion	Waterway						
Water Table Interval											
MW-1	X					0-10		10+			Coordinate sampling event with Art Brass Plating
MW-2	X						0-10	10+			
MW-3	X					0-10					
MW-4	X					0-10		10+			
MW-5	X					0-10			X		
MW-6										X	None - Alley ROW
MW-7		X	X	X		0-10		10+			None - 3rd Ave ROW
MW-8	X			X		0-10		10+			None - Findlay St ROW
MW-9		X	X	X		0-10		10+			Contact tenant in 220 Findlay building for access
MW-10										X	None - 2nd Ave ROW
MW-11										X	None - 3rd Ave ROW
MW-12				X		0-10		10+			Coordinate sampling event with Art Brass Plating
MW-13	X						0-10	10+			Contact tenant in 220 Findlay building for access
MW-14		X	X	X		0-10		10+			None - Findlay St ROW
MW-15				X		0-10		10+			None - Findlay St ROW
MW-16										X	None - 2nd Ave ROW
MW-24							0-10		X		None - Fidalgo St ROW
MW-27	X						0-10	10+			None - 3rd Ave ROW
PMW-1										X	Coordinate sampling event with Art Brass Plating
PZ-1	X						0-10				
PSC-CG-138-WT										X	None - 2nd Ave ROW (Clean Earth)
PSC-CG-140-WT										X	
PSC-CG-142-WT										X	None - Orcas St ROW (Clean Earth)
PSC-CG-143-WT										X	None - Lucille St ROW (Clean Earth)
Shallow Interval											
MW-3-30						0-10			X		Coordinate sampling event with Art Brass Plating
MW-6-30										X	None - Alley ROW
MW-8-30	X						0-10	10+			None - Findlay St ROW
MW-11-30										X	None - 3rd Ave ROW
MW-16-40	X					0-10		10+			None - 2nd Ave ROW
MW-17-40	X					0-10		10+			After 3pm - Alley ROW next to Alki Bakery
MW-19-40										X	None - Alley ROW
MW-20-40		X					0-10	10+			None - 1st Ave ROW
MW-22-30					X	0-10		10+			Contact CertainTeed Gypsum for access
MW-23-30					X	0-10		10+			Contact CertainTeed Gypsum for access
MW-24-30	X					0-10		10+	X		None - Fidalgo St ROW
MW-26-40	X					0-10		10+			None - E Marginal Way S ROW
PSC-CG-135-40										X	None - 4th Ave ROW (Clean Earth)
PSC-CG-138-40										X	None - 2nd Ave ROW (Clean Earth)
PSC-CG-139-40										X	None - Brandon St ROW (Clean Earth)
PSC-CG-140-30										X	None - Fidalgo St ROW (Clean Earth)
PSC-CG-140-40		X					0-10	10+			None - Fidalgo St ROW (Clean Earth)
PSC-CG-142-40										X	None - Orcas St ROW (Clean Earth)
PSC-CG-143-40										X	None - Lucille St ROW (Clean Earth)
PSC-CG-144-35										X	None - Ohio Ave ROW (Clean Earth)
PSC-CG-145-35										X	None - Ohio Ave ROW (Clean Earth)
PSC-CG-151-25 †					X	0-10		10+			None - Fidalgo St ROW (Clean Earth)

