United States Environmental Protection Agency

Office of Land and Emergency Management
Office of Superfund Remediation and
Technology Innovation

FINAL

OPTIMIZATION REVIEW

LAKEWOOD-PONDERS CORNER SUPERFUND SITE
PIERCE COUNTY, WASHINGTON

FINAL TECHNICAL MEMORANDUM
November 11, 2024

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NOTICE AND DISCLAIMER

Work described herein was performed by Tetra Tech, Inc. (Tetra Tech) for the U.S. Environmental Protection Agency (EPA). This final document was developed for EPA under the Region 5 Superfund Technical Assessment Response Team (START) V contract number 68HE0519D0005, under Task Order 68HE0520F0031, Task Order Line Item Number 0001BD001.

This optimization review is an independent study funded by the EPA that focuses on opportunities for optimization related to protectiveness, cost-effectiveness, site closure, technical improvements, and efficient use of resources at the Lakewood-Ponders Corner Superfund Site in Pierce County, Washington. Detailed consideration of EPA policy was not part of the scope of work for this review. This technical memorandum does not impose legally binding requirements, confer legal rights, impose legal obligations, implement any statutory or regulatory provisions, or change or substitute for any statutory or regulatory provisions. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Recommendations are based on an independent evaluation of existing site information, represent the technical views of the optimization review team, and are intended to help the site team identify opportunities for improvements in the current site remediation strategy. These recommendations do not constitute requirements for future action; rather, they are provided for consideration by the EPA and other site stakeholders, including the Washington Department of Ecology (Ecology).

While certain recommendations may provide specific details to consider during implementation, these recommendations are not meant to supersede other, more comprehensive, planning documents such as work plans, sampling plans, and quality assurance project plans (QAPP); nor are they intended to override applicable or relevant and appropriate requirements (ARAR). Further analysis of recommendations, including review of EPA policy may be needed before implementation.

PREFACE

This technical memorandum has been prepared as part of the *National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion* implemented by the U.S. Environmental Protection Agency (EPA) Office of Land and Emergency Management Office of Superfund Remediation and Technology Innovation (OSRTI)[1]. The project contact is as follows:

Organization	Key Contact	Contact Information
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[1] EPA. 2012. Memorandum: *Transmittal of the National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion.* From: James. E. Woolford, Director Office of Superfund Remediation and Technology Innovation (OSRTI). To: Superfund National Policy Managers (Regions 1 - 10). Office of Solid Waste and Emergency Response (OSWER) 9200.3-75. September 28.

ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter of air
ACS	American Community Survey
ARAR	applicable or relevant and appropriate requirements
ARD	Assessment and Remediation Division
bgs	below ground surface
cfm	cubic feet per minute
cis-1,2-DCE	cis-1,2-dichloroethene
cm/sec	centimeters per second
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
DMA	Disaster Mitigation Act of 2000
DNR	Washington State Department of Natural Resources
DPT	direct-push technology
Ecology	Washington Department of Ecology
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
ft	feet
FYR	Five Year Review
GAC	granular activated carbon
gpm	gallons per minute
HMP	Hazard Mitigation Plan
HQ	Hazard Quotient
HP	horsepower
ICs	Institutional Controls
IRM	interim remedial measure
ISCO	in-situ chemical oxidation

JBLM	Joint Base Lewis-McChord
K	permeability
km	kilometer
KW	kilowatt
KWhr	kilowatt hour
MCL	Maximum Contaminant Level
MMI	Modified Mercalli Intensity
ND	non-detection
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRI	National Risk Index
OLEM	Office of Land and Emergency Management
OSRTI	Office of Superfund Remediation and Technology Innovation
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PCE	Tetrachloroethylene or Perchloroethylene
PFAS	per- and polyfluoroalkyl substances
PFOS	perfluorooctanesulfonic acid
P.E.	Professional Engineer
P.G.	Professional Geologist
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	Remedial Action Objective
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
SVE	soil vapor extraction
SDWA	Safe Drinking Water Act
TCE	trichloroethylene

TIFSD	Technology Innovation and Field Services Division
VI	vapor intrusion
VIMS	vapor intrusion mitigation system
VISL	vapor intrusion screening level
VOC	volatile organic compounds
WUI	wildland urban interface

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1.0 INTRODUCTION AND OBJECTIVES OF OPTIMIZATION REVIEW

This technical memorandum provides the findings and recommendations of an independent optimization review of remedial activities at the Lakewood-Ponders Corner Superfund Site in Pierce County, Washington. **Figure A-1** in **Attachment A** shows the site location.

Findings and recommendations are based on the optimization review team's evaluation of site documents and data and information obtained from interviews and conversations with the site team through project conference calls, emails, and written correspondence.

U.S. Environmental Protection Agency (EPA) Region 10 requested this independent optimization review of site-wide groundwater contamination and current remediation efforts to obtain recommendations on the following:

- Potential alternatives to improve the site remedy and clean-up timeframe for a chlorinated volatile organic compound (CVOC) plume; and
- An update of the conceptual site model (CSM) based on evaluating historical and recent data to support decisions regarding any further investigative or remedial activity related to horizontal and vertical delineation of the plume and seasonal fluctuations in CVOC concentrations and vertical groundwater flow gradient.

A climate vulnerability (CV) screening was performed for the site in response to EPA's Superfund Climate Resilience (CR) initiative.[2] The goal of the CR initiative is to raise awareness of the vulnerabilities associated with climate change and extreme weather events, and to apply climate change and weather science as a standard operating practice in cleanup projects. This screening identifies general surface vulnerabilities, potential impacts to site and remedial infrastructure, and impacts to site hydrology, hydrogeology, and site contaminant sources and plumes. In addition, the review identifies potential mitigation measures to address identified concerns and help ensure the site's resilience to potential climate change impacts over time.

An environmental justice (EJ) screening was also performed for the site in response to EPA's Office of Environmental Justice (OEJ) mission to incorporate EJ considerations into agency actions[3].

[2] https://www.epa.gov/superfund/superfund-climate-resilience
[3] https://www.epa.gov/environmentaljustice

2.0 OPTIMIZATION REVIEW TEAM AND APPROACH

The optimization review team included independent, third-party technical personnel from Tetra Tech who collaborated with representatives of EPA Headquarters, Office of Land and Emergency Management (OLEM), Office of Superfund Remediation and Technology Innovation (OSRTI), EPA Region 10, and Washington Department of Ecology (Ecology).
Table 1 lists the members of the optimization review team.

Table 1: Optimization Review Team

Name	Organization	Title
Kirby Biggs	EPA OLEM OSRTI TIFSD	National Optimization Program Manager
Amanda Van Epps	EPA OLEM OSRTI ARD CPCMB	Environmental Engineer
Jody Edwards, P.G.	Tetra Tech, Inc.	Program Manager; Principal Hydrogeologist
Robert Cohen, P.G.	Tetra Tech, Inc.	Principal Hydrogeologist
Peter Rich, P.E.	Tetra Tech, Inc.	Principal Engineer
Jen Johnson	Tetra Tech, Inc.	Project Coordinator

***Notes**: EPA = U.S. Environmental Protection Agency; OLEM = Office of Land and Emergency Management;*
OSRTI = Office of Superfund Remediation Technology Innovation; TIFSD = Technology Innovation and Field Services Division;
ARD = Assessment and Remediation Division; CPCMD = Construction and Post-Construction Management Branch;
P.E. = Professional Engineer; P.G. = Professional Geologist

On February 16, 2024, EPA, Ecology, and Tetra Tech participated in a project kick-off conference call to exchange information and address questions from the optimization review team. Attendees included the optimization review team and individuals listed in **Table 2**.

Table 2: Optimization Review Contributors

Name	Organization	Title
Jaclyn Satira[4]	EPA Region 10	Remedial Project Manager
Dustan Bott	EPA Region 10	Section Manager
Kathleen Peshek	EPA Region 10	Environmental Engineer
Rebecca Feldman	EPA Region 10	Regional Optimization Liaison
Andrew Smith	Ecology	Site Manager
Rebecca Lawson	Ecology	Southwest Section Manager (outgoing)
Jerome Lambiotte	Ecology	Southwest Section Manager (incoming)
Pam Marti	Ecology	Groundwater Monitoring Unit Supervisor (outgoing)
Matt Moore	Ecology	Groundwater Monitoring Unit Supervisor (incoming)

***Notes:** EPA = U.S. Environmental Protection Agency; Ecology= Washington Department of Ecology*

[4] Recently replaced as Shannon McClellan as RPM.

3.0 INFORMATION REVIEWED

The optimization review team performed a preliminary review of all documents and data provided for review and determined the following list of site-related documents were the most pertinent to this optimization review:

- United States Environmental Protection Agency (EPA). 2024. *Presentation: Optimization Review, Goals, and Site Background.* February 16.
- EPA. 2022, *Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site.* July.
- EPA. 2019. *Explanation of Significant Differences, Lakewood-Ponders Corner Superfund Site*. September 3.
- EPA. 2017. *Technical Memorandum: Groundwater Sampling and Hydraulic Monitoring at Lakewood/ Ponders Corner Superfund Site.* July 20.
- EPA. 1992. *Explanation of Significant Differences, Lakewood-Ponders Corner Superfund Site*. September 15.
- EPA 1989. *Lakewood SVES Operation Summary*. April 25.
- EPA 1986. *Record of Decision Amendment, OU1, Lakewood, WA*. November 14.
- EPA 1985. *Record of Decision, Ponders Corner, WA.* September 30.
- EPA 1984. *Record of Decision Interim Remedial Alternative Selection, Ponders Corner, Washington.* June 1.
- EPA 1983. *Report of the Groundwater Investigation, Lakewood, Washington, October 1981- February 1983.* March.
- EPA 1981. *Report of the Preliminary Groundwater Contamination Investigation*, *Lakewood, Washington, October-November 1981.* January (sic).
- EPA Robert S. Kerr Environmental Research Laboratory (EPA Kerr ERL). 1989. *Review of Soil Vacuum Extraction Design and Performance at the Ponders Corner Site*. May 30.
- CH2MHill. 1992. *Remedial Action Report (Project Closeout) for Soil Excavation and Disposal and Vapor Extraction System Decommissioning, Lakewood Superfund Site.* September.
- CH2MHill. 1988. *Quality Assurance Project Plan and Field Sampling Plan, Remedial Action, Soil Vapor Extraction System*, February.
- CH2MHill. 1984. *Final Feasibility Study Ponders Corner Well Water Treatment Facility*. May.
- Joint Base Lewis-McChord. 2023. *Presentation: PFAS RI Results, Soil and Groundwater Strategy*. October 12.

- Washington Department of Ecology, 2021. *Lakewood Plaza Cleaners/Ponders Corner Groundwater Monitoring Results. October 2018 and October 2020,* October.

These documents are cited in the text. Additional technical literature references are listed in footnotes in this review.

4.0 SITE BACKGROUND AND UNDERSTANDING

This section summarizes site background information and the optimization review team's general understanding of the site. Additional details on findings are presented in **Section 5.0**.

4.1 Site Location and Key Site Features

Lakewood-Ponders Corner Superfund Site is in the City of Lakewood in Pierce County, Washington, south of Tacoma. The site street address is 12511 Pacific Highway Southwest. As shown on **Figure A-1** in **Attachment A**, Interstate 5 (I-5) borders the site on the south. Joint Base Lewis-McChord (JBLM) is within 0.25 miles of the site to the south and east.

The site operated as the Plaza Cleaners dry cleaning and laundry business, which ceased operations in 1984. The site currently houses Rainier Lighting & Electric Supply. The surrounding properties include commercial and light industrial businesses. Another dry-cleaning facility (J&F Cleaners) was formerly located across Pacific Highway Southwest to the northwest of the site. Residential areas are approximately 500 feet (ft) southeast (across I-5) and 500 ft northwest of the site. Lakewood municipal supply wells H1 and H2 are approximately 800 ft southwest of the site (**Figure A-1** in **Attachment A**).

4.2 Climate

Tacoma, Washington has mild temperatures year-round. During summer, the average temperature is around 70°F (21°C), and during winter, the average temperature is around 45°F (7°C). Rainfall is spread evenly throughout the year, with slightly more rain in the winter months. Snowfall is rare in Tacoma, typically occurring only a few days each year. Tacoma receives 41 inches of rain, on average, per year[5].

4.3 Geology, Hydrogeology, and Groundwater Use

This section summarizes the optimization review team's understanding of site geology, hydrogeology, and groundwater use.

4.3.1 Geology

As shown on **Figure A-2** in **Attachment A,** the site is underlain by semi-consolidated and unconsolidated sediments laid down in lakes or by streams during the Holocene, Pleistocene, and late Tertiary time. These sediments include clay, silt, sand and gravels, glacial till, and peat with a combined thickness of more than 2,000 ft (EPA 1983).

The following information on site geology was reported in a previous groundwater investigation report (EPA 1983):

> *"The Site is underlain by Steilacoom gravels. These were deposited in large meltwater streams that flowed westward across the area during the retreat of the Puget ice lobe. This unit consists of coarse sand and gravels with cobbles, and is consistently coarse*

[5] Tacoma, WA Climate (bestplaces.net)

over a large area. This characteristic distinguishes the Steilacoom gravels from other outwash deposits. The unit was encountered in all the monitoring wells; and its thickness ranges from one foot to 35 feet. Underlying the Steilacoom gravels is the Vashon till. This unsorted mixture of clay, silt, sand and gravels, cobbles and boulders was deposited beneath the ice sheet and compacted by the weight of the ice. The till is grey and has the general appearance and characteristics of concrete. It is very tough to drill through, and drillers usually refer to it as "hardpan". The thickness of this unit ranges from three to 36 feet in the study area, and was encountered in all the monitoring wells. Advance outwash deposits underlie the Vashon till. These deposits were laid down by meltwater streams during the advance of the ice. The unit generally consists of well sorted stratified gravels and cobbles with sand and clay lenses. The advance outwash gravels were encountered in all the monitoring wells. The advance outwash overlies the Colvos Sands, and the contact between these two units is sometimes not readily apparent due to the similarities of their lithology. The Colvos Sands generally consist of well sorted sands with lenses of gravel. The basal portion of the unit consists of blue clay, probably deposited in proglacial lakes that formed in front of the advancing ice. The Colvos Sands were encountered in some of the monitoring wells.

4.3.2 Hydrogeology

Unconsolidated deposits at the site vary in degree of permeability (K). Glacial outwash sand and gravel deposits generally have high K and are productive aquifers where saturated. Clay, peat, and glacial till deposits are characterized by low K and are much less productive, yielding only small amounts of water to wells.

The primary hydrogeological units of interest under the site include the Steilacoom gravel unit (at depths of about 0 to 30 ft below ground surface [bgs]), the low-K Vashon till (at depths of about 30 to 75 ft bgs), and the advance outwash deposits (sands) forming the primary aquifer (at depths of about 75 to 110 ft bgs). These units are underlain by less permeable Colvos sand and clay below 100 ft bgs. Lakewood municipal supply wells H1 and H2 are screened in the advance outwash sands (EPA 2022).

Depth to water is typically approximately 30 to 40 ft bgs with the Steilcoom gravel unit above the water table at most locations at the site. **Figure A-2** in **Attachment A** shows a cross-section with a conceptual flow model of conditions created during pumping (of H1 and H2) from the Record of Decision (ROD) (EPA 1985).

Regional groundwater flow is to the west/northwest with localized influence from supply wells. Based on monitoring in 2016 (EPA 2017) which was conducted during non-continuous pumping conditions, vertical gradients between the Vashon till and advance outwash deposits are believed to vary seasonally with upward gradient expected during drier periods typically from May to November and downward gradients in the wetter part of the year.

4.3.3 Groundwater Use

The Lakewood Water District has two active water supply wells, H1 and H2, located south of Interstate 5 and about 800 ft southwest of the former Plaza Cleaners facility (**Figure A-1 in Attachment A**). Wellhead treatment by air stripping of CVOCs at H1 and H2 removes site-related contamination from a typical production rate 2,800 gallons per minute (gpm) of groundwater before it is distributed. There are no known private wells within the area of site-related groundwater contamination.

4.4 Regulatory History, Decision Documents and Cleanup Levels

A site chronology including regulatory history and decision documents is included in **Table B-1** of **Attachment B**. The chronology begins in July 1981, with the identification of volatile organic compounds (VOCs) in groundwater in Lakewood municipal supply wells H1 and H2. The site includes two operable units (OU); OU1 addresses groundwater and OU2 addresses soil. A summary of key site decision documents is provided in the paragraphs below.

The 1984 Interim ROD (EPA 1984) includes the following primary objectives:

- Restrict the spread of contamination in the aquifer to reduce ultimate cleanup needs and protect the quality of water supply from other wells.
- Restore full water service to the area of the Lakewood Water District that is adversely affected by the shutdown of wells H1 and H2.
- Initiate groundwater treatment as soon as is practical.

The 1985 ROD (EPA 1985) includes the following remedial action objectives (RAOs):

- Evaluate the potential health risks associated with the no-action alternative, which assumes the status quo of continued operation of the stripping towers.
- Reduce potential health risks associated with on-site excavation and use of contaminated groundwater below those risks for the no-action alternative.
- Meet the requirements of other environmental regulations.
- Increase the efficiency of the existing interim remedial measure (IRM) to reduce energy requirements and thereby reduce costs.

The selected remedy components in the 1985 ROD (EPA 1985), as modified by the 1986 ROD Amendment (EPA 1986), 1992 Explanation of Significant Differences (ESD) (EPA 1992), and 2019 ESD (EPA 2019), include:

OU1 – Groundwater

- Continued operation of the H1 and H2 wellhead air stripping treatment system (1985 ROD).
- Installation of higher-efficiency equipment or modification of existing equipment used in the treatment system (1985 ROD).
- Installation of more monitoring wells, upgradient of existing wells, and continued sampling of the aquifer to monitor progress and provide early warning of potential new contaminants (1985 ROD).

- Placement of administrative restrictions on the installation and use of groundwater wells (1985 ROD).
- Maintenance of existing groundwater use restrictions, such as public outreach and education for homeowners who have, or could potentially install, private drinking water wells (1992 ESD).
- Clarification of required public outreach and education activities and incorporation of local regulatory requirements as an institutional control for the Site (2019 ESD) (see the Institutional Control Review section of the Five-Year Review (FYR) Report for more information on required activities).

OU2 – Soil

- Cleanout of three existing "bottomless" septic tanks at the Plaza Cleaners property (1986 ROD Amendment).
- Construction of a soil vapor extraction (SVE) system concentrated along the utility and drain field lines, with soil and vapor analysis until soil treatment is complete (1986 ROD Amendment).
- Excavation of remaining tetrachloroethylene (PCE)-contaminated sludge/soil after implementation of SVE (1992 ESD).
- Elimination of land use restrictions at the Plaza Cleaners property after completion of the OU2 remedial action soil (1992 ESD).

4.4.1 Cleanup Levels

The 1992 ESD (EPA 1992) established groundwater cleanup levels for the site which are the federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCL) for PCE (5 micrograms per liter [µg/L]), trichloroethene (TCE) (5 µg/L), and cis-1,2-dichloroethene (cis-1,2-DCE) (70 µg/L).

The 1992 ESD (EPA 1992) also established a PCE soil cleanup level of 500 micrograms per kilogram (µg/kg). The 1992 ESD (EPA 1992) stated that this cleanup level was compliant with state regulatory requirements, within EPA's acceptable risk range of 10-4 to 10-6, and protective of the groundwater.

Based on an assumption that the treatment system would operate on a continuous basis, EPA estimated that the remedial action would remediate the groundwater in 10 to 15 years. (EPA 2022).

4.4.2 Implementation of Groundwater Remedy

In September 1984, two air stripping systems were installed to treat VOCs in groundwater from municipal supply wells H1 and H2. Operation of the air strippers was confirmed in the 1985 ROD (EPA 1985).

In 1992, Ecology began a groundwater monitoring program at the site. Several monitoring wells have been decommissioned and replaced since the program began. As shown on **Figure A-3** in **Attachment A**, the current monitoring well network for the site includes 10 monitoring wells and the two Lakewood Water District municipal supply wells (H1 and H2). Eight of the ten monitoring wells are completed in advance outwash sands at depths between 93 and 118 ft bgs. One well (MW-20B) is completed in the Vashon till at a depth of 53 ft bgs, and one well (LPMW-2) is completed in the Steilacoom gravels at a depth of 29 ft bgs. The two municipal supply wells, H1 and H2, are completed in the advance outwash sands to depths of 108 and 105 ft bgs, respectively. Construction details for all wells in the monitoring plan are presented in **Table B-2** in **Attachment B**.

As shown on the schedule included as **Table B-3** in **Attachment B**, groundwater monitoring is performed at the two municipal supply wells and ten monitoring wells at variable frequencies and numbers of wells.

H1 and H2 have been operated intermittently in recent years because of municipal water use. In 2016/2017, EPA studied concerns regarding potential protectiveness associated with intermittent pumping and concluded the plume was contained in the advance outwash sands (EPA 2017).

