Former Olympia Dry Cleaners Site

Compliance Monitoring Plan

Prepared for

Washington State Department of Ecology
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LIMITATIONS

This report has been prepared for the exclusive use of the Estate of Katherine Burleson and GJG, LLC for the Former Olympia Dry Cleaners Site. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
CAP	Cleanup Action Plan
CMP	Compliance Monitoring Plan
COC	Chemical of concern
DCE	Dichloroethene
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
HASP	Health and Safety Plan
$\mu g/m^3$	Microgram per cubic meter
MTCA	Model Toxics Control Act
PCE	Tetrachloroethene
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
SAP	Sampling and Analysis Plan
Site	Former Olympia Dry Cleaners Site
STEL	Short-Term Exposure Limit
TCE	Trichloroethene
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
WAC	Washington Administrative Code

1.0 Introduction

This Compliance Monitoring Plan (CMP) was prepared to provide details for post-remediation groundwater monitoring and vapor intrusion monitoring that will be completed at the Former Olympia Dry Cleaners Site (Site). The Site is located at 606 Union Avenue Southeast in Olympia, Washington (refer to Figure 1.1).

The remedial actions performed consisted of source removal via excavation to remove tetrachloroethene- (PCE) and trichloroethene- (TCE) contaminated soil that resulted from former dry cleaning operations at the Site. Excavation of source areas were completed between July 2015 and September 2015. The remedial actions and associated compliance monitoring are being completed in accordance with the Washington State Department of Ecology's (Ecology's) October 29, 2014, Cleanup Action Plan (CAP) for the Site (Ecology 2014), and are consistent with Washington Administrative Code (WAC) 173-340-360, the Model Toxics Control Act (MTCA). Specific details regarding the cleanup actions were also included in the Ecology-approved Remedial Action Work Plan (RAWP) dated April 2015 and the RAWP Addendum dated June 2015.

The cleanup action and associated compliance monitoring is being conducted under Consent Decree No. 14-2-02104-3, which was executed November 4, 2014. In accordance with the Consent Decree, this CMP includes both a long-term groundwater monitoring plan and a vapor intrusion monitoring plan. This CMP will be implemented upon Ecology approval.

1.1 SITE DESCRIPTION

The Former Olympia Dry Cleaners Property is located at 606 Union Avenue Southeast in Olympia, Washington (Figure 1.1). The property is located at the intersection of Union Avenue Southeast and Cherry Street Southeast, and is currently in operation as Howard's Prestige Cleaners, which provides eco-friendly dry cleaning, stain removal, and tailoring services. Improvements to this property include the one-story, slab-on-grade Former Olympia Dry Cleaners Building (2,584 square feet in area) and asphalt-paved areas, which serve as parking along the west and south perimeters. An unpaved alley, approximately 6 feet in width, borders the north side of the Former Olympia Dry Cleaners Building, and is located between the Former Olympia Dry Cleaner's Building and the adjacent (to the north) Cherry Street Q-Tip Trust Building.

The Site is defined by the lateral and vertical extent of contamination that has resulted from the operation of a former dry cleaning machine on the Former Olympia Dry Cleaners Property. Based on the extent of contamination, the Site includes a portion of the Former Olympia Dry Cleaners Property, a portion of the property located adjacent to the north (the Cherry Street Q-Tip Trust Property), and a portion of the Cherry Street Southeast right-of-way (ROW). Refer to Figure 1.2 for pertinent site features.

1.2 CHEMICALS OF CONCERN

The chemicals of concern (COCs) for the Site are the chemical compounds associated with dry cleaning activities that were detected in soil, groundwater, and surface water (i.e., the seep) at concentrations exceeding the applicable MTCA cleanup levels. Indoor air is also a media of concern for the Site due to elevated soil vapor (soil gas) sample results from beneath the slab of the Former Olympia Dry Cleaners Building (sub-slab sample). Prior testing of indoor air at the Cherry Street Q-Tip Trust Building did not indicate impacts to indoor air from site releases; therefore, no indoor air sampling will be collected at this location.

The following are COCs identified for the Site: PCE, TCE, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, 1,1-DCE, and vinyl chloride. The suspected source of PCE and its degradation compounds (TCE, cis-1,2-DCE, and vinyl chloride) are associated with release of solvent to site soils from former dry cleaning operations.