Table B-1 - SU1 Compliance Monitoring Plan

Project No. AS050067U, West of 4th Site, Site Unit 1, Seattle, Washington

Well Location	Long-Term Compliance Monitoring Purpose					Frequency			Potential Performance Monitoring (Frequency TBD in Design)	Decommission	Access Considerations
	Plume conditions			Exposure Pathway		Annual	Biennial	Every 5 Years			
	Source Area/Centerline	CVOC Plume Boundary	Metal Plume Boundary	Vapor Intrusion	Waterway						
Intermediate Interval											
MW-3-50							0-10		X		None - Findlay St ROW
MW-8-70										X	None - Findlay St ROW
MW-16-75	X						0-10	10+			None - 2nd Ave ROW
MW-17-60	X						0-10	10+			After 3pm - Alley ROW next to Alki Bakery
MW-18-50		X					0-10	10+			None - Alley ROW
MW-18-70										X	None - Alley ROW
MW-19-60										X	None - Alley ROW
MW-20-60		X					0-10	10+			None - 1st Ave ROW
MW-21-50										X	None - E Marginal Way S ROW
MW-21-75										X	None - E Marginal Way S ROW
MW-22-50										X	Contact CertainTeed Gypsum for access
MW-23-50		X						0-10			Contact CertainTeed Gypsum for access
MW-24-50						0-10			X		None - Fidalgo St ROW
MW-25-50	X					0-10		10+			None - Mead St ROW
MW-25-75	X						0-10	10+			None - Mead St ROW
MW-26-55										X	None - E Marginal Way S ROW
PSC-CG-135-50										X	None - 4th Ave ROW (Clean Earth)
PSC-CG-138-70										X	None - 2nd Ave ROW (Clean Earth)
AB-CG-140-70										X	None - Fidalgo St ROW
Metals Pilot Test Wells											
IW-1						0-10			X		
IW-2						0-10			X		
PSW-6						0-10			X		
PSW-7						0-10			X		
PSW-8						0-10			X		
CVOCs Pilot Test Wells											
DR-1						0-10			X		Coordinate sampling event with Art Brass Plating
DR-2						0-10			X		
PSW-1						0-10			X		
PSW-2						0-10			X		
PSW-3						0-10			X		
PSW-4						0-10			X		None - Alley ROW
PSW-5						0-10			X		None - 3rd Ave ROW

Notes

CVOC - chlorinated volatile organic compounds TCE - trichloroethene VC - vinyl chloride

ND = Non-detect

Plating metals include dissolved cadmium, copper, nickel, and zinc.

Field parameters will be collected from wells that are sampled for groundwater quality. Parameters will include turbidity, temperature, pH, conductivity, dissolved oxygen, and oxidation/reduction potential.

Dissolved metals will be field filtered.

† indicates that the well is tidally influenced.

Table B-2. SU2 Compliance Monitoring Plan, BDC/CI Plant 2 Area

Project No. AS0500067U, West of 4th Site, Site Unit 2, Seattle, Washington

Well	Monitoring Type	Monitoring Frequency[i]	Notes
CI-13-WT	Long-Term Monitoring	Annual	Contingency action evaluation monitoring well. On downgradient edge of plume. No detections above CULs. Below CULs since 2013
CI-13-40	Long-Term Monitoring	Annual	Contingency action evaluation monitoring well. Above CULs for TCE 2013-2022.
CI-13-60	Long-Term Monitoring	Annual	Contingency action evaluation monitoring well. Downgradient edge of plume. Intermediate-zone well with no PCE/TCE detections 2013-2021.
CI-10-WT	Long-Term Monitoring	Every 5 years	MNA performance monitoring well; above TCE CULs in center of plume
CI-10-35	Long-Term Monitoring	Every 5 years	MNA performance monitoring well. Above CULs 2013-2023. Center of plume.
CI-10-65	Long-Term Monitoring	Every 5 years	MNA performance monitoring well. Intermediate zone well with no detections 2013-2022.
CI-12-35	Long-Term Monitoring	Every 5 years	MNA performance monitoring
CI-14-35	Long-Term Monitoring	Every 5 years	MNA performance monitoring well. Above CULs for TCE 2013-2022. Center of plume.
CI-14-70	Long-Term Monitoring	Every 5 years	MNA performance monitoring well.
CG-137-40	Long-Term Monitoring	Every 5 years	Former source area performance monitoring well. Above CULs for VC 2013-2023; below CULs for PCE/TCE 2013-2023
MW-2	Long-Term Monitoring	Every 5 years	Former source area performance monitoring well. Above CULs 2014-2023
BDC-6-WT	Long-Term Monitoring	Every 5 years	Former source area performance monitoring well. Above CULs 2014-2023
BDC-6-30	Long-Term Monitoring	Every 5 years	Former source area performance monitoring well. Near upgradient edge of plume.
BDC-6-60	Long-Term Monitoring	Every 5 years	Former source area performance monitoring well. Near upgradient edge of plume. Intermediate zone well with PCE/TCE less than CULs 2014-2016.
CG-137-50	Long-Term Monitoring	Every 5 years	Former source area performance monitoring well. Above CULs 2014-2023