The air strippers were replaced in 2020. Granular activated carbon (GAC) treatment was added recently to treat per- and polyfluoroalkyl substances (PFAS) contamination in groundwater migrating from JBLM. Based on photographs on pages H-3 and H-5 in the seventh FYR report (EPA 2022), the optimization review team assumes that each of four vessels contain 10,000 pounds of GAC.

4.4.3 Implementation of Soil Remedy

EPA completed the remedial design for the soil component of the remedy in 1987 and began remedial action shortly thereafter. EPA removed contaminated solids and water from three septic tanks located behind Plaza Cleaners for off-site disposal. However, not all of the solids could be excavated from one of the bottomless septic tanks. Therefore, EPA decided to address remaining contamination with SVE.

The SVE system operated intermittently between 1988 and April 1989. Follow-up soil sampling conducted in October 1990 indicated elevated concentrations of PCE at about 10 to 12 ft bgs within one septic tank (CH2MHill 1992). Based on the uncertainty that SVE could reduce PCE concentrations in the septic tank sludge below the 500 µg/kg cleanup level, EPA decided to excavate the contaminated sludge and soil from within and around the septic tank for off-site disposal. Excavation was completed by July 1992. Subsequent soil sampling and analysis confirmed that sitewide and subsurface soil concentrations were well below 500 µg/kg. With soil remediation complete, EPA decommissioned and dismantled the SVE system. In November 1996, EPA removed OU2 (soil) from the National Priorities List (NPL) (EPA, 2022).

4.4.4 Institutional Controls

The history and status of institutional controls (ICs) at the site is described in the seventh FYR report (EPA 2022):

> *"The 1985 ROD included a requirement to place administrative restrictions on the installation and use of new wells within the area of contamination to minimize the potential use of contaminated groundwater. The 1986 ROD Amendment did not change*

this requirement. The 1992 ESD determined that public education and outreach were sufficiently protective of human health, and that other administrative controls such as deed restrictions were not necessary. The 1992 ESD also removed the requirement for land use controls at the former Plaza Cleaners property because EPA had remediated the soil.

The 2019 ESD clarified the timeline and nature of public education and outreach, and added local regulatory requirements designed to limit the installation of private wells in areas of contaminated groundwater as an additional institutional control. The Tacoma-Pierce County Health Department requires by regulation that new wells be subject to approval by the Health Department prior to drilling, and that such approval may be withheld for wells or well sites which are subject to known or potential sources of contamination.

While no new wells have been drilled in the area of concern for at least 35 years and the local regulations in place since 2015 restrict drilling new wells in areas subject to known or potential sources of contamination, the 2019 ESD required the following public education and outreach activities:

- *Periodic public notification of the presence of the groundwater contamination and advisement against the use of contaminated groundwater. At a minimum, such notification will be provided at least once every five years and will be mailed to all property owners whose land overlies areas of groundwater contamination.*
- *The Health Department will be contacted to ascertain whether there has been installation of any individual drinking water wells at the Site or land use changes which potentially impact the use of wells.*

... As required by the 2019 ESD, Ecology contacted the Tacoma Pierce County Health Department in April 2022. The Health Department confirmed no drinking water wells are in the vicinity of the Site and Lakewood Water District service area. The Health Department also confirmed that any new proposed wells would need approval..."

Figure A-4 in Attachment A includes the properties identified for outreach in the 2019 ESD (EPA 2019) and the monitoring wells with recent VOC exceedances in groundwater.
Table B-4 in Attachment B summarizes ICs for the site.

4.5 Overview of Contaminant Nature and Extent

The following sections describe the nature and extent of contamination at the site.

4.5.1 Soil and Soil Vapor Contamination

Soil contamination was addressed by excavations and SVE operation between 1987 and 1992. Initial SVE operation included 10 extraction wells with a total flow of approximately 650 cubic feet per minute (cfm) (EPA 1989). Operating extraction wells were later decreased to three and then finally two SVE wells. Concentrations in soil vapor extracted by the SVE system decreased from 170 parts per million (ppm) to approximately 10 ppm during SVE operation. SVE operation removed 360 pounds of contaminant mass in the initial month of operation and a significant additional amount (estimated, but not calculated, at over 100 pounds) through April 1989 when the SVE system was shut down. **Figure A- 5** in **Attachment A** shows the SVE system layout and septic tank locations.

Soil excavation activities in 1987 included excavating to the top of the three septic tanks and removing and solidifying contents (CH2MHill 1992). Septic tank #1 and surrounding soil were removed in 1992. **Figure A-6** in **Attachment A** shows the location of soil removal.

To date, soil vapor sampling beneath the existing site building has not been performed.

4.5.2 Groundwater Contamination

PCE in groundwater appears to emanate from the former Plaza Cleaners source area and migrate downward and toward the municipal supply wells H1 and H2. The highest concentrations of PCE in groundwater have been detected in groundwater from shallow till zone monitoring well MW-20B in the source area (**Figure A-4** in **Attachment A**), while PCE has not been detected in groundwater from the deeper advance outwash sands well MW-20A in the same location. PCE has been detected in groundwater samples from well MW-16A, which is located approximately 400 ft southwest of the site source and wells MW-20A and MW-20B. Wells MW-16A and MW-20A are screened in the advance outwash sands; MW-20B is screened in the Vashon till. There are no additional monitoring wells in this downgradient area. Municipal supply wells H1 and H2 are located across I-5 and south of MW-16A, indicating that the plume migrates toward municipal supply wells H1 and H2 from the source, with MW-16A intercepting the plume as it migrates. The site team plans to install a new monitoring well, southwest of MW-16A, screened within the advance outwash sands.

Figure A-7 in **Attachment A** shows PCE concentrations in groundwater from sampling in 2018 and 2020. **Figure A-8** and **A-9** in **Attachment A** and **Tables B-5** and **B-6** in **Attachment B** show PCE concentration over time at key wells MW-16A and MW-20B, respectively, from 1991 to 2020.

Figure A-10 in **Attachment A** shows PFOS contamination originating from JBLM, with concentrations in municipal supply wells H1 and H2 and many nearby monitoring wells within and near the JBLM installation boundary. PFOS is present at relatively elevated concentrations in many monitoring wells at JBLM, and a groundwater contaminant plume appears to be migrating to the north and west from JBLM. PFOS is a regulated chemical, which is part of the PFAS group of chemicals; thus, PFOS was not considered in early site investigation and remediation efforts. PFOS has an MCL of 4 parts per trillion (ppt).

5.0 FINDINGS

The optimization review team developed findings relative to the following items:

- CSM and potential data gaps;
- Plume migration and groundwater contamination delineation;
- Groundwater remediation progress and timetable;
- Soil vapor investigation and mitigation;
- Groundwater monitoring frequency and locations;
- Annual remedy costs;
- Alternative remedial approaches; and
- Resource use and efficiency.

These findings are addressed in the following subsections.

5.1 CSM and Potential Data Gaps Plume Migration and Groundwater Contamination Delineation

The current CSM appears to indicate that the majority of remaining PCE mass is present in the till layer (with analytical results from well MW-20B as the indicator) from where it will continue to diffuse out of low K (storage) zones into higher K (transport) zones (with analytical results from well MW-16A as the indicator). This process is likely to occur over several decades as concentrations slowly decrease, based on PCE trends in MW-20B, MW-16A, and municipal supply wells H1 and H2 since 1991.

Pumping from municipal supply wells H1 and H2 appears to be generally containing the PCE plume. Groundwater contaminated with PFAS is being captured by municipal wells H1 and H2. The PFAS appears to be originating at JBLM. Based on the information reviewed regarding the existence and scale of the PFAS plume emanating from JBLM, the optimization review team has no reason to suspect there is a separate PFAS source from the former Plaza Cleaners. A relatively small mass of PCE contamination in groundwater appears to be migrating to the northwest and west from the source area based on the low concentrations of PCE (below MCLs) detected in MW-31 and MW-32. The results of sampling from a new monitoring well that the site team plans to install to the southwest of MW-16A north of I-5 is intended to provide additional information regarding the amount of plume capture (and non-capture) by municipal supply wells H1 and H2.

SVE efforts removed significant soil vapor mass during intermittent operation over a 13-month period in 1988 and 1989. SVE operation was terminated with relatively high concentrations (up to 50 ppm) and significant soil vapor mass remaining. In addition, soil gas concentrations were used as the basis for determining SVE shutdown; therefore, the decision to terminate did not consider impact to groundwater or vapor intrusion (VI) risks.

The excavation and SVE efforts completed by 1992 appear to have been an incomplete source area removal, leaving significant shallow PCE contaminant mass in the unsaturated surficial outwash deposits. PCE contamination continued to diffuse into the underlying till layer and subsequently impact the productive sand aquifer. Although there are seasonal variations in vertical gradients between the till and sands, the PCE contamination is migrating vertically through the till and into the sands. PCE concentrations also show decreasing trends from 1992 to present due to mass removal from pumping wells and natural attenuation.

Even with more complete SVE in the vadose zone, the PCE mass in the lower K till would continue to serve as a source to the higher K advance sand unit.

Concentrations of PCE are stable in MW-20B and MW-16A; however, they are decreasing (now below MCLs) in municipal supply wells H1 and H2, indicating some attenuation is occurring at the site. PCE breakdown product concentrations are low, indicating minimal biological attenuation. Physical attenuation processes (adsorption, diffusion, dilution) are continuing.

Migration of the dissolved phase plume appears limited by the following factors:

- Pumping of municipal supply wells H1 and H2;
- The presence of a consistent clay layer at approximately 110 ft bgs; and
- Downward migration in response to the downward vertical component of hydraulic gradients.

5.2 Groundwater Remediation Progress and Timetable

PCE concentrations have decreased since 1991; however, they remain well above MCLs in MW-16A and MW-20B. The concentration trends indicate that several additional decades of groundwater extraction and treatment will be required before concentrations achieve MCLs. This diffusion-controlled contaminant mass will continue to diffuse out of low K (storage) zones into higher K (transport) zones for decades. Any remedial efforts to achieve restoration will need to address the sequestered contaminant mass in the till to be effective at advancing progress.

5.3 Vapor Intrusion

SVE was operated near the Plaza Cleaners facility between 1988 and 1989. The optimization review team is not aware of investigation of indoor air or sub-slab VOC concentrations at the former cleaners building, which currently houses Rainier Lighting & Electric Supply.

5.4 Groundwater Monitoring

Currently, groundwater from eight wells is sampled every 18 months, three wells are sampled every 3 years, and one well is sampled every 5 years. Samples are analyzed with VOCs.

5.5 Annual Remedy Costs

Remedy operations include municipal water treatment, with air stripping and GAC, which is operated by Lakewood Water District. Ecology conducts groundwater monitoring and reporting.

Table 3 summarizes annual remediation and monitoring costs estimated by the optimization review team for those items where the scope of work could be assumed. Cost information was not provided by the site team.

Table 3: Estimated Annual Remediation and Monitoring Costs

Cost Category	Estimated Annual Cost	Assumptions
WTP Operator Labor	Not Estimated	Costs borne by Lakewood Water District
Reporting, Project Management, Engineering Support Labor	Not Estimated	Costs borne by Lakewood Water District and Ecology
Process Sampling	Not Estimated	Costs borne by Lakewood Water District
Groundwater Sampling Labor	$4,898	Average 6.53 wells sampled per year at an estimated $750 per well
Groundwater Analysis	$653	Average 6.53 analyses per year at $100 per VOC analysis
Utilities	$39,420	Lakewood Water District Air Stripper Blowers - estimate 50 HP total for 37.5KW at $0.12 per KWhr
GAC	$60,000	Lakewood Water District for JBLM PFAS treatment – estimate 20,000 pounds per year usage at $3 per pound for supply and disposal
	$105,000+	

Notes: *WTP = water treatment plant; VOC = volatile organic compound; HP = horsepower; KWhr = kilowatt-hour; GAC = granular activated carbon; JBLM = Joint Base Lewis-McChord; PFAS = per- and polyfluoroalkyl substances.*

5.6 VOC Source Remedial Options

Groundwater extraction and treatment systems (commonly referred to as “pump and treat”) are typically best suited for controlling plume migration, versus achieving restoration goals because of long-term back-diffusion of contamination from low-K zones into adjacent high-K zones. Pump and treat has advantages for plume migration control because it can be accomplished with relatively few wells and can be monitored with standard groundwater elevation and contamination measurements and groundwater modeling.

Excavation and SVE have both been implemented for source removal at the site in relatively shallow vadose zones. The main source of remaining VOCs is likely low-K material in the saturated till. Analytical results from well MW-20B indicate the presence of this contaminant source; however, the extent and volume of the source are not known. Further characterization of this contamination would be needed to recommend potential in-situ remedial approaches, technologies, and costs. Options would need to consider possible negative interactions with the co-located PFAS and could include adsorptive material (generally GAC) injection. Typically, these technologies require multiple injections in many horizontal and vertical locations within a plume to achieve restoration goals. The low permeability of the till would likely result in a very high number of required injection points. Thermal technologies are not limited by back-diffusion and may be applicable source mass removal options for saturated till; however, the cost for implementation could be extremely high depending on the extent of contamination.

5.7 Resource Use and Efficiency

The main resource uses at the site due to the groundwater contaminant plume are air stripper blowers; the municipal supply well pumps would operate regardless of the groundwater contaminant plume. The optimization review team did not review the municipal water supply equipment information; thus, a total average electric load of 37.5 KW was assumed.

5.8 Climate Vulnerability Screening

The optimization review team's summary findings of the CV screening performed for the site include the following:

- Data and resources identified in the Pierce County Hazard Management Plan (HMP) were sufficient to support this screening effort.
- The remedial and monitoring systems of concern include groundwater monitoring wells and the groundwater treatment system, including air strippers and GAC vessels.
- Based on the moderate probability of occurrence and the moderate potential for damages in the event of earthquakes, the vulnerability of the site to impact from earthquakes would be considered moderate.
- Tsunamis from earthquakes or seiches pose relatively moderate risk to the site.
- Drought and thunderstorms both ranked as moderate risks for the site. However, climate change could potentially exacerbate the risks and impacts associated with drought and thunderstorms.
- Flooding, winter weather, and wildland urban interface (WUI) fire hazards all pose a low to moderate threat to the site. However, climate change could increase the probability of occurrence and intensities of floods, winter storms, and WUI fires.
- Landslides poses a low threat to site vulnerability based on the low-to-moderate probability of occurrence.
- All hazards would pose a risk to utilities related to the site water treatment system. Damage to utilities could decrease or temporarily impact the operation of the air strippers and GAC vessels thus compromising water treatment operations.

Attachment C presents the detailed findings of the CV screening effort.

5.9 Environmental Justice Screening

This section presents the summary findings of the optimization review team's EJ screening, which was performed for the site using EPA's EJScreen (Version 2.2) EJ screening and mapping tool. **Attachment D** provides the EJScreen Community Report for the site.

According to the EJScreen Community Report (based on data from the Census Bureau American Community Survey [ACS] for the 2017-2021 time-period), 8,352 people lived within 1 mile of the site. Approximately 6 percent of the population was between the ages of 1 and 4 years old, 22 percent was between the ages of 1 and 18 years old, 78 percent was between the ages 18 and 64, and 12 percent was 65 years and older.

Based on the EJScreen Community Report, the population's racial composition was 46 percent White, 18 percent Hispanic, 16 percent Black, 6 percent Hawaiian/Pacific Islander, 5 percent Asian, and 9 percent identified as Two or More Races.

5.9.1 Environmental Indicators Data

A review of the environmental indicators data provided in the EJScreen Community Report for the site indicates the following:

- The Particulate Matter for the site was 7.15 micrograms per cubic meter of air ($\mu g/m^3$), compared to the state average of 7.02 $\mu g/m^3$ and national average of 8.08 $\mu g/m^3$.
- The Ozone value for the site was 50 parts per billion (ppb), compared to the state average of 49.8 ppb and national average of 61.6 ppb.
- The Diesel Particulate Matter for the site was 0.402 $\mu g/m^3$, compared to the state average of 0.355 $\mu g/m^3$ and national average of 0.261 $\mu g/m^3$.
- The Air Toxics Cancer Risk (lifetime risk per million) for the site was 30, compared to the state average of 27 and national average of 25.
- The Air Toxics Respiratory Hazard Index for the site was 0.49, compared to the state average of 0.39 and national average of 0.31.
- The Toxic Releases to Air for the site was 350, compared to the state average of 1,800 and national average of 4,600.
- The Traffic Proximity (daily traffic count/distance to road) for the site was 460; compared to the state average of 190 and national average of 210.
- Lead Paint (percent Pre-1960 Housing) for the site was 0.24, compared to the state average of 0.23 and national average of 0.3.
- The Superfund proximity value (site count per kilometer [km] distance) for the site was 2.3/km, compared to the state average of 0.18/km and national average of 013/km.
- The Risk Management Plan Facility Proximity (facility count per km distance) for the site was 0.13/km, compared to the state average of 0.4/km and national average of 0.43/km.
- The Hazardous Waste Proximity (facility count per km distance) for the site was 0.18/km, compared to the state average of 1.6/km and national average of 1.9/km.

5.9.2 Socioeconomic Indicators Data

A review of socioeconomic indicators within a 1-mile radius of the site indicated that:

- Approximately 48 percent of the population qualified as low income, compared to the state average of 24 percent and national average of 31 percent.
- Fifty-four (54) percent of the population consisted of people of color, compared to a state average of 32 percent and national average of 39 percent.

- Approximately 10 percent of the population had less than a high school education, compared to the state average of 8 percent and national average of 12 percent.
- Four (4) percent of the population was characterized as Limited English-Speaking Households, compared to the state average of 4 percent and national average of 5 percent.
- The average life expectancy was 78 years.
- Per capita income was $33,924.
- The unemployment rate was 10 percent, compared to the state average of 5 percent and national average of 6 percent.
- There were 3,411 households located within a 1-mile radius of the site; 26 percent of these were owner occupied.

The predominant language spoken within 1 mile of the site was English (77 percent of the population), followed by Spanish (15 percent), Other Asian and Pacific Island (3 percent), and 1 percent each of German or other West Germanic, Korean, Chinese, Vietnamese, and Tagalog.

6.0 RECOMMENDATIONS

This section provides recommendations based on the optimization review team's independent review and is organized into the following categories:

- Protectiveness
- Cost-effectiveness
- Technical improvement
- Site completion
- Conservation of resources

These recommendations do not constitute requirements for future action but are provided for consideration by the EPA Region and other site stakeholders. While the recommendations may provide some details to consider during implementation, the recommendations are not meant to replace other, more comprehensive, planning documents such as work plans, sampling plans and quality assurance project plans (QAPPs).

6.1 Recommendations to Improve the Remedy's Ability to Achieve Protectiveness Goals

This subsection presents the optimization review team's recommendations with respect to improving the remedy's ability to achieve protectiveness goals.

6.1.1 Investigate Remaining Contaminant Material in Saturated Till, Back Diffusion and Restoration Timeframe

The original cleanup timeframe for the site CVOCs was estimated at 10 to 15 years. To date, 30 years of remedy operations have been completed, with operations continuing. Concentrations of contaminants in groundwater from wells MW-20B and MW-16A are fluctuating; however, they have generally been steady since 2000.

The transfer of CVOC contaminant mass via diffusion driven by a concentration gradient from the high K sand or sand and gravel zones (where advection is the dominant process), to the low K till, silt, or clay zones (where diffusion is the dominant process) results in the storage of a significant mass of contaminants in the low K zones. As time passes and the processes of advection, dispersion, volatilization, and degradation reduce the dissolved phase concentrations in the high K zones, the direction of the concentration gradient driving the diffusive flux of contaminants into the low K zones reverses. This results in contaminant mass diffusing back out of the till, silts, and clays into the sands (a process referred to as back-diffusion). Once back-diffused back into the high K zones, the processes of advection and hydrodynamic dispersion transport the contaminants more rapidly in a down-hydraulic gradient direction.

The optimization review team recommends that the site team evaluate the CVOC contaminant mass currently stored in the low K zones near MW-20B and the extent of diffusive mass transfer of dissolved phase contamination. This evaluation will help assess the length of time potentially required to achieve RAOs.

This effort would include careful sampling and analysis of soil samples from vertical coring profiles at depths between approximately 30 and 75 ft bgs. The optimization review team recommends using a direct-push technology (DPT) dual casing coring tool, with an internal core liner, or a piston coring tool advanced using percussion and/or down pressure. Sonic coring is not recommended unless soils are cored using a sonic piston coring tool such as the AquaLock core barrel system soil sampler or similar. This is because direct sonic coring uses relatively large amounts of water, which can dilute contaminant concentrations in cored soils and generates a large amount of heat, which can drive volatile contaminants out of the soils. In addition, sonic drilling methods use high-intensity vibration to drive drill casing into the subsurface, essentially liquifying the soils, which causes them to flow readily into the core barrel. This process destroys the stratigraphic structure of the soils and can cause the mobilization, and loss, of contaminants within the core during drilling and retrieval. These effects, however, can be substantially reduced using a sonic piston coring tool such as the AquaLock core barrel system soil sampler or similar.

