**Final Feasibility Study Report**



**Property:**

Troy Laundry Seattle Site

300 Boren Avenue North and 399 Fairview Avenue North

Seattle, Washington

Ecology Facility ID: 19135499

**Report Date:**

January 28, 2025

**Prepared for:**

Touchstone SLU LLC

1425 Fourth Avenue, Suite 200

Seattle, Washington

TB TS/RELP LLC

9830 Colonnade Boulevard, Suite 600

San Antonio, Texas

**Feasibility Study Report**

*Prepared for:*

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**Troy Laundry Seattle Site**

300 Boren Avenue North and

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Seattle, Washington 98121

Ecology Facility ID: 19135499

Project No.: 0731-004-07

*Prepared by:*

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January 28, 2025

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Acronyms and Abbreviations

|  |  |
| --- | --- |
| µg/L | micrograms per liter |
| AS | air sparge |
| AO | Agreed Order No. DE 8996 |
| ARAR | applicable or relevant and appropriate requirement |
| bgs | below ground surface |
| cis-1,2-DCE | cis-1,2-dichloroethene |
| CLARC | Cleanup Levels and Risk Calculation |
| COC | contaminant of concern |
| CPOC | conditional point of compliance |
| CSM | conceptual site model |
| CVOC | chlorinated volatile organic compound |
| DHC | Dehalococcoides genus |
| DRPH | diesel-range petroleum hydrocarbons |
| EC | Environmental Covenant |
| Ecology | Washington State Department of Ecology |
| Ecology Climate Guidance | Washington State Department of Ecology’s Sustainable Remediation: Climate Change Resiliency and Green Remediation dated November 2017, revised January 2023 |
| EHD Map | Washington State Department of Health’s Environmental Health Disparities Map |
| EJ Screening Tool | Environmental Justice Screening and Mapping Tool |
| EOS | edible oil substrate |
| EPA | US Environmental Protection Agency |
| EPI | Environmental Partners, Inc. aka TRC Companies, Inc. |
| ERD | enhanced reductive dechlorination |
| Final FS Report | Final Feasibility Study Report |
| Final RI Report | Final Remedial Investigation Report |
| FS Report | Feasibility Study Report |
| GAC | granular activated carbon |
| GRPH | gasoline-range petroleum hydrocarbons |
| IRA | interim remedial action |
| mcl | maximum contaminant level |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MNA | monitored natural attenuation |
| MTCA | Washington State Model Toxics Control Act |
| NAVD88 | North American Vertical Datum 1988 |
| O&M | operation and maintenance |
| ORPH | oil-range petroleum hydrocarbons |
| PAC | powdered activated carbon |
| PCE | tetrachloroethene |
| Property | Troy Laundry property located at 300 Boren Avenue North and 399 Fairview Avenue North in Seattle, Washington |
| RAO | remedial action objective |
| RCW | Revised Code of Washington |
| RI Report | remedial investigation report |
| RL | remediation level |
| ROW | right-of-way |
| SDOT | Seattle Department of Transportation |
| Site | the Property; portions of the rights-of-way to the north, south, and west of the Property; and the northern portion of the adjoining former Seattle Times property located to the south across the Thomas Street ROW where groundwater contaminated with tetrachloroethene; trichloroethene; cis-1,2-dichloroethene, and/or vinyl chloride originating from the Property have come to be located |
| Seattle Times Site | the south-adjoining property located at 1120 John Street in Seattle, Washington located across the Thomas Street right-of-way (Washington State Department of Ecology Cleanup Site ID No. 14495, Facility Site ID 4377754, and King County Parcel Number 1986200525) |
| SoundEarth | SoundEarth Strategies, Inc. |
| SSI | statistically significant increase |
| SVE | soil vapor extraction |
| TCE | trichloroethene |
| TEE | Terrestrial Ecological Evaluation |
| Touchstone | Touchstone SLU LLC and TB TS/RELP LLC |
| UIC | underground injection control |
| USC | United States Code |
| UST | underground storage tank |
| VC | vinyl chloride |
| VFA | volatile fatty acid |
| WAC | Washington Administrative Code |
| WA DOH | Washington State Department of Health Environmental Health Disparities Map |

Executive Summary

On behalf of Touchstone SLU LLC and TB TS/RELP LLC (collectively Touchstone), SoundEarth Strategies, Inc. (SoundEarth) has prepared this Final Feasibility Study Report (Final FS Report) for the Troy Laundry Seattle Site located at 300 Boren Avenue North and 399 Fairview Avenue North in Seattle, Washington (Site). The Site encompasses the following areas:

* The Troy Laundry property located at 300 Boren Avenue North and 399 Fairview Avenue North in Seattle, Washington (Property).
* Portions of the rights-of-way (ROWs) to the north, south, and west of the Property.
* The northern portion of the adjoining former Seattle Times property located at 1120 John Street in Seattle, Washington (Seattle Times Site; Ecology Cleanup Site ID No. 14495, Facility Site ID 4377754, and King County Parcel Number 1986200525). The Seattle Times Site is located to the south across the Thomas Street ROW and is where groundwater contaminated with tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) originating from the Property has come to be located.

This FS Report was prepared in accordance with Agreed Order No. DE 8996 between Touchstone and the Washington State Department of Ecology (Ecology) and the requirements of Chapters 173-340-351 and 173-340-360 of the Washington Administrative Code, following the completion of an Ecology-approved Remedial Investigation Report (RI Report) for the Site. The RI Report sufficiently defines the nature and extent of contamination and characterizes the Site for the purpose of developing and evaluating cleanup action alternatives in this FS Report.

An interim remedial action (IRA) was conducted at the Site between 2014 and 2017 in conjunction with the redevelopment of the Property. The redevelopment required a lot line–to–lot line excavation that extended to approximately 70 feet below street grade. The IRA included the removal of underground storage tanks containing solvents and petroleum hydrocarbons and 97,000 tons of chlorinated solvent–contaminated soil as part of the Property development mass excavation. The IRA also included treating groundwater containing chlorinated volatile organic compounds (CVOCs) using enhanced reductive dechlorination (ERD) technology that included the injection of edible oil substrate into groundwater in May and June 2015 and in April and May 2016, followed by bioaugmentation in June 2017.

As of the fourth quarter of 2023, PCE and TCE were not detected at concentrations exceeding the laboratory reporting limit or cleanup levels in groundwater beneath the Property, except for PCE in injection well IW50 and TCE in monitoring well MW25. Prior to the fourth quarter of 2023, PCE and TCE concentrations in the wells were below cleanup levels for the previous eight rounds of sampling, which suggests the detections in Q4 2023 are anomalous and likely represent a sampling artifact or temporary desorption of PCE and TCE from the soil to the dissolved phase.

cis-1,2-DCE and/or VC concentrations exceed the cleanup levels in several monitoring wells located on the Property. Statistical trend analyses generally demonstrate that cis-1,2-DCE and VC concentrations in groundwater samples collected from beneath the Property are increasing with time, which is expected because of ERD groundwater treatment.

cis-1,2-DCE and VC were not detected at concentrations exceeding the laboratory reporting limits or cleanup levels for groundwater in the ROWs. PCE or TCE was detected at concentrations exceeding the cleanup level in groundwater samples collected from monitoring wells MW04, MW07, MW13, MW26, MW27, and MW34, which are located in the ROWs. As of the fourth quarter of 2023, statistical trend analyses demonstrate that the PCE or TCE concentrations detected in groundwater samples from the ROWs are either declining or the trend is statistically undetermined.

The RI Report defined the extent of CVOC-contaminated groundwater at the Site after implementation of the IRA. In addition, the RI Report documented through two indoor air sampling events that the vapor intrusion pathway is incomplete and indoor air is not a medium of concern for the Site.

Based on the results of the RI Report and the findings from performance of the IRA and recent pilot study activities, this FS Report was prepared to develop and evaluate cleanup action alternatives to address remaining CVOCs in groundwater at the Site.

The four cleanup action alternatives that were developed and evaluated include the following:

* Cleanup Action Alternative 1, Monitored Natural Attenuation (MNA) and Environmental Covenant
* Cleanup Action Alternative 2, In Situ ERD and Environmental Covenant with MNA
* Cleanup Action Alternative 3, In Situ Powder Activated Carbon Adsorption and Environmental Covenant with MNA

Cleanup Action Alternative 1 (MNA) has been selected as the recommended remedial alternative because it is technically feasible, implementable, sustainable, protective of human health and environment, and cost-effective. Selection of MNA recognizes that the source of CVOCs was removed to the maximum extent practicable as part of the IRA during redevelopment of the Property.

Based on the disproportionate cost analysis, it was determined that the incremental benefit of implementing an active treatment alternative compared to MNA is not warranted based on the following conclusions:

* The CVOC impacts in groundwater do not pose a risk to human health or the environment given the depth to groundwater beneath the Site.
* There is no direct or indirect exposure pathway or receptor.
* The overall mass of the CVOC plume has significantly declined over time.
* The benefit from additional in situ groundwater treatment will be *de minimis* given the low CVOC concentrations remaining in groundwater.

Cleanup Action Alternative 1 will include continued groundwater monitoring and sampling, data analysis to confirm that the footprint of the CVOC groundwater plume remains stable or continues to decline over time. The recording of an environmental covenant with an institutional control will ensure there is no direct contact with or ingestion of contaminated groundwater.

This executive summary is presented solely for introductory purposes, and the information contained in this section should be used only in conjunction with the full text of this report.

# Introduction

On behalf of Touchstone SLU LLC and TB TS/RELP LLC (collectively Touchstone), SoundEarth Strategies, Inc. (SoundEarth) has prepared this Feasibility Study Report (FS Report) for the Troy Laundry Seattle Site located at 300 Boren Avenue North and 399 Fairview Avenue North in Seattle, Washington (Site). The Site encompasses the following:

* The Troy Laundry property located at 300 Boren Avenue North and 399 Fairview Avenue North in Seattle, Washington (Property). The location of the Property is shown on Figure 1.
* Portions of the rights-of-way (ROWs) to the north, south, and west of the Property.
* The northern portion of the adjoining former Seattle Times property, located at 1120 John Street in Seattle, Washington (Seattle Times Site; Ecology Cleanup Site ID No. 14495, Facility Site ID 4377754, and King County Parcel Number 1986200525). The Seattle Times Site is located to the south across the Thomas Street ROW and is where groundwater contaminated with tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) originating from the Property has come to be located.

This Final Feasibility Study Report (Final FS Report) was prepared under the authority of Agreed Order No. DE 8996 between Touchstone and the Washington State Department of Ecology (Ecology; AO). The Final FS Report includes data gathered following the completion of an Ecology-approved Remedial Investigation Report (RI Report) for the Site (Final RI Report; SoundEarth 2020).

The Final RI Report included data and information obtained through implementation of an interim remedial action (IRA) and information obtained pursuant to investigation conducted under Prospective Purchaser Consent Decree No. 19-2-07344-6 SEA for the Property between Ecology and Ponte Gadea Seattle LLC. This FS Report was developed in accordance with the AO and with the requirements of Chapters 173-340-351 and 173-340-360 of the Washington Administrative Code (WAC 173-340-351 and 173-340-360).

## Site Background

According to historical records, Troy Laundry operated as one of the Pacific Northwest’s largest laundry and dry cleaning facilities. At least 15 underground storage tanks (USTs) containing heating oil, fuel, and dry cleaning solvents and several aboveground storage tanks containing propane, wash water, water-softening agents, dry cleaning solvents, and heating oil were used on the Property throughout its operation (Figure 2).

An RI was initiated at the Property in 1985 and completed in 2019. The RI Report documented the release and the nature and extent of gasoline-, diesel-, and oil-range petroleum hydrocarbons (GRPH, DRPH, and ORPH, respectively); PCE; TCE; cis-1,2-DCE; and VC released to soil and groundwater. The areas affected by releases of contaminants from the Property are presented on Figure 3. The RI activities included advancing 59 borings and installing 33 groundwater monitoring wells, performing a vapor intrusion assessment, and conducting groundwater monitoring and sampling events.

SoundEarth conducted an IRA at the Site between 2014 and 2017 in conjunction with the redevelopment of the Property. The redevelopment required a lot line–to–lot line excavation that extended to a depth of 70 feet below street grade. The IRA included the removal of USTs containing solvents and petroleum hydrocarbons and 97,000 tons of chlorinated volatile organic compound (CVOC)–contaminated soil as part of the Property development mass excavation. The IRA also included treating CVOC–contaminated groundwater using enhanced reductive dechlorination (ERD) technology. The ERD groundwater treatment included the injection of edible oil substrate (EOS) in May and June 2015 and April and May 2016, followed by bioaugmentation in June 2017. As a result of groundwater treatment and natural attenuation processes, concentrations of PCE and its degradation products have declined in groundwater throughout the Site.

Currently, the Troy Block development at the Property occupies the full city block bounded by Harrison Street to the north, Fairview Avenue North to the east, Thomas Street to the south, and Boren Avenue North to the west. The development includes two office towers and a five-level underground parking garage (levels P1 through P5) with 1,120 parking stalls. The North Tower consists of 13 stories with 418,999 square feet of rentable space, and the South Tower consists of 12 stories with 392,521 square feet of rentable space. Both towers are currently leased and occupied by Amazon. The development also includes approximately 1 acre of public open space between the two towers. The lowest level of the underground parking garage covers the entire subsurface area of the Property, and there are no areas where there could be any direct contact with residual groundwater contamination beneath the Property.

## Supplemental Site Investigation Activities

Previous investigations and the IRA conducted at the Site were performed in consultation with Ecology and in accordance with the AO and are summarized in Sections 3.0 through 6.0 of the Final RI Report (SoundEarth 2020). The locations of soil borings and monitoring wells are shown on Figure 4 and illustrated in cross-sections on Figures 5 through 8. Soil, groundwater, and indoor air analytical results are summarized in Tables 1 through 9.

Since approval of the RI Report in 2020, SoundEarth has conducted supplemental site investigation activities at the Site that have included eight groundwater monitoring and sampling events (in the second and fourth quarters of 2020, 2021, 2022, and 2023) and a pilot study. The supplemental site investigation and pilot study activities and results are summarized in the following sections.

### 2020 Second and Fourth Quarter Groundwater Monitoring and Sampling Events

Groundwater monitoring and sampling events were performed in June and December 2020 (second and fourth quarters, respectively). The groundwater elevation contour map for June and December 2020 events are shown on Figures 9 and 10, respectively. Results of the 2020 groundwater monitoring and sampling event are presented below.

* PCE was detected at concentrations exceeding the cleanup level in groundwater samples collected from monitoring wells MW13, MW28, and MW29 and injection well IW61 (only in the second quarter of 2020).
* TCE was detected at concentrations exceeding the cleanup level in groundwater samples collected from monitoring wells MW04, MW07, MW26 (only in the second quarter of 2020), MW27, MW28 (only in the second quarter of 2020), MW29, and MW31.
* cis-1,2-DCE and/or VC were detected at concentrations exceeding the cleanup level in groundwater samples collected from monitoring wells MW18, MW19, MW21 through MW25, MW28, and MW29 and injection wells IW04, IW50, and IW61.

The groundwater elevation contours for the second quarter 2020 monitoring event indicated that groundwater at the Site flowed generally to the west-northwest. This groundwater flow direction is a departure from the flow to the south-southeast that was observed during previous groundwater monitoring and sampling events performed at the Property. The change in groundwater flow direction to the west-northwest can be attributed to the hydraulic influence of construction dewatering associated with a redevelopment project northwest of the Property.