Notes:

[i] Contingency action and MNA performance evaluation monitoring = Annual frequency; MNA and plume stability performance monitoring = biannual (every other year) frequency; and source area performance monitoring = every 5 year frequency

Table B-3. SU2 Compliance Monitoring Plan, CI Plant 4 Area

Project No. AS0500067U, West of 4th Site, Site Unit 2, Seattle, Washington

Well	Monitoring Type	Monitoring Frequency	Notes
CI-7-40	Long-Term Monitoring	Every 5 years	Shallow interval monitoring well
CI-9-WT	Long-Term Monitoring	Every 5 years	Shallow interval monitoring well
CI-9-40	Long-Term Monitoring	Every 5 years	Shallow interval monitoring well
MW-6	Short-Term Monitoring	Annual	Annual SVE and MNA performance monitoring. Detections below CULs 2015-2023
MW-7	Long-Term Monitoring	Annual	Annual SVE and MNA performance monitoring. Detections above CULs 2016-2022

Notes:

[i] SVE and MNA performance evaluation monitoring = Annual frequency; shallow interval monitoring wells = Every 5 year interval

Table B-4 - Site Unit Boundary Compliance Monitoring Plan

Project No. AS0500067U, West of 4th Site, Site Unit 2, Seattle, Washington

Well	Monitoring Type	Monitoring Frequency	Notes
CI-19-30	Long-Term Monitoring	Annual	Contingency action evaluation monitoring. Above CULs for VC 2013-2022
MW-23-30	Long-Term Monitoring	Annual	Contingency action evaluation monitoring. Above CULs 2023.
MW-23-50	Long-Term Monitoring	Every 5 years	Contingency action evaluation monitoring. ND in 2023
CG-141-40	Long-Term Monitoring	Every 5 years	Performance monitoring. Above CULs for VC 2013-2023
CG-141-50	Long-Term Monitoring	Every 5 years	Performance monitoring. Above CULs for VC 2014-2023
CG-140-40	Long-Term Monitoring	Every 5 years	Performance monitoring. Downgradient of CG-141, with VC concentrations above CULs 2013-2020
CI-15-40	Long-Term Monitoring	Every 5 years	Performance monitoring. Above CULs for VC 2013-2022
CI-15-60	Long-Term Monitoring	Every 5 years	Performance monitoring. Above CULs for VC 2013-2022
CI-12-35	Long-Term Monitoring	Every 5 years	Performance monitoring

Notes:

[i] Contingency action and MNA performance evaluation monitoring = Annual frequency; and plume periphery and where elevated VC concentrations have been detected = every 5 year frequency

Table B-5. SU2 Monitoring Wells to be Decommissioned

Project No. AS0500067U, West of 4th Site, Site Unit 2, Seattle, Washington

Well Location	Decommission
BDC-1-WT	X
BDC-2-WT	X
BDC-3-40	X
BDC-3-60	X
BDC-3-WT	X
BDC-4-WT	X
BDC-11-40	X
BDC-11-60	X
BDC-11-WT	X
BDC-13-40	X
BDC-14-WT	X
BDC-15-WT	X
CI-7-60	X
CI-8-60	X
CI-9-70	X
CI11-30	X
CI-11-60	X
CI-11-WT	X
CI-12-60	X
CI-12-WT	X
CI-16-30	X
CI-16-60	X
CI-16-WT	X
CI-17-30	X
CI-17-WT	X
CI-20-80	X
CI-MW-1-40	X
CI-MW-1-60	X
CI-MW-1-WT	X
CI-MW-5	X
CI-MW-8	X