Continuous cores would be advanced to 75 ft bgs, with soil sampling focused on low K materials (silts and clays) from their contact with overlying/underlying higher K materials (sands) deeper into the low K zone. Samples would be collected on a close average vertical spacing (for example, 1 ft) to establish a contaminant concentration profile within the low K materials. Cores would only be retrieved when the field sampler/logger indicates that sampling of the previous core run is completed, and another core run is ready for processing. Once the core barrel is retrieved, the core liner is only opened once the liner has been placed on the sampling table. Samples of the low K materials would be collected immediately upon opening the core liner using a disposable syringe style sampler. The soil sampler would then be extruded into a sample vial containing a pre-dispensed volume of methanol. Once the sample has been placed in the vial, the vial would be sealed with the cap and Teflon tape wrapped around the cap and bottle neck. Sampling personnel would need to avoid disturbing, agitating, or leaving the sample exposed to the atmosphere before it is submerged in methanol. Samples would then be placed in a cooler under chain-of-custody procedures for shipment to the laboratory for analysis. The optimization review team recommends that a formal scoping effort be performed to ensure proper design and execution of this work.

Assuming that five borings are advanced to 70 ft bgs, and 225 soil samples are collected and analyzed for CVOCs, the cost is estimated to be approximately $80,000, which includes a brief work plan, sample analysis, data evaluation, and reporting.

6.1.2 Vapor Intrusion Investigation and Mitigation

The optimization review team recommends that the site team complete sub-slab vapor and indoor air sampling at Rainier Lighting & Electric Supply. This recommendation includes:

- Developing a sampling plan with approximately five sub-slab locations with two locations focused in the areas nearest to the former septic tanks;
- Installing Vapor Pins® or a similar sampling device into the subsurface at the chosen locations;

- Sampling sub-slab vapor and indoor air at the chosen locations with analysis for VOCs; and
- Developing a brief report of work performed and results.

The optimization review team estimates this work could be performed in 2 days and cost approximately $15,000.

Depending on the comparison of analytical results to vapor intrusion screening levels (VISL), installation of a vapor intrusion mitigation system (VIMS) may be warranted. Cost estimates for implementing contingent recommendations are not provided.

Sampling at nearby facilities is likely not necessary based on their locations relative to the plume.

6.2 Recommendations to Improve Cost-Effectiveness

This subsection presents the optimization review team's recommendations with respect to improving cost effectiveness of current site activities.

6.2.1 Remove Air Strippers from Municipal Water Treatment System

The current municipal water treatment system includes air stripping for removal of low levels of PCE, which are recently below the MCL of 5 µg/L in municipal supply wells H1 and H2, and potential degradation products (recently not detected) and GAC for adsorption of PFAS chemicals based on PFOS detections at approximately 0.04 µg/L in groundwater from municipal supply wells H1 and H2 exceeding the 0.004 µg/l MCL.

The optimization review team recommends that the site team bypass the air stripping treatment component and treat both PFAS and PCE with GAC. PCE is readily adsorbed by GAC so that treatment of the water from municipal supply wells H1 and H2 by GAC only is appropriate. Adding the PCE removal would not be expected to increase GAC usage above that required for PFAS alone. A full PFAS analysis of the H1 and H2 water is recommended to confirm the expected GAC usage. Note that air stripping does not remove PFAS constituents so the need for PFAS sampling to confirm GAC usage is unrelated to the recommendation.

Suspending operation of the air stripper will save over $40,000 per year, mainly in costs for power but also routine maintenance.

6.3 Recommendations for Technical Improvement

There are no recommendations for technical improvement.

6.4 Recommendations for Site Completion (Remedy Approach Moving Forward)

This subsection presents the optimization review team's recommendations with respect to site completion.

The site currently has PCE concentrations in groundwater monitoring wells that are relatively stable and well above the 5 µg/L MCL. Based on concentration trends, the current groundwater pumping remedy will not achieve restoration for at least several decades. However, there is no current human health risk from groundwater because groundwater from the municipal supply wells is treated, and concentrations of contaminants in influent to the treatment units are already below their respective MCLs. In addition, ICs are in place preventing other groundwater use.

The optimization review team recommends that the site team proceed without delay to implement the VI investigation and potential mitigation efforts detailed in **Section 6.1.2**. The optimization review team also recommends the investigation of till zone contamination as described in **Section 6.1.1** to determine by relative feasibility of in-situ treatment in the till unit to accelerate progress towards site cleanup.

6.5 Recommendations for Conservation of Resources

This subsection presents the optimization review team's recommendations with respect to conservation of resources.

Removing the air stripper blower and treating with GAC only would save an estimated 330,000-kilowatt hours (KWh) per year. The cost savings associated with the conservation of resources is included in **Section 6.2**.

6.6 Climate Vulnerability

The optimization review team's summary recommendations for mitigation measures based on the CV screening performed for the site include the following:

- *Drought* – Measure groundwater elevations in preparation of monitoring events.
- *Earthquake* – Consider using seismic-resistant materials to repair or replace infrastructure of monitoring systems. Brace pipes to increase flexibility to aboveground connections or hard points.
- *Flooding/Tsunami* – Monitor weather forecasts and post-earthquake advisories to be aware of inundation conditions that could impact the site. Continue to monitor the groundwater plume after considerable inundation.
- *Landslide* – No recommendations for landslides.
- *Thunderstorms* – Install lightning rod(s) to prevent damage from lightning strikes. Consider other hazards that may follow, such as hail and high winds.
- *Wildfire* – Mow and remove any dead or buildup of grasses. Consider wildfire-resilient landscaping when planning site redevelopment.
- *Winter Weather* – Monitor heavy snowfall in preparation of site operations. Insulate all components of the monitoring systems that are vulnerable to extreme cold.
- *All Hazards* – Prepare a backup generator or pumps for use during monitoring events.

Based on the results of the CV screening, the optimization review team does not believe that the site warrants a focused CV Evaluation.

Detailed recommendations of the CV screening are presented in **Attachment C.**

6.7 Environmental Justice

As EPA Region 10 has responsibility for supporting programs and projects to address community EJ concerns within the region, no recommendations are provided. The summary of EJ screening findings provided in **Section 5.9** are intended for EPA's information convenience.

6.8 Estimated Costs and Savings

Table 4 provides a summary of estimated costs and savings for the optimization review team's recommendations.

Table 4: Summary of Estimated Costs and Savings

Recommendation	#	Sub-Recommendation	Estimated Costs	Estimated Savings
6.1 Recommendations to Improve the Remedy's Ability to Achieve Protectiveness Goals	6.1.1	Investigate Remaining Contaminant Material in Saturated Till, Back-Diffusion and Restoration Timeframe.	$80,000	N/A
	6.1.2	Conduct a Vapor Intrusion Investigation.	$15,000*	N/A
6.2 Recommendations to Improve Cost-Effectiveness		Remove Air Strippers from Municipal Water Treatment System.	Minimal	$40,000
6.3 Recommendations for Technical Improvement		None	N/A	N/A
6.4 Recommendations for Site Completion		Implement Recommendations 6.1.1 and 6.1.2.	See 6.1.1; 6.1.2	See 6.1.1; 6.1.2
6.5 Recommendations for Conservation of Resources		Implement Recommendation 6.2.1.	See 6.2.1	See 6.2.1

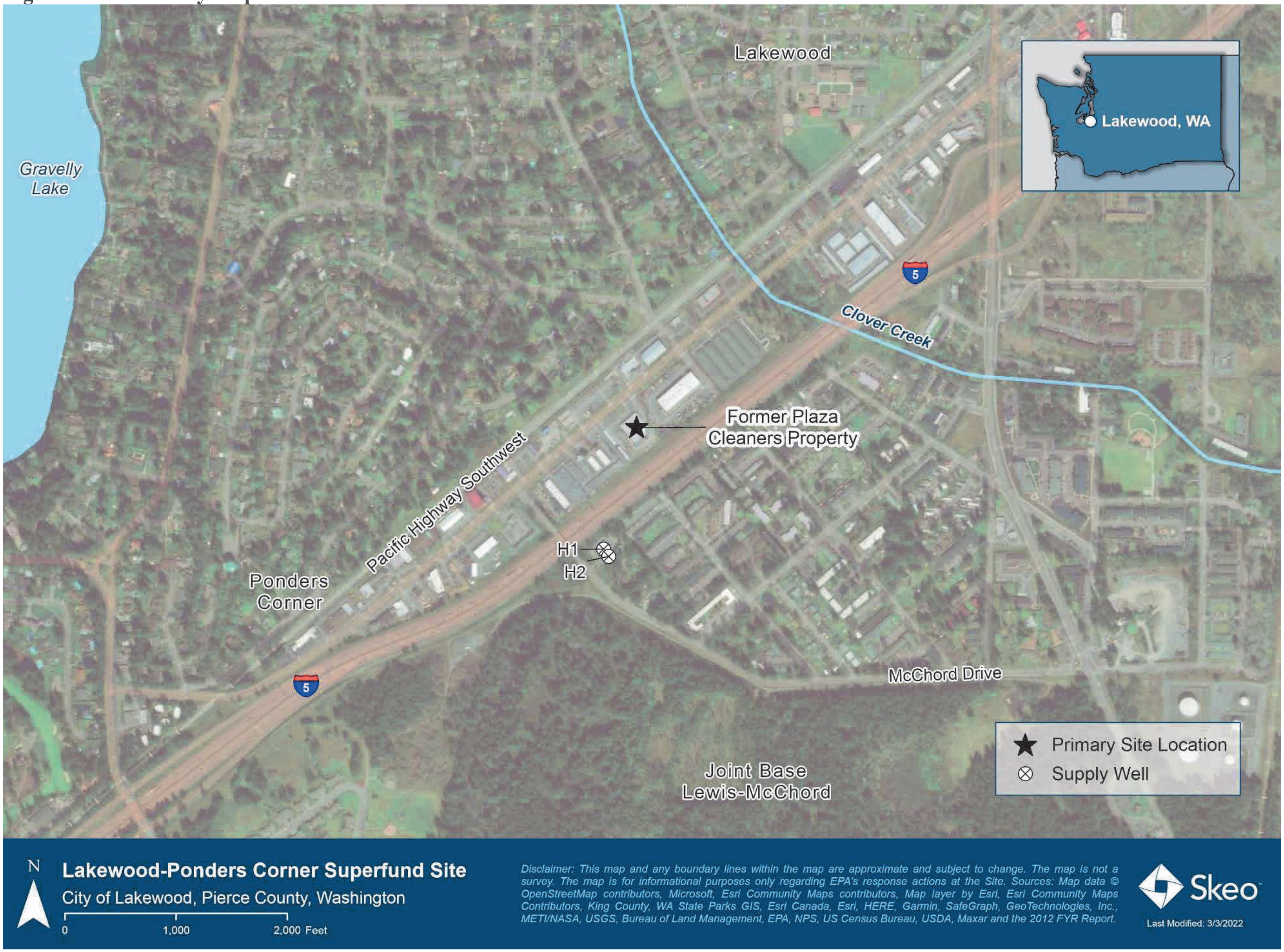
Notes: *N/A = not applicable*
**Estimated costs do not include vapor intrusion mitigation efforts*

ATTACHMENT A:

Selected Figures from Site Documents

Figure A-1 – Site Location Map

Figure 1: Site Vicinity Map



Source: Figure 1. Site Vicinity Map From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

Figure A-2 – Cross Section and Groundwater Flow Conceptual Model

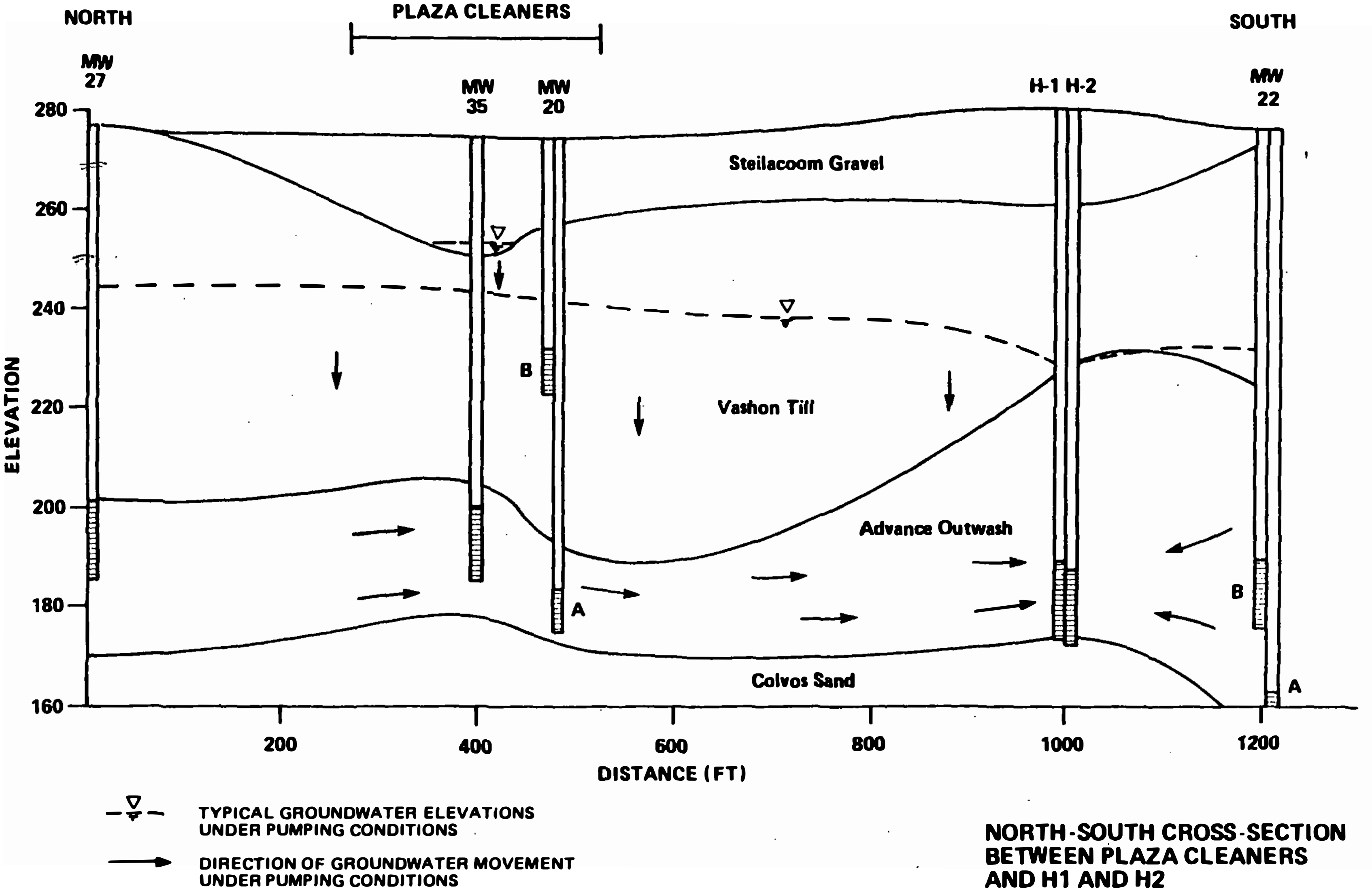
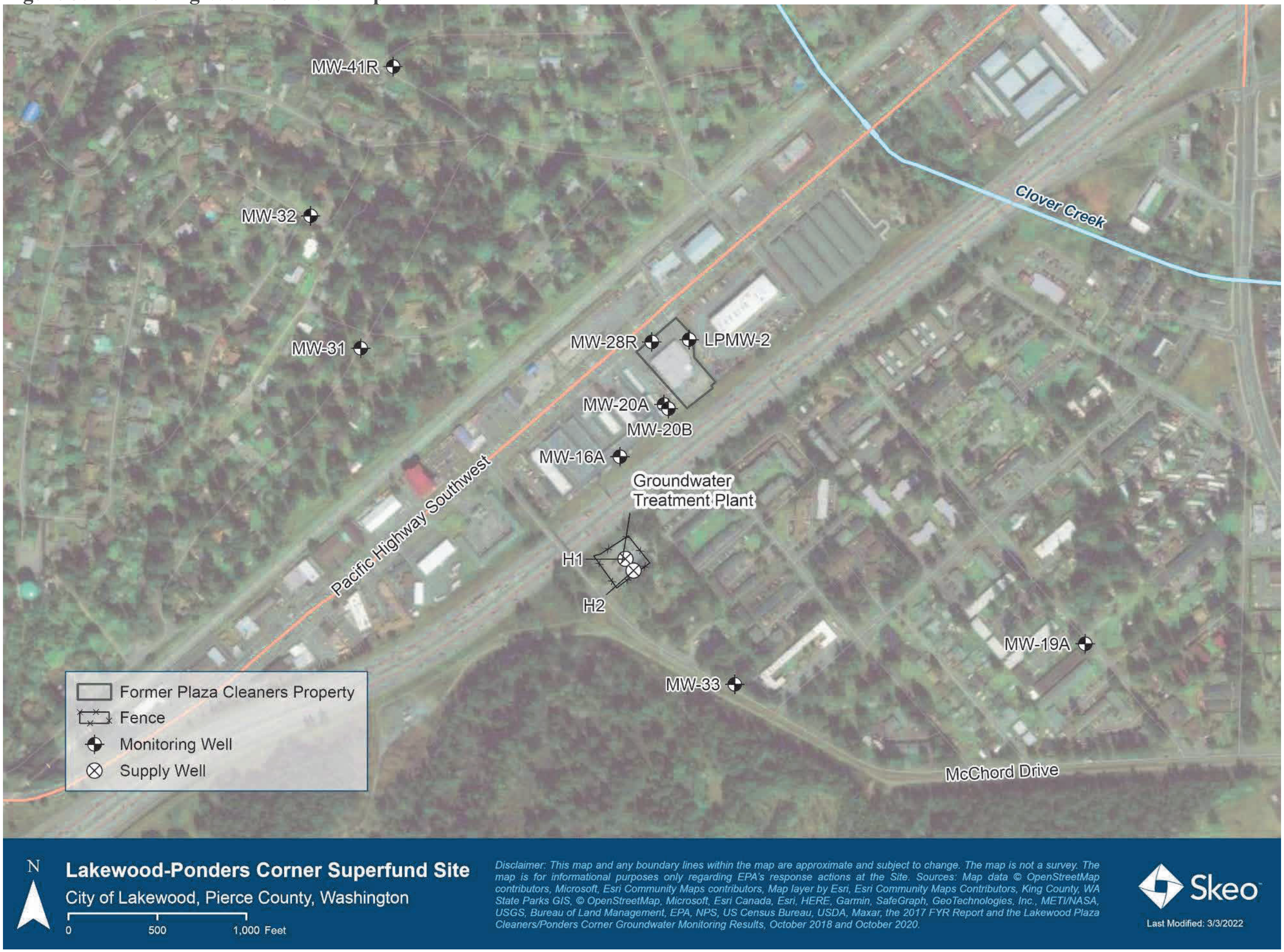


FIGURE 3

Source: Figure 3. North-South Cross-Section Between Plaza Cleaners And H1 And H2 From Ernesta B Barnes Record of Decision, September 30, 1985. Record of Decision Remedial Alternative Selection.