1.3 CLEANUP LEVELS

Two factors control designation of appropriate cleanup standards for specific sites: specification of cleanup levels (the chemical concentrations that are protective of human health and the environment) for each COC in each impacted media; and identification of the point of compliance (the location on the Site where the cleanup levels must be attained). Table 1.1, originally presented in the CAP, identifies the site-specific numerical cleanup levels, based on the applicable cleanup levels by media for each specific COC identified in Section 1.2.

Table 1.1
Cleanup Levels[a]

Chemical	Soil	Groundwater	Surface Water (Seep)	Indoor Air-Residential[b]	Indoor Air-Commercial[c]
PCE	0.05 mg/kg	5 µg/L	3.3 µg/L[d]	9.6 µg/m^3	32 µg/m^3
TCE	0.03 mg/kg	5 µg/L	30 µg/L[d]	0.37 µg/m^3	2 µg/m^3
cis-1,2-DCE	0.03 mg/kg[e]	16 µg/L[f]	NA	NA	NA
trans-1,2-DCE	0.043 mg/kg[e]	100 µg/L[g]	10,000 µg/L[d]	27 µg/m^3	60 µg/m^3
1,1-DCE	0.03 mg/kg[e]	7 µg/L[g]	3.2 µg/L[h]	91 µg/m^3	670 µg/m^3
Vinyl Chloride	0.03 mg/kg[e]	0.2 µg/L	2.4 µg/L[d]	0.28 µg/m^3	0.9 µg/m^3

Notes:

a Cleanup levels are MTCA Method A unless otherwise noted. Values taken from a query of Ecology's CLARC website on January 10, 2014 and CLARC Guidance documents for TCE, PCE, cis- and trans-1,2-DCE, 1,1-DCE, and vinyl chloride.

b MTCA Standard Method B Indoor Air Cleanup Level. This cleanup level will be used only if the use of the property is converted to residential in the future.

c MTCA Modified Method B to account for current commercial land use. This is the appropriate cleanup level for current commercial use of the Former Olympia Dry Cleaner building. Refer to Appendix A of the CAP.

d Surface Water ARAR – Human Health, Marine, Clean Water Act.

e MTCA Method B calculated value for protection of the soil-to-groundwater pathway (adjusted up to the soil PQL as appropriate).

f MTCA Method B non-carcinogen Standard Formula Value.

g Ground Water ARAR – State and Federal Maximum Contaminant Level.

h Surface Water ARAR – Human Health, Marine, National Toxics Rule.

Abbreviations:

ARAR Applicable or Relevant and Appropriate Requirements
CLARC Cleanup Levels and Risk Calculation
µg/m^3 Micrograms per cubic meter
µg/L Micrograms per liter
mg/kg Milligram per kilogram
NA Not applicable or no cleanup level has been established
PQL Practical quantitation limit

1.4 HEALTH AND SAFETY

Compliance monitoring will be performed under a site-specific Health and Safety Plan (HASP). Workers will wear the appropriate personal protective equipment, which is expected to be Modified Level D, to limit exposure to site COCs during sample collection.

2.0 Pre-Construction Environmental Conditions

This section summarizes the pre-construction conditions for the media that will be monitored as part of this CMP (groundwater, seep, and sub-slab vapor/indoor air) as presented in the Sound Earth Strategies Remedial Investigation (SES 2009) and Feasibility Study (SES 2013).

2.1 GROUNDWATER

PCE, TCE, cis-1,2-DCE, and vinyl chloride have been detected at levels greater than their applicable MTCA Method A or B groundwater cleanup levels in multiple wells during the last three rounds of groundwater sampling at the Site, conducted in 2008, 2010, and 2013. The groundwater analytical data collected from reconnaissance borings and monitoring wells indicated that concentrations of PCE and its degradation compounds, TCE, cis-1,2-DCE, and vinyl chloride, decrease significantly both laterally and vertically with distance from the former source areas. Any downward vertical migration of PCE from the source areas appears to be restricted by the upward vertical hydraulic gradient caused by artesian conditions at the Site. The greatest concentrations of PCE in groundwater have been detected near the northwest corner of the Former Olympia Dry Cleaners Property in the former main source area. The vertical extent of the dissolved-phase PCE plume is limited to approximately 20 feet below ground surface (bgs). More recent groundwater monitoring data from 2010 and 2013 suggest that groundwater concentrations have been decreasing over time.