A comprehensive discussion of the 2020 groundwater monitoring and sampling events and results, including a statistical analysis to evaluate the stability of the contaminated groundwater plume, is presented in the 2020 Groundwater Monitoring Report (SoundEarth 2021).

### 2021 Second and Fourth Quarter Groundwater Monitoring and Sampling Events

Groundwater monitoring and sampling events were performed in June and December 2021 (second and fourth quarters, respectively). The groundwater elevation contour map for June and December 2021 events are shown on Figures 11 and 12, respectively. Results of the 2021 groundwater monitoring and sampling events are presented below.

* PCE was not present at concentrations exceeding the laboratory reporting limit or cleanup level in groundwater on the Property. PCE was detected at a concentration exceeding the cleanup level in monitoring wells MW13 (only in the fourth quarter of 2021) located on the Boren Avenue North ROW and monitoring wells MW28 and MW29, located in the Thomas Street ROW and northern portion of the Seattle Times Site, respectively.
* TCE was detected at concentrations exceeding the cleanup level in groundwater samples collected from monitoring wells MW04, MW07, MW26, MW27, MW31 (only in the fourth quarter of 2021) and MW34 (only in the fourth quarter of 2021). TCE was detected at a concentration exceeding the cleanup level in a groundwater sample collected from monitoring well MW29.
* cis-1,2-DCE and/or VC were detected at concentrations exceeding the cleanup level in groundwater samples collected from on-Property monitoring wells MW18, MW19, and MW21 throughMW25 and from on-Property injection wells IW04, IW06, IW50, and IW61. cis-1,2-DCE and VC were not detected at concentrations exceeding laboratory reporting limits or cleanup levels in groundwater samples collected from the monitoring wells in the ROWs, except for cis-1,2-DCE in monitoring well MW28, which is located in the Thomas Street ROW.

The groundwater elevation contours for the second quarter 2021 monitoring event indicated that groundwater at the Site flowed generally to the west-northwest, as it did in 2020, due to ongoing construction dewatering associated with a redevelopment project northwest of the Property.

A comprehensive discussion of the 2021 groundwater monitoring and sampling events and results, including a statistical analysis to evaluate the stability of the contaminated groundwater plume, is presented in the 2021 Groundwater Monitoring Report (SoundEarth 2022).

### Powdered Activated Carbon Pilot Study

In support of developing remedial alternatives, a pilot test was performed in consultation with Ecology to evaluate the efficacy of using powdered activated carbon (PAC) to reduce CVOC concentrations in groundwater. In early April 2021, three injection wells (IW92, IW93, and IW94) were constructed upgradient of monitoring well MW28 in the Thomas Street ROW. The injection wells were installed to an approximate depth of 5 feet North American Vertical Datum 1988 (NAVD88) with a screened interval of between 5 and 15 feet NAVD, which is consistent with the screened interval for monitoring well MW28. The injection well locations are shown on Figure 4. Injection well construction logs for injection wells IW92, IW93, and IW94 are provided in Appendix A.

In late April 2021, an injection slurry was prepared that consisted of 55 pounds of PAC mixed with 150 gallons of potable water in an aboveground tank (one batch). The PAC injection slurry was delivered to the newly installed injection wells and two existing angled injection wells (AIW10 and AIW11) under moderate injection pressure. Two batches of slurry were delivered to injection wells IW92, IW93, and IW94 and two-and-a-half batches were delivered to angled injection wells AIW10 and AIW11 for a total of 11 batches delivered. As the delivery of the PAC slurry to the subsurface progressed, injection rates diminished, likely due to clogging of the soil pores given the presence of low-permeability soils. If further injections were performed beneath the Thomas Street ROW, it is anticipated the aerial distribution and contact with CVOC-contaminated groundwater would be limited.

Pilot study performance groundwater monitoring was performed in May 2021 (approximately 1 month following injections), in August and September 2021 (approximately 4 and 5 months following the injections), and concurrently with the semiannual groundwater monitoring program (second and fourth quarters of 2021 and 2022). Performance monitoring consisted of the collection of groundwater samples from monitoring well MW28 and submission of the samples for analysis of CVOCs.

PCE and TCE concentrations have decreased in groundwater samples collected from monitoring well MW28 following the PAC injections. In the second and fourth quarters of 2022 (i.e., approximately 14 and 20 months following the injections, respectively) and 2023, PCE and TCE were detected at concentrations below the cleanup level in groundwater samples collected from monitoring well MW28. The pilot study results indicate that the observed reductions in PCE and TCE concentrations are attributed to absorption by the PAC and/or natural attenuation processes.

### 2022 Second and Fourth Quarter Groundwater Monitoring and Sampling Events

Groundwater monitoring and sampling events were performed in June and December 2022 (second and fourth quarters, respectively). In July 2022, five monitoring wells (MW29, MW30, ONNI-MW-4, ONNI-MW-5, and ONNI-MW-9) were decommissioned on the Seattle Times Site. The groundwater elevation contour map for the June and December 2022 events are shown on Figures 13 and 14, respectively. Results of the 2022 groundwater monitoring and sampling event are presented below.

* PCE was not present at concentrations exceeding the laboratory reporting limit or cleanup level in groundwater samples collected from wells on the Property or in the ROWs. PCE was detected at a concentration exceeding the cleanup level in monitoring well MW29 in the second quarter 2022.
* TCE was detected at concentrations exceeding the cleanup level in groundwater samples collected from monitoring wells MW04, MW07, MW26 (only during the second quarter 2022), MW27, and MW34. TCE was detected at a concentration exceeding the cleanup level in monitoring well MW29 in the second quarter of 2022.
* cis-1,2-DCE and/or VC were detected at concentrations exceeding the cleanup level in groundwater samples collected from on-Property monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and on-Property injection wells IW04, IW50, and IW61. cis-1,2-DCE and VC were not detected at concentrations exceeding laboratory reporting limits or cleanup levels in groundwater samples collected from the monitoring wells in the ROWs, except for cis-1,2-DCE in monitoring well MW28, which is located in the Thomas Street ROW.

For the second and fourth quarters of 2022, the groundwater elevation contours indicated that groundwater at the Site flowed generally to the southeast. The groundwater flow direction is similar to what was observed prior to the construction dewatering activities for the project northwest of the Property.

A comprehensive discussion of the 2022 groundwater monitoring and sampling events and results, including a statistical analysis to evaluate the stability of the contaminated groundwater plume, is presented in the 2022 Groundwater Monitoring Report (SoundEarth 2023).

### 2023 Second and Fourth Quarter Groundwater Monitoring and Sampling Events

Groundwater monitoring and sampling events were performed in June and December 2023 (second and fourth quarters, respectively). The groundwater elevation contour map for the June and December 2023 events are shown on Figures 15 and 16, respectively. Results of the 2023 groundwater monitoring and sampling event are presented below.

* PCE was detected at a concentration exceeding the cleanup level in groundwater samples collected from on-Property injection well IW50 (only during the second quarter) and monitoring well MW13 located in the Boren Avenue North ROW (only during the second quarter) and monitoring well MW29R, located on the Former Seattle Times Site.
* TCE was detected at concentrations exceeding the cleanup level in groundwater samples collected from on-Property monitoring well MW25 (only during the second quarter); monitoring wells MW04, MW07 (only during the second quarter), and MW27 (only during the second quarter), located in the Boren Avenue North ROW; monitoring well MW26, located in the Harrison Street ROW; monitoring well MW34 (only during the second quarter), located in the Terry Avenue North ROW; and monitoring well MW29R (only during the second quarter), located on the Former Seattle Times Site.
* cis-1,2-DCE and/or VC were detected at concentrations exceeding the cleanup level in groundwater samples collected from on-Property monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and on-Property injection wells IW04, IW50, and IW61. cis-1,2-DCE was also detected at a concentration exceeding the cleanup level in the groundwater sample collected from monitoring well MW29R (only during the second quarter), located on the Former Seattle Times Site. cis‑1,2-DCE and VC were not detected at concentrations exceeding laboratory reporting limits or cleanup levels in groundwater samples collected from the monitoring wells in the ROWs.

For the second and fourth quarters of 2023, the groundwater elevation contours indicated that groundwater at the Site flowed generally to the southeast.

A comprehensive discussion of the 2023 groundwater monitoring and sampling events and results, including a statistical analysis to evaluate the stability of the contaminated groundwater plume, is presented Section 2.0 and in the 2023 Groundwater Monitoring Report (SoundEarth 2024).

# Statistical Trend Analysis

SoundEarth performed a statistical trend analysis to evaluate the trend of concentrations of CVOCs in the groundwater at monitoring wells at the Site for groundwater samples collected between May 2015 and December 2023 (Tables 3 and 3A). In cases where a monitoring well was installed after 2015, the earliest sample results were used to perform the trend analysis. Wells not included in the trend analysis did not contain CVOCs at the concentrations above the laboratory reporting limits or groundwater cleanup levels for the previous four groundwater sampling events. Results from the trend analysis are used to inform the conceptual site model for the Site.

The “target wells” used to perform the trend analyses include:

* On-Property Wells: Monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and injection wells IW04, IW50, and IW61
* ROW Wells: Monitoring wells MW04, MW07, MW13, MW26 through MW28, and MW34
* Former Seattle Times Wells: Monitoring wells MW29 and MW29R

The trend in CVOC concentrations at each target well (i.e., increasing, decreasing, or stable) were analyzed using the Mann-Kendall non-parametric trend analysis method as presented in the EPA *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (Wiedemeier et al. 1998). The trend analysis was performed using EPA Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations dated June 2022 (ProUCL version 5.2.00); CVOC results reported as non-detect were entered at half the laboratory reporting limit to perform the trend analyses.

Results from the trend analyses are summarized in Table 10. The output from the Mann-Kendall trend analysis is provided in Appendix B. The performance of CVOC concentrations over time in the groundwater at the target wells is present in Charts A to Q in Appendix B. A trend analysis for monitoring well MW29 was performed by combining analytical results from monitoring wells MW29 and MW29R, which are located on the Former Seattle Times Site.

## PCE and TCE Trend Analysis

In 2023, PCE was detected at concentrations exceeding the groundwater cleanup level in groundwater samples collected from on-Property injection well IW50 and monitoring well MW13 located in the Boren Avenue ROW, and TCE was detected at concentrations exceeding the groundwater cleanup level in groundwater samples collected from on-Property monitoring well MW25 and monitoring wells MW04, MW07, MW26, MW27, and MW34, located in the ROWs. PCE and TCE concentrations were evaluated for the trend analysis in conjunction with the current footprint of the PCE and TCE groundwater plume originating at source areas located both on and upgradient/cross-gradient from the Property.

As of the fourth quarter of 2023, findings from the PCE and TCE trend analysis are as follows:

* The trend analysis for PCE at on-Property injection well IW50 indicates there is insufficient evidence to identify a significant trend as of the fourth quarter of 2023. In the second quarter of 2023, the concentration of PCE in the groundwater at injection well IW50 was 2.5 times less than the groundwater cleanup level. The fluctuations of PCE concentrations likely result from periodic desorption of PCE from solid phase to the dissolved phase (which is eventually biologically degraded), PCE leaching from the soil due to changes in groundwater elevation, and/or analytical variability. As shown in Chart A, the performance of PCE in groundwater at injection well IW50 has generally declined since January 2017. PCE concentrations were below the laboratory reporting limit or groundwater cleanup level for eight sampling events prior to the fourth quarter of 2023.
* The trend analysis for PCE in the groundwater at monitoring well MW13 located in the Boren Avenue ROW indicates a decreasing in concentration with time. As shown in Chart B, the performance of PCE in the groundwater shows an occasional fluctuation in PCE concentrations but overall decline in concentrations since August 2015. The fluctuations in the PCE concentrations may result from periodic desorption of PCE from solid phase to the dissolved phase, PCE leaching from the soil due changes in groundwater elevation, and/or analytical variability.
* The trend analysis for PCE in the groundwater at monitoring well MW29-29R located on the Former Seattle Times Site indicates the concentration of PCE in the groundwater is stable. As shown in Chart C, the performance of PCE concentrations has declined and has remained relatively constant since October 2019.
* The trend analysis for TCE in the groundwater at monitoring well MW25 located on the Property indicates decreasing concentrations with time. As shown in Chart D, the performance of TCE concentrations has shown a dramatic decline since May 2015.
* The trend analyses for TCE in the groundwater at monitoring wells MW04 and MW07 located in the Boren Avenue ROW indicate decreasing concentrations with time, which was also observed in the fourth quarter of 2022. The performances of TCE in the groundwater over time at monitoring well MW04 and MW07 are shown in Charts E and F.
* Trend analysis for TCE in the groundwater at monitoring well MW26 located in the Harrison Street ROW indicates a decreasing concentration with time. The performance of TCE in the groundwater at monitoring well MW26 over time is shown in Chart G. The trend analysis for the TCE concentrations in the groundwater at monitoring well MW27 located in the Boren Avenue ROW indicates the concentrations of TCE in the groundwater are stable. The performance of TCE in the groundwater at monitoring well MW27 is shown in Chart H.
* The trend analysis for TCE concentrations in the groundwater at monitoring well MW34 located in the Terry Street ROW is stable with time. The performance of TCE in groundwater at monitoring well MW34 is shown in Chart I.
* The trend analysis for TCE in the groundwater at monitoring well MW29-29R located on the Former Seattle Times Site indicates the concentration of TCE in the groundwater is stable. As shown in Chart B, the performance of TCE concentrations has declined and has remained relatively constant since October of 2018.

## Cis-1,2-DCE and VC Trend Analysis

Results of the cis-1,2-DCE and VC trend analyses were evaluated in conjunction with the current footprint of the cis-1,2-DCE and VC groundwater plume originating from the Property. In 2023, cis-1,2-DCE and/or VC were detected at concentrations exceeding the applicable groundwater cleanup level in groundwater samples collected from on-Property monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and injection wells IW04, IW50, and IW61. As of the fourth quarter of 2023, findings from the cis-1,2-DCE and VC trend analysis are as follows:

* The trend analysis for cis-1,2-DCE concentrations in the groundwater at monitoring well MW28 located in the Thomas Street ROW indicates a decreasing trend with time. This condition was also observed in the fourth quarter of 2022. The performance of cis-1,2-DCE in the groundwater at monitoring well MW28 with time is shown in Chart J. The chart shows a dramatic decline in the concentration of cis-1,2-DCE since June 2019. The absence of cis-1,2-DCE and VC suggest conditions in the groundwater are optimum for aerobic biodegradation in this part of the aquifer beneath the Thomas Street ROW.
* The trend analyses for cis-1,2-DCE concentrations in groundwater at on-Property monitoring well MW22 shows an increasing trend with time. The trend analysis for monitoring well MW24 indicates the cis-1,2-DCE concentration in the groundwater is stable. The trend analyses for cis-1,2-DCE concentrations in groundwater at on-Property injection wells IW61 shows an increasing trend with time. The performance of cis-1,2-DCE in the groundwater at monitoring wells MW22, MW24, and IW61 are shown in Charts K, L, and M, respectively. The charts show an increase in cis-1,2-DCE concentrations since July 2016, which is the results of degradation of PCE and TCE to cis-1,2-DCE as anticipated.
* The trend analysis for cis-1,2-DCE concentrations in groundwater at on-Property injection well IW50 indicates a decreasing trend. As shown in Chart A, the performance of cis-1,2-DCE in the groundwater at injection well IW50 shows that concentrations periodically fluctuate with time. The fluctuation may be due to seasonal fluctuations in the groundwater elevation, which results in adsorption and desorption of CVOCs from solid phase to dissolved phase. This periodic desorption leads to a temporary increase in the concentration of 1,2-cis-DCE.
* The trend analysis for cis-1,2-DCE in the groundwater at monitoring well MW29-29R located on the Former Seattle Times Site indicates a decreasing tend. As shown in Chart C, the performance of cis-1,2-DCE concentrations has declined since October 2018.
* The trend analyses for VC concentrations in the groundwater at on-Property monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and injection wells IW04 and IW61 indicate an increasing trend. The concentrations of VC over time at monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and injection wells IW04 and IW61 are shown on Charts K, L, M, N, O, P, and Q. The increase in the concentration of VC with time suggests there is ongoing residual PCE and/or TCE mass at the Property, which degrades to cis-1,2-DCE that then degrades to VC.
* The trend analysis for VC concentrations in groundwater at on-Property injection well IW50 located on the Property indicates an increasing trend. As shown in Chart A, the performance of VC concentration in the groundwater at injection well IW50 occasionally fluctuates with time. The fluctuation may be due to seasonal fluctuations in the groundwater elevation, resulting in adsorption and desorption of CVOCs from solid phase to the dissolved phase. This periodic desorption leads to a temporary increase in the concentration of VC.
* The trend analysis for VC in the groundwater at monitoring well MW29-29R located on the Former Seattle Times Site indicates that trend is undeterminable. As shown in Chart C, the performance of VC concentrations has declined since October 2018.