Table B-5. SU2 Monitoring Wells to be Decommissioned

Project No. AS0500067U, West of 4th Site, Site Unit 2, Seattle, Washington

Well Location
BDC-1-WT
BDC-2-WT
BDC-3-40
BDC-3-60
BDC-3-WT
BDC-4-WT
BDC-11-40
BDC-11-60
BDC-11-WT
BDC-13-40
BDC-14-WT
BDC-15-WT
CI-7-60
CI-8-60
CI-9-70
CI11-30
CI-11-60
CI-11-WT
CI-12-60
CI-12-WT
CI-16-30
CI-16-60
CI-16-WT
CI-17-30
CI-17-WT
CI-20-80
CI-MW-1-40
CI-MW-1-60
CI-MW-1-WT
CI-MW-5
CI-MW-8

Table B-5. SU2 Monitoring Wells to be Decommissioned

Project No. AS0500067U, West of 4th Site, Site Unit 2, Seattle, Washington

Well Location
BDC-1-WT
BDC-2-WT
BDC-3-40
BDC-3-60
BDC-3-WT
BDC-4-WT
BDC-11-40
BDC-11-60
BDC-11-WT
BDC-13-40
BDC-14-WT
BDC-15-WT
CI-7-60
CI-8-60
CI-9-70
CI11-30
CI-11-60
CI-11-WT
CI-12-60
CI-12-WT
CI-16-30
CI-16-60
CI-16-WT
CI-17-30
CI-17-WT
CI-20-80
CI-MW-1-40
CI-MW-1-60
CI-MW-1-WT
CI-MW-5
CI-MW-8

APPENDIX C

Tables Summarizing Disproportionate Cost Analysis and Comparison to MTCA Criteria

Table 6-1. Disproportionate Cost Analysis and Comparison to MTCA Criteria

Project No. 050067, West of 4th, Site Unit 1, Seattle, Washington

			Alternative 2A	Alternative 2B
			Source pH neutralization, Downgradient ISCR/EAnB @Fidalgo	Source pH neutralization, Downgradient ISCR/EAnB @Fidalgo and Shoreline
Threshold Criteria				
	Protection of Human Health and the Environment		Yes	Yes
	Compliance with Cleanup Standards		Yes	Yes
	Compliance with Applicable State and Federal Laws		Yes	Yes
	Provision for Compliance Monitoring		Yes	Yes
Weighted Benefits Ranking for Disproportionate Cost Analysis (Score 1-10)				
Weighting Criteria				
	30%	Overall Protectiveness	6	7
	20%	Permanence	5	5
	20%	Long Term Effectiveness	6	6
	10%	Management of Short Term Risk	8	7
	10%	Implementability	7	6
	10%	Consideration of Public Concerns	5	6
	MTCA Overall Benefit Score (1-10)		**6**	**6.2**
Disproportionate Cost Analysis				
	Estimated Remedy Cost		$3,950,000	$4,570,000
	Estimated Initial Capital Cost		$944,000	$1,631,950
	Estimated O&M Cost		$3,006,000	$2,938,050
	Relative Benefit to Cost Ratio (multiplied by 1,000,000)		1.5	1.4
	Estimated contingency cost		$1,900,000	$1,130,000
Evaluation of Restoration Time Frame				
	Time to Achieve RAOs		280 Years	280 Years
	Estimated Time to Achieve VI CULs		25 Years	20 Years
	Estimated Time to Achieve cVOC SW CULs at Waterway		50 Years	35 Years
	Estimated Time to Achieve cVOC SW CULs		50 Years	50 Years
	Estimated Time to Achieve metals SW CULs		280 Years	280 Years
	Provides for a Reasonable Restoration Time Frame		Yes	Yes

Notes:

Remedial Alternative cost details in Tables 5-1 and 5-2. Contingency cost details in Tables 5-3 and 5-4.