Figure A-3 – Monitoring Well Location Map

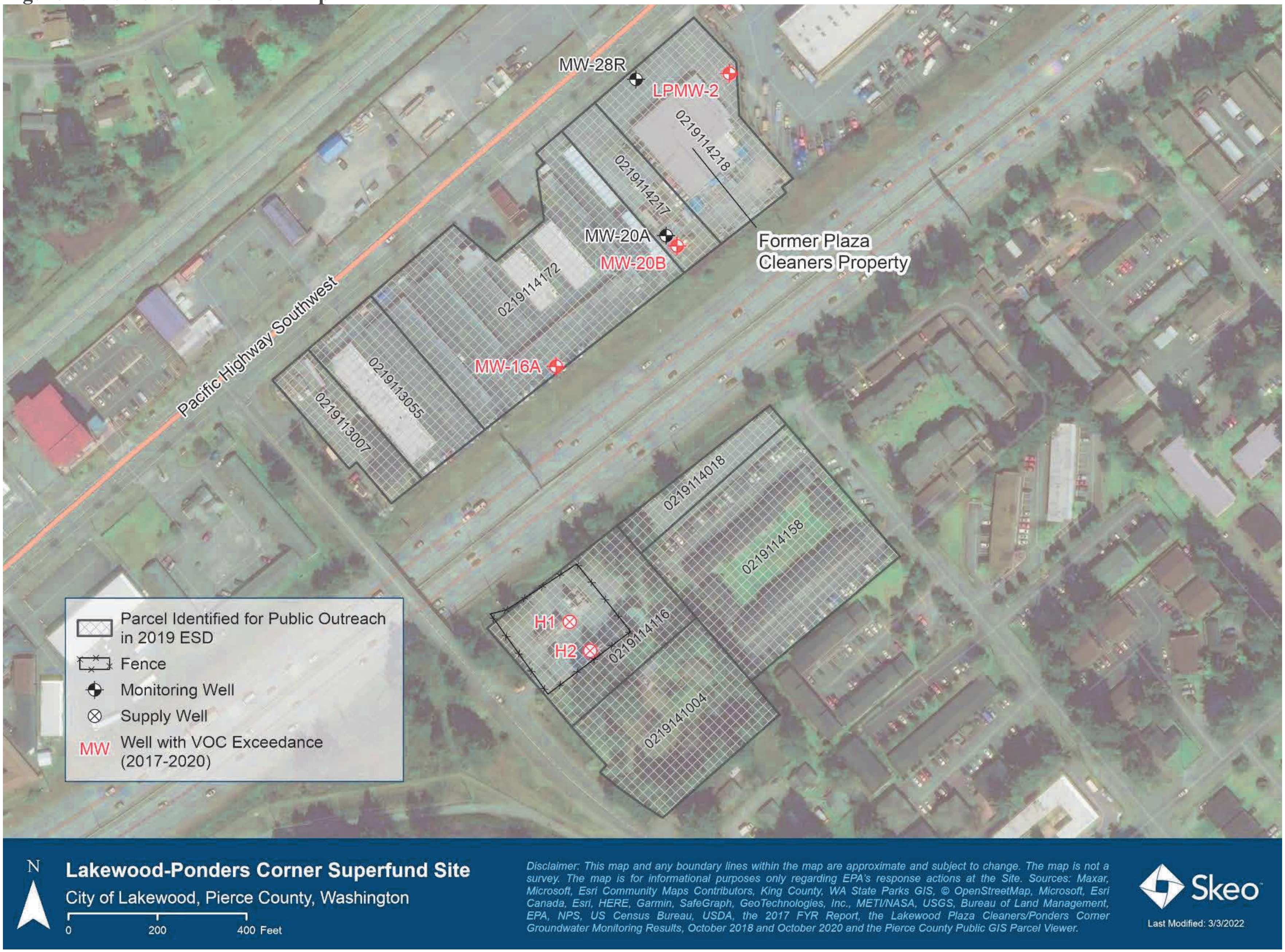
Figure 3: Monitoring Well Location Map



Source: Figure 3. Monitoring Well Location Map From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

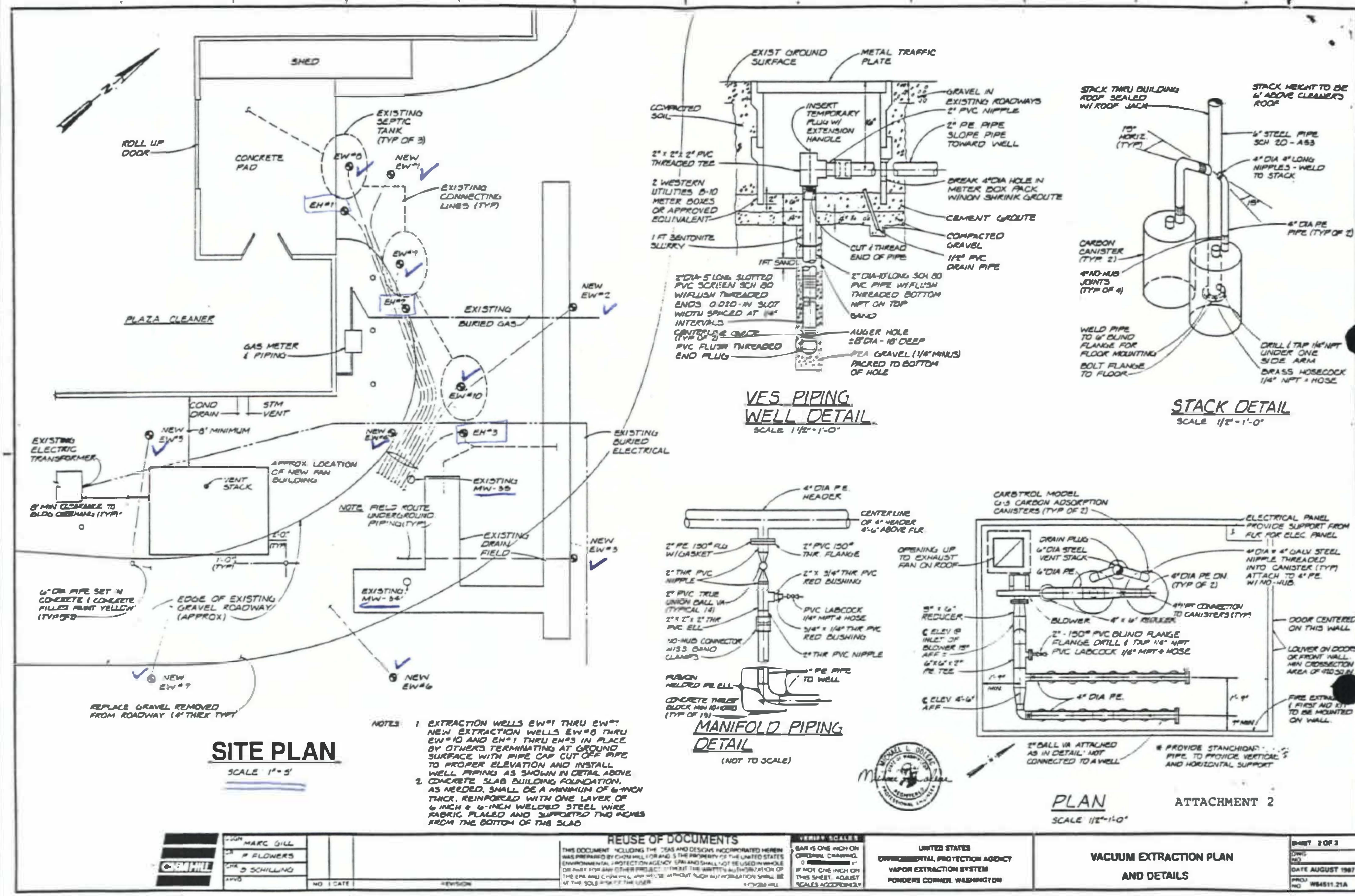
Figure A-4 – Institutional Control Map

Figure 2: Institutional Control Map



Source: Figure 2. Institutional Control Map From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

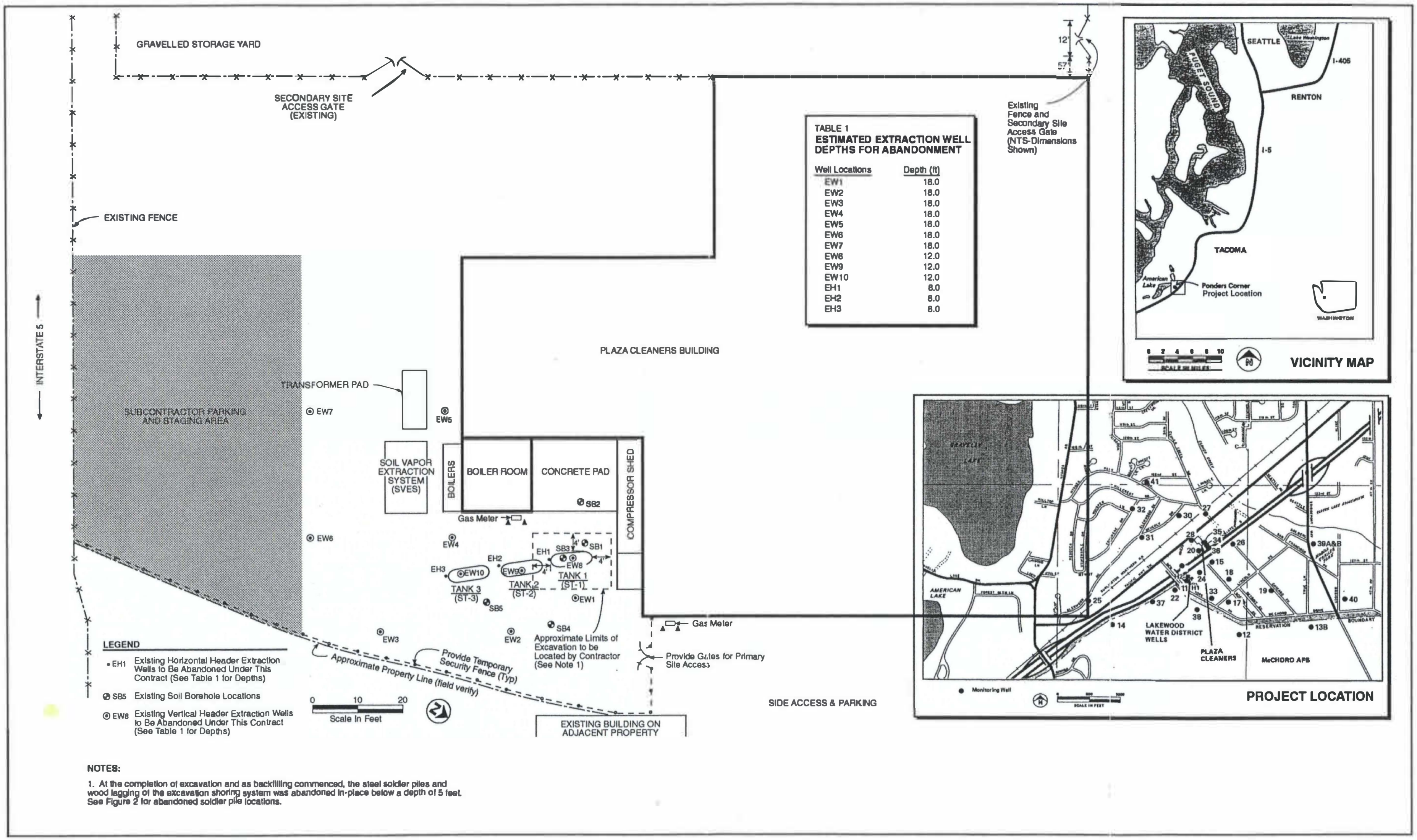
Figure A-5- Vacuum Extraction Plan and Details



Source: Attachment 2. Vacuum Extraction Plan And Details From Kathy Lombardo Steve Van Slyke Jerry Ninteman, April 25, 1989. Memorandum to Summarize The Initial Assumptions Regarding The Operation of The Soil Vapor Extraction System (SVES).

Figure A-6 – Lakewood Remedial Action Site and Excavation Plan

SEA 69018.FR.FD/Lakewood RA/Disk 98-3/2-28-92/CJS



Source: Figure 1. Lakewood Remedial Action Site And Excavation Plan From CH2M HILL, September 1, 1992. Remedial Action Report for Soil Excavation and Disposal and Vapor Extraction System Decommissioning Lakewood Superfund Site, Lakewood, Washington.

FIGURE 1
LAKEWOOD REMEDIAL ACTION SITE AND EXCAVATION PLAN

Figure A-7- PCE Concentrations (µg/L) in Samples from October 2018 and October 2020

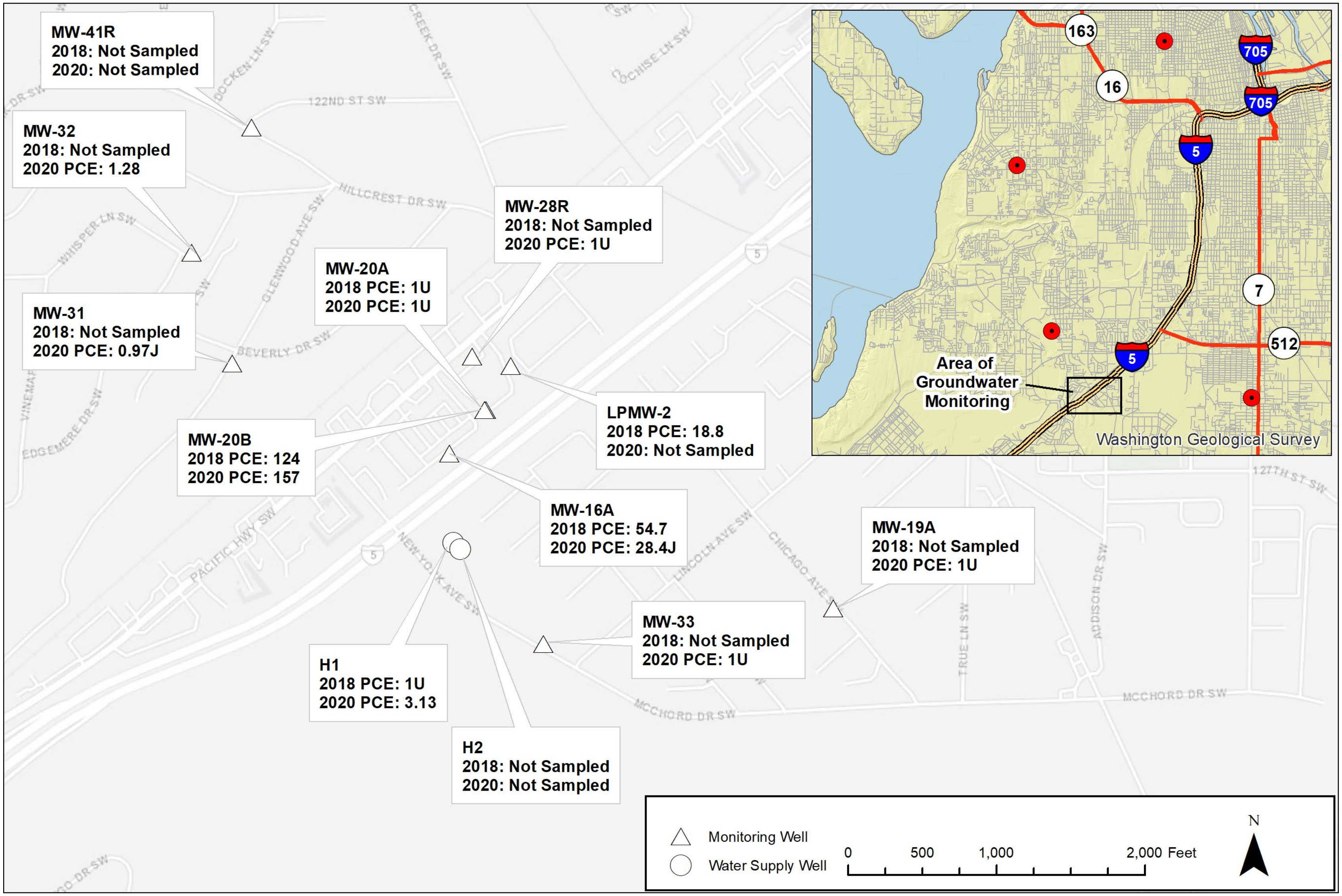


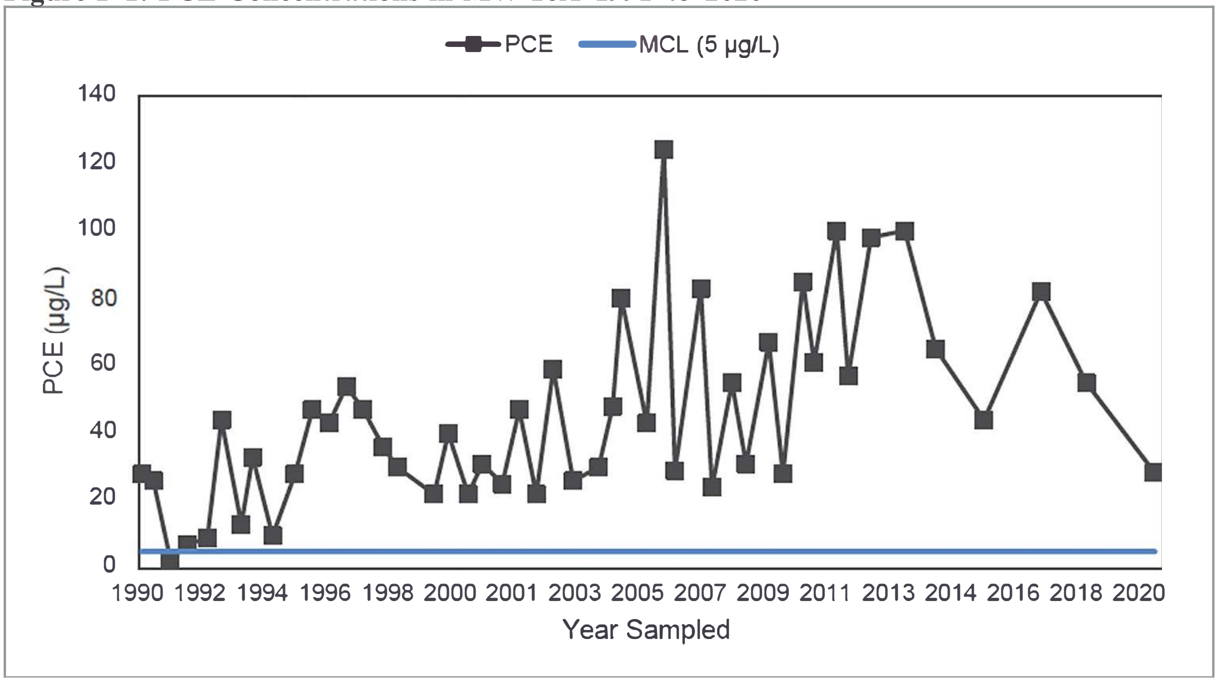
Figure 2. PCE concentrations (µg/L) in samples from October 2018 and October 2020.

Source: Figure 2. PCE concentrations (µg/L) in samples from October 2018 and October 2020 From Department of Ecology State of Washington, October 2021. Lakewood Plaza Cleaners/Ponders Corner Groundwater Monitoring Results, October 2018 and October 2020.

Figure A-8 - PCE Concentrations in MW-16A, 1991 to 2020

APPENDIX F – DATA REVIEW SUPPLEMENT

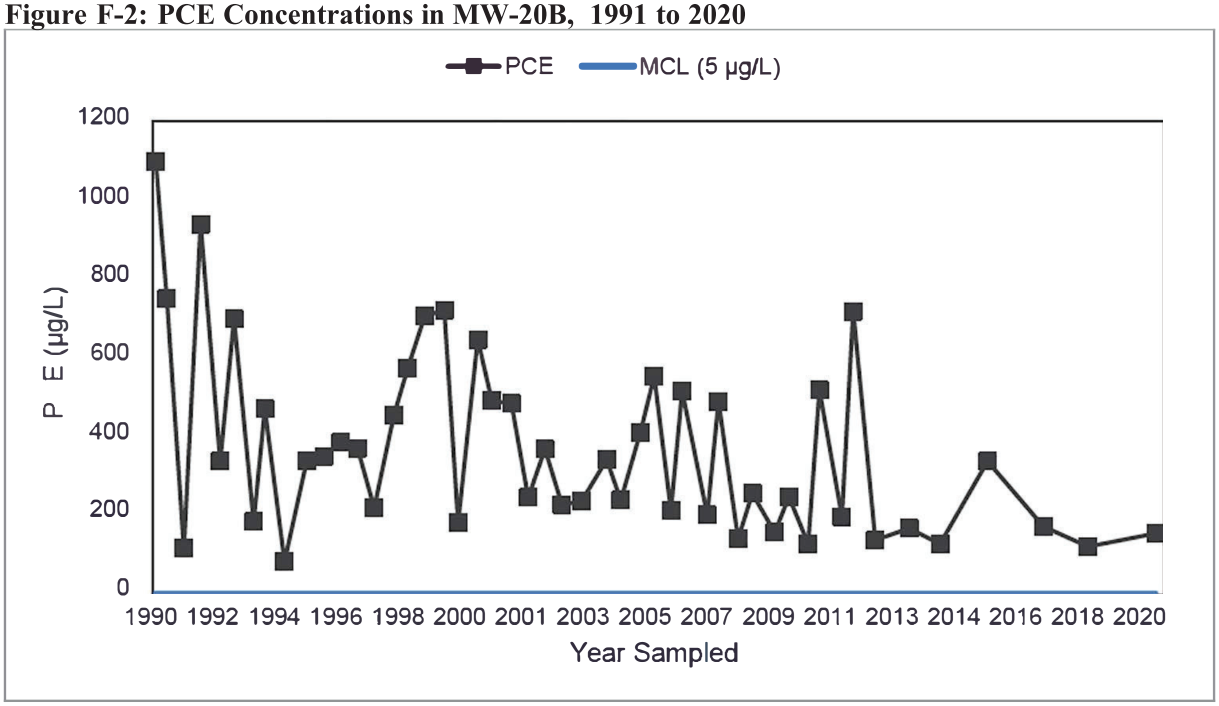
Figure F-1: PCE Concentrations in MW-16A 1991 to 2020



Source: Figure F-1: PCE Concentrations in MW-16A, 1991 to 2020 From US EPA, July 2022, Seventh Five-Year Review Report For Lakewood-Ponders Corner Superfund Site, Pierce County, Washington.