2.2 SURFACE WATER SEEP

Seep concentrations for PCE, TCE, and vinyl chloride exceeded the applicable MTCA Method B cleanup levels in samples collected in 2007 and 2008. Upward vertical flow of groundwater through the backfill material in the 2006 interim action soil excavation area was the result of the artesian conditions commonly observed in this area. This caused seep discharge within the previous soil excavation area, approximately 13 feet west of the southwest corner of the Cherry Street Q-Tip Trust Building. The seep has had elevated concentrations of PCE, TCE, and vinyl chloride, which was expected given that the seep reflects contaminant conditions in groundwater within the former main source area. The seep water has been collected and treated since 2007, but collection was ceased prior to the start of construction in July 2015. This seep area was backfilled and capped as part of the 2015 remedial actions and seep discharge has not reappeared in its former location.

2.3 SOIL VAPOR AND INDOOR AIR

Sub-slab soil vapor sample results from the Former Olympia Dry Cleaners Building in June 2011 contained concentrations of PCE and TCE at levels greater than Ecology's guidance screening levels for protection of the vapor intrusion exposure pathway. Vapor intrusion occurs when volatile hazardous substances migrate from the subsurface to indoor air; therefore, the Former Olympia Dry Cleaners Building has the potential for vapor intrusion. Based on 2010 and previous indoor air sampling results, the vapor intrusion pathway for the Cherry Street Q-Tip Trust Building is considered to be incomplete and further evaluation is not necessary. Further sampling is necessary to evaluate if indoor air at the Former Olympia Dry Cleaners Building could be impacted by solvents remaining under the floor slab.

3.0 Long-Term Groundwater Monitoring Plan

This long-term groundwater monitoring plan includes specific details associated with both the long-term monitoring of groundwater and monitoring of the presence of seeps during each groundwater sampling event and subsequent sampling of re-emergent seeps.

3.1 GROUNDWATER MONITORING

Groundwater monitoring will occur to assess the effectiveness of remedial actions, which consisted of source soil excavations in the Main Excavation Area, Secondary Excavation Area, and a portion of the Alley. This long-term groundwater monitoring includes performance monitoring to collect data for the evaluation and demonstration of source removal in meeting the remedial objectives. The source removal areas are shown on Figure 3.1 for reference.

Quarterly groundwater monitoring will occur for the first year following the cleanup action, and will be initiated within 30 days of Ecology's approval of this CMP. After the first year of quarterly monitoring, the monitoring frequency will be reduced to semi-annual, and eventually to annual with Ecology's concurrence. The monitoring network includes five downgradient wells (MW-6, MW-09, MW-11, MW-13, and MW-14) as shown on Figure 3.1.

During each monitoring event, groundwater samples will be collected and analyzed from the five wells for the six site COCs (i.e., PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride). Sample results will be compared to the groundwater cleanup levels identified in Table 1.1 (Section 1.3) of this CMP. Field water quality parameters will also be measured during each monitoring event and will include dissolved oxygen, oxygen reduction potential, conductivity, turbidity, and pH. Additional details regarding groundwater monitoring procedures are included in the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) included as Appendix A.

3.2 SEEP MONITORING

Subsequent to the completion of soil excavation and backfilling in the Main Excavation Area, a French drain was installed in the previous seep area for the purpose of sample collection and as a contingency for future seep treatment, if warranted by reappearance of the seep and discharge to surface waters with COCs at concentrations greater than cleanup levels. Refer to Figure 3.2 for the location of the French drain and sample access location (FD-1), which is a vertical standpipe. A seep water sample will be collected from this seep access pipe during the first four quarterly groundwater monitoring events to establish an average concentration, which will provide baseline post-excavation water quality data for the seep. Additional samples may be collected to facilitate treatment design, if warranted. The seep sample will be analyzed for the site COCs, which consist of PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride.

During each groundwater monitoring event, the Site will be inspected for any visible surface water seeps. If a seep is observed, its location and approximate flow rate will be documented. If sufficient flow is present, a water sample will be collected to evaluate the water quality of the seep. Sample results will be compared to the surface water cleanup levels identified in Table 1.1 (Section 1.3) of this CMP. If COCs are not detected in a seep sample or are detected at concentrations less than the cleanup levels for four quarters, additional monitoring of that seep will not be warranted, unless a change in location or flow is observed. Refer to Section 3.4 for contingency actions to be followed should a seep sample contain COCs at concentrations greater than the cleanup levels. Additional details regarding seep monitoring procedures are included in the SAP/QAPP included as Appendix A.