While the overall statistical trend in VC concentrations on the Property is increasing with time, engineering controls on the Property protect the vapor intrusion pathway, which is documented in the two vapor intrusion studies performed at the Property (SoundEarth 2019).

In areas downgradient of the Property in the Thomas Street ROW and on the Seattle Times Site, VC is absent in the groundwater. These represent optimum conditions to reduce human health risk when considered in conjunction with continued adherence to remediation levels (RLs) for roadway excavation workers to protect the inhalation pathway in the Thomas Street ROW and with RLs and engineering controls to protect the vapor intrusion pathway on the Seattle Times Site.

These conditions support the conclusion that additional active treatment of the groundwater is not warranted since treating residual concentrations of PCE and/or TCE in the ROWs and on the Property would only increase VC concentrations in the groundwater in the ROW and beneath the Seattle Times Site. Given the high solubility, higher toxicity, and greater volatility of VC compared to PCE, TCE, and cis-1,2-DCE, the absence of VC or low concentrations of VC are the preferred conditions for the protection of human health and the environment.

# Conceptual Site Model

This section discusses the components of the conceptual site model (CSM) developed for the Site. Included in the following sections are a discussion of the confirmed and suspected source areas, affected environmental media, fate and transport mechanisms, contaminants of concern, and exposure pathways and potential receptors; an updated Terrestrial Ecological Evaluation (TEE); and a CSM summary. The CSM serves as the basis for developing technically feasible cleanup alternatives and selecting a final cleanup action.

Based on results of the RI, the Property is a confirmed source of CVOCs in groundwater at the Property, in the Boren Avenue ROW, and downgradient of the Property at Seattle Times Site. CVOCs in the groundwater originating from the Property are comingled with yet unknown source area located upgradient and cross gradient from the Property.

The following subsections provide a summary of the likely sources and extents of the COCs on and off the Property that were identified during the RI. Figures 5 through 35 provide visual representations of the information presented below.

## On-Property Confirmed and Suspected Source Areas

### On-Property Chlorinated and Stoddard Solvents in Soil and Groundwater

The results of the RIs and IRAs conducted at the Site indicate that the chlorinated solvent and Stoddard solvent impacts detected in soil and groundwater beneath the Property, in a portion of the south-adjacent Thomas Street ROW, and on the northern portion of the Seattle Times Site are primarily the result of releases from the Troy Laundry facility that operated on the Property from 1927 through 1985. Historical building plans indicate that the bulk of the dry cleaning operations after the mid-1960s were conducted on the southwestern portion of the Property (Figure 2). Consistent with this information, the highest concentrations of chlorinated solvents in soil were historically located near the center of the Property in the vicinity of the former loading dock, and the highest concentrations of GRPH as Stoddard solvent were observed to the south of the three closed-in-place USTs under the former Troy Building on the southwestern portion of the Property. The distribution of solvents in soil and groundwater on the Property and in groundwater in the Thomas Street ROW and on the northern portion of the Seattle Times Site indicates that the primary sources of the releases were located at the loading dock and UST cluster on the Property (Figure 2), although additional smaller releases from other source areas may have contributed to shallow solvent contamination elsewhere on the Property.

#### PCE and TCE in Groundwater

The results of groundwater monitoring events performed prior to implementation of the groundwater treatment program at the Property confirmed that PCE was present at concentrations exceeding the MTCA Method A cleanup level in groundwater samples collected from on-Property monitoring wells MW21 through MW25 and injection well IW61. Since groundwater treatment was implemented in 2015 and 2017, and due to ongoing anaerobic deductive dechlorination, the PCE and TCE plume footprint on the Property has decreased considerably. This decrease is evident when comparing the plume footprint in 2015 (Figure 18) with the plume footprint in 2023 (Figure 32). As of the fourth quarter of 2023, PCE and TCE were not detected at concentrations exceeding the laboratory reporting limit or cleanup levels in groundwater beneath the Property, except for PCE in injection well IW50 and TCE in monitoring well MW25 in the fourth quarter of 2023. Prior to the fourth quarter of 2023, PCE and TCE concentrations in the wells were below cleanup levels for the previous eight rounds of sampling, which suggests this condition is anomalous and likely represents a sampling artifact or temporary desorption of PCE and TCE from the soil to the dissolved phase.

#### cis-1,2-DCE and VC in Groundwater

The presence of cis-1,2-DCE and VC is attributed to anaerobic reductive dechlorination of PCE and/or TCE on the Property, as well as additional TCE from unknown, upgradient off-Property source areas. As anticipated, and as shown in Figures 19 and 33, the cis-1,2-DCE and VC plume footprint has expanded across the Property following implementation of the groundwater treatment program. During the two most recent groundwater monitoring events performed in the second and fourth quarter of 2023, the results of groundwater monitoring sampling at the Property indicate that cis-1,2-DCE and/or VC are present at concentrations exceeding the applicable MTCA Method A and B cleanup levels, respectively, in samples collected from on-Property monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and injection wells IW04, IW50, and IW61.

#### Petroleum Hydrocarbons in Groundwater

The results of groundwater monitoring events performed following treatment of groundwater on the Property indicate that DRPH and/or ORPH were detected at concentrations exceeding the MTCA Method A cleanup levels in groundwater samples collected from on-Property monitoring wells MW18, MW19, and MW21 through MW25.

For DRPH and ORPH, each sample was flagged by the laboratory as having a chromatographic pattern that did not match the fuel standard used for quantification. Additionally, these concentrations were detected in samples collected following the 2015 and 2016 EOS injection events. GRPH concentrations detected in groundwater samples collected from monitoring well MW21 were not flagged by the laboratory; however, GRPH was not detected in groundwater until after the 2016 injection event (groundwater monitoring began in May 2015; Table 4). It is SoundEarth’s opinion that the GRPH, DRPH, and/or ORPH detections are due to the presence of the EOS solution originating from the 2015 and 2016 injection events and are not considered reflective of actual petroleum constituents in groundwater on the Property.

## Off-Property Confirmed and Suspected Source Areas

### PCE in Groundwater

The groundwater beneath adjacent Boren Avenue and Harrison Street ROWs has primarily contained TCE, which has been attributed to a release from yet unknown source areas located upgradient and cross gradient of Property. In this area of the Site, there is comingling of CVOCs originating at the Property and off-property source areas. This conclusion is supported by the presence of PCE in groundwater monitoring wells MW5 (decommissioned in 2015) and MW13 (located at the intersection of Boren Avenue North and Thomas Street) which is RI and Interim Cleanup Action confirmed originated at the Property.

PCE has been detected at concentrations exceeding the MTCA cleanup level in monitoring well MW29 (decommissioned in July 2022) and MW29R, which is located on the northwestern portion of the Seattle Times Site. The presence of PCE in groundwater at monitoring well MW29 and MW29R can be attributed to a release of CVOC at the Property.

### TCE in Groundwater

Groundwater monitoring results have demonstrated that TCE is the primary contaminant of concern in the Boren Avenue North, Harrison Street, and Terry Avenue North ROWs. As of the fourth quarter of 2023, the TCE has been detected at concentrations exceeding the MTCA Method A cleanup level in groundwater samples collected from ROW monitoring wells MW04, MW26, and MW34. TCE in groundwater can primarily be attributed to a release of chlorinated solvents from sources upgradient of the Property, although some TCE may have reached ROWs adjacent to the Property during periods when groundwater flowed northwest. The presence of TCE in the groundwater at monitoring well MW34, located in the Terry Avenue ROW, is unlikely related to release of CVOCs at the Property because the well is located approximately 250 to 300 feet east and hydraulic upgradient of the Property. TCE observed in groundwater collected from monitoring well MW29 (decommissioned in July 2022) and MW29R on the northwestern portion of the Seattle Times Site can be attributed to the degradation of PCE released on the Property following implementation of the groundwater treatment program.

### cis-1,2-DCE and VC in Groundwater

cis-1,2-DCE and VC were not detected at concentrations above laboratory reporting limits and/or MTCA Method A cleanup levels in groundwater collected upgradient of the Property from monitoring wells MW04, MW07, MW13, MW15, MW26, MW27, and MW31, which are in the Boren Avenue North or Harrison Street ROWs. cis-1,2-DCE and/or VC in groundwater on the Property and downgradient of the Property in the Thomas Street ROW and on the northern portion of the Seattle Times Site can be attributed to the degradation of PCE and TCE following implementation of the groundwater treatment program.

As of the fourth quarter of 2023, cis-1,2-DCE and VC were detected at concentrations below the cleanup level in groundwater collected from monitoring wells MW29R and MW35 on the Seattle Times Site. VC was present at concentrations slightly exceeding the MTCA Method A cleanup level in one groundwater sample collected from monitoring well ONNI-MW-5 on the Seattle Times Site during the fourth quarter 2019 sampling event. However, VC was not detected at concentrations above laboratory reporting limits when monitoring well ONNI-MW-5 was initially sampled by Environmental Partners, Inc. n/k/a TRC Companies, Inc. (TRC) in 2018 (EPI 2018) or when resampled by SoundEarth in 2020 and 2021. Monitoring well ONNI-MW-5 was decommissioned in July 2022 during the redevelopment of the Seattle Times Site.

### TCE in Shallow Soil and Perched Groundwater

Prior to redevelopment, shallow CVOC impacts to soil and perched groundwater were present on the central portion of the Property at depths of approximately 20 to 30 feet below ground surface (bgs). Of the 59 borings advanced at the Property, three borings (B21, B22, and B27) were advanced approximately 20 to 40 feet north of the southern boundary of the Property (Figure 4). SoundEarth collected soil samples from the borings at sample depth intervals of 5 to 10 feet to depths ranging from 5 to 110 feet bgs. These soil samples did not contain PCE, TCE, cis-1,2-DCE, or VC at concentrations above laboratory reporting limits, with the exception of one sample collected at 5 feet bgs in boring B21, which contained a PCE concentration of 0.28 milligrams per kilogram (mg/kg). Borings B21, B22, and B27 are located approximately 80 to 90 feet from the Seattle Times Site, with the Thomas Street ROW separating the Property and the Seattle Times Site.

Following redevelopment excavation activities at the Property, 28 confirmation soil samples were collected from the southern sidewall of the mass excavation, adjacent to the Thomas Street ROW, at depths of approximately 5 to 70 feet bgs (27 to 95 feet NAVD88). None of these samples contained CVOCs at concentrations above laboratory reporting limits.

#### TCE in Shallow Soil Beneath the Seattle Times Site

In May 2018, TRC performed a subsurface investigation at the Seattle Times Site. As part of that investigation, 16 soil borings (U1 through U16) were advanced proximate to the former Ink Room, Northern UST Complex and Fuel Dispenser, and Maintenance Garage, which were formerly located on the northern portion of the Seattle Times Site. The USTs were reported to contain waste oils and liquids, heating oil, diesel and gasoline fuel, and petroleum- and solvent-based inks.

Borings U1 through U16 were advanced to depths of 20 to 25 feet bgs. Reconnaissance groundwater samples collected from borings U10 through U13 contained TCE at concentrations ranging from 1.9 to 7.9 µg/L. The reconnaissance groundwater sample collected from boring U11 at a depth of 25 feet bgs contained PCE at a concentration of 1.2 µg/L. A soil sample collected from boring U11 at a depth of 15 feet bgs contained TCE at a concentration of 0.021 mg/kg. Breakdown products of TCE were not detected in the soil and reconnaissance groundwater samples collected from the TRC borings.

Following its 2013 investigation at the Seattle Times Site, TRC concluded that the TCE detected in shallow soil and groundwater originated from a source on the Seattle Times Site and not the Property. In its Limited Subsurface Investigation Report dated August 16, 2013 (EPI 2013), EPI states that “TCE is a known contaminant from the Troy Laundry site adjacent to the north of the subject property; however, a water sample collected from a shallow ground water well installed on the northern property boundary did not contain detectable concentrations of TCE. This suggests that the TCE detected in shallow ground water may be from an on-site source.”

During SoundEarth’s 2019 supplemental monitoring well installation activities, borings B54 and B55 were advanced on the northern portion of the Seattle Times Site and completed as groundwater monitoring wells MW29 and MW30 to depths of approximately 105 feet bgs (0 feet NAVD88) and 106 feet bgs (-1.8 feet NAVD88), respectively. TCE was detected at concentrations exceeding the MTCA Method A cleanup level in two soil samples collected from borings B54 and B55: 0.093 mg/kg and 0.033 mg/kg, respectively. Analytical results for soil samples collected from borings B54 and B55 correspond to analytical results of soil samples collected from borings advanced by EPI in 2018.

The results of the investigations described above confirm that the release of chlorinated solvents on the Property have not impacted shallow soil or shallow groundwater at the Seattle Times Site, based on the following conclusions:

* Prior to redevelopment, shallow groundwater contaminated with PCE and its breakdown products was present at the Property at depths of 20 to 30 feet bgs. However, the shallow groundwater was encountered in only 4 of 59 soil borings near the center of the Property. Shallow groundwater at the Seattle Times Site primarily contains TCE with no breakdown products. If a release at the Property was impacting shallow soil and groundwater at the Seattle Times Site, PCE and its breakdown products would be present in groundwater.
* TCE was detected at depths of 15 to 30 feet bgs in soil samples collected from borings advanced by EPI and SoundEarth at the Seattle Times Site. The borings were advanced proximate to the former Ink Room, Northern UST Complex and Fuel Dispenser, and Maintenance Garage. TCE and/or other solvents were not detected in either: (1) soil samples collected at depths of 5 to 110 feet bgs on the southern portion of the Property from borings B21, B22, and B27; or (2) soil samples collected from the southern sidewall of the redevelopment excavation at depths of 5 to 70 feet bgs. There is no mechanism to transport solvents from the Property to shallow soils on the Seattle Times Site. Therefore, the TCE in the shallow soil at the Seattle Times Site is the result of a release on the Seattle Times Site, most likely from the former Ink Room, Northern UST Complex and Fuel Dispenser, and/or Maintenance Garage.
* The primary solvent of concern in the soil at the Seattle Times Site is TCE, while the primary solvents of concern in soil and groundwater at the Property are PCE and its breakdown products. Because PCE and its breakdown products are not present in the shallow soil at the Seattle Times Site, the source of TCE originated from the Seattle Times Site. This conclusion is supported by the fact that shallow reconnaissance groundwater samples collected by TRC proximate to the former Ink Room, Northern UST Complex and Fuel Dispenser, and Maintenance Garage contained only TCE, not PCE, except for in one reconnaissance groundwater sample collected from boring U11 at a depth of 25 feet bgs.