Figure A-9 - PCE Concentrations in MW-20B, 1991 to 2020

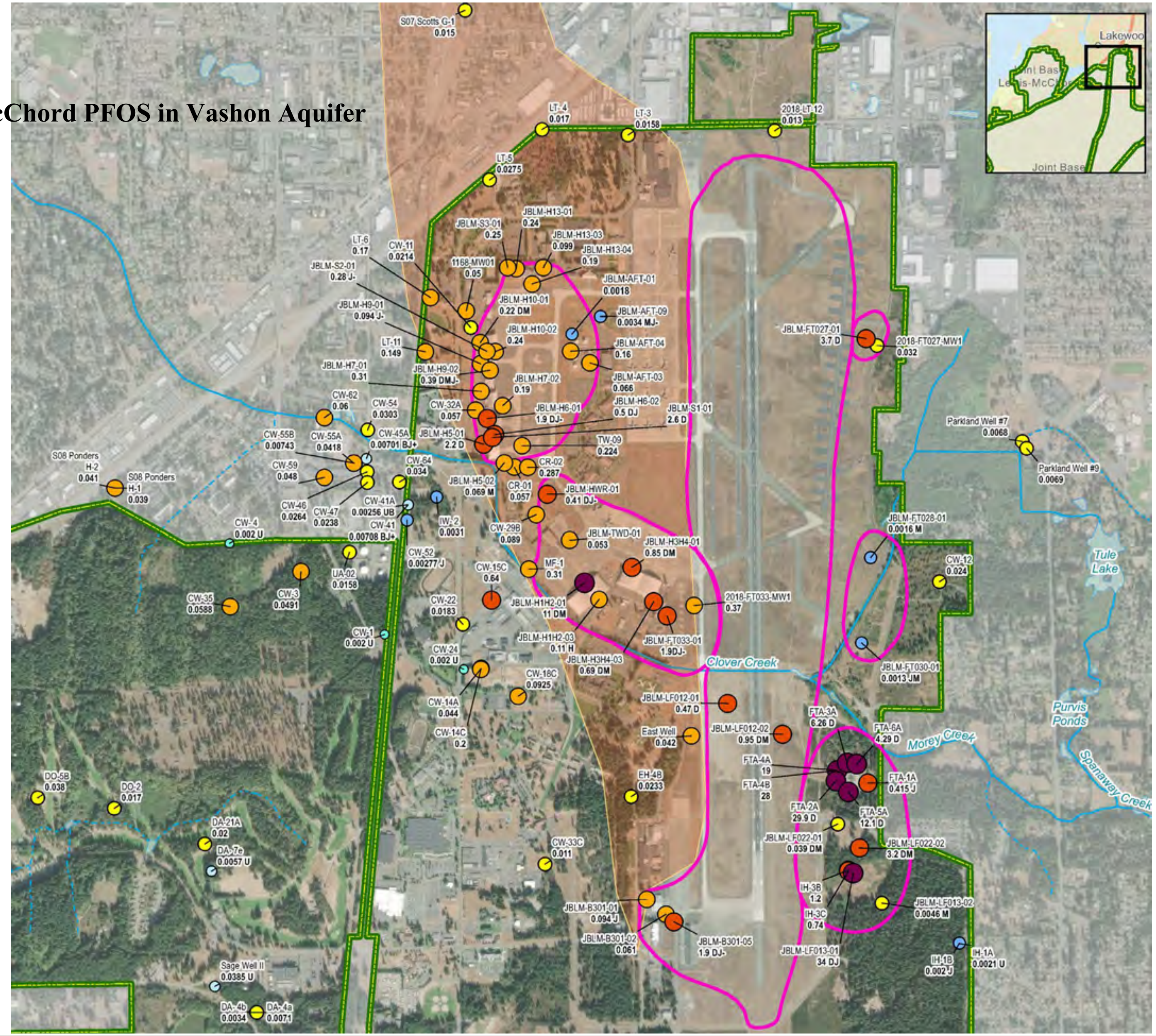
Figure F-2: PCE Concentrations in MW-20B, 1991 to 2020



Source: Figure F-2: PCE Concentrations in MW-20B, 1991 to 2020 From US EPA, July 2022, Seventh Five-Year Review Report For Lakewood-Ponders Corner Superfund Site, Pierce County, Washington.

McChord - PFOS in Vashon Aquifer

Figure A-10 – McChord PFOS in Vashon Aquifer



Legend

- Installation Boundary
- AOI Boundary
- Down Gradient Area Of Interest
- Water Body
- River/Stream (Perennial)
- Stream (Intermittent)

Maximum PFOS Results in Vashon Aquifer

- Greater than 1000x SL
- Between 100x SL and 1000x SL
- Between 10x SL and 100x SL
- Between SL and 10x SL
- Detection less than SL
- Non-detect (RL > SL)
- Non-detect (RL <= SL)
- Results Pending

JBLM-B301-02 —Sample Location Identifier
0.061 —Maximum PFOS Result in µg/L

Source: Slide 52. McChord - PFOS in Vashon Aquifer From Joint Base Lewis-McChord, Washington, October 12, 2023. PFAS RI Results, Soil and Groundwater Strategy.

N

0 1,000 2,000 3,000
Feet

ATTACHMENT B:

Selected Tables from Site Documents

Table B-1 – Site Chronology

Table B-1: Site Chronology

Event	Date
EPA identified PCE, TCE and cis-1,2-DCE contamination in Lakewood Water District drinking water supply wells H1 and H2	July 1981
Lakewood Water District temporarily took wells H1 and H2 out of service while monitoring wells were installed	August 1981
EPA proposed listing the Site on the NPL	December 1982
EPA finalized the Site's listing on the NPL	September 1983
Ecology and Plaza Cleaners reached a stipulated agreement for remedial action	September 1983
Plaza Cleaners removed contaminated soil and wastewater EPA conducted soil cleanup and installed an SVE system	1983 – 1987
EPA began the RI and feasibility study (FS)	March 1984
EPA completed a focused feasibility study identifying an IRM	May 1984
EPA issued an Interim ROD selecting the air stripping remedy for contaminated groundwater	June 1984
Lakewood Water District installed two air strippers for drinking water supply wells H1 and H2 to treat contaminated groundwater	September 1984
EPA completed the RI/FS EPA issued a final ROD selecting continued operation of the air strippers, installation of more groundwater monitoring wells, excavation of septic tanks and the drain field, excavation of contaminated soils, and the placement of administrative restrictions on wells	September 1985
EPA began the remedial design	May 1986
EPA issued a ROD Amendment for modifications to the Soil OU cleanup – the amended remedy included installation of an SVE system for treatment of soils in place, reduction in the amount of septic tank contents to be removed and treated off site, and continued soil and vapor testing until soil treatment was deemed complete	November 1986
EPA completed the remedial design and began the remedial action for the soil component of the remedy	September 1987
Intermittent operation of the SVE system	1988 – 1989
EPA completed a potentially responsible party (PRP) search – no viable PRPs were identified	December 1989
EPA excavated more soil from the Site	June – July 1992
EPA issued an ESD to establish site-specific cleanup levels for contaminants in soil and groundwater, to eliminate the requirement to implement institutional controls on land and groundwater use, and to document revisions to the remedial action necessary to remove the source of contamination at the Site	September 1992
EPA issued the Site's first FYR Report	September 1992
EPA signed the Site's Preliminary Close-Out Report	September 1992
EPA completed the remedial action for the soil cleanup	May 1993
EPA announced, in the Federal Register, the partial deletion of the Soil OU from the NPL	November 1996
EPA sent letters to residences, realtors and well drillers regarding administrative control restrictions	February 1997
EPA transferred O&M responsibilities to the state (Ecology) as a part of the ongoing long-term response action	July 1997
EPA issued the Site's second FYR Report	September 1997
EPA issued the Site's third FYR Report, prepared by the state	September 2002
EPA sent letters to residences, realtors and well drillers regarding administrative control restrictions EPA also sent notices to trade magazines (for well drillers) and realtors	March 2007
EPA issued the Site's fourth FYR Report	September 2007

Source: Table B-1. Site Chronology From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

Event	Date
EPA sent letters to realtors and well drillers regarding administrative control restrictions	March 2008
EPA sent out fact sheets notifying homeowners, realtors and well drillers about administrative control restrictions and providing site information	May 2012
Ecology decommissioned three monitoring wells	July 2012
EPA signed the Site's fifth FYR Report, prepared by the United States Army Corps of Engineers	September 2012
EPA began a supplemental investigation at the Site, which included installation of two monitoring wells, sampling of 10 monitoring wells and hydraulic monitoring with transducers	August 2015
EPA's hydrogeologist issued a Technical Memorandum to document the results of the supplemental investigation	May 2017
EPA issued the Site's sixth FYR Report	September 2017
EPA issued an ESD to clarify institutional controls at the Site	September 2019
Lakewood Water District replaced the wellhead air strippers and installed a GAC system for supply wells H1 and H2	January 2020
Ecology contacted the Health Department and confirmed there are no private wells near the Site	April 2022

Source: Table B-1. Site Chronology From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

Table B-2 – Well Construction Details

Hydrogeologic Setting

The current monitoring plan for the Lakewood Ponders Corner site includes 10 monitor wells and the two Lakewood Water District supply wells. Eight of the 10 monitoring wells are completed in Advance Outwash deposits at depths between 93 feet (ft.) and 118 ft. One well (MW-20B) is completed in the Vashon Till at a depth of 53 ft., and the remaining well (LPMW-2) is completed in the Steilacoom Gravels at a depth of 29 ft. The two municipal supply wells, H1 and H2, are completed in the Advance Outwash to depths of 108 ft. and 105 ft., respectively. Construction details for all wells in the monitoring plan are given in Table 1.

Table 1. Well construction details.

Well ID	Well Depth (feet bgs)	Screen Interval (feet bgs)	Surface Elevation (feet, NAVD88)
MW-16A	109	105 – 109	278.4
MW-19A	106	96 – 106	289.9
MW-20A	103	93 – 103	279.8
MW-20B	53	43 – 53	279.8
MW-28R	102	88 – 98	280.6
MW-31	93	79 – 93	283.4
MW-32	118	102 – 118	300.4
MW-33	97	75 – 97	277.7
MW-41R	97	84.5 – 94.5	274.1
LPMW-2	29	15 – 29	280.3
H1	108	85 – 106	282.6
H2	105	86 – 105	281.8

bgs: below ground surface

Source: Table 1. Well Construction Details From Department of Ecology State of Washington, October 2021. Lakewood Plaza Cleaners/Ponders Corner Groundwater Monitoring Results, October 2018 and October 2020.

Table B-3 – Groundwater Monitoring Schedule

Systems Operations/Operation and Maintenance (O&M)

In October 1985, the Lakewood Water District assumed all O&M responsibilities associated with the air stripping towers at wells H1 and H2. This included influent/effluent water sampling and analysis, pump maintenance and inspection, general equipment observations and maintenance of data records. In 1997, Ecology assumed O&M responsibilities related to sitewide groundwater monitoring.

The Lakewood Water District personnel collect influent samples at H1 and H2 and treated effluent samples quarterly for VOCs. In 2019, wells in the Lakewood Water District were shut down temporarily because PFAS, most likely from Joint Base Lewis-McChord, was detected above EPA's 2016 health advisory threshold of 0.07 micrograms per liter (µg/L). In June 2022 EPA released updated interim health advisories for PFAS compounds. The interim updated health advisories are 0.004 ppt for PFOA, 0.02 ppt for PFOS, 10 ppt for GenX chemicals, and 2,000 ppt for PFBS. Lakewood Water District completed planned upgrades to the treatment system in January 2020 and the system has been online since that time. The Lakewood Water District conducts O&M of the treatment system, as needed, to ensure its continued operation and effectiveness.

Ecology currently conducts routine groundwater monitoring at the Site for VOCs. The current monitoring plan for the Site includes 10 monitoring wells and two supply wells. To capture seasonal variation in contaminant concentrations, Ecology now samples primary wells (H1, H2, MW-16A, MW-20A, MW-20B, MW-31, MW-32 and LPMW-2) every 18 months, effective April 2018. Ecology delayed monitoring in 2020 due to restrictions associated with the COVID-19 public health emergency. Table 4 includes the monitoring frequency for all wells in the network. Figure 3 includes the locations of the monitoring wells. In the 2017 FYR Report, EPA proposed installation of a new well to monitor the Advance outwash sand zone at the corner of Pacific Highway Southwest and New York Avenue Southwest (McChord Drive Southwest). Ecology concurred with this recommendation, but installation has not yet occurred.

Table 4: Groundwater Monitoring Schedule

Well ID	Well Depth (feet bgs)	Monitoring Frequency
H1	108	18 months
H2	105	18 months
MW-16A	109	18 months
MW-19A	106	3 years
MW-20A	103	18 months
MW-20B	53	18 months
MW-28R	102	3 years
MW-31	93	18 months
MW-32	118	18 months
MW-33	97	3 years
MW-41R	97	5 years
LPMW-2	29	18 months

Sources: Lakewood Plaza Cleaners/Ponders Corner Groundwater Monitoring Results, October 2018 and October 2020, Table 1, 2017 FYR Report.

Source: Table 4. Groundwater Monitoring Schedule From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

Table B-4 – Summary of Planned or Implemented ICs

Table 3: Summary of Planned and/or Implemented ICs

Media, Engineered Controls, and Areas That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	Parcels that overlie groundwater contamination[a]	Restrict exposure to untreated drinking water.	Tacoma-Pierce County Health Department, Environmental Health Code Chapter 3, Water Regulations (April 1, 2015)
Groundwater	Yes	Yes	Parcels that overlie groundwater contamination[a]	Educate public of risks from drinking contaminated groundwater.	Outreach described in 2019 ESD, to be documented in O&M plan and planned to occur prior to September 2024

Notes:

a. The 2019 ESD identified affected parcels, based on a 2016 PCE plume map (Figures C-1 and C-2, Appendix C). Figure 2 also shows the parcels identified in the 2019 ESD.

Source: Table 3. Summary of Planned and/or Implemented ICs From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington

Table B-5 – PCE Concentrations in MW-16A, 1991 to 2020

Table A2. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-16A from January 1991 to October 2020.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	41.32	**28**	**1 J**	**2.4 J**	1 U
5/1991	39.48	**26**	**0.6 J**	**2**	1 U
11/1991	45.18	**2.7 J**	1 U	**0.6 J**	1 U
5/1992	45.15	**7**	1 U	**1**	1 U
12/1992	--	**9 J**	**0.3 J**	**0.8 J**	1 UJ
5/1993	38.96	**44**	10 U	**2 J**	10 U
12/1993	45.53	**13**	**0.3 J**	**0.7 J**	1 U
4/1994	41.67	**33**	**0.6**	**1.4**	1 U
11/1994	46.95	**9.7**	**0.3 J**	**0.5 J**	1 U
7/1995	42.34	**27**	**0.5 J**	**0.8 J**	1 U
1/1996	36.03	**47 E**	**0.8 J**	**1.5**	2 U
7/1996	38.65	**43**	**0.7 J**	**1.9**	1 U
1/1997	26.32	**54**	**1.1**	**3.1**	1 U
7/1997	39.07	**47**	**0.7 J**	**2.5**	1 U
2/1998	33.82	**36**	**0.7 J**	**2 J**	5 U
7/1998	42.58	**30**	1 U	**1.5**	1 U
8/1999	44.14	**22**	**0.4 J**	**1.1**	1 U
1/2000	36.24	**40**	**0.7 J**	**1.9**	1 U
8/2000	45.06	**22**	**0.3 J**	**0.7**	1 U
1/2001	40.93	**31**	**0.4 J**	**1**	1 U
8/2001	44.46	**25**	**0.3 J**	**0.7 J**	1 U
2/2002	32.47	**47**	**0.8 J**	**2.3**	1 UJ
8/2002	44.64	**22**	**0.3 J**	**0.8 J**	1 U
2/2003	32.60	**59 J**	**0.2 J**	**2.4**	1 U
9/2003	47.91	**26**	**0.3 J**	**0.5 J**	5 U
6/2004	43.29	**30**	**0.4 J**	**0.8 J**	1 U
11/2004	38.47	**48**	1 U	**1.4**	5 U
6/2005	35.06	**80**	**1.3**	**2.8**	5 U
11/2005	38.01	**43**	**0.7 J**	**1 J**	2 U
5/2006	36.59	**124**	**1.8**	**4.6**	5 U
9/2006	41.93	**29**	**0.3 J**	**0.5 J**	2 U
6/2007	35.95	**83**	**1.2**	**2.5**	2 U
10/2007	40.61	**24**	1 U	**0.6 J**	2 U
5/2008	38.23	**55**	**1.2**	**2.8**	1 U
10/2008	43.76	**31**	**0.5 J**	**0.6 J**	1 U
6/2009	34.43	**67**	**0.9 J**	**2.2**	1 U
11/2009	36.75	**28**	**0.5 J**	**0.8 J**	1 U
6/2010	32.04	**85**	**1.3**	**1.6**	1 U
10/2010	36.52	**61**	**0.9 J**	**1.2**	1 U
6/2011	32.93	**100**	**1.4**	**1.6**	1 UJ
10/2011	37.76	**57**	**0.8 J**	**1**	2 U
6/2012	33.37	**98**	**1.3**	**2.4**	1 U
6/2013	34.81	**100**	**1.3**	**2.6**	1 U
5/2014	28.8	**65**	**1.1**	**1.3**	1 U
10/2015	42.5	**44**	**0.5 J**	**0.6 J**	1 U
6/2017	34.54	**82 J**	**0.82 J**	**1.3**	1 UJ
10/2018	36.71	**55**	**0.73 J**	**0.99 J**	1 U
10/2020	45.37	**28.4 J**	**0.44 J**	**0.78 J**	1 U
Project Cleanup Level	**n/a**	**5**	**5**	**70**	**0.2**

Source: Table A2. Summary of water levels and sample results in monitoring well MW-16A from January 1991 to October 2020 From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington.

Table B-6 – PCE Concentrations in MW-20B, 1991 to 2020

Table A4. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-20B from January 1991 to October 2020.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	33.94	**1100**	**18**	**33**	1 U
5/1991	30.57	**752**	**16**	**30**	1 U
11/1991	40.99	**120**	**2.6 J**	**6.7**	1 U
5/1992	38.57	**940**	**13**	**32**	1 U
12/1992	40.57	**340 J**	**14 J**	**20 J**	5 UJ
5/1993	32.48	**700**	**12**	**21**	10 U
12/1993	41.38	**187**	50 U	**8.2 J**	50 U
4/1994	35.49	**472**	**8.6 J**	**12.6**	50 U
11/1994	41.12	**86**	50 U	**3 J**	50 U
7/1995	36.48	**340**	**8.4**	**17**	1 U
1/1996	27.90	**353**	**7.2**	**15**	2 U
7/1996	33.15	**387**	**7.6**	**15**	1 U
1/1997	15.60	**373**	100 U	**6.4 J**	100 U
7/1997	30.31	**222**	**4**	**6.4**	1 U
2/1998	25.28	**456**	**7 J**	**12**	10 U
7/1998	35.78	**575**	**10**	**23**	1 U
1/1999	27.14	**708**	**5.2**	**12**	1 U
8/1999	37.18	**722**	**8.4 J**	**16 J**	1 U
1/2000	27.87	**184**	**6**	**13**	1 U
8/2000	38.39	**648**	200 U	100 U	100 U
1/2001	33.88	**493**	**6.6 J**	**12**	10 U
8/2001	37.67	**486**	**8.2**	**18**	100 U
2/2002	23.50	**248**	200 U	100 U	100 UJ
8/2002	37.92	**371**	**8.5**	**16**	1 U
2/2003	26.60	**230**	100 U	100 U	100 U
9/2003	39.49	**239**	**5.4 J**	**12**	50 U
6/2004	35.76	**344**	**6.5 J**	**15**	10 U
11/2004	32.36	**241**	**6.7**	**13**	5 U
6/2005	29.06	**413**	**6.6**	**12**	5 U
11/2005	32.58	**555**	**6.4**	**11**	2 U
5/2006	27.56	**216**	**4.2**	**6.6**	5 U
9/2006	39.00	**518**	**5.6**	**11**	2 U
6/2007	29.64	**204**	**4.4**	**7.8**	2 U
10/2007	36.9	**491**	**7.5**	**15**	2 U
5/2008	30.65	**143**	**5.5**	**12**	1 U
10/2008	37.48	**258**	**4.5**	**9**	1 U
6/2009	28.24	**160**	**4.1**	**7.4**	1 U
11/2009	32.04	**250**	**4.7**	**9.6**	1 U
6/2010	25.86	**130**	**3.7**	**6.3**	1 U
10/2010	31.79	**520**	**5.8**	**10**	1 U
6/2011	23.39	**200**	**3.5**	**5.6**	1 UJ
10/2011	33.18	**720**	**4.8**	**7.9**	2 U
6/2012	26.85	**140**	**3.3**	**5.7**	1 U
6/2013	29.00	**170**	**3.9**	**7**	1 U
5/2014	21.80	**130**	**2.1**	**3**	1 U
10/2015	36.91	**340**	**5.4**	**12**	1 U
6/2017	27.71	**174 J**	**2.9**	**4.5**	1 UJ
10/2018	31.59	**124**	**1.8**	**2.7**	1 U
10/2020	38.86	**157**	**4.34**	**6.73**	1 U
Project Cleanup Level	**n/a**	**5**	**5**	**70**	**0.2**

Source: Table A4. Summary of water levels and sample results in monitoring well MW-20B from January 1991 to October 2020 From US EPA Region 10, July 2022. Seventh Five-Year Review Report for Lakewood-Ponders Corner Superfund Site Pierce County, Washington.