3.3 SAMPLING METHODS, PROCEDURES, AND LABORATORY ANALYSES

Specific field sampling methods, sample handling procedures, and laboratory analytical methods and procedures for groundwater and seep samples that will collected during compliance monitoring are described in the SAP/QAPP included as Appendix A.

The analytical method that will be used for groundwater and seep compliance monitoring is chlorinated volatile organic compounds (CVOCs) by USEPA Method 8260B. Only the project-specific COCs identified in Section 1.2 will be reported (PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride). Samples will be submitted to Fremont Analytical, Inc. in Seattle, Washington. Refer to the SAP/QAPP (Appendix A) for further details on this laboratory analytical method and the laboratory quality assurance (QA)/quality control (QC) requirements.

3.4 CONTINGENCY ACTIONS

Should a new or existing seep emerge and contain COCs at concentrations greater than the surface water cleanup levels shown in Table 1.1, resampling of the seep must occur within 1 week of obtaining preliminary data to confirm the results. Results from the second sampling shall be obtained via a rapid turnaround from the laboratory (3 days or less). If the second sampling result confirms the presence of COCs greater than the cleanup levels, the seep must be contained and the water collected and discharged to the sanitary sewer. A permanent form of treatment, such as granular activated carbon or activated persulfate, may be necessary before discharge if the following conditions are met.

- Measurable concentrations of the site COCs are present in the seep at concentrations greater than the cleanup levels during two consecutive sampling events and the average concentration of the seep is greater than the cleanup levels; and
- The seep expresses itself at the surface and is discharging to surface waters via the City of Olympia stormwater system or other conveyance method.

A treatment vault or similar structure that would be adequately sized for a pre-treatment cartridge or filter would be installed and connected to the French drain collection pipe, if it is deemed necessary. Alternatively, the water in the standpipe could be pumped to an aboveground treatment system.

Authorization to connect to sanitary sewer would be obtained from the City of Olympia and authorization to discharge treated water to the sanitary sewer would be requested from the LOTT Clean Water Alliance. A permit to discharge would be necessary prior to implementing this contingency.

If the seep is not contaminated or if it does not express itself at the surface (i.e., no exposure), then the seep will not require treatment or re-routing to the sanitary sewer unless it has the potential to adversely affect a building or structure. Quarterly site visits for the first year will inspect for this condition.

4.0 Vapor Intrusion Monitoring Plan

This vapor intrusion monitoring plan describes a phased approach for vapor intrusion monitoring and describes how samples will be collected from the Former Olympia Dry Cleaners Building. A pre-sampling survey will be completed prior to indoor air monitoring event(s) to identify known or suspected indoor sources of volatile organic compounds (VOCs). If identified, indoor sources of VOCs will be controlled or removed prior to and during sample collection to the extent practical, and the area will be well ventilated prior to sample collection.

4.1 VAPOR INTRUSION ASSESSMENT PHASED APPROACH

Post-remedial action vapor intrusion monitoring will be conducted at the Site using a phased approach, as follows.

1. Sub-slab vapor points will be installed and samples will be collected from three locations, VP-1 through VP-3, as shown on Figure 4.1.
2. Sample results will be compared to Ecology's Sub-Slab Soil Gas Screening Levels published in April 2015 as a revision to their October 2009 draft *Guidance for Evaluating Soil Vapor Intrusion in Washington State* (Ecology 2009).
3. If the results from the three locations are less than the screening levels, then vapor intrusion monitoring will be considered complete, and no additional monitoring will be necessary.
4. If the results from any location are greater than the screening levels, then indoor air sampling will be conducted at the two indoor air sample locations within the building, shown on Figure 4.1. An outside/ambient air sample will be collected concurrently. As mentioned above, a pre-screening survey will be conducted prior to sample collection.
5. If the results of indoor air samples are less than the indoor air commercial cleanup levels, as shown on Table 1.1 (as adjusted for background), and PCE and/or TCE sub-slab concentrations have not increased to levels greater than the 2011 measured concentrations, then vapor intrusion monitoring will be considered complete, and no additional monitoring will be necessary.
6. If the indoor air results are greater than the indoor air commercial cleanup levels (as adjusted for background) or if a TCE Short-Term Exposure Limit (STEL) 21-day exposure assessment is conducted and the results exceed 8.4 $\mu g/m^3$, then vapor mitigation measures shall be evaluated and implemented as part of a vapor mitigation plan approved by Ecology.
7. If the results of indoor air samples are less than the indoor air commercial cleanup levels, as shown in Table 1.1 (as adjusted for background), but PCE and/or TCE sub-slab concentrations have increased to concentrations greater than the 2011 measured concentrations, then additional vapor intrusion monitoring shall be performed as directed by Ecology. This additional monitoring may include indoor air, sub-slab, and/or STEL 21-day exposure assessment.