The TCE impacts identified in the shallow soil on the Seattle Times Site are attributed to a release at the Seattle Times Site and not a release from the Property due to the the horizontal distance between shallow TCE impacts identified on the Seattle Times Site and the TCE originating from the Property, the discontinuous nature of the perched groundwater zone, the elevation change between the Property and the Seattle Times Site, the inferred northwesterly flow of perched groundwater due to local topography, and the lack of a defined transport mechanism.

## Contaminants and Media of Concern

Based on the findings of the RI for the Site, the contaminants of concern at the Site include PCE, TCE, cis-1,2-DCE, and VC in groundwater located beneath the western half of the Property; portions of the north-, west-, and south-adjoining ROWs; and the northern portion of the Seattle Times Site. The CVOCs in groundwater beneath the Site are confirmed to be present at concentrations requiring cleanup in accordance with the AO.

Previous investigations at the Site identified GRPH (as Stoddard solvent), DRPH, and ORPH as contaminants of concern. Petroleum hydrocarbons previously present in soil at the Site were removed during the 2014 to 2015 construction excavation (SoundEarth 2016), with the exception of a small area of inaccessible petroleum-contaminated soil along the northern sidewall along Harrison Street (approximately 10 feet east to west at an approximate elevation of 32 feet NAVD88).

GRPH, DRPH, and ORPH detected in groundwater samples are attributable to the presence of EOS and its polar breakdown products in groundwater. This conclusion is supported by the detection of petroleum hydrocarbons in groundwater samples being flagged by the laboratory as having a chromatographic pattern that did not match the fuel standard used for quantification. In addition, residual petroleum contamination at or outside the Property boundary is in the vadose zone in areas that are fully capped and contained. Therefore, the petroleum hydrocarbon source has been removed or contained, and petroleum hydrocarbons are no longer considered contaminants of concern for the Site. Any residual GRPH present in groundwater can be attributed to residual EOS given the fact that GRPH was not detected in groundwater prior to implementation of the treatment. An example of this condition is the sporadic presence of GRPH in groundwater at monitoring well MW21 (Table 4).

Soil on the Property identified as containing CVOCs at concentrations exceeding cleanup levels was removed during the remedial excavation conducted as part of the IRA, except for a small area of inaccessible CVOC-contaminated soil along the western Property boundary along Boren Avenue North (approximately 100 feet north to south at approximate elevations between 80 and 20 feet NAVD88). Soil is no longer a medium of concern for the Site because CVOC-contaminated soil was removed by mass excavation during redevelopment and residual contaminated soil was capped with the lowest level of the underground parking garage. Any residual CVOC soil contamination that may be present in the ROWs outside the boundaries of the Property are capped by hardscapes (e.g., buildings, concrete, asphalt pavement). Based on analytical results of sidewall soil samples and soil samples collected from soil borings advanced during the IRA, the soil contamination in the ROWs, if present, would only be encountered at depths greater than 15 feet bgs. In accordance with MTCA, a depth of 15 feet bgs is a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface in the ROWs under a construction scenario. Therefore, no human exposure via direct contact or other exposure pathways related to the soil will occur.

The results of SoundEarth’s 2018 and 2019 vapor intrusion assessment demonstrated contaminants of concern were in compliance with applicable MTCA indoor air cleanup levels for indoor air (SoundEarth 2018, 2019). Therefore, the vapor intrusion pathway is incomplete and soil vapor and indoor air are not media of concern for the Troy building.

## Contaminant Fate and Transport of Chlorinated Solvents

This section includes a discussion of the transport mechanisms and environmental fate of chlorinated solvents in the subsurface.

### Transport Mechanisms Affecting Distribution of Chlorinated Solvents in the Subsurface

Chlorinated solvents released to the environment are transported in groundwater in a dissolved phase and in partially saturated and unsaturated soil in a vapor phase. In groundwater, chlorinated solvents are transported through advection and dispersion and in the vapor phase by advection and diffusion.

The primary mechanism for transport of chlorinated solvents originating at the Property is advection and dispersion in groundwater. Transportation of chlorinated solvents in soil vapor at the Property has been eliminated because of the removal of source areas and has been confirmed by the vapor intrusion assessment performed at the Property (SoundEarth 2018, 2019).

PCE and its degradation products in groundwater at the Site have migrated in the direction of groundwater flow by advection and dispersion transport. Given the relatively flat groundwater gradient at the Site and the heterogenous texture of the primary regional water-bearing zone, particularly in the southern half of the Property and beneath the Thomas Street ROW, the footprint of the chlorinated solvent plume has been primarily confined to the Property, to portions of the Thomas Street and Boren Avenue North ROWs, and to the northern portion of the Seattle Times Site.

### Environmental Fate of Chlorinated Solvents in the Subsurface

Once PCE enters the subsurface, chemical attenuation processes such as direct mineralization and reductive dechlorination may cause a natural reduction or breakdown of PCE into nontoxic components such as ethene, ethane, chloride, and carbon dioxide. Biological attenuation processes such as reductive dechlorination may also affect the reduction of PCE in soil and groundwater under conducive subsurface conditions. Degradation of CVOCs also occurs in groundwater as a result of advection and dispersion, sorption, volatilization, and dilution resulting from the exchange of uncontaminated groundwater for contaminated groundwater in the aquifer.

The transport of PCE and its degradation products is retarded in groundwater by adsorption on organic matter in the aquifer and heterogenous soil texture within the regional aquifer. The heterogeneous soil texture beneath the Thomas Street and Boren Avenue North ROWs inhibits the migration of CVOCs in groundwater. Furthermore, the relatively flat groundwater gradient at the Property reduces the downgradient migration of PCE and its degradation products.

An indication of ongoing reductive dechlorination of PCE is the presence of degradation compounds that include TCE, cis-1,2-DCE, trans-1,2-dichloroethene, and VC. The soil and groundwater analytical data for the Site indicate that concentrations of TCE and cis-1,2-DCE have been detected in the vadose zone, the discontinuous perched interval, and the primary regional water-bearing zone beneath the Site, which means that biological and natural attenuation processes are occurring. These findings are consistent with data generated from the borings and wells completed throughout the Site. The implemented groundwater treatment program has enhanced the attenuation of PCE and its degradation products occurring in groundwater beneath the Property and enhanced the degradation of the off-Property groundwater contamination migrating towards the Site.

### Enhanced Reductive Dechlorination

The implementation of ERD at the Site enhanced the degradation of PCE and its degradation products by producing anaerobic conditions in groundwater. These conditions, compared to baseline conditions, are represented by low concentrations of dissolved oxygen, negative oxidation-reduction potentials, an increase in the concentrations of fatty acids, a reduction of sulfate and ferric iron, and an increase in the concentrations of methane and ethene. As the EOS carbon substrate is depleted, the groundwater chemistry will revert to aerobic conditions that are more conducive to the intrinsic mineralization of low concentrations of VC in groundwater to nontoxic end products like ethene, carbon dioxide, water, and chloride. The literature indicates the first order decay rate of VC under aerobic conditions is 1.5 to 2 orders of magnitude greater than that under anaerobic degradation (US Geological Survey 2012).

Currently, groundwater geochemistry indicates anaerobic conditions are present on the Property, as does the continued degradation of cis-1,2-DCE to VC. Off-property concentrations of TCE in the ROWs remain relatively stable as a result of the aerobic condition of the groundwater, which has also promoted the aerobic degradation of cis-1,2-DCE and VC in groundwater beneath the ROWs. Given the high solubility and greater volatility of VC compared PCE, TCE, and cis-1,2-DCE, the absence of VC is the preferred condition for the protection of human health and the environment.

## Exposure Pathways and Potential Receptors

This section discusses the confirmed and potential human health and ecological exposure pathways at the Site with the goals of: (1) identifying those pathways requiring remediation to reduce or eliminate risks to human health or the environment; and (2) applying the findings to the development of feasible remedial technologies. Pathways associated with each media of potential concern are described below.

### Exposure Pathways: Soil

The IRA and subsequent redevelopment of the Property eliminated soil as a medium of concern at the Site. At a few locations on the western and northern Property boundaries, one or more CVOCs were detected at concentrations slightly exceeding applicable cleanup levels. However, the mechanisms for exposure to COCs in the soil have been eliminated.

* **Direct Contact Pathway:** The direct contact/ingestion pathway for soil is not complete because the mass excavation during the IRA removed the majority of contaminated soil. The remaining soil on the Property was capped with five levels of underground parking and adjacent ROWs are capped with hardscapes (e.g., concrete and asphalt pavement).
* **Inhalation Pathway:** The inhalation pathway is not complete because residual CVOC concentrations in soil were mitigated by engineering controls, including a vapor barrier beneath the lowest level of the underground parking garage and a continuously operating HVAC system in the parking garage. The vapor intrusion assessment conducted at the Property confirmed that the inhalation pathway for soil is not complete.
* **Soil to Groundwater Leaching Pathway:** The soil to groundwater leaching pathway is not complete. The pathway was eliminated by mass removal of the soil during redevelopment and the capping of the soil with the underground parking garage. The paved hardscapes in the ROWs have minimized the potential for infiltration of surface water into the soil underlying the Site.

Soil samples collected from borings advanced in the ROWs adjacent to the Property either do not contain COCs at concentrations above applicable soil cleanup levels or contain contaminated soil at a depth greater than 15 feet bgs (mainly in the primary regional water-bearing zone). Per WAC 173-340-740(6)(d), a depth of 15 feet bgs is a reasonable estimate of the depth of soil that could be excavated and disturbed in the ROWs under a construction scenario.

### Exposure Pathways: Groundwater

The IRA and subsequent redevelopment of the Property eliminated exposure to potentially contaminated shallow perched groundwater and deep groundwater in the primary regional water-bearing zone. Perched groundwater on the Property was removed during the mass removal of soil during redevelopment. Perched groundwater containing CVOCs has not been identified in any areas outside the boundaries of the Property.

The primary regional water-bearing zone at the Site contains one or more CVOCs at concentrations exceeding the cleanup levels presented in the AO. However, the mechanisms for exposure to CVOCs in groundwater at the Site have been eliminated:

* **Direct Contact Pathway**: The direct contact pathway for groundwater is not complete because groundwater containing CVOCs in the primary regional water-bearing zone occurs at depths of at least 60 to 80 feet bgs. Any direct contact with groundwater during groundwater sampling events will be mitigated using personal protective equipment. Future institutional controls will prohibit beneficial use of or access to groundwater at the Site.
* **Inhalation Pathway**: The inhalation pathway at the Property is not complete because of the underground parking garage cap, the presence of a vapor barrier beneath the lowest parking level, and a continuously operating HVAC system in the parking garage. The inhalation pathway in the ROW is not complete for roadway excavation workers because the CVOC concentrations detected in groundwater samples collected from the ROWs do not exceed the proposed groundwater RLs for roadway excavation workers for the inhalation pathway. The proposed RLs for roadway excavation workers are presented in Table 5-2.
* There is no inhalation pathway for the Seattle Times Site because the concentration of CVOCs, except for TCE, in groundwater beneath the Seattle Times Site do not exceed the proposed groundwater commercial RLs for the inhalation pathway. In the second quarter of 2022, TCE was detected at a concentration exceeding the proposed groundwater RL for a commercial worker in a sample collected from monitoring well MW29 (decommissioned in July 2022). In 2023, PCE, TCE, and cis-1,2-DCE were not detected at concentrations exceeding the proposed RL for a commercial worker in a sample collected from monitoring well MW29R. The new building design for the Seattle Times Site includes five levels of underground parking and a sub-slab vapor barrier that covers the footprint of the building. These engineering controls will further eliminate the inhalation pathway on the Seattle Times Site. The proposed RLs for a commercial worker are presented in Table 5-2.
* **Ingestion Pathway**: The ingestion pathway for groundwater is not complete for the Site because groundwater at the Site is not a source of drinking water. Further, groundwater at the Site will never be used for a drinking water supply, as outlined in Section 3.8, Regional Aquifer Determination. In addition, an environmental convent will be placed on the Seattle Times Site following completion of remedial activities.

### Exposure Pathway: Soil Vapor

The IRA and subsequent redevelopment of the Property eliminated contaminated soil and groundwater vapor as media of concern at the Property. In March 2018 and February 2019, SoundEarth conducted a soil vapor intrusion assessment and supplemental vapor intrusion assessment for air in the on-Property building and for ambient outdoor air (SoundEarth 2018, 2019). The results of the indoor and outdoor air sampling demonstrated that contaminants of concern complied with indoor air cleanup levels. In a letter dated July 8, 2019, Ecology confirmed that no further assessment of indoor air quality at the Troy building is required based on the results of the vapor intrusion assessments (Ecology 2019).

## Terrestrial Ecological Evaluation

A TEE is required by WAC 173-340-7940 at locations where a release of a hazardous substance to soil has occurred. The TEE is intended to assess potential risk to plants and animals that live entirely or primarily on affected land. The TEE takes into account the Site area, Site land use, Site habitat quality, likelihood that the Site will attract wildlife, and CVOCSs occurring in Site soil.

The Site qualifies for a TEE exclusion per WAC 173-340-7491(1)(a)(b) on the basis that soil contamination occurs at a depth of at least 15 feet bgs and is covered by physical barriers that prevent exposure to plants and wildlife (Appendix D of the Final RI Report [SoundEarth 2020]). No further consideration of ecological impacts is required under MTCA.

## CSM Summary

The nature and extent of the CVOC plume originating from the Property has been fully delineated. Analysis of CVOC concentrations in groundwater identified beneath the Boren Avenue North and Harrison Street ROWs, located upgradient of the Property, and in shallow perched soil and groundwater on the south-adjacent Seattle Times Site, indicate that these impacts are not related to a source originating from the Property. However, as shown on Figure 34, the portion of the Boren Avenue North and Harrison Street ROWs in the vicinity of monitoring wells MW04, MW07, MW26, and MW27 has been identified as an area where potential commingling of CVOC impacts originating from the Property and TCE impacts originating upgradient or cross-gradient of the Property has occurred.

As shown of Figure 34, as of the fourth quarter of 2024, the CVOC plume originating from the Property has migrated west beneath the Boren Avenue North ROW, south-southeast beneath Thomas Street ROWs, and south beneath the northwestern portion of the Seattle Times Site. On the Property, the cross-gradient eastern extent of the CVOC plume is bounded by monitoring wells MW17 and MW20 and injection well IW91. West of the Property, in the Boren Avenue North ROW, the Troy CVOC plume is bounded monitoring wells MW04, MW07, MW13, and MW27. At monitoring wells MW04, MW07, and MW27, the CVOC plume is comingled with TCE originating from a yet unknown upgradient source area. The downgradient southern extent of the CVOC plume is bounded by monitoring well MW35 located on the northwestern portion of the Seattle Times Site.

The IRA, engineering controls, and natural attenuation processes have eliminated the direct contact, ingestion, and inhalation pathways at the Site. Long-term groundwater monitoring will continue to ensure that residual contamination in groundwater at the Site does not pose a threat to human health or the environment.