ATTACHMENT C:

Climate Vulnerability Screening

ATTACHMENT C: CLIMATE VULNERABILITY SCREENING

1.0 INTRODUCTION

In response to EPA's Superfund Climate Resilience (CR) initiative[1], a climate vulnerability (CV) screening was performed as part of the independent optimization review of the Lakewood-Ponders Corner Superfund Site in Pierce County, Washington. The goal of the CR initiative is to raise awareness of the vulnerabilities associated with climate change and extreme weather events and to apply climate change and weather science as a standard operating practice in cleanup projects.

2.0 SITE BACKGROUND

The Lakewood-Ponders Corner Superfund site is in the city of Lakewood in Pierce County, Washington. The site address is 12511 Pacific Highway Southwest. Interstate 5 (I-5) borders the site on the south and Joint Base Lewis-McChord is within 0.25 miles of the site to the south and east. Currently, the site houses Rainier Lighting & Electric Supply. The surrounding properties house commercial and light industrial businesses. Residential areas are approximately 500 feet (ft) southeast (across I-5) and 500 ft northwest of the site. The site consists of the former Plaza Cleaners property and groundwater contamination resulting from historical dry-cleaning operations. Before 1983, dry-cleaning process wastes were dumped into three "bottomless" septic tanks and on the ground near the facility. These activities contaminated the soil with solvents that moved into the groundwater, with a plume extending about 2,000 ft downgradient of Plaza Cleaners.

The primary hydrogeological units of interest under the site include the Steilacoom gravel unit, the low-permeability Vashon till, and the Advance outwash sands forming the primary aquifer.

The Lakewood Water District has two active municipal supply wells, H1 and H2, located south of I-5 and approximately 800 ft southwest of the former Plaza Cleaners. Groundwater is treated before distribution. There are no known private wells within areas of site-related groundwater contamination.

3.0 CLIMATE VULNERABILITY SCREENING PROCESS

The CV screening identified natural hazard risks and their potential impacts on site remedial and monitoring attributes, which include groundwater monitoring wells and groundwater treatment equipment. It also evaluated the potential impacts of climate change to increase hazard risks and impacts. Finally, it identified measures to mitigate these potential impacts at the site.

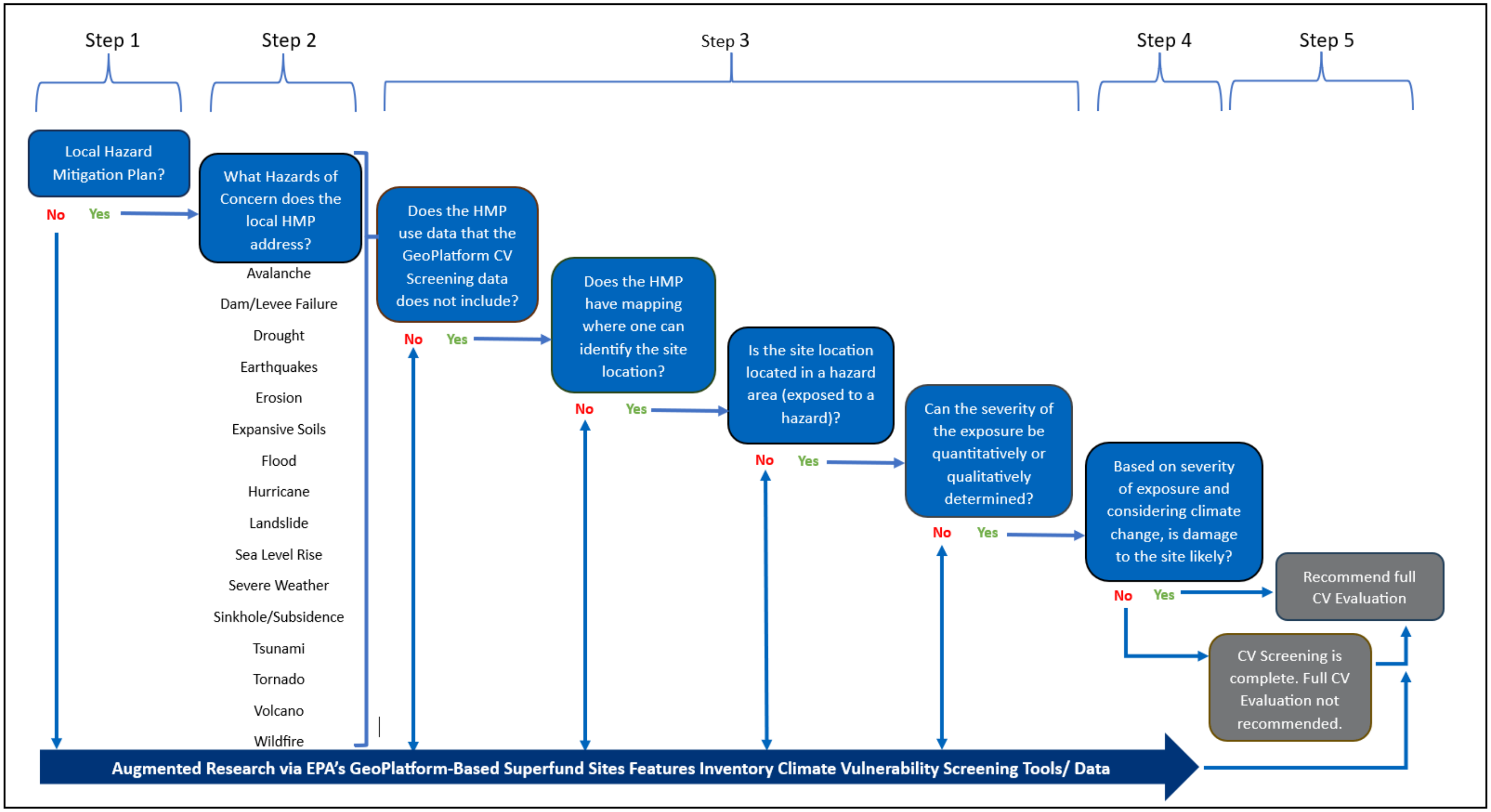
The methodology applied for the CV screening uses best available data and science regarding risk and vulnerabilities to natural hazards applied for local hazard mitigation plans (HMP) developed pursuant to the Disaster Mitigation Act (DMA) of 2000 (Public Law 106-109). The DMA emphasizes the need for state, tribal, and local entities to closely coordinate mitigation

[1] https://www.epa.gov/superfund/superfund-climate-resilience

through proactive planning with an emphasis on the understanding risks associated with natural hazards that can impact a planning area.

The CV screening process uses available, local HMPs and other resources to inform a decision-making process that identifies natural hazard risks associated with a site location. **Figure C-1** presents the five-step CV screening process.

Figure C-1. Five-Step Climate Vulnerability Screening Process



3.1 Vulnerability Screening

Step 1-Identify Local Hazard Mitigation Plan

The 2020-2025 Pierce County HMP was approved by the U.S. Federal Emergency Management Agency (FEMA) in 2020. This plan is effective until 2025 and provides valuable data sources for CV screening.

Current FEMA guidance requires HMPs to consider adaptive capacity. This CV screening did not consider adaptive capacity in the risk analysis. However, combined with other information, it can be used to provide some recommendations to support the site's adaptive capacity to climate change.

Step 2-Identify Hazards of Concern

The HMP was determined to have sufficient information to identify the natural hazards of concern that could potentially impact the site. It includes assessments for the following natural hazards in the county: earthquake, landslide, tsunami, flood, drought, severe weather, and wildland urban interface (WUI) fire.

The probability of future occurrence of dam/pipeline failure was deemed unlikely in the HMP; therefore dam/pipeline failure was not considered in the CV screening. All remaining hazards were identified as the hazards to focus on for the site CV screening. Climate change is considered as a phenomenon that could exacerbate the impacts of each hazard in the discussion below.

Step 3-Risk Assessment of Site

The HMP did not include sufficient resolution in its risk analysis for a site-specific hazard risk assessment of the site. However, the HMP included useful data references for the hazards that were used to support the development of the hazard risk assessment of the site. The following data sources were used to support the CV screening for the site:

- General Site Data:
  - EPA Superfund Site Web Page. Accessed at: LAKEWOOD | Superfund Site Profile | Superfund Site Information | US EPA
  - Pierce County Hazard Mitigation Plan. Accessed at: Risk Assessment Section (piercecountywa.gov)
- Landslides:
  - Washington Geological Information Portal. Accessed at: Washington Geologic Information Portal
- Drought:
  - NOAA National Integrated Drought Information System. Accessed at: Washington | Drought.gov
- Thunderstorms
  - FEMA. *National Risk Index*. Accessed at: Community Report - Census tract 53053071806, Pierce County, Washington | National Risk Index (fema.gov)

- Snow/Ice Storms
  - FEMA. *National Risk Index*. Accessed at: [Community Report - Census tract 53053071806, Pierce County, Washington | National Risk Index (fema.gov)]
- Wildfire
  - Washington State Department of Natural Resources (DNR). Accessed at: fortress.wa.gov/dnr/protection/firedanger/

Step 4-Resilience Assessment Findings

The data sources identified in Step 3 were used to perform the CV screening of the site. The hazards evaluated include earthquake, landslide, tsunami, flood, drought, severe weather, and WUI fire. Findings for each hazard are presented below.

Earthquake: Based on the HMP, Pierce County has a probability of an earthquake hazard occurring every 40 years or less.

There are several faults that could potentially affect Pierce County with the two primary faults, the Nisqually Fault and SeaTac Fault. Another major fault in the area is the Tacoma fault. The county could experience earthquakes from three sources (subduction zone, crustal fault, and deep earthquakes); therefore, the entire region is at risk for the earthquake hazard. The site is located near the Seattle and Tacoma Faults.

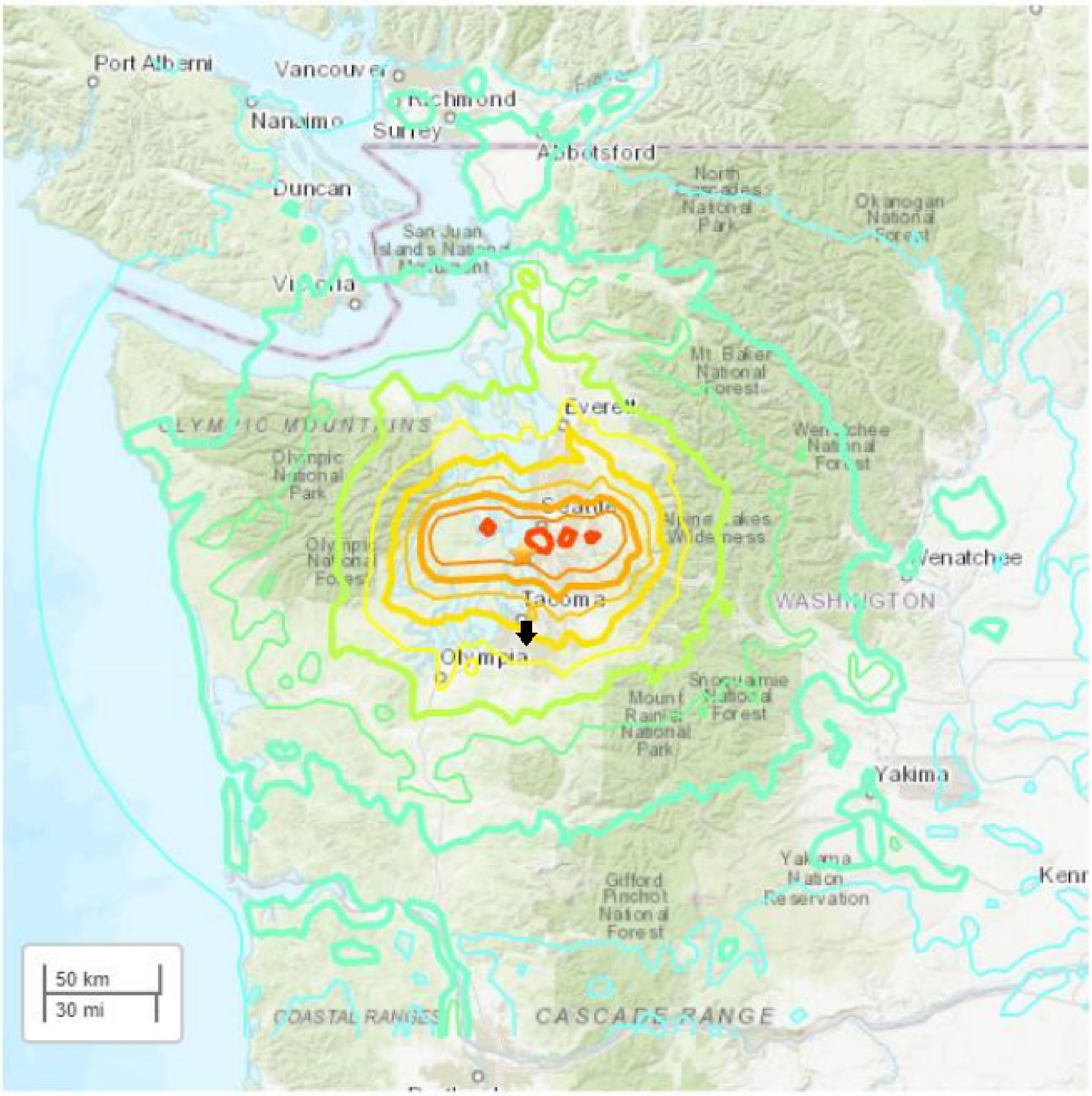
Figure C-2 shows earthquake modeling for a 7.2 magnitude earthquake for the Seattle Fault Zone. The Modified Mercalli Intensity (MMI) Scale is used to estimate the intensity of shaking. This figure shows intensities of VIII or VII, which indicates severe or very strong perceived shaking, which can lead to moderate to heavy potential damage.

The amounts and types of potential damages would be dependent upon the intensity of seismic activity experienced, soil type, and type of materials used in monitoring system infrastructure at the site. The impact of earthquakes on the cohesion and structure of unconsolidated deposits at sites can vary depending on the degree of moisture (dry to saturated) within those materials. Liquefaction can occur on soft soils or human-made fills which can cause a lateral spreading and lack of support for structures on liquefiable soils. **Figure C-3** shows the liquefaction susceptibility hazard areas for Pierce County.

Typically, subterranean components of groundwater monitoring wells, the currently active Lakewood Water District groundwater treatment system, or areas of soil removal would be vulnerable to shaking. The remedial and monitoring infrastructure would also be vulnerable to any secondary hazards stemming from earthquake activity, such as flooding or ground failure.

Figure C-2. ShakeMaps developed by USGS for Scenario Modeling

Map 4.2-4 Magnitude 7.2 Scenario Earthquake – Seattle Fault Zone – Northern 9.0 km depth



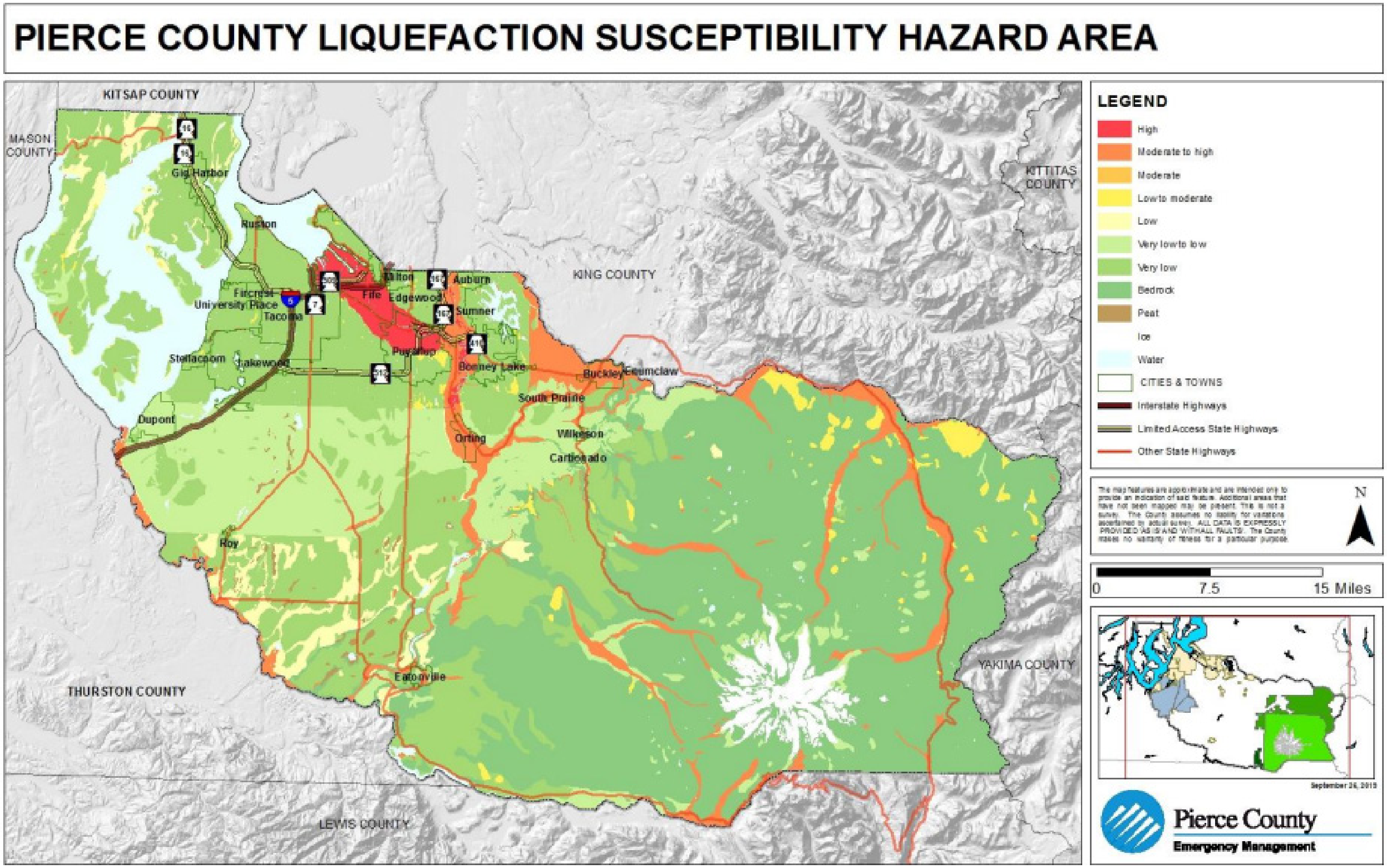
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Adapted from: [*Risk Assessment Section (piercecountywa.gov)*]

Figure C-3 shows the Pierce County Liquefaction Susceptibility Hazard Areas. The majority of liquefiable soils in the county are present in near the river valleys. Lakewood is shown to have a Very Low probability for liquefaction.

Figure C-3. Pierce County's Liquefaction/Susceptibility Hazard



Adapted from: [Risk Assessment Section (piercecountywa.gov)]

Based on the moderate probability of occurrence and the moderate potential for damages in the event of earthquakes, the impact vulnerability of the site to earthquakes would be considered moderate. Earthquakes are caused by the sudden release of elastic strain energy along geologic faults deep in the earth. While primarily related to the movement of tectonic plates, earthquakes can be caused by changes in fluid weight and pressure in the subsurface from impoundment of water in reservoirs, mining, subsurface withdrawal of fluids and gas, and injection of fluids into underground formations.[2] Recent research indicates that climate change could cause more earthquakes through increases in fluid pressures from recharge of increasingly large volumes of water from precipitation and glacial melt.[3]

Landslides: Landslides are caused by gravity-driven, downslope movement of a sliding mass composed of rock, soil, and vegetation. Factors that influence the stability of a slope include steepness of slope, composition of soil and rock, groundwater conditions, recent precipitation patterns, earthquakes, vegetation on slope, and anthropogenic activities.

The landslide inventory for Pierce County contains 1,276 landslides. The landslide hazard areas within the county include walls of major river valleys, mountainous regions, coastal areas, and parts of the peninsula. The site is not located within an area that has a high risk of landslides (as shown on **Figure C-4**), which depicts the site as a point indicated by a circle surrounded by historical areas of landslide occurrence and **Figure C-5**, which depicts the shallow landslide hazard areas in Pierce County.