4.2 SUB-SLAB SAMPLE LOCATIONS

Three vapor points (VP-1 through VP-3) will be installed in the northern portion of the building near the former dry cleaning machine, as shown on Figure 4.1. One grab sample will be collected per location. Minor adjustments to the proposed sample locations may be made as necessary based on operations and accessibility at the time of sampling.

4.3 INDOOR AND AMBIENT AIR SAMPLE LOCATIONS

If the results of the sub-slab vapor sampling indicate an exceedance of Ecology's current sub-slab screening levels, then two 8-hour indoor air samples will subsequently be collected in the Former Olympia Dry Cleaner Building (currently Howard's Prestige Cleaners) within 2 weeks of receipt of preliminary sub-slab soil vapor data. One ambient (outdoor) sample will also be collected during the monitoring event. The two indoor samples would be collected from the northern portion of the building closest to the former source areas and from the main work area in the central portion of the building. The ambient sample would be collected from outside the south/southwest corner of the Former Olympia Dry Cleaner Building, under the roof awning. The approximate locations are depicted on Figure 4.1.

Minor adjustments to the proposed sample locations may be made, as appropriate, based on visual inspections of the contents and operations occurring in the building at the time of sampling.

4.4 SAMPLING METHODS, PROCEDURES, AND LABORATORY ANALYSES

Specific field sampling methods, sample handling procedures, and laboratory analytical methods and procedures for vapor intrusion samples that will collected during compliance monitoring are described in the SAP/QAPP, included as Appendix A.

VOCs will be analyzed in sub-slab vapor samples, and indoor and ambient air if necessary, based on the results of the sub-slab assessment. The analytical method that will be used for sub-slab vapor samples is USEPA Method TO-15 (SCAN); indoor and ambient air samples will be analyzed by USEPA Modified Method TO-15-SIM (Selective Ion Monitoring). Only the project-specific COCs identified in Section 1.2 will be reported (PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride). Samples will be submitted to Fremont Analytical, Inc. in Seattle, Washington. Refer to the SAP/QAPP (Appendix A) for further details on the laboratory analytical methods and field and laboratory QA/QC requirements.

The contaminant concentrations in indoor air will be corrected to account for ambient (background) concentrations in accordance with Section 3.2.3 of Ecology's *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Actions*, Draft October 2009 (Ecology 2009). Adjusted concentrations will be compared to the commercial indoor air cleanup levels presented in Table 1.1 (Section 1.3).

4.5 SHORT-TERM EXPOSURE LIMITS FOR TRICHLOROETHENE

The U.S. Environmental Protection Agency (USEPA) recommends that TCE concentrations in indoor air be evaluated over a 21-day exposure period to protect against fetal heart malformations when women of child-bearing age are present. The average TCE concentration over this 21-day exposure period should be compared to the STELs for TCE, which are currently under development by Ecology. The USEPA-recommended commercial STEL is 8.4 $\mu g/m^3$ (USEPA 2012). This STEL is significantly greater than the commercial TCE indoor air cleanup level for this project, which is 2.0 $\mu g/m^3$. Ecology may direct that a STEL assessment be performed if the results of the indoor air evaluation show an exceedance of indoor air-commercial cleanup levels and/or PCE and/or TCE sub-slab concentrations have increased to levels greater than the 2011 measured concentrations. If the 8-hour indoor air results indicate that TCE concentrations are not detected or are less than the commercial cleanup level of 2.0 $\mu g/m^3$ and/or PCE and/or TCE sub-slab concentrations have not increased to concentrations greater than the 2011 measured concentrations, then additional monitoring to assess a 21-day exposure for comparison to the STEL will not be necessary. If sample results are greater than the cleanup level mitigation measures will be evaluated, as described in Section 4.7.