## Regional Aquifer Determination

The regional aquifer beneath the Site is not considered a current or future source of drinking water under Section 12.32.10 (A) of Title 12 of the King County Board of Health; the King County Coordinated Water Supply Plan; and Chapter 70.116 of the Revised Code of Washington (RCW 70.116). Further, the regional aquifer is not considered a drinking water source by the City of Seattle.

The lines of evidence to support these conclusions are summarized below, followed by a discussion of applicable or relevant and appropriate requirements (ARARs) in Section 4.0 that restrict the domestic use of groundwater in the South Lake Union neighborhood where the Site is located.

### Site-Specific Considerations

The main conditions considered for the determination that groundwater beneath the Site is not and will not be used for domestic consumption are presented below.

* **Site Groundwater as a Drinking Water Source.** The groundwater at the Site does not serve as a current source of drinking water. A total of 70 percent of the drinking water for the City of Seattle is sourced from the municipal Cedar River and South Fork Tolt River watersheds located in King County. Chester Morse Lake, located in the upper region of the Cedar River, supplies the remaining 30 percent of drinking water to the City of Seattle. The City of Seattle municipal water supplies serve more than 1.4 million people in the Puget Sound area and will do so for the foreseeable future. Regulations exist that prohibit the installation of domestic drinking water wells in the City of Seattle (see below).
* **Location of Drinking Water Supplies for the City of Seattle.** Ecology’s website currently indicates that there are no drinking water supply wells within 1 mile of the Site (Ecology 2023). The nearest public water supply wells are located approximately 20 miles south of the Site and are operated by the City of Seattle during the summer only. These wells are too distant to have influence on groundwater beneath the Site or in the South Lake Union neighborhood. Furthermore, the public water supply wells are screened in a different geological formation as the Highline Intermediate and Deep Aquifers. The uppermost aquifer in the well field is Vashon Stade Advanced Outwash (Qva) and occurs approximately 250 to 400 feet above mean sea level (approximately NAVD88 246 to 396 feet).

The following additional rules and regulations are in place that prohibit the use of groundwater for domestic consumption at the Site and in the South Lake Union neighborhood:

**Section 12.32.10 (A) of Title 12 of the King County Board of Health:** Users of water at the Site and throughout the City of Seattle are required to connect to an existing public water supply system under Section 12.32 (1a, b, and c) (2)(3).

**WAC 246-290 and 246-291, Public Water Systems:** Domestic water is supplied to the Site and the South Lake Union neighborhood by an Ecology-approved Group A Water Supply System managed by the City of Seattle.

**King County Coordinated Water Supply Plan (RCW 70.116):** Regional groundwater beneath the Site and the South Lake Union neighborhood is not part of an approved Coordinated Water Supply System Plan in King County. Therefore, the neighborhood’s groundwater is not considered a critical water supply by the county.

**WAC 173-160, Well Construction Standards:** Domestic drinking water wells cannot be located within a certain minimum distance of known potential sources of contamination such as hazardous waste sites like those present in the South Lake Union neighborhood (WAC 173-360-171[3][a][iv]).

### Criteria for Not Designating Site Groundwater as a Source of Drinking Water

The regional aquifer does not serve as a current or and will not serve as a future source of drinking water. Specifically:

* There are no known uses of groundwater from the regional aquifer beneath the Site and the South Lake Union neighborhood for drinking water purposes.
* The City of Seattle’s municipal watershed system is located well outside the city limits and will continue to be so for the foreseeable future. The nearest domestic water supply wells are located 20 miles south of the Site.
* The regional aquifer beneath the Site is hydraulically connected to Elliott Bay, which is a saline surface water body that is not suitable as a source of domestic water.
* There are no drinking water wells located in the vicinity of the Site or that are hydraulically connected to the Site.

# Applicable or Relevant and Appropriate Requirements

Under WAC 173-340-351 and 173-340-710, other applicable laws (ARARs) include regulatory cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that specifically address a contaminant, remedial action, location, or other circumstances at a site. Remedial actions conducted under MTCA must comply with the substantive requirements of the ARARs but are exempt from their procedural requirements (WAC 173-340-710[9]).This exemption applies to state and local permitting requirements under the Washington State Water Pollution Control Act, Solid Waste Management Act, Hazardous Waste Management Act, Clean Air Act, State Fisheries Code, and Shoreline Management Act.

ARARS were screened to assess their applicability to the Site. Table 4-1 summarizes the preliminary ARARs for the Site.

**Table 4-1: Preliminary ARARs for the Site**

| **Preliminary ARAR** | **Citation or Source** |
| --- | --- |
| MTCA Statute | RCW 70A.305 |
| MTCA Cleanup Statute and Regulation | WAC 173-340 |
| State Group A Public Water Supplies | WAC 246-290 |
| Ecology, Toxics Cleanup Program (Guidance to Be Considered) | *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*, Review DRAFT, October 2009, Publication No. 09-09-047 |
| State Environmental Policy Act | RCW 43.21C |
| State Uniform Environmental Covenants Act | RCW 64.70 |
| King County Board of Health | Title 12, Section 12.32.10 (A) |
| Federal Clean Water Act | 33 United States Code (USC) 1251 et seq. |
| State Water Pollution Control Act | RCW 90.48 |
| Comprehensive Environmental Response, Compensation, and Liability Act of 1980 | 42 USC 9601 et seq. and Part 300 of Title 40 of the Code of Federal Regulations (40 CFR 300) |
| The Fish and Wildlife Coordination Act | 16 USC 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401 |
| Endangered Species Act | 16 USC 1531 et seq.; 50 CFR 17, 225, and 402 |
| Native American Graves Protection and Repatriation Act | 25 USC 3001 through 3013; 43 CFR 10 and Washington’s Indian Graves and Records Law (RCW 27.44) |
| Archaeological Resources Protection Act | 16 USC 470aa et seq.; 43 CFR 7 |
| Washington Dangerous Waste Regulations | WAC 173-303 |
| Solid Waste Management Act | WAC 173-304 and 173-351 |
| Indian Graves and Records | RCW 27.53 |
| Human Remains | RCW 68.50 |
| Abandon and Historic Cemeteries and Graves | RCW 68.60 |
| Occupational Safety and Health Administration Regulations | 29 CFR 1910 and 1926 |
| Washington Department of Labor and Industries Regulations | WAC 296 |
| Water Quality Standards for Ground Water | WAC 173-200 |
| Department of Transportation Hazardous Materials Regulations | 40 CFR 100 through 185 |
| Washington State Water Well Construction Act | WAC 173-160 |
| City of Seattle regulations, codes, and standards | All applicable or relevant and appropriate regulations, codes, and standards |
| King County regulations, codes, and standards | All applicable or relevant and appropriate regulations, codes, and standards |

# Cleanup Standards for the Site

The selected cleanup standards for the Site must comply with the MTCA cleanup regulations specified in WAC 173-340, applicable state and federal laws, and the remedial action objectives (RAOs) as presented in Section 5.1, Remedial Action Objectives.

### Groundwater Cleanup and Remediation Levels

Cleanup levels are based on the protection of human health and the environment from all applicable exposure pathways and receptors, considering the most beneficial use of groundwater in the regional aquifer beneath the Site. The proposed groundwater RLs are based on the protection of the inhalation pathway for commercial workers at the Property and for roadway excavation workers in the ROWs.

The following pathways were considered for the establishment of groundwater cleanup levels and proposed RLs at the Site:

* **Protection of drinking water.** The default assumption under MTCA is that the most beneficial use of groundwater is for human consumption. Groundwater in the regional aquifer beneath the Site is not currently and is unlikely to become a source of drinking water for the City of Seattle based on previous discussion in Section 3.8. Because there is no ingestion pathway for groundwater beneath the Site, groundwater cleanup levels under WAC 173-340-720(3) and (4) for this exposure pathway are not applicable.
* **Protection of indoor air**. A vapor intrusion assessment was conducted at the Property in 2018 and 2019. Results of that assessment indicated that CVOCs and petroleum hydrocarbons were detected at concentrations below MTCA residential indoor air cleanup levels and indoor RLs for commercial workers in indoor air (SoundEarth 2018, 2019). In addition, CVOCs were detected at concentrations below the proposed RLs in groundwater samples collected from the ROWs, which is protective of the inhalation pathway for roadway excavation workers in the ROWs. Based on a review of the indoor air results, Ecology has confirmed that the analytical results demonstrated the contaminants of concern complied with MTCA and that no further assessments are necessary (Ecology 2019).
* **Protection of surface water resources**. Although the regional aquifer flows toward Elliott Bay, the southern boundary of the CVOC groundwater plume is defined by monitoring well MW35 located on the northwestern portion of the Seattle Times Site (Figure 34). Therefore, surface water resources are protected for human health (via the consumption of aquatic organisms) and ecological receptors.
* **Protection of sediment quality.** Given the stability of the CVOC plume at the Site and the Site’s distance from Elliott Bay, CVOC-contaminated groundwater originating at the Site would not impact sediment quality. Also, CVOCs are not regulated under the Sediment Management Standards (WAC 173-204) due to chemical properties that prevent CVOCs from partitioning into sediments.

### Potential Promulgated Standard for the Site

Because groundwater beneath the Site will not be used for domestic consumption and the overall footprint of the CVOC groundwater plume is stable, the following ARARs were used to identify concentrations that may serve as groundwater cleanup levels for the Site:

* Surface Water Cleanup Standards, MTCA: WAC 173-730(3)
* Washington State Surface Water Quality Standards: WAC 173-201A
* Washington State Group A Public Water Supplies: WAC 246-290
* MTCA Regulation: WAC 173-340-355
* MTCA Regulation: WAC 173-340-720 (3)(4)
* National Toxics Rule: 40 CFR 13
* Federal Clean Water Act Regulation 304

### Groundwater Cleanup and Proposed Remediation Levels

Because groundwater is the only media of concern at the Site, groundwater cleanup levels and proposed RLs have been established to demonstrate that contaminants of concern comply with MTCA cleanup standards. The groundwater cleanup levels and proposed RLs are presented in Tables 5-1 and 5-2, respectively.

Groundwater cleanup levels will be applied to CVOCs at the conditional point of compliance (CPOC) for the Site, as discussed in Section 5.2. The proposed groundwater RLs will apply to commercial workers at the Property and roadway excavation workers in the ROWs, respectively. The proposed groundwater RLs are based on the protection of inhalation pathway. Groundwater cleanup levels and proposed RLs for the Site are as follows:

**Table 5-1: Groundwater Cleanup Levels**

|  |  |  |
| --- | --- | --- |
| **Contaminant of Concern** | **Cleanup Level** (µg/L) | **Regulations** |
| PCE | 5 | MTCA Method A, WAC 173-340-720 and table values in Cleanup Levels and Risk Calculation (CLARC) |
| TCE | 5 |
| cis-1,2-DCE | 16 | MTCA Methods A and B, WAC 173-340-720 and table values in CLARC |
| VC | 0.2 |

**Table 5-2: Proposed Groundwater RLs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Contaminant of Concern** | **Commercial Worker Groundwater RLs at the Property** (µg/L) | **Roadway Excavation Worker Groundwater RLs in the ROWs** (µg/L) | **Regulations** |
| PCE | 120 | 760 | Table values in CLARC, Ecology’s *Guidance for Evaluating Vapor Intrusion in Washington State: Investigation and Remedial Action* dated 2009, revised 2022 (Ecology 2009), and Ecology’s South Lake Union Group Memorandum (Ecology 2022a) |
| TCE | 12 | 40 |
| cis-1,2-DCE | 1,600 | 10,000 |
| VC | 1.6 | 9.9 |

## Point of Compliance

The point of compliance is the location where the cleanup levels that are set in accordance with WAC 173‑340 will be measured and cannot be exceeded. Once the cleanup levels have been attained at the defined points of compliance, the impacts present beneath the Site will no longer be considered a threat to human health or the environment.

The standard point of compliance for groundwater under MTCA is “throughout the site from the uppermost level of the saturated zone extending vertically to the lowest depth which could potentially be affected by the site” (WAC 173-340-720 [8]). However, per MTCA (WAC 173-340-720[8]), where it can be demonstrated that it is not practicable to meet the cleanup levels throughout the Site in a reasonable restoration time frame, and/or it is not technically possible to design, construct, and implement a reliable and cost-effective remedy to clean up the entire Site, a CPOC may be approved by Ecology.

For the Site, a CPOC is warranted because it is not practicable to meet the cleanup levels throughout the Site because there is an ongoing upgradient source of TCE commingling with the CVOC plume originating from the Property. This source of TCE will continue to impact groundwater quality beneath the Boren Avenue North and Harrison Street ROWs and the Property for the foreseeable future.

The CPOCs for the Site will be established at the following monitoring wells:

* MW04, MW07, and MW27
* MW26
* MW28
* MW29R and MW35

Compliance groundwater monitoring and sampling for the Site will be performed at monitoring wells where CVOCs were detected at concentrations exceeding groundwater cleanup levels). The groundwater compliance monitoring and sampling well network will include:

* MW18, MW19, MW21, MW22, MW23, MW24, MW25, IW04, IW50, and IW61 on the Property
* MW04, MW07, MW13, and MW27 in the Boren Avenue North ROW
* MW26 in the Harrison Street ROW
* MW28 in the Thomas Street ROW
* MW29R and MW35 on the Former Seattle Times Site (see Appendix A for monitoring well construction logs)

Groundwater monitoring events will be performed semiannually for the first 2 years (2024 and 2025). If the plume under the Troy Laundry building, the ROWs, and Former Seattle Time Site is stable or decreasing based on statistical trend analyses, the frequency of monitoring may be reduced to annual (alternating between June [second quarter] and December [fourth quarter]) for the third, fourth, fifth, sixth, and seventh years. Long-term groundwater monitoring and sampling and statistical evaluation will be performed in consultation with Ecology.

Regulatory compliance with MTCA groundwater cleanup standards at the Site will be achieved when CVOCs are detected at concentrations below cleanup levels (Table 5-1) in groundwater samples collected from the CPOCs wells (MW04, MW07, MW26, MW27, MW28, MW29R, and MW35) for four consecutive groundwater monitoring events. At that time, SoundEarth will consult with Ecology regarding the necessity for ongoing compliance groundwater monitoring and sampling as part of the periodic review process. Groundwater compliance for protection of the inhalation pathway for commercial workers at the Property and the roadway excavation workers in the ROWs is achieved when CVOCs are detected at concentrations below the proposed RLs in samples collected during four consecutive groundwater monitoring events (Table 5-2).

As of the second and fourth quarters of 2023, VC was detected at concentrations exceeding the proposed commercial worker RL in select groundwater monitoring wells located on the Property. However, results of SoundEarth’s 2018 and 2019 vapor intrusion assessment have demonstrated that contaminants of concern are in compliance with applicable MTCA indoor air cleanup levels for indoor air (SoundEarth 2018, 2019). CVOCs have not been detected at concentrations exceeding the proposed roadway excavation worker RL since implementation of the IRA.

## Environmental Justice

SoundEarth conducted an evaluation of potential impacts to likely vulnerable populations and overburdened communities in the vicinity of the Site in accordance with Ecology’s *Implementation Memorandum No. 25: Identifying Likely Vulnerable Populations and Overburdened Communities under the Cleanup Regulations* dated January 2024 (Memorandum No. 25). The purpose of this evaluation is to identify and reduce the impact of environmental and health disparities in Washington State, to improve the health of Washington State residents, and to support Ecology’s determinations regarding site prioritization, cleanup decisions, and site hazard rankings.