Shallow landslides are the most common type of landslide in Pierce County, involving the movement of a relatively thin layer of slope material and a shallow failure plane (generally less than 10-15 feet deep.)

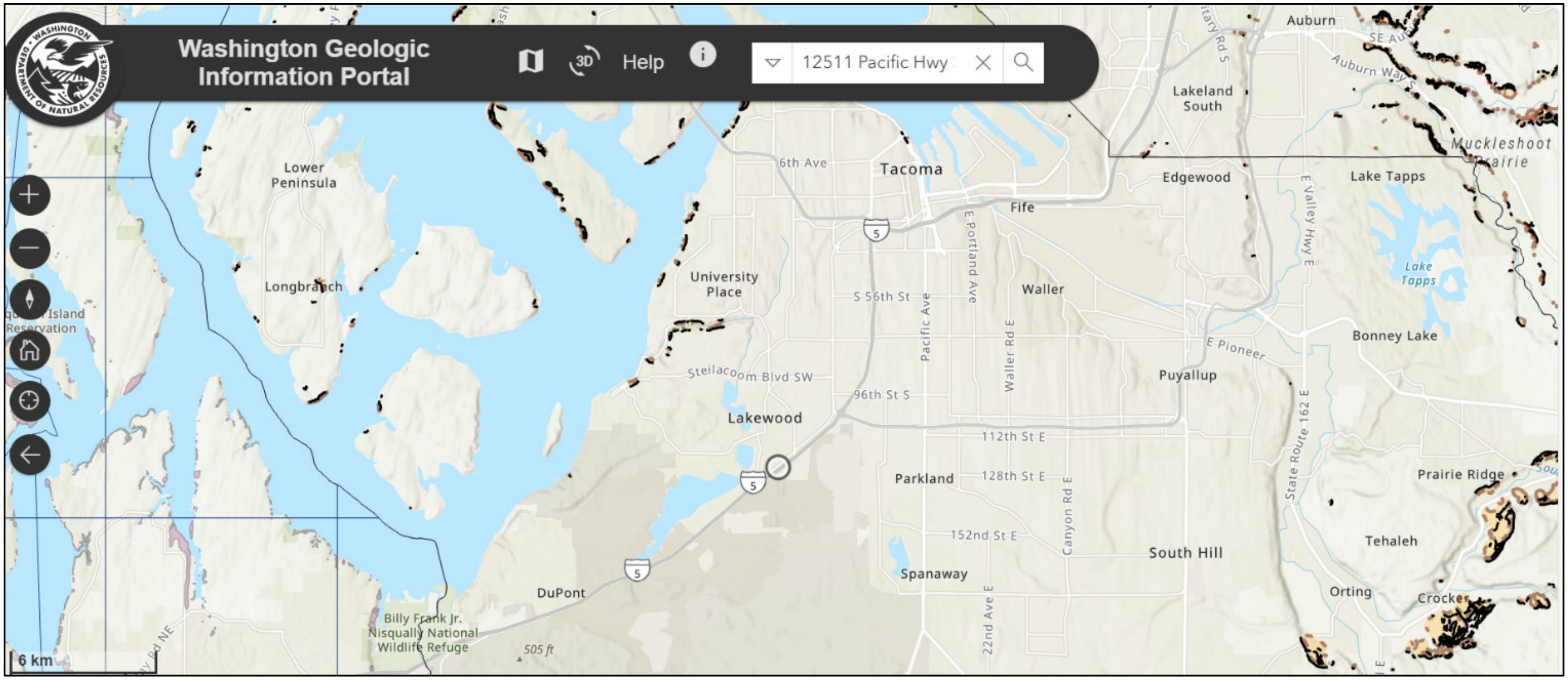
Increasing intense rain events or flood conditions associated with climate change can increase the likelihood of occurrence.

The effects of landslides vary from possibly blocking rivers or streams to causing a backup of surface water that can cause a flashflood downstream. They can also cause damage to pipelines, sewer lines, or impact the storage of hazardous chemicals. Extreme landslides at the site could damage or impair all components of the remedial and monitoring systems and utilities.

Based on the low probability of occurrence and the low potential for damages in the event of landslides at the site, the vulnerability of the site to landslides would be considered low.

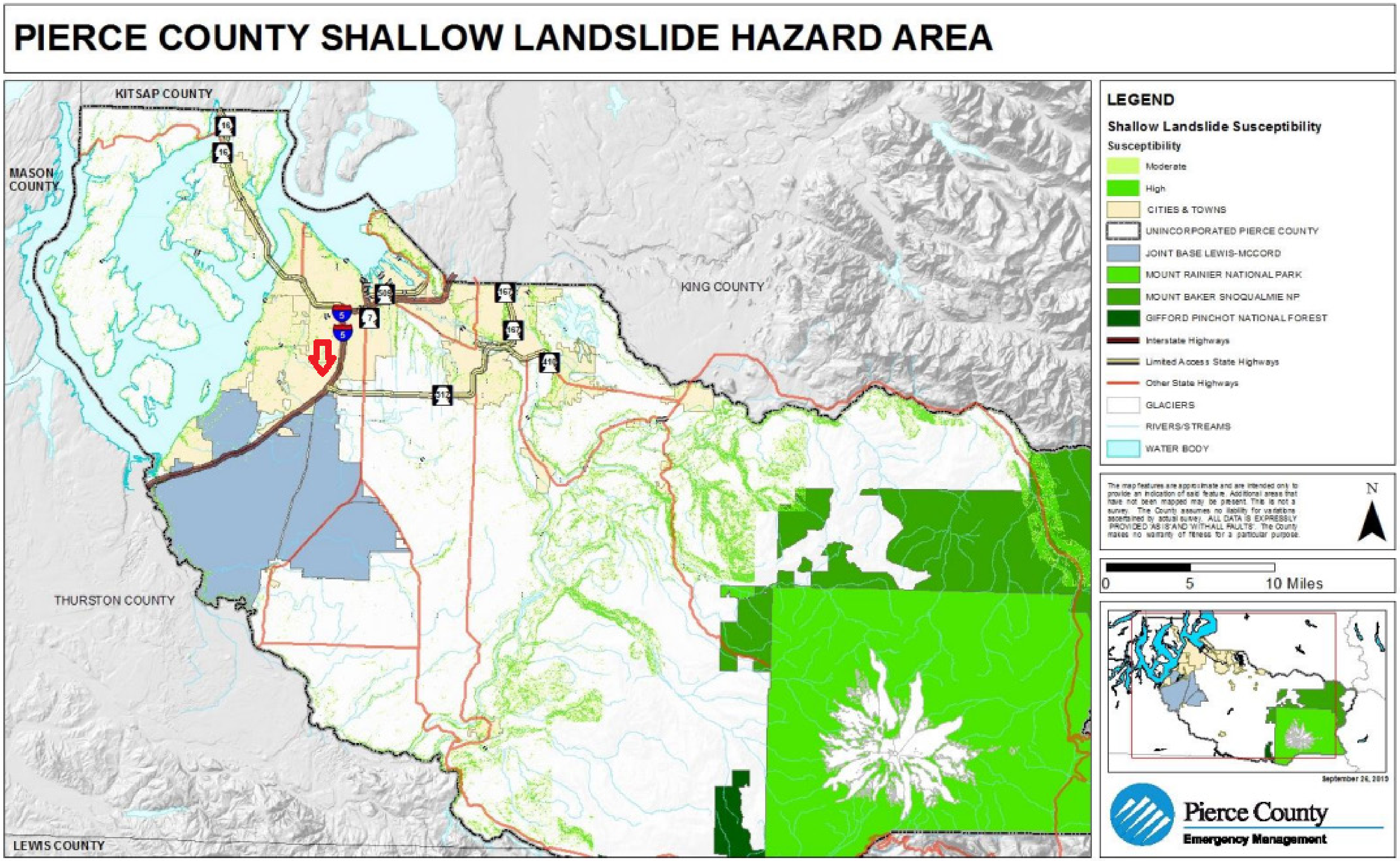
[2] https://www.usgs.gov/faqs/what-earthquake-and-what-causes-them-happen
[3] https://www.weforum.org/agenda/2023/08/climate-change-trigger-earthquakes-volcanoes/

Figure C-4. Historical Landslides in Pierce County



Adapted from: [Washington Geologic Information Portal]()

Figure C-5. Pierce County Shallow Landslide Hazard Areas



Adapted from: [Risk Assessment Section (piercecountywa.gov)]

Tsunami: Tsunamis and seiches (water waves generated in enclosed bodies of water) are secondary hazards that can be triggered by earthquakes and landslides. The two main Washington earthquake scenarios that may generate a tsunami are a Cascadia Subduction Zone event of approximately a magnitude 9 (reoccurrence ~500-600 years) and a shallow crustal earthquake such as the Tacoma or Seattle Faults of approximately a magnitude 7 (reoccurrence 100s to 1,000s of years.) The FEMA National Risk Index (NRI) tsunami risk map indicates that the site is in an area of relatively moderate tsunami risk.[4]

The Tacoma Fault scenario has significant projected inundation in the Port of Tacoma region. Near the site, large lakes and other enclosed bodies of water, near the Tacoma Narrows, could be affected by a seiche. Projected increases in sea level due to climate change combined with subsidence in portions of Puget Sound (north of the site), would exacerbate these problems.

Figure C-6 depicts the Tacoma Fault lines and their proximity to bodies of water that could affect the site in the event of an earthquake and secondary seiche or tsunami.

Tsunami and seiche inundation have the potential to damage structures and utilities on the site. The groundwater treatment systems could also be damaged. Tides could carry hazardous chemicals from or outside of the site that could cause environmental impact.

Based on the low of occurrence of tsunamis and seiches and the moderate potential for damage, the vulnerability of the site to tsunami and seiche inundation would be considered low-moderate.

Drought: Drought is defined as a period of abnormally dry weather prolonged for the lack of water to cause hydrologic imbalance in an affected area. An area is considered to be in drought when the water supply for that geographic area is below or projected to be below 75 percent of normal. The entire region of Pierce County has experienced drought, which under the right conditions could lead to available sources of water, such as reservoirs and lakes drying up.

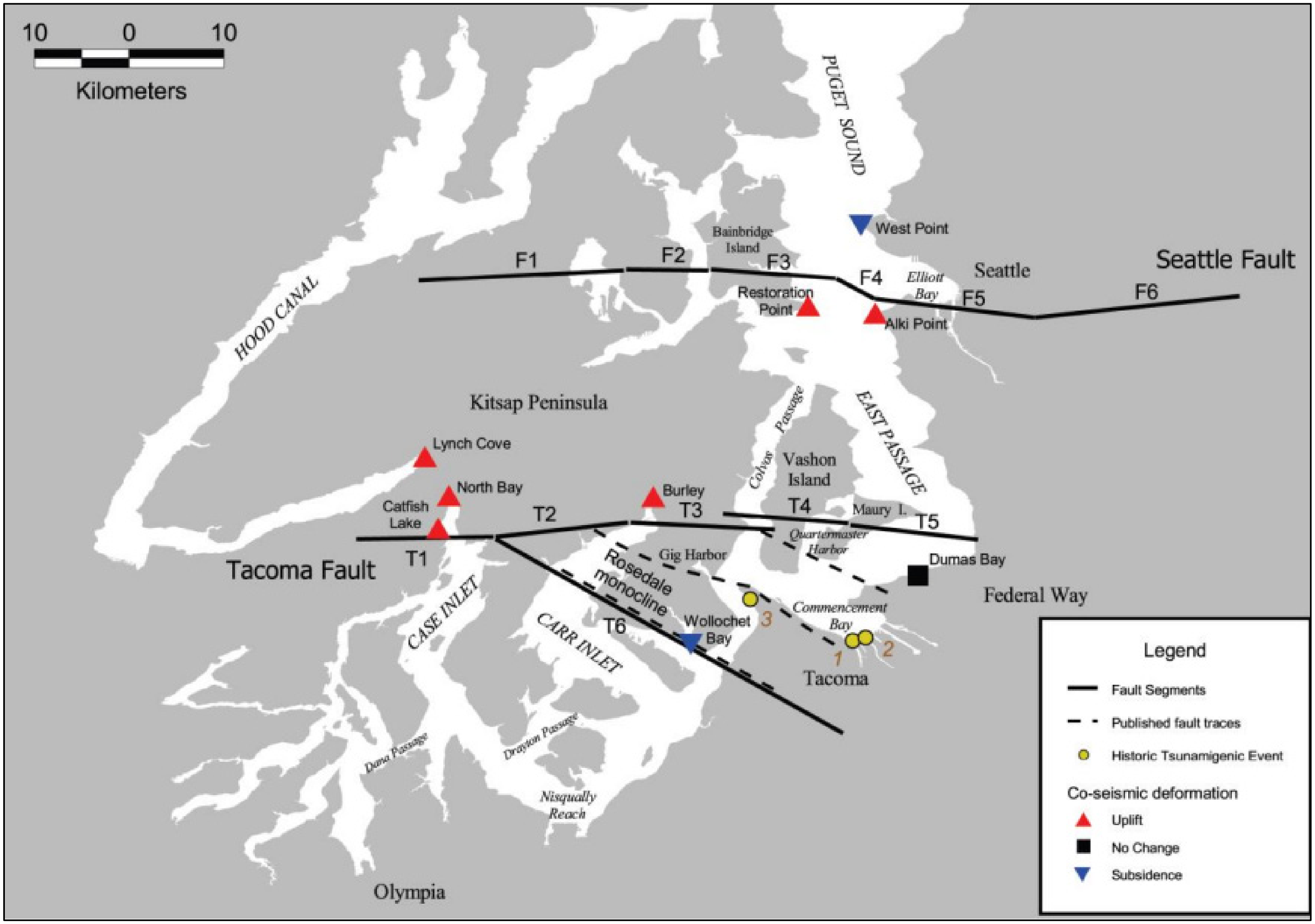
Figure C-7 depicts the U.S. Drought Monitor for Pierce County, which is under the D0 classification, indicating areas that are Abnormally Dry. This indicates areas that may be going into or coming out of drought.

Climate change can exacerbate the effects of drought in Pierce County and at the site. Warming trends can alter snow fall and the recovery of water from aquifers and reservoirs. Drier summers can also have an impact on the frequency and intensity of drought in the area.

Drought could affect groundwater monitoring wells on site. Their ability to recover after a long period of drought, when the water table is depressed can lead to lack of available groundwater for sampling. Lakewood Water District supply well pumping can also be affected by changes to the depth of the groundwater that may be associated with droughts.

[4] https://hazards.fema.gov/nri/map

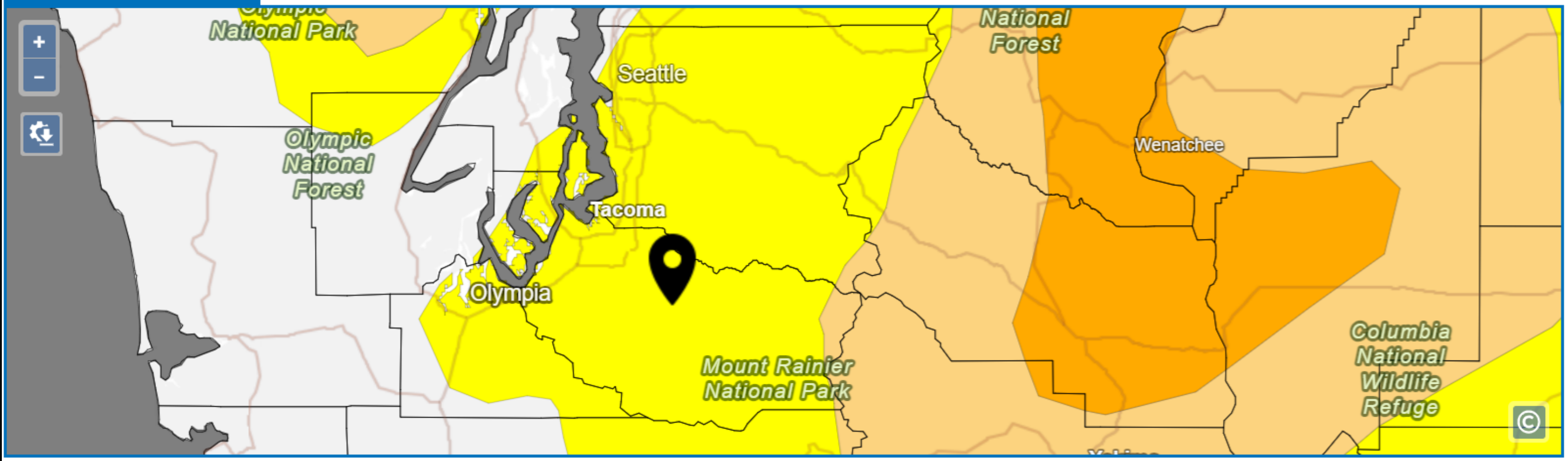
Figure C-6. Tacoma and Seattle Fault Lines and Their Proximity to Bodies of Water



Adapted from: [Risk Assessment Section (piercecountywa.gov)]

Figure C-7. U.S. Drought Monitor Map for Pierce County Encompassing the Site

U.S. Drought Monitor **30-Day Precipitation** **30-Day Temperature**



The U.S. Drought Monitor depicts the location and intensity of drought across the country using 5 classifications: Abnormally Dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought (D1–D4).

The U.S. Drought Monitor is a joint effort of the National Drought Mitigation Center, U.S. Department of Agriculture, and National Oceanic and Atmospheric Administration.

Source(s): NDMC, NOAA, USDA

Legend —

Drought & Dryness Categories	% of Pierce County
D0 - Abnormally Dry	**94.03%**
D1 – Moderate Drought	**3.97%**
D2 – Severe Drought	**0%**

Adapted from: Washington | Drought.gov

Based on the moderate probability of occurrence and moderate potential for damages, the vulnerability of the site to drought would be considered moderate.

Flood: There are several types of flooding that can affect areas within Pierce County. This includes riverine, coastal, urban/stream, and groundwater.

The site is located inland of the coast and south of the Lower Pauyallup River. As shown in **Figure C-8**, any riverine flooding would not reach the site, as the river flows approximately 20 miles north of it. The site is marked with a red dot on the small-scale map of the county (it is not within the large-scale map).

Coastal flooding is a possibility within the areas surrounding the site. The 2017 FEMA flood insurance rate map shows that 79 percent of the marine shoreline is mapped as a high hazard velocity zone. This would happen during high tide events. NOAA climate model projections estimate that the sea level will be 5 ft higher in the next 80 years, which can further exacerbate coastal flooding in the area.

Within urban areas, drainage and creek systems can experience flash flooding events that can be intensified by landcover changes. Near the site, there is a United States Geological Survey (USGS) monitoring location at Clover Creek near Tillicum, Washington.