Restoration Time Frame based on time to achieve surface water cleanup levels across the Site.

Table excerpted from Site Unit 1 Feasibility Study Addendum (Aspect, 2023). Disproportionate cost analysis for Alternatives 1-9 in separate table, also included in this appendix.

Table excerpted from Site Unit 1 Feasibility Study (Aspect, 2016). Disproportionate cost analysis for Alternatives 2A and 2B in separate table, also included in this appendix.

Table 8-1 - Disproportionate Cost Analysis and Comparison to MTCA Criteria

Project No. 050067
West of 4th, Site Unit 1, Seattle, Washington

		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
		Source pH neutralization, Monitored Natural Attenuation	Source pH neutralization, Downgradient ISCR (PRB@Fidalgo)	Source pH neutralization+EAnB, Downgradient EAnB (PRB@Fidalgo)	Source pH neutralization+ISCR, Downgradient ISCR (PRB@Fidalgo)	Source pH neutralization+ISCR, Downgradient EAnB (PRB@Fidalgo)	Source pH neutralization+ISCR, Downgradient ISCR (PRBs@Fidalgo and EMW)	Source pH neutralization+ISCR, Downgradient ISCR (PRBs@Fidalgo, EMW, and 1st Ave)	Source ISCO+ Groundwater Pump-and-Treat, Downgradient ISCR (PRB@Fidalgo)	Source Excavation+ISS, Downgradient ISCR (Areal Coverage)
Threshold Criteria										
	Protection of Human Health and the Environment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Compliance with Cleanup Standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Compliance with Applicable State and Federal Laws	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Provision for Compliance Monitoring	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weighted Benefits Ranking for Disproportionate Cost Analysis (Score 1-10)										
Weighting Criteria										
30%	Overall Protectiveness	4	5	6	6	8	7	7	6	9
20%	Permanence	5	5	5	6	6	6	6	7	8
20%	Long Term Effectiveness	3	4	5	6	7	7	7	5	8
10%	Management of Short Term Risk	9	8	8	8	8	8	8	6	5
10%	Implementability	8	7	6	6	4	4	4	5	2
10%	Consideration of Public Concerns	3	4	5	5	6	5	5	5	3
MTCA Overall Benefit Score (1-10)		**4.8**	**5.2**	**5.7**	**6.1**	**6.8**	**6.4**	**6.4**	**5.8**	**6.9**
Disproportionate Cost Analysis										
	Estimated Remedy Cost	$2,800,000	$4,600,000	$6,000,000	$5,200,000	$7,800,000	$8,000,000	$8,200,000	$6,800,000	$18,100,000
	Estimated Remedy Cost	$1,000,000	$2,300,000	$3,700,000	$2,900,000	$3,000,000	$5,900,000	$6,100,000	$4,500,000	$16,300,000
	Sparge Curtain Cost[1]	--	--	--	--	$2,500,000	--	--	--	--
	Estimated Vapor Mitigation Cost	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$200,000
	Estimated Compliance Monitoring Cost[2]	$1,500,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$1,800,000	$1,800,000	$2,000,000	$1,600,000
	Relative Benefit to Cost Ratio (multiplied by 1,000,000)	1.7	1.1	1.0	1.2	0.9	0.8	0.8	0.9	0.4
	Estimated Contingency Cost	$1,800,000	$1,800,000	$1,300,000	$1,300,000	$0	$1,300,000	$1,300,000	$1,300,000	$0
Evaluation of Restoration Time Frame										
	Time to Achieve RAOs	280 Years	280 Years	280 Years	280 Years	280 Years	280 Years	280 Years	>1000 Years	1000 Years
	Estimated Time to Achieve VI CULs	25 Years	25 Years	20 Years	20 Years	20 Years	20 Years	20 Years	20 Years	20 Years
	Estimated Time to Achieve cVOC SW CULs at Waterway	55 Years	50 Years	50 Years	50 Years	35 Years	40 Years	35 Years	50 Years	30 Years
	Estimated Time to Achieve cVOC SW CULs	55 Years	50 Years	50 Years	50 Years	50 Years	40 Years	40 Years	50 Years	40 Years
	Estimated Time to Achieve metals SW CULs	280 Years	280 Years	280 Years	280 Years	280 Years	280 Years	280 Years	>1000 Years	1000 Years
	Provides for a Reasonable Restoration Time Frame	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:

Remedial Alternative cost details in Appendix E.