In accordance with Memorandum No. 25, potentially exposed populations are likely to include vulnerable populations or overburdened communities if the population meets any of the following criteria:

* The potentially exposed population is located in a census tract that ranks a 9 or 10 on the Environmental Health Disparities Index from the Washington State Department of Health’s Environmental Health Disparities Map (EHD Map).
* The potentially exposed population is located in a census tract that is at or above the 80th Washington State percentile of the Demographic Index from the EPA’s Environmental Justice Screening and Mapping Tool (EJ Screening Tool); or
* The potentially exposed population is located in a census tract that is at or above the 80th Washington State percentile of the Supplemental Demographic Index from the EJ Screening Tool.

SoundEarth used the EPA EJ Screening Tool and the Washington State Department of Health Environmental Health Disparities Map (WA DOH Map) to evaluate whether vulnerable populations are present in the vicinity of the Site. The EJ Screening Tool considers 13 environmental justice indexes and supplemental indexes reflecting 13 environmental indicators. According to the EPA guidance regarding use of the EJ Screening Tool, areas with index scores exceeding the 80th percentile nationally should be considered as potential candidates for further review, including considering other factors and sources of information such as health-based information, local knowledge, proximity and exposure to environmental hazards, susceptible populations, unique exposure pathways, or other environmental and socioeconomic information. SoundEarth used the EJ Screening Tool to evaluate the census track containing the Site and surrounding area (census track 73.03), which comprise a portion of the census tracts evaluated by the WA DOH Map and represent a total population of approximately 1,240 residents.

Results from the EJ Screening Tool for communities in the vicinity of the Site indicate that environmental justice index scores exceeded the 80th percentile nationally for only 1 of the 13 indexes, identified as Air Toxics Cancer Risk. Environmental justice indexes exceeded the statewide 80th percentile for 8 of the 13 indexes, including diesel particulate matter, air toxics risks, traffic proximity, proximity to Superfund sites, proximity to hazardous waste facilities, and proximity to UST facilities.

The EJ Screening Tool also includes seven socioeconomic indicators for factors including demographics, income, employment, language barriers, education, and age. These indicators provide additional information on whether a community may be more vulnerable to environmental impacts. The EJ Screening Tool socioeconomic indicator scores for the communities in the vicinity of the Site were generally consistent with or less than indicator scores for the City of Seattle as a whole, indicating that communities proximate to the Site are not more vulnerable to environmental harms due to socioeconomic factors.

The WA DOH Map is an interactive mapping tool that compares communities across the state for environmental health disparities. It shows pollution assessments such as diesel emissions and ozone, proximity to hazardous waste sites, and measures like poverty and cardiovascular disease. The WA DOH Map was used to evaluate census track 73.03 comprising the Site and surrounding area. Results from the WA DOH Map indicate that census tracts comprising the Site and surrounding area are ranked 8 out of 10 and 9 out of 10 for potential environmental health disparities, evaluated based on environmental exposures, environmental effects, socioeconomic factors, and sensitive populations. However, the WA DOH Map indicates that the same census tract scores 5 out of 10 for environmental risk due to socioeconomic factors, indicating that communities in the vicinity of the Site generally are at low to moderate risk of environmental harms due to factors such as education, income, housing costs, unemployment, and transportation expenses.

Based on the above analysis, the Site is in proximity to vulnerable populations and overburdened communities. However, these results are generally consistent with the results for the City of Seattle as a whole, indicating that the potentially exposed populations proximate to the Site generally are not more vulnerable or overburdened than other populations in the City of Seattle. Significantly, the highest index scores for potentially exposed populations proximate to the Site are attributable to emissions from heavy vehicle traffic due to the location of the Site in a highly developed urban area proximate to major roadways.

Based on the results from the EJ Screening Tool evaluation, review of the WA DOH Map, and the location of the Site in a highly developed area in the City of Seattle, further evaluation of the impact of the Site on environmental justice factors is not warranted. Although the threshold determination does not indicate that vulnerable populations or overburdened communities were impacted by the Site contamination, redevelopment and cleanup activities at the Site have protected human health and the environment and eliminated the potential exposure of hazardous substances attributed to the Site to all human receptors, including vulnerable populations and overburdened communities.

## Climate Change

In accordance with WAC 173-340-350(6)(f), SoundEarth evaluated current and projected local and regional climatological characteristics to determine whether these characteristics could affect the migration of hazardous substances or the resilience of cleanup action alternatives for the Site. According to Ecology’s Sustainable Remediation: Climate Change Resiliency and Green Remediation dated November 2017, revised January 2023 (Ecology 2017; Ecology Climate Guidance), sea level rise, flooding, extreme precipitation, wildfires, landslides and erosion, and drought are the climate-related impacts that generally pose the highest potential risk for upland cleanup sites. Based on this evaluation and the location of the Site in a highly developed area in Seattle, current and projected local and regional climatological characteristics are not anticipated to affect the migration of hazardous substances or the resilience of cleanup action alternatives at the Site. A summary of this evaluation is presented in the following sections.

## Sea Level Rise

The Site is located at an elevation of approximately 80 feet NAVD88 and approximately 1,500 south of Lake Union. The Lake has an elevation of approximately 30 feet NAV88. According to the Ecology Climate Guidance, high projections estimate up to 4 feet of sea level rise by the year 2100. The water level of Lake Union is controlled at an elevation of approximately 20 to 22 feet above sea level, and the high projections for sea level rise would remain less than the height of the dam that regulates the water level of Lake Union. Sea level rise likely would not affect the surface elevation of Lake Union and as a result is not likely to affect the migration of hazardous substances or the resilience of cleanup action alternatives at the Site.

## Flooding

SoundEarth reviewed Federal Emergency Management Agency flood maps for the area in the vicinity of the Site, which indicated that the Site is in an area of minimal flood hazard. As described above, sea level rise is not anticipated to affect the Site, and inundation due to sea level rise is not a concern. In addition, the water level of Lake Union is maintained at a consistent elevation by a dam and spillway and is unlikely to cause flooding in the surrounding area. The completed redevelopment of the Site consists of a building that covers almost the entire ground surface. Based on these conditions, flooding is not likely to affect the migration of hazardous substances or the resilience of cleanup action alternatives at the Site.

## WildFires

The Ecology Climate Guidance indicates there is an increased risk of wildfires which is a potential climate related hazard in areas proximate to forests or grasslands. Due to the location of the Site in a highly developed area of Seattle, the risk of wildfires is unlikely.

## Landslide and Erosion

The Site is located in a relatively flat and highly developed area of Seattle, with minimal exposed ground surface that could create a landslide or erosion hazard. Due to the flat and highly developed nature of South Lake Union and much of the ground surface in the vicinity of the Site, there is an extremely low risk of landslides and erosion.

# Technical Elements

RAOs are used to define the technical elements of the technology screening and to select remedial alternatives for detailed evaluation of remedial alternatives for the Site. The technical elements address ARARs, contaminants of concern, media of concern, and cleanup standards applicable to the Site.

## Remedial Action Objectives

RAOs are statements of the goals that a remedial alternative should achieve to be retained for further consideration as part of the FS. The purpose of establishing RAOs for a site is to provide remedial alternatives that protect human health and the environment (WAC 173-340-351). In addition, RAOs are designed to:

* Implement administrative principles for cleanup (WAC 173-340-130).
* Meet the requirements, procedures, and expectations for conducting an FS and developing cleanup action alternatives, as discussed in WAC 173-340-351 through 173-340-370.
* Develop cleanup levels (WAC 173-340-700 through 173-340-760) and remedial alternatives that are protective of human health and the environment.

RAOs must address the following threshold requirements from WAC 173-340:

* Protect human health and the environment.
* Comply with cleanup levels.
* Comply with applicable state and federal laws.
* Provide for compliance monitoring.

# Feasibility Study

The purpose of this FS is to develop and evaluate cleanup action alternatives to facilitate selection of the final cleanup action at the Site in accordance with WAC 173-340-351. This FS includes screening of potentially feasible remedial technologies and development of cleanup action alternatives intended to achieve the objectives described in Section 6.1, Remedial Action Objectives. The cleanup action alternatives are evaluated with respect to threshold and other requirements for cleanup actions set forth under MTCA.

This FS evaluates the cleanup action alternatives and identifies those that are not effective, not technically possible, or whose costs are disproportionate under the provisions of WAC 173-340-360(5). The FS also provides the basis for identifying a preferred cleanup action alternative. Details regarding the implementation of the selected cleanup action alternative for the Site will be documented in a Cleanup Action Plan.

## Expectations for Chlorinated Solvent Cleanup Sites

Following completion of the IRA, the cleanup of the Site involves remediation of residual CVOCs in groundwater. Full restoration is often not possible at sites with CVOC contamination in groundwater due to many factors, including depth of the contamination, varying hydraulic conditions, persistence in low permeability layers, and limitations of remedial technologies (Kavanaugh, Michael C. and Rao P. Suresh C. 2003; Interstate Technology & Regulatory Council 2002). As early as 1993, the US Environmental Protection Agency (EPA) recognized the difficulty of degradation of residual concentrations of cis-1,2-DCE and VC after implementation of ERD technologies (e.g., establishment of conducive geochemical conditions and presence of Dehalococcoides genus [DHC] bacteria to promote complete reductive dechlorination). In these circumstances, further degradation of residual concentrations of cis-1,2-DCE and VC becomes technically impracticable, and existing technologies are unable to achieve full compliance with applicable cleanup standards within a reasonable restoration time frame (EPA 1993).

## Identification and Evaluation of Technologies

Remedial components (technologies) were evaluated with respect to the degree to which they comply with the cleanup requirements set forth in MTCA. A cleanup action alternative must satisfy all the minimum threshold requirements for RAOs, as outlined in Section 5.1. WAC 173 340-360 (3) also requires the cleanup action alternative to:

* Use permanent solutions to the maximum extent practicable.
* Provide for a reasonable restoration time frame.
* Consider public concerns on the proposed cleanup action alternative.

Using the above criteria, remedial technologies were evaluated and screened for effectiveness, ability to implement, and relative cost. SoundEarth produced a short list of these remedial technologies for further inclusion in the development of cleanup action alternatives. Table 11 summarizes the remedial component screening process.

The remedial technologies that passed the screening process include the following:

* **Reductive Dechlorination (Anaerobic Bioremediation).** Reductive dechlorination is a proven remedial technology for CVOCs. The fermentation of edible oil by indigenous microorganisms injected into the groundwater produces a rapid and significant reduction in dissolved oxygen concentrations in the saturated zone resulting in anaerobic conditions (i.e., negative oxidation-reduction potential). The anaerobic zone extends beyond the injection radius of influence of the edible oil itself and enhances attenuation of contaminants both upgradient and cross-gradient of the active treatment zone. The edible oil serves as a permeable reactive barrier, which reduces the flux of the contaminant mass downgradient of the active treatment zone. Reductive dechlorination is a biotic process completed by anaerobic bacteria. Complete dechlorination of PCE produces nontoxic chloride, ethene, and ethane gas.
* **Powdered Activated Carbon.** Due to its high ratio of surface area to volume, PAC adsorbs to and immobilizes CVOC molecules that come into contact with it. This adsorption reduces contaminant concentrations in groundwater through a mass transfer process.
* **Monitored Natural Attenuation.** Contaminants released to the environment at concentrations that pose risks to human health or the environment are subject to natural attenuation processes such as advection and dispersion, volatilization, diffusion, and biotic and abiotic reactions. These naturally occurring attenuation processes are distinguished from an engineered remedy employed to increase the rate of remediation above the rate observed through the “natural” processes. Natural attenuation is the most cost-effective means for achieving cleanup levels as long as there is no threat to human health or the environment presented by the contamination while it attenuates.

MNA refers to the methods used to evaluate whether natural attenuation processes are effectively remediating a contaminant plume, and if so, at what rate. To be consistent with the expectations for natural attenuation as provided under MTCA, MNA is generally retained as a complimentary remedial component to other engineered remedial components rather than as a stand-alone or sole remedial component. However, MNA can be considered a stand-alone remedial measure if site conditions conform to the expectations listed in WAC 173-340-370(7), as follows:

* + Source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable.
  + Leaving contaminants in place during the restoration time frame does not pose an unacceptable threat to human health or the environment.
  + There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur within a reasonable time frame.
  + Appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected.
* **Air Sparge with Soil Vapor Extraction.** Air sparge (AS) combined with soil vapor extraction (SVE; collectively, AS/SVE) is a proven technology for the remediation of CVOCs in groundwater. AS delivers compressed air to the saturated zone to enhance aerobic bioremediation using increased oxygen levels and strip volatile compounds from the water. SVE induces a pressure and concentration gradient in the subsurface that causes volatile compounds to desorb from the soil and flow with the vapor stream to a common collection point for discharge or treatment. SVE also collects the stripped compounds from the AS process.
* **Environmental Covenant.** If residual groundwater contamination remains on the Site after the cleanup action is implemented, an environmental covenant (EC) would be recorded to ensure there is no direct contact with contaminated groundwater under alternative land use scenarios.

## Development of Cleanup Action Alternatives and Descriptions

The evaluation of remedial alternatives considered the practicable remedial components confirmed to be effective at treating CVOCs in groundwater. SoundEarth also considered whether Site-specific constraints would preclude application of a remediation technology due to the creation of a greater risk to human health and/or the environment or that such constraints could result in the remedial technology being technically or administratively infeasible to implement.

The four cleanup action alternatives that were retained for additional consideration, which are described in more detail in the following subsections, are as follows:

* Cleanup Action Alternative 1, MNA and EC
* Cleanup Action Alternative 2, In Situ Reductive Dechlorination and EC with MNA
* Cleanup Action Alternative 3, In Situ PAC Adsorption and EC with MNA

### Common Components and Basic Assumptions

The following assumptions are common to all of the cleanup action alternatives:

* As of the fourth quarter of 2023, PCE and TCE were not detected at concentrations exceeding the laboratory reporting limit or cleanup levels in groundwater beneath the Property, except for PCE in injection well IW50 and TCE in monitoring well MW25 in one monitoring event. cis-1,2-DCE and/or VC were detected at concentrations exceeding the cleanup level in groundwater monitoring wells MW18, MW19, MW21, MW22, MW24, and MW25 and injection wells IW04, IW50, and IW61, all of which are located on the Property.

The geochemical condition of groundwater beneath the Property is currently anaerobic due to the EOS injections and supports biodegradation of PCE and TCE via the anaerobic reductive dechlorination process. The evidence for anaerobic conditions in groundwater beneath the Property are the presence of dissolved oxygen at concentrations below 1 milligram per liter (mg/L); low oxidation-reduction potential (i.e., negative values); detection of methane; dissolved organics at concentration greater than 5 mg/L, which is indicative of the presence of an organic substrate acting as an electron donor; and the presence of fatty acids, which is indicative of the fermentation of EOS.

As EOS is depleted, groundwater will gradually restore to pre-injection aerobic conditions. Under slightly aerobic conditions, cis-1,2-DCE and VC will degrade more rapidly compared to under anaerobic conditions. The literature indicates the first order decay rate of cis-1,2-DCE and VC under aerobic conditions is 1.5 to 2 orders of magnitude greater than that under anaerobic degradation (US Geological Survey 2012). Natural attenuation, including both abiotic and biotic degradation, will continue to be relied upon for degradation of cis-1,2-DCE and VC on the Property.

* Impacted soil and groundwater removed from the Site that is generated during monitoring well installation and groundwater monitoring would be properly characterized for proper off-site disposal at a permitted facility.
* Monitoring and injection wells installed at the Site would be decommissioned when cleanup standards are met.
* An EC would be recorded against the Property and Former Seattle Times Site in accordance with WAC 173-340-440. Periodic reviews would be performed to confirm that the terms of the EC are satisfied.