4.6 MONITORING SCHEDULE

Vapor intrusion monitoring is proposed in the Former Olympia Dry Cleaner Building to document post-remedial sub-slab vapor conditions, and indoor air quality if necessary. Sub-slab vapor sampling will occur within 45 days of Ecology's approval of this CMP, which is estimated to be sometime in early 2016. If the results of the sub-slab vapor sampling indicate that site COCs are not present at levels greater than the screening levels, then indoor air sampling or further vapor intrusion monitoring will not be necessary. If the results of the sub-slab vapor sampling indicate concentrations are greater than the screening levels, then indoor air monitoring will be completed within 2 weeks of obtaining the results from the laboratory (estimated late winter/early spring 2016). If necessary, a second indoor air monitoring event would occur approximately 2 months after the first, and would occur in spring 2016.

If sub-slab vapor sample results indicate that vapor intrusion is not likely, then vapor intrusion monitoring will cease. Additional vapor intrusion monitoring may be completed if sampling results indicate that additional long-term monitoring is warranted or if mitigation is needed. Refer to Section 4.7 for contingency measures.

4.7 CONTINGENCY ACTIONS

If indoor air results are greater than the indoor air-commercial cleanup levels (as adjusted for background) or if a STEL 21-day exposure assessment is conducted and the results exceed 8.4 $\mu g/m^3$, then vapor mitigation measures will be evaluated and implemented. The nature of the vapor intrusion mitigation measures at the Site will depend on the magnitude of the exceedance, and may include physical modification to ventilation systems, sealing of floors and foundation cracks, or installation of a passive or active building or sub-slab ventilation system.

A Vapor Mitigation Plan will be completed as requested by Ecology to outline recommended vapor intrusion mitigation measures. Additional details regarding reporting are included in Section 5.0.

5.0 Schedule and Reporting

Per the Consent Decree, groundwater monitoring reports will be prepared and submitted to Ecology within 30 days of receipt of validated groundwater data, but no later than 90 days following the groundwater sampling event. At a minimum, each summary report will contain a brief description of the sampling event, an updated groundwater analytical data summary table, and copies of analytical reports. Groundwater quality trend analysis will be completed on an annual basis.

Vapor intrusion monitoring report(s) will also be submitted no later than 90 days following a monitoring event. At a minimum, summary report(s) will contain a brief description of the sampling event including monitoring locations, an analytical data summary table, and copies of analytical reports.

As described in Section 4.7, if indoor air results are greater than the indoor air-commercial cleanup levels (as adjusted for background) or if STEL 21-day exposure assessment results exceed 8.4 $\mu g/m^3$, then vapor mitigation measures will be evaluated and a Vapor Mitigation Plan will be completed. This plan shall be submitted to Ecology within 60 days of the receipt and validation of indoor air sample results and, if warranted, will include design details. Revisions to incorporate Ecology comments shall be completed within 30 days of the receipt of Ecology's comments. Based on the type of mitigation implemented, Ecology may request additional reporting to include details regarding system construction completion (as-built details) and/or operation, maintenance, and monitoring.

Pursuant to WAC 173-340-840(5), Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements), and the Consent Decree, all data collected during the implementation of the Cleanup Action Plan and Compliance Monitoring Plan shall be submitted to Ecology's Environmental Information Management (EIM) database in electronic format. Data shall be submitted to EIM no later than 90 days following the sampling/monitoring event.

Consistent with the requirements of WAC 173-340-420, Ecology will review the remedial action every 5 years to ensure protection of human health and the environment, as described in the CAP (Ecology 2014).

6.0 References

Sound Earth Strategies (SES). 2009. *Revised Draft Remedial Investigation Report, Former Olympia Dry Cleaners*. Prepared for Mrs. Katherine Burleson. 9 October.

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Former Olympia Dry Cleaners Site

Compliance Monitoring Plan

Figures

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Compliance Monitoring Plan
Former Olympia
Dry Cleaners Site
Olympia, Washington

Figure 1.1
Site Vicinity Map

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