Restoration Time Frame based on time to achieve surface water cleanup levels across the Site. See Appendix C.

Table 3. Disproportionate Cost Analysis and Comparison to MTCA Criteria
West of Fourth, Site Unit 2, Seattle, Washington

		Alternative 1	Alternative 2a	Alternative 2b	Alternative 3a	Alternative 3b	Alternative 4
		NA + Plant 4 ISCO	Enhanced Anaerobic + Plant 4 ISCO	Enhanced Anaerobic + Plant 4 Excavation + Downgradient Line 2	ISCR + Plant 4 ISCO	ISCR + Plant 4 ISCO + Downgradient Line 2	NA + Plant 4 AS/SVE
Weighted Benefits Ranking for Disproportionate Cost Analysis (Score 1-10)							
Weighting	*Criteria*						
30%	Overall Protectiveness	7	8	8	8	8	7
20%	Permanence	8	9	9	9	9	7
20%	Long Term Effectiveness	6	7	8	8	8	7
10%	Management of Short Term Risk	8	6	6	7	7	6
10%	Implementability	9	7	7	7	6	7
10%	Consideration of Public Concerns	9	9	9	9	9	9
MTCA Overall Benefit Score (1-10)	*Row A)*	**7.5**	**7.8**	**8**	**8.1**	**8**	**7.1**
Disproportionate Cost Analysis							
Cost Basis Table (Appendix B)		Table B1	Table B2	*no table*	Table B3	Table B3	Table B4
Estimated Remedy Cost	*Row B)*	$2,130,000	$5,240,000	$8,110,000	$7,020,000	$11,130,000	$2,780,000
Relative Cost/Benefit Ratio (divided by 100,000)	*Row C) = (Row B / 100,000) / Row A*	2.8	6.7	10.1	8.7	13.9	3.9
Estimated Time (Appendix A)		60	40	40	40	40	60
Remedy Permanent to the Maximum Extent Practicable		Yes	Yes	Yes	Yes	Yes	Yes
Meets Remediation Objectives		Yes	Yes	Yes	Yes	Yes	Yes
Estimated Contingency Amount		*$1,018,000*	*$637,000*	*$637,000*	*$637,000*	*$637,000*	*$1,053,000*

Notes:
Costs are rounded to the nearest ten thousand dollars.
Remedial Alternative cost details in Appendix B.
DCA: Disproportionate Cost Analysis
Overall Benefit Score weighting factors are commonly applied factors accepted by Ecology at similar sites. Weighting factors are not an Ecology policy and other benefit approaches are used.

Table excerpted from Site Unit 2 Feasibility Study (PGG, 2016).

Costs and associated disproportionate cost analysis for Alternative 1 are applicable to selected Alternative 1R. Alternative 1R is a modified version of Alternative 1 where SVE at CI Plant 4 replaced ISCO due to pilot testing results confirming that ISCO was not a feasible cleanup technology. Alternative 1R was selected based on discussions with Ecology in April 2022 where Ecology concurred that the revisions to Alternative 1, including substitution of SVE at CI Plant 4 and a more comprehensive contingency action for active treatment at the LDW, made Alternative 1R an acceptable preferred remedial alternative (Farallon, 2023). Ecology also concurred that the change from ISCO to SVE at CI Plant 4 would not substantively affect the costs and benefits for Alternative 1R in a manner that could result in the cost to benefit ranking score exceeding the next lowest remedial alternative ranking score of 3.9 for Alternative 4.