### Cleanup Action Alternative 1: MNA and EC

Cleanup Action Alternative 1 relies on MNA processes for continued degradation of CVOCs at the Site to attain compliance with cleanup levels. Source control has been performed to the maximum extent practicable because the bulk of the CVOC-contaminated soils has been removed through mass soil excavation completed as part of the IRA and Property redevelopment. In addition, the implementation of ERD at the Site has enhanced the degradation of PCE and its degradation products.

In 2022 and 2023, PCE and/or TCE were detected at concentrations exceeding the cleanup levels in now-decommissioned monitoring well MW29 (decommissioned in July 2022) and replacement monitoring well MW29R, which is located on the Seattle Times Site. The footprint of the CVOC groundwater plume in the Thomas Street ROW will continue to decrease as the PCE flux in groundwater located upgradient of monitoring well MW29R is reduced by groundwater treatment (PAC injections) and natural attenuation processes. This anticipated reduction is based on the observed and/or statistical decline in PCE concentrations over time in groundwater samples collected from monitoring wells MW13 and MW28 (Tables 3 and 3A).

Cleanup Action Alternative 1 would consist of the following:

* Groundwater monitoring would be performed to ensure that natural attenuation processes are occurring, demonstrating that the CVOC plume is decreasing over time and confirming that contaminants of concern are in compliance with groundwater cleanup levels at the CPOC monitoring wells. Per Ecology’s email dated February 20, 2024 (Ecology 2024), groundwater monitoring would be performed semiannually in 2024 and 2025 and annually (one event per year, alternating between June and December) thereafter for 30 years. Groundwater monitoring would include the collection of groundwater samples for analysis of CVOCs, total organic carbon (TOC), volatile fatty acids (VFA), and MNA parameters (Ecology 2022b). Groundwater cleanup level compliance would be attained at a given monitoring or injection well when CVOCs are detected at concentrations below cleanup levels in samples collected from those wells over four consecutive quarters of sampling. The compliance groundwater monitoring well network is shown on Figure 36.
* An EC would be recorded for the Property and Seattle Times Site to ensure there is no direct contact with contaminated groundwater under alternative land use scenarios.

The FS-level cost estimate for this cleanup action alternative is presented in Table 12. The estimated present worth cost is approximately **$1,272,000**. Alternative 1 estimated cost is based on a 30-year restoration timeframe.

### Cleanup Action Alternative 2: In Situ Reductive Dechlorination and EC with MNA

Cleanup Action Alternative 2 includes the injection of EOS to provide a substrate for the native microbial population (i.e., biostimulation) and to promote the bioremediation of CVOCs present in saturated zone soil and groundwater via the anaerobic reductive dechlorination pathway. The EOS solution would be delivered to existing or newly installed vertical injection wells in the Thomas Street ROW and existing vertical and angled injection wells on the southwestern portion of the Property and in the Boren Avenue North and Thomas Street intersection. This cleanup action alternative would also include the injection of microbial consortium (i.e., for bioaugmentation) into the subsurface consisting of DHC bacteria to promote complete reductive dechlorination to ethene/ethane, which would prevent cis-1,2-DCE and VC stall or accumulation. Natural attenuation processes, predominantly biological degradation of cis-1,2-DCE and VC under anaerobic or aerobic conditions, would be relied upon for continued degradation of CVOCs in groundwater beneath the Property and following active treatment in the Boren Avenue North and Thomas Street ROWs.

Figure 37 provides an illustration of the conceptual implementation of this cleanup action alternative, including the layout of the injection program. Cleanup Action Alternative 2 would consist of the following:

* A request to update the existing underground injection control (UIC) registration would be submitted.
* A Seattle Department of Transportation (SDOT) Street Use permit would be secured to install the new injection wells and perform injections in Thomas Street.
* Four new vertical injection wells would be installed in the Thomas Street ROW (IW95 through IW98).
* The EOS injection solution would be prepared by mixing the EOS stock material with potable water in an aboveground mixing tank(s).
* The EOS solution would be delivered to the subsurface under gravity or moderate injection pressure via the following: newly installed injection wells (IW95 through IW98), existing vertical injection wells (IW55, IW56, IW70 through IW73, and IW92 through IW94), and/or angled injection wells (AIW08 through AIW11).
* Following biostimulation and a period of acclimation, the DHC bioaugmentation solution would be delivered to the subsurface using select injection wells.
* Groundwater monitoring would be performed on a quarterly basis for up to 10 years and include the collection of groundwater samples for analysis of CVOCs, TOC, VFA, and/or MNA parameters and annually (one event per year alternating between June and December) thereafter for 30 years. Groundwater cleanup level compliance would be attained at a given monitoring or injection well when CVOCs are detected at concentrations below cleanup levels in samples collected from those wells over four consecutive quarters of sampling.
* An EC would be recorded for the Property and Former Seattle Times Site to ensure there is no direct contact with contaminated groundwater under alternative land use scenarios.

The FS-level cost estimate for this cleanup action alternative is presented in Table 13. The estimated present worth cost is approximately **$2,715,000**. Alternative 2 estimated cost is based on a 10-year restoration timeframe.

### Cleanup Action Alternative 3: In Situ PAC Adsorption and EC with MNA

Cleanup Action Alternative 3 includes the injection of PAC to adsorb and immobilize CVOCs present in saturated zone soil and groundwater. This adsorption process reduces COC concentrations in groundwater through a mass transfer process. The PAC would be delivered to existing and newly installed vertical injection wells in the Thomas Street ROW and existing vertical and angled injection wells located on the southwestern portion of the Property and in the Boren Avenue North and Thomas Street intersection. Natural attenuation processes would be relied upon for continued degradation of CVOCs (i.e., predominately biological degradation of cis-1,2-DCE and VC under anaerobic or aerobic conditions) in groundwater beneath the Property and following active treatment in the Boren Avenue North and Thomas Street ROWs.

Figure 38 provides an illustration of the conceptual implementation of this cleanup action alternative, including the layout of the injection program. Cleanup Action Alternative 3 would consist of the following:

* A request to update the existing UIC registration would be submitted.
* An SDOT Street Use permit would be secured to install the new injection wells and perform injections in the Thomas Street ROW.
* Four new vertical injection wells would be installed in the Thomas Street ROW (IW95 through IW98).
* The PAC slurry would be prepared at a mix ratio of 55 pounds of PAC for every 150 gallons of potable water in an aboveground mixing tank (equal to one batch).
* The PAC slurry would be delivered to the subsurface under gravity or moderate pressure via the following: newly installed injection wells (IW95 through IW98), existing vertical injection wells (IW55, IW56, IW70 through IW73, and IW92 through IW94), and/or angled injection wells (AIW08 through AIW11).
* Groundwater monitoring would be performed on a quarterly basis for up to 10 years and include the collection of groundwater samples for analysis of CVOCs, TOC, VFA, and/or MNA parameters and annually (one event per year alternating between June and December) thereafter for 30 years. Groundwater cleanup level compliance would be attained at a given monitoring or injection well when CVOCs are detected at concentrations below cleanup levels in samples collected from those wells over four consecutive quarters of sampling.
* An EC would be recorded for the Property and Former Seattle Times Site to ensure there is no direct contact with contaminated groundwater under alternative land use scenarios.

The FS-level cost estimate for this cleanup action alternative is presented in Table 14. The estimated present worth cost is approximately **$2,625,000**. Alternative 3 estimated cost is based on a 10-year restoration timeframe.

## Evaluation of Cleanup Action Alternatives

This section presents the criteria used to evaluate the potentially feasible remedial alternatives with respect to the RAOs established for the Site. Remedial components were identified in accordance with the requirements set forth in MTCA under WAC 340-351, and the focused screening of potential remedial components was conducted using the requirements and procedures for selecting cleanup actions as set forth in MTCA under WAC 173-340-360. The criteria used to evaluate and compare applicable remedial alternatives were derived from WAC 173-340-360(3) and include the following:

* **Protectiveness.** The overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, the time required to reduce risk at the facility and attain cleanup standards, the risks resulting from implementing the cleanup action alternative, and improvement of overall environmental quality.
* **Permanence.** The degree to which the cleanup action alternative permanently reduces the toxicity, mobility, or volume of hazardous substances, including the adequacy of the cleanup action alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and the sources of releases, the degree of irreversibility of the waste treatment process, and the characteristics and quantity of treatment residuals generated during the treatment process.
* **Effectiveness over the Long Term.** The degree of certainty that the cleanup action alternative will be successful, the reliability of the cleanup action alternative during the period over which hazardous substances are expected to remain on the Site, and the magnitude of residual risk associated with the contaminated soil and/or groundwater components. The following types of cleanup action components, presented in descending order, may be used as a guide when assessing the relative degree of long-term effectiveness of the chosen cleanup action alternative:
  + Reuse or recycling
  + Destruction or detoxification
  + Immobilization or solidification
  + On-site or off-site disposal in an engineered, lined, and monitored facility
  + On-site isolation or containment with attendant engineering controls
  + Institutional controls and monitoring
  + Provide resilience to climate change
* **Management of Short-Term Risks.** The risk to human health and the environment associated with the cleanup action alternative during its construction and implementation, and the effectiveness of measures that will be taken to manage such risks.
* **Technical and Administrative Implementability.** The ability to implement the cleanup action alternative, including consideration of the technical feasibility of the cleanup action alternative, administrative and regulatory requirements, permitting, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with the future development plans for the Property.
* **Consideration of Public Concerns.** The protection of the public interest, including considerations of perception, protection of the community, trust in the cleanup and involved parties, and impact on the surrounding areas.
* **Cultural Resource Protection.** The protection of cultural resources is intended to avoid, minimize, or mitigate adverse effects from remedial actions on archaeological and historic archaeological sites, historic buildings and structures, traditional cultural places, sacred sites, and other cultural resources.
* **Vulnerable Populations and Overburdened Communities**. The protection of populations threatened by a contaminated site includes a likely vulnerable population or overburdened community. The MTCA Cleanup Regulations define the terms “vulnerable population” and “overburdened community” mean a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts, and includes, but is not limited to, highly impacted communities.

## Comparision of Cleanup Action Alternatives

A summary of the evaluation of the cleanup action alternatives described above using the MTCA evaluation criteria (WAC 173-340-360[3]) is presented below:

* **Protectiveness.** Each of the cleanup action alternatives provides a high degree of protectiveness given that the source of CVOCs has been removed through mass excavation and CVOC concentrations in groundwater have decreased significantly following implementation of groundwater treatment. In addition, the concrete floor slab and foundation walls of the on-Property underground parking garage and surrounding concrete and asphalt hardscapes in the ROWs throughout the Site serve as a barrier against direct contact with subsurface contamination. Each of the cleanup action alternatives ranked equally for protectiveness because groundwater beneath the Site will not be used or accessed as drinking water based on regulatory statute and such use will be further prohibited through an EC.
* **Permanence.** Each of the cleanup action alternatives provides a high degree of permanence because source removal and groundwater treatment has significantly reduced the toxicity, mobility, and mass of CVOCs at the Site. Also, the majority of the mass of CVOCs has been removed from the Site under the IRA. Therefore, whether implemented under a passive approach (MNA) or an active approach (ERD application orPAC injections), additional groundwater treatment would only result in the removal of de minimis quantity of CVOC mass at the Site. Each of the cleanup action alternatives ranked equally for permanence because the CVOC mass at the Site has been removed to the maximum extent practicable.
* **Effectiveness over the Long Term.** Cleanup Action Alternative 2 scored the lowest for long-term effectiveness because there is potential for incomplete reductive dechlorination to occur following an ERD application, resulting in the generation of cis-1,2-DCE and VC and possible expansion of the footprint of the CVOC plume on the Seattle Times Site.

Based on the PCE detections at now-decommissioned monitoring well MW29 and replacement monitoring well MW29R and after applying stoichiometric calculations, it is estimated that VC would be generated in excess of 3 µg/L.

The injection of carbon substrate to injection wells located in the Thomas Street ROW will result in successful remediation of PCE and TCE, as demonstrated and observed on the Property. However, given the high solubility of VC in groundwater, there is potential for VC generated in the Thomas Street ROW to migrate to the Seattle Times Site. This downgradient advancement of the VC plume would pose a risk to human health via the vapor intrusion pathway at the Seattle Times Site and would require treatment and/or installation of engineering controls at the Seattle Times Site.

For Cleanup Action Alternative 3, results of the PAC pilot study indicated a decrease in PCE and TCE to concentrations below cleanup levels. However, during the pilot test, the delivery of the PAC slurry to the subsurface via injection wells IW92 through IW94 and angled injection wells AIW10 through AIW12 became increasingly more difficult likely due to clogging of the soil pores. Given the presence of low-permeability soils, it is anticipated that further injections beneath the Thomas Street ROW would result in limited aerial distribution and contact with CVOC-contaminated groundwater.

There are no known climate change impacts that have a high likelihood of occurring and severely compromising its long-term effectiveness of Cleanup Action Alternatives 1 through 3. The proposed Cleanup Action Alternatives will not impact sea level rise, air quality, temperature, or potential for wildfires since the cleanup action alternatives rely on in-situ treatment and intrinsic remediation.

Overall, Cleanup Action Alternatives 1 and 3 ranked highest and equally because they do not have the potential to exacerbate the CVOC groundwater plume that would result in compounding an environmental issue in the Thomas Street ROW and on the Seattle Times Site.

* **Management of Short-Term Risks.** Cleanup Action Alternative 1 scored the highest for this criterion because there is minimal risk associated with contacting contaminated groundwater during low-flow groundwater sampling. Cleanup Action Alternatives 2 and 3 ranked equally given the safety hazards associated with performing work in the Thomas Street ROW (i.e., implementing traffic control measures, encountering subsurface utilities).
* **Technical and Administrative Implementability.** Cleanup Action Alternative 1 scored the highest for this criterion because groundwater monitoring is straightforward to implement and has been routinely performed at the Site. Cleanup Action Alternatives 2 and 3 ranked lower because both cleanup actions require obtaining street use permits, installing injection wells, and performing injections in the Thomas Street ROW under protection provided by traffic control measures and the presence of a uniformed police officer. In addition, installation of injection wells in the Thomas Street ROW poses a safety concern specifically related to the potential for encountering dense clusters of subsurface utilities recently installed by the City of Seattle in the Thomas Street ROW in the form of an east-to-west-aligned power and communication utility corridor beneath Thomas Street ROW.
* **Consideration of Public Concerns.** There are no known active public concerns regarding the specific impacts at the Site. For all of the cleanup action alternatives, human and ecological receptors are protected given that groundwater at the Site will not be used for domestic consumption and that the CVOC groundwater plume is stable. In addition, exposure pathways to soil and groundwater via direct contact, inhalation, and soil leaching to groundwater are incomplete.

Cleanup Action Alternatives 2 and 3 would temporarily affect traffic flow in the Thomas Street ROW during the installation of injection wells and the injection process. Cleanup Action Alternative 1 has relatively no impact to the public given that only groundwater monitoring and sampling would be performed in the ROWs.

* **Cultural Resource Protection**. There are no known impacts on cultural resources from the proposed Cleanup Action Alternatives 1 through 3. The Site is located in the South Lake Union district, which has hosted residential housing and industrial and commercial facilities since 1887 (The Johnson Partnership 2011).
* **Vulnerable Populations and Overburdened Communities**. There is no impact to vulnerable populations and overburdened communities in the vicinity of the Site. The interim remedial action performed at the Site has mitigated potential any environmental harms vulnerable populations and overburdened communities.