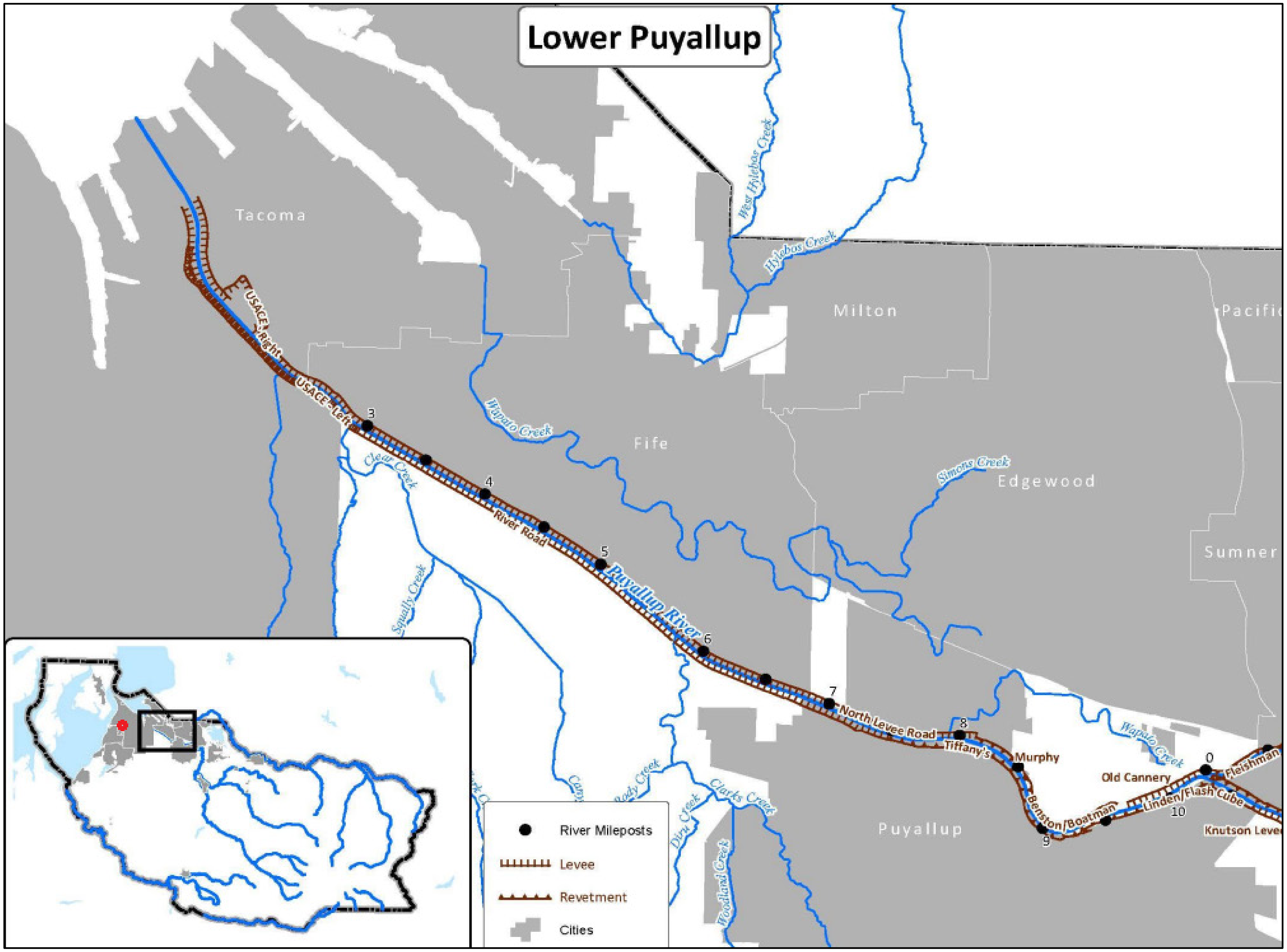
Pierce County is characterized by a mix of well-draining soils and impervious hard till and clay. This geology can result in pockets of groundwater recharge flooding where underlying soils fill up after extended periods of rain. Groundwater will move in a west-northwesterly direction until it reaches Puget Sound from further inland. These flows can originate from Graham, Fredrickson, and Spanaway, which are all proximal to the area surrounding the site.

Climate change influences the levels of precipitation that occurs in Pierce County. Winter precipitation can expect heavier rainfall and higher soil water content that can influence flooding around the site in nearby streams or in the groundwater below.

The amounts and types of potential damages would be dependent upon the types of flooding faced at the site. Surface and subterranean components of groundwater monitoring wells, water treatment infrastructure, and exposed utilities would be vulnerable to potential damages from the flooding inundation. Damage to utilities could decrease or temporarily impact remedial and monitoring operations. Exposed, contaminated soils and sediments could be displaced offsite.

Based on the low probability of occurrence and moderate potential for damages in the event of extreme flooding, the vulnerability of the site would be considered low to moderate.

Figure C-8. Lower Puyallup River Flow



Adapted from: [Risk Assessment Section (piercecountywa.gov)]

Severe Weather: This can include primarily thunderstorms and winter events in the area of interest.

Thunderstorms, Lightning, Hail: The HMP states that thunderstorms occur almost every year and their frequency has become a larger focus in recent years when combined with droughts and wildfires. Severe thunderstorms can produce tornados, winds of at least 58 miles per hour (mph), and/or hail at least 1 inch in diameter, as well as lightning.

According to FEMA NRI, the census tract of the site (53053071806) experiences 0.8 lightning events per year and approximately 0 hail events per year. Compared to the remainder of the United States, the census tract hazard risk rating for lightning, hail, and tornado are Very Low 12.3, Very Low 16.1, Very Low, 18.9; respectively.

The Fifth National Climate Assessment describes that thunderstorms have become more frequent and long-lasting. Conditions suitable to hail have become more frequent. Trends have not been identified for lightning or tornado.

Lightning has the potential to strike and damage tall structures and utilities on the site. Hail of the indicated size would have limited impacts to the remedial or monitoring structures.

Based on the high probability of occurrence of thunderstorms, including lightning and hail, and a low potential for damage, the vulnerability of the site to strong winds would be considered moderate.

Snow/Ice Storms: The HMP addresses the winter weather hazard as snowstorms and ice storms. There have been 16 significant winter weather events recorded in the county from 1950-2019, with four of them being classified as Federal Disasters.

Based on the HMP, ice storms can accumulate freezing rain on all exposed surfaces and the accumulated weight of the ice, especially combined with wind, can cause damage. Snowstorms may be accompanied by damaging high winds and poor visibility; and tree limbs overloaded with snow can break off, landing on buildings or equipment and overloaded powerlines can break causing fires and conditions that are immediately dangerous to life and health risks.

The FEMA NRI for the census tract of the site (53053071806) experiences 0.6 ice storm events per year and 0.9 winter weather events per year. These events are characterized with the NRI as Relatively Low 38.7 and Relatively Low 31.3; respectively.

Ice storms and snowstorms alone are not likely to damage the remedial or monitoring systems. In the event of strong winds associated with the storms, aboveground utilities may become vulnerable. Damage to utilities could decrease or temporarily impact the operation of the remedial and monitoring systems.

Based on the moderate probability of occurrence of winter weather and low potential for damage the vulnerability of the site to ice storms and snowstorms would be considered low-moderate.

WUI Fire Hazard: The site is in an industrial and commercial area amongst some vegetation. A WUI area is one where structures and other human development intermingles with wildland or vegetative fuels. Fires can occur from natural or anthropogenic causes and in Washington; the expansion of the WUI in recent decades has increased the likelihood of fire-related damages.

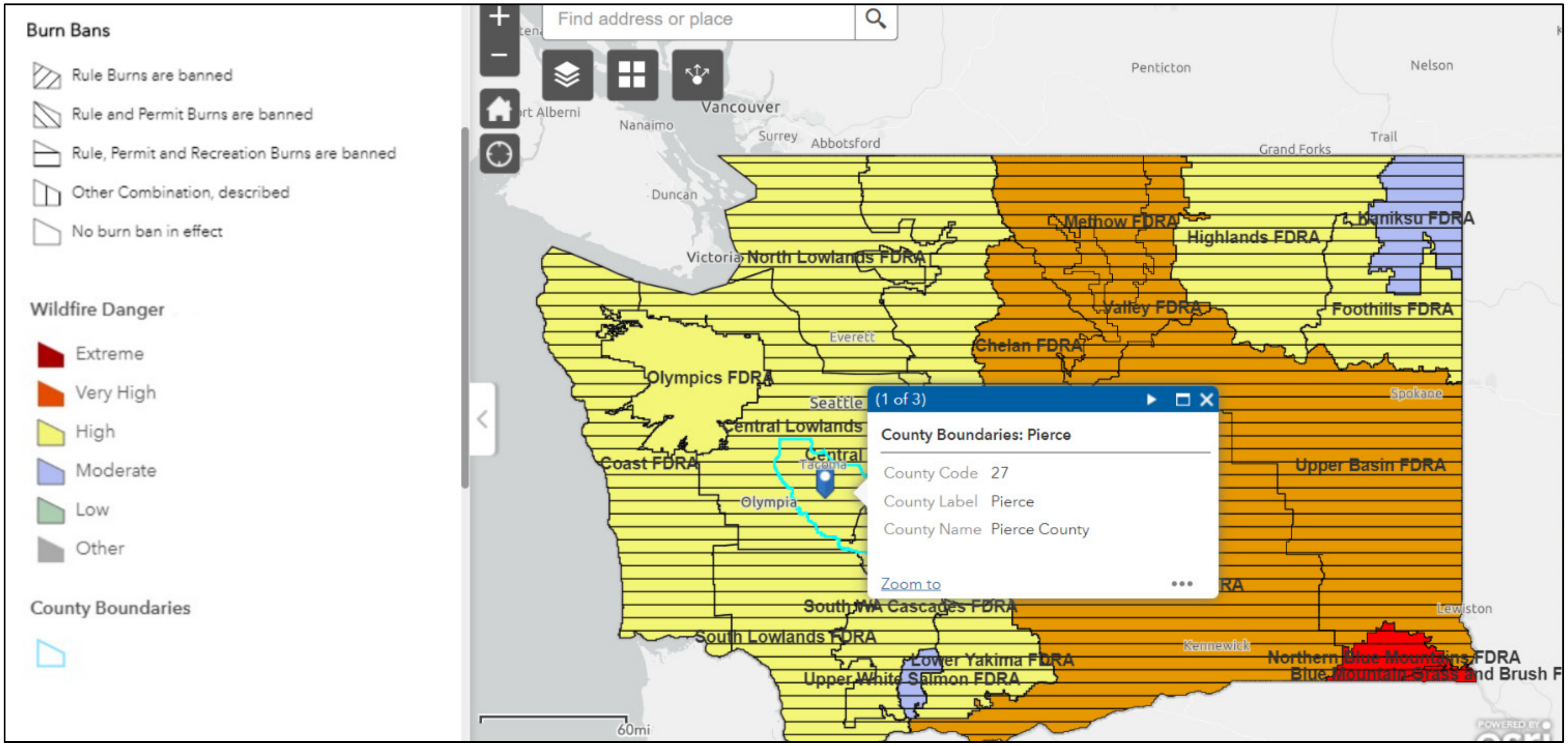
Figure C-9 depicts a Fire Risk map of Washington from the Washington DNR. This shows Pierce County having a High wildfire danger and that permits for recreational burns are required.

Climate change is increasing wildfire frequency and range, however, wildfire risk at the site might remain low based on its urban location.

Any exposed elements of the monitoring wells or the groundwater treatment system equipment could be damaged from fire. Damage to utilities could decrease or temporarily impact the operation of site activities.

Based on the low probability of occurrence and moderate potential for damage in the event of wildfire, the vulnerability of the site to WUI fires would be considered low to moderate.

Figure C-9. Fire Danger and Outdoor Burning in Pierce County



Adapted from: fortress.wa.gov/dnr/protection/firedanger/

4.0 SUMMARY OF FINDINGS

This section provides the optimization review team's summary findings from the CV screening performed for the site:

- Data and resources identified in the Pierce County HMP were sufficient to support this screening effort.
- The remedial and monitoring systems of concern include groundwater monitoring wells and the groundwater treatment system, including air strippers and granular activated carbon (GAC) vessels.
- Based on the moderate probability of occurrence and the moderate potential for damages in the event of earthquakes, the vulnerability of the site to impact from earthquakes would be considered moderate.
- Tsunamis from earthquakes or seiches pose relatively moderate risk to the site.
- Drought and thunderstorms both ranked as moderate risks for the site. However, climate change could potentially exacerbate the risks and impacts associated with drought and thunderstorms.
- Flooding, winter weather, and WUI fire hazards all pose a low to moderate threat to the site. However, climate change could increase the probability of occurrence and intensities of floods, winter storms, and WUI fires.
- Landslides poses a low threat to site vulnerability based on the low to moderate probability occurrence.
- All hazards would pose a risk to utilities related to the site water treatment system. Damage to utilities could decrease or temporarily impact the operation of the air strippers and GAC vessels, thus compromising water treatment operations.

Step 5-Recommendations

The optimization review team's summary recommendations based on the CV screening performed for the site are provided below:

- *Drought* – Measure groundwater elevations in preparation of monitoring events.
- *Earthquake* – Consider using seismic-resistant materials to repair or replace infrastructure of monitoring systems. Brace pipes to increase flexibility to aboveground connections or hard points.
- *Flooding/Tsunami* – Monitor weather forecasts and post-earthquake advisories to be aware of inundation conditions that could impact the site. Continue to monitor the groundwater plume after considerable inundation.
- *Landslide* – No recommendations for landslides.
- *Thunderstorms* – Install lightning rod(s) to prevent damage from lightning strikes. Consider other hazards that may follow, such as hail and high winds.
- *Wildfire* – Mow and remove any dead or buildup of grasses. Consider wildfire-resilient landscaping when planning site redevelopment.

- *Winter Weather* – Monitor heavy snowfall in preparation site operations. Insulate all components of the monitoring systems that are vulnerable to extreme cold.
- *All Hazards* – Prepare a backup generator or pumps for use during monitoring events.

Based on the results of the CV screening, the optimization review team does not believe that the site warrants a focused CV evaluation.

ATTACHMENT D:

Environmental Justice Screening

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Lakewood, WA

1 mile Ring Centered at 47.143420,-122.513261
Population: 8,352
Area in square miles: 3.14

COMMUNITY INFORMATION

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	77%
Spanish	15%
German or other West Germanic	1%
Korean	1%
Chinese (including Mandarin, Cantonese)	1%
Vietnamese	1%
Tagalog (including Filipino)	1%
Other Asian and Pacific Island	3%
Total Non-English	23%

Low income: 48 percent
People of color: 54 percent
Less than high school education: 10 percent
Limited English households: 4 percent
Unemployment: 9 percent
Persons with disabilities: 17 percent
Male: 51 percent
Female: 49 percent
78 years Average life expectancy
$33,924 Per capita income
Number of households: 3,411
Owner occupied: 26 percent

BREAKDOWN BY RACE

White: 46%
Black: 16%
American Indian: 0%
Asian: 5%
Hawaiian/Pacific Islander: 6%
Other race: 0%
Two or more races: 9%
Hispanic: 18%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	22%
From Ages 18 and up	78%
From Ages 65 and up	12%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	68%
Speak Other Indo-European Languages	0%
Speak Asian-Pacific Island Languages	32%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race. Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

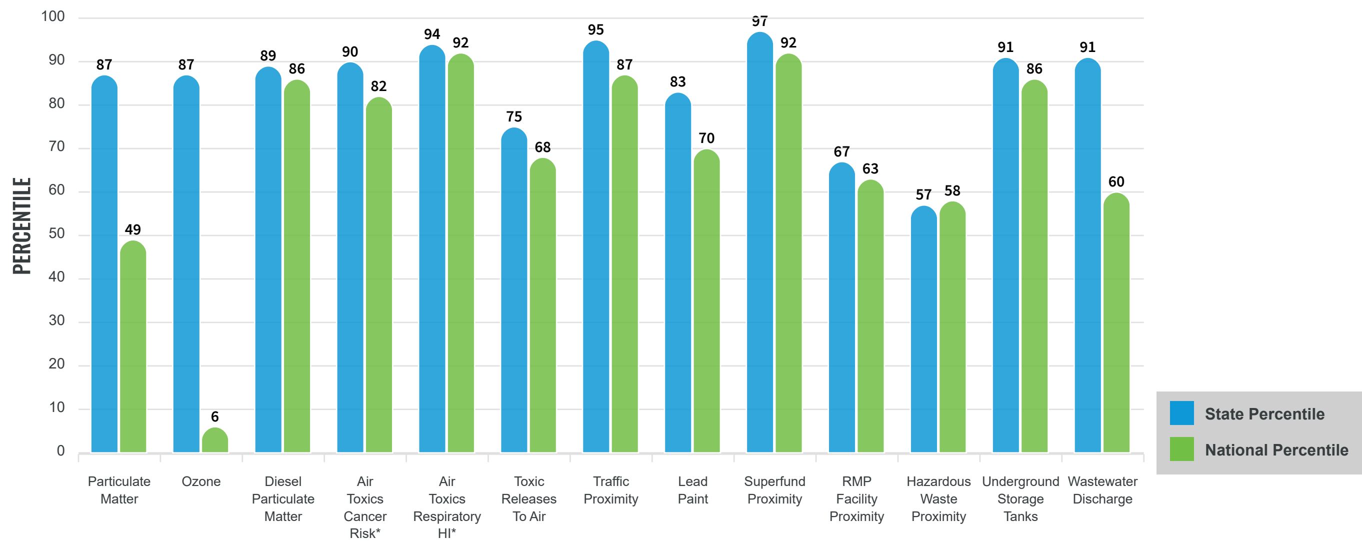
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

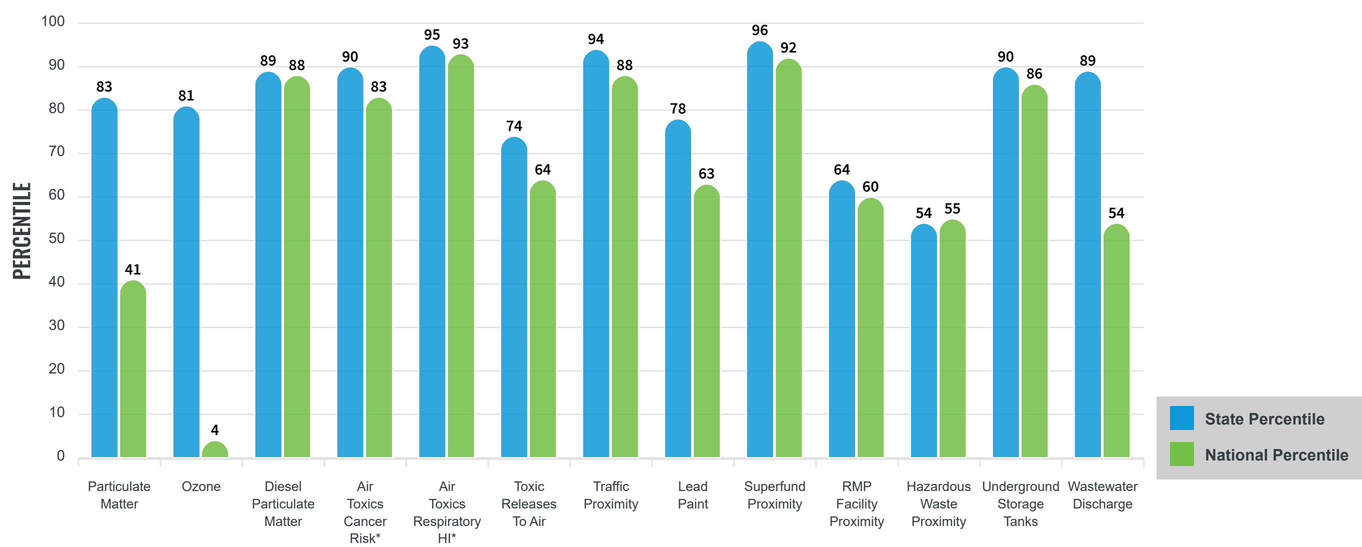
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 1 mile Ring Centered at 47.143420,-122.513261

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter ($\mu g/m^3$)	7.15	7.02	57	8.08	23
Ozone (ppb)	50	49.8	54	61.6	2
Diesel Particulate Matter ($\mu g/m^3$)	0.402	0.355	65	0.261	83
Air Toxics Cancer Risk* (lifetime risk per million)	30	27	37	25	52
Air Toxics Respiratory HI*	0.49	0.39	39	0.31	70
Toxic Releases to Air	350	1,800	40	4,600	40
Traffic Proximity (daily traffic count/distance to road)	460	190	91	210	89
Lead Paint (% Pre-1960 Housing)	0.24	0.23	63	0.3	52
Superfund Proximity (site count/km distance)	2.3	0.18	99	0.13	99
RMP Facility Proximity (facility count/km distance)	0.13	0.4	37	0.43	38
Hazardous Waste Proximity (facility count/km distance)	0.18	1.6	27	1.9	32
Underground Storage Tanks (count/km^2)	7.8	6.3	76	3.9	85
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00014	0.024	72	22	33
SOCIOECONOMIC INDICATORS					
Demographic Index	51%	28%	90	35%	75
Supplemental Demographic Index	19%	12%	87	14%	75
People of Color	54%	32%	83	39%	69
Low Income	48%	24%	89	31%	79
Unemployment Rate	10%	5%	85	6%	82
Limited English Speaking Households	4%	4%	70	5%	71
Less Than High School Education	10%	8%	72	12%	59
Under Age 5	6%	6%	64	6%	65
Over Age 64	12%	16%	36	17%	33
Low Life Expectancy	8%	18%	0	20%	0

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund	1
Hazardous Waste, Treatment, Storage, and Disposal Facilities	0
Water Dischargers	9
Air Pollution	0
Brownfields	0
Toxic Release Inventory	0

Other community features within defined area:

Schools	2
Hospitals	1
Places of Worship	2

Other environmental data:

Air Non-attainment	Yes
Impaired Waters	Yes

Selected location contains American Indian Reservation Lands*	No
Selected location contains a "Justice40 (CEJST)" disadvantaged community	Yes
Selected location contains an EPA IRA disadvantaged community	Yes

Report for 1 mile Ring Centered at 47.143420,-122.513261

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	8%	18%	0	20%	0
Heart Disease	5.5	5.3	55	6.1	39
Asthma	12.3	10.5	94	10	92
Cancer	4.7	6.3	12	6.1	19
Persons with Disabilities	15.9%	13.1%	70	13.4%	70

CLIMATE INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	27%	11%	89	12%	90
Wildfire Risk	0%	12%	0	14%	0

CRITICAL SERVICE GAPS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	13%	9%	74	14%	55
Lack of Health Insurance	14%	6%	93	9%	81
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Report for 1 mile Ring Centered at 47.143420,-122.513261