As indicated in Table 16, after weighting factors are used for each of the evaluation criteria, Cleanup Action Alternative 1 achieved the highest-ranking score (9.0) compared to Cleanup Action Alternatives 2 and 3, which achieved scores of 7.0and 7.8, respectively.

## Restoration Time Frame

Restoration time frame is an important consideration when comparing remedial alternatives. Because the DCA tables include only a summary of the overall restoration time frames associated with each of the proposed alternatives, a detailed discussion is included below. The following section provides details on the anticipated restoration time frames associated with the various technologies proposed and impacted media.

* **Cleanup Action Alternative 1: MNA and EC.** Cleanup Action Alternative 1 relies on MNA processes for continued degradation of CVOCs at the Site to attain compliance with cleanup levels. For Cleanup Action Alternative 1, the restoration time frame to achieve cleanup levels is estimated to be 30 to 50 years. The restoration time is primarily affected by the rate of decay of VC in the groundwater. Anaerobic conditions in the groundwater beneath the Property are not conducive to a rapid degradation of VC. The rate of decay of VC will begin to accelerate when aerobic conditions are present in the groundwater, which could take several decades.
* **Cleanup Action Alternative 2: In Situ Reductive Dechlorination and EC with MNA.** Cleanup Action Alternative 2 relies on the injection of EOS into the existing injection well network to provide a substrate for the native microbial population (i.e., biostimulation) and to promote the bioremediation of CVOCs present in saturated zone soil and groundwater via the anaerobic reductive dechlorination pathway. The estimated restoration time frame for Cleanup Action Alternative 2 is 30 to 50 years because the remedy will likely increase the mass of vinyl chloride in the groundwater. Therefore, VC will remain in the groundwater above the groundwater cleanup level until aerobic conditions are present in the groundwater, which are more conducive to the degradation of VC than are anaerobic conditions.
* **Cleanup Action Alternative 3: In Situ PAC Adsorption and EC with MNA.** Cleanup Action Alternative 3 relies on the injection of PAC to adsorb and immobilize CVOCs present in saturated zone soil and groundwater. Cleanup Action Alternative 3 is estimated to achieve groundwater cleanup levels and the anticipated restoration time frame throughout the Site is 30 to 50 years because PAC would only be injected in the Thomas Street ROW, while the remedy for the remainder of the Site is MNA through transition of anaerobic to aerobic conditions for degradation of VC. Furthermore, PAC’s ability to adsorb and immobilize CVOCs present in saturated zone soil and groundwater is finite, and any residual CVOCs in the groundwater after the PAC is spent will degrade by intrinsic bioremediation..

## Disproportionate Cost Analysis and Ranking Criteria

The purpose of a disproportionate cost analysis is to facilitate selection of the cleanup action alternative that would provide the highest degree of permanence to the maximum extent practicable. Costs are considered disproportionate if the incremental costs of one cleanup action alternative exceed the incremental benefit achieved by a more expensive cleanup action alternative.

### Cleanup Action Alternative Cost Estimating

* **Capital Costs.** These costs include expenditures for equipment, labor, and materials necessary to install a remedial action. Indirect costs may be incurred for engineering, financial, or other services not directly involved with installation of remedial cleanup action alternatives but necessary for completion of this activity.
* **O&M Costs.** O&M costs are post-construction costs necessary to provide effective implementation of the cleanup action alternative. Such costs may include but are not limited to operating labor, maintenance materials and labor, disposal of residues, and administrative, insurance, and licensing costs.
* **Monitoring Costs.** These costs are incurred as a result of monitoring activities associated with remedial activities. Cost items may include sampling labor, laboratory, analyses, and report preparation.
* **Present Worth Analysis.** Present worth analysis provides a method of evaluating and comparing costs that occur over different time periods by discounting all future expenditures to the present year. The present worth cost or value represents the amount of money that would be sufficient to cover all costs associated with a remedial alternative if it was invested in Year 0 and disbursed as needed. The assumptions necessary to derive a present worth cost are inflation rate, discount rate, and period of performance. A discount rate, which is similar to an interest rate, is used to account for the time value of money.

Because it is assumed that all capital costs are incurred in Year 0, the present worth analysis is performed only on annual O&M and monitoring costs. The total present worth for a given cleanup action alternative is equal to the sum of the capital costs and the present worth of annual O&M and monitoring costs over the anticipated life cycle of the cleanup action alternative.

Using these criteria, the present worth costs for Cleanup Action Alternatives 1 through 4 are approximately as follows and detailed in Tables 12 through 15, respectively:

* Cleanup Action Alternative 1: $1,272,000
* Cleanup Action Alternative 2: $2,715,000
* Cleanup Action Alternative 3: $2,625,000

As indicated above, the costs to implement Cleanup Action Alternatives 2 and 3 are approximately 2.5 times higher than the cost of Cleanup Action Alternative 1. The ranking score for Cleanup Action Alternative 1 is higher than Cleanup Action Alternatives 2 and 3. Chart 1 plots the relative cost and ranking scores, and Chart 2 plots the cost-to-benefit ratios for the four cleanup action alternatives to illustrate the relative costs and benefits afforded by each cleanup action alternative. The charts demonstrate that Cleanup Action Alternative 1 exhibits the lowest (best) cost-to-benefit ratio compared to those of Cleanup Action Alternatives 2 and 3.

PCE and TCE concentrations are stable in the ROWs and beneath the Seattle Times Site. In the Thomas Street ROW, the stability of the CVOC plume and aerobic groundwater conditions are acting to inhibit the downgradient migration and formation of VC, which is more volatile and soluble compared to PCE, TCE, and cis-1,2-DCE. Over time, PCE and TCE concentrations on the Seattle Times Site will decline due to groundwater treatment and natural attenuation processes, including advection and dispersion, diffusion, sorption, volatilization, and biodegradation. Over time, it is anticipated that the groundwater geochemistry will revert to aerobic conditions beneath the Property, which are also conducive to direct oxidation of cis-1,2-DCE and VC in groundwater.

Overall, the incremental benefit associated with the added cost to implement an active treatment cleanup action alternative such as ERD application or PAC injections compared to that of MNA is not warranted. The CVOC impacts in groundwater do not pose a risk to human health or the environment given the depth of groundwater beneath the Site, the groundwater will not be used as a source for drinking water, and the footprint of the CVOC groundwater plume is stable.

# Preferred Cleanup Action Alternative

After performing the analysis and ranking of cleanup action alternatives in accordance with MTCA, Cleanup Action Alternative 1 is the most feasible and cost-effective remedy. Cleanup Action Alternative 1 is the recommended alternative for the Property because it achieves the RAOs, meets the requirements set forth in WAC 173-340-360 and WAC 173-340-370, and is favorable with respect to the established evaluation and ranking criteria. Finally, Cleanup Action Alternative 1 exhibits the lowest cost-to-benefit ratio compared to the other cleanup action alternatives.

# Vapor Intrusion Assessment – Former Seattle Time Property

Touchstone will conduct 2 years of semiannual indoor air monitoring in the parking garage of Onni’s new building located on the Former Seattle Time Property once it is completed and its air handling units are operational. SoundEarth will perform indoor air sampling following similar procedures presented in SoundEarth’s Vapor Intrusion Assessment Work Plan, dated January 25, 2018, and Supplemental Vapor Intrusion Assessment Work Plan, dated February 12, 2019 (SoundEarth 2018, 2019). SoundEarth will prepare a work plan for the Onni vapor intrusion assessment under separate cover and submit the work plan to Ecology for concurrence before implementation.

It is Touchstone’s understanding that Ecology agrees that if CVOCs concentrations are below method reporting limit or MTCA Indoor Air Method B cleanup levels for unrestricted uses no additional air monitoring will be required. This condition assumes the Onni building will include residential living. The proposed indoor air cleanup levels for the Onni building are as follows:

**Table 9-1: Proposed Indoor Air Cleanup Level – Onni Building**

|  |  |  |
| --- | --- | --- |
| **Contaminant of Concern** | **Unrestricted Use**  **Indoor Air Cleanup Level (**µg/m3) | **Regulations** |
| PCE | 9.62 | Table values in CLARC 2024 |
| TCE | 0.334 |
| cis-1,2-DCE | 18.3 |
| VC | 0.284 |

# Contingency Actions

For the Troy Site, the projected restoration time for the preferred remedial action (natural attenuation remedy with an environmental covenant) is 30 years. In this time frame, the CVOC concentrations in the groundwater at the Site are anticipated to reach compliance with groundwater cleanup levels at the CPOC wells.

On the Troy Property, compliance will be achieved when CVOC concentrations in the groundwater are less than RLs for the protection of indoor air for a commercial exposure scenario. On the Onni Property, compliance will be achieved when CVOC concentrations are less than groundwater cleanup levels.

CVOC concentrations in the groundwater are expected to fluctuate and decrease over time due to a variety of factors, including: (1) an ongoing unresolved source of TCE in the groundwater in areas upgradient of the Boren Avenue ROW, (2) sampling and analytical variability, (3) seasonal fluctuations in the groundwater elevations, and (4) desorption of CVOCs from soil to the groundwater where it can degrade in the dissolved phase.

Touchstone will be prepared to implement contingency actions if future CVOC concentrations exceed screening levels for indoor air quality at the Site, either on the Troy Property or on the Onni Property, as described below. These contingency actions include mitigation measures, if deemed necessary and appropriate, to alleviate screening level exceedances for indoor air quality.

## Troy Property

The chemistry of the groundwater beneath the Troy Property is expected to change over time from anaerobic to aerobic due to the continuing decline of anthropogenic carbon substrate in the groundwater. Under aerobic conditions, VC in the groundwater will mineralize to non-toxic end products.

However, since VC concentrations are increasing with time and currently exceed the commercial screening level for the protection of indoor air, a contingency plan will be implemented if there is a statistically significant increase (SSI) in the VC concentrations in the groundwater. To be declared an SSI, the change in VC concentrations must be significant after accounting for anticipated variability in the sample data due to the factors outlined previously.

To determine if an SSI has occurred for VC results, SoundEarth will follow guidance presented in EPA Statistical Analysis of Groundwater Monitoring Data for RCRA Facilities, dated 2019 (EPA 2019), and perform analysis for SSI testing using ProUCL version 5.2.00. The SSI test will assess variability over time in groundwater beneath the Troy Property. The results from the SSI test will be more representative of the overall stability of the plume than changes in VC concentrations at individual wells.

June 2024 analytical results at groundwater monitoring wells with VC concentrations exceeding the groundwater RL or showing an increasing statistical trend will act as the baseline results to determine if SSI has occurred in the future. Baseline results will be compared to groundwater analytical results for samples collected after June 2024. As with the baseline results, concentrations of VC exceeding the groundwater RL or showing an increasing statistical trend at monitoring wells at the Troy Property will be used to determine if SSI has occurred.No SSI will have occurred if the mean of the VC baseline is greater than or equal to the future VC sample results at the 95 percent level of significance (baseline VC mean >= future VC result). An SSI will occur if the mean of the baseline is less than the future VC sample results at the 95 percent level of significance (baseline VC mean < future VC result) over two consecutive groundwater sample events. If an SSI is verified, a contingency action will be implemented. The first stage of the contingency action will include two semiannual indoor air sampling events at the Troy Property. SoundEarth will perform indoor air sampling following procedures presented in SoundEarth’s Vapor Intrusion Assessment Work Plan, dated January 11, 2018, and SoundEarth’s Supplemental Vapor Intrusion Assessment Work Plan, dated May 21, 2018 (SoundEarth 2018, 2019).

If results from two semiannual events indicate VC concentrations exceed indoor air cleanup standards, mitigation measures will be considered with Ecology and implemented as a second stage of contingency action to alleviate any potential risk to human health. Mitigation measures may include the following, listed in likely order of preference:

* Modifying or upgrading the parking garage ventilation system.
* Installing and maintaining a sub-slab depressurization system (e.g., extracting soil gas from select existing injection wells).
* Implementing in-situ groundwater remediation, such as: (a) carbon substrate addition and bioaugmentation (i.e., anaerobic reductive dechlorination), or (b) oxygen enhancement of aerobic oxidation.

At 6 and 12 months after implementation of a mitigation measure, SoundEarth will perform two indoor air sampling events to confirm the efficacy of mitigation measures on indoor air quality. Based on the results of these air sampling events, no further mitigation will be required if indoor air results are below screening levels. If exceedances persist, additional mitigation measures will be proposed for Ecology review and approval.

## SEATTLE TIMES SITE (ONNI PROPERTY)

A trend analysis performed at the end of the fourth quarter of 2023, which combined groundwater results for MW29 and MW29R (total of 10 sampling events) on the Onni Property, showed no statistically determinable trends in the concentrations of PCE and TCE and decreasing statistical trends in the concentrations of cis-1,2-DCE and VC. Currently, in MW29R, the PCE and TCE concentrations exceed groundwater screening levels for the protection of indoor air for a residential exposure scenario but are less than groundwater screening levels for the protection of indoor air for a commercial exposure scenario.

After the Onni building is completed, Ecology requires 2 years of semiannual indoor air monitoring. If after 2 years of indoor air sampling, concentrations of CVOCs are below residential cleanup levels, Ecology will not require additional indoor air monitoring, irrespective of the concentration of CVOCs in the groundwater. However, if concentrations of CVOCs exceed the MTCA Method B groundwater screening levels and concentrations of CVOCs in the indoor air exceed cleanup levels, a contingency action will be implemented to mitigate the potential impacts to indoor air quality in the parking garage at the Onni building.

If a contingency action is implemented, Touchstone will perform two semiannual indoor air sampling events at the Onni Property based upon a work plan to be approved by Ecology. If results from two semiannual events establish that concentrations of COCs exceed indoor air cleanup standards, then vapor mitigation measures may be implemented similar to those described for the Troy Property after Ecology review and approval.

At 6 and 12 months after the implementation of the mitigation measure, SoundEarth will perform two indoor air sampling events to confirm the efficacy of mitigation measures on indoor air quality. Based on the results of these air sampling events, no further mitigation will be required if indoor air results are below screening levels. If exceedances persist, mitigation measures will be proposed for Ecology review and approval.

## RIGHTS-OF-WAY

CVOC concentrations in groundwater within the ROWs do not exceed Roadway Excavation Groundwater RLs that are protective of the inhalation pathway for excavation workers. This condition has been present in the groundwater beneath the ROWs for several years. Given the decrease in CVOC concentrations in the groundwater in the ROWs demonstrated over time and the absence of current risk to excavation workers, no contingency action plan is needed for the ROWs. The City of Seattle, through the Seattle Department of Transportation, will receive a notice letter regarding the groundwater contamination beneath the ROWs as part of the process of finalizing Environmental Covenants for the Troy Property and for the Onni Property.

# Limitations

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with SoundEarth’s agreement with the client. This report is solely for the use and information of the client unless otherwise noted. Any reliance on this report by a third party is at such party’s sole risk.

Opinions and recommendations contained in this report are derived, in part, from data gathered by others, and from conditions evaluated when services were performed, and are intended only for the client, purposes, locations, time frames, and project parameters indicated. SoundEarth does not warrant and is not responsible for the accuracy or validity of work performed by others, nor from the impacts of changes in environmental standards, practices, or regulations subsequent to performance of services. SoundEarth does not warrant the use of segregated portions of this report.

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Figures

Tables

Charts

Appendix A

Soil Boring and Monitoring Well Construction Logs

Appendix B

Statistical Trend Analysis

Appendix C

Groundwater Analytical Results for June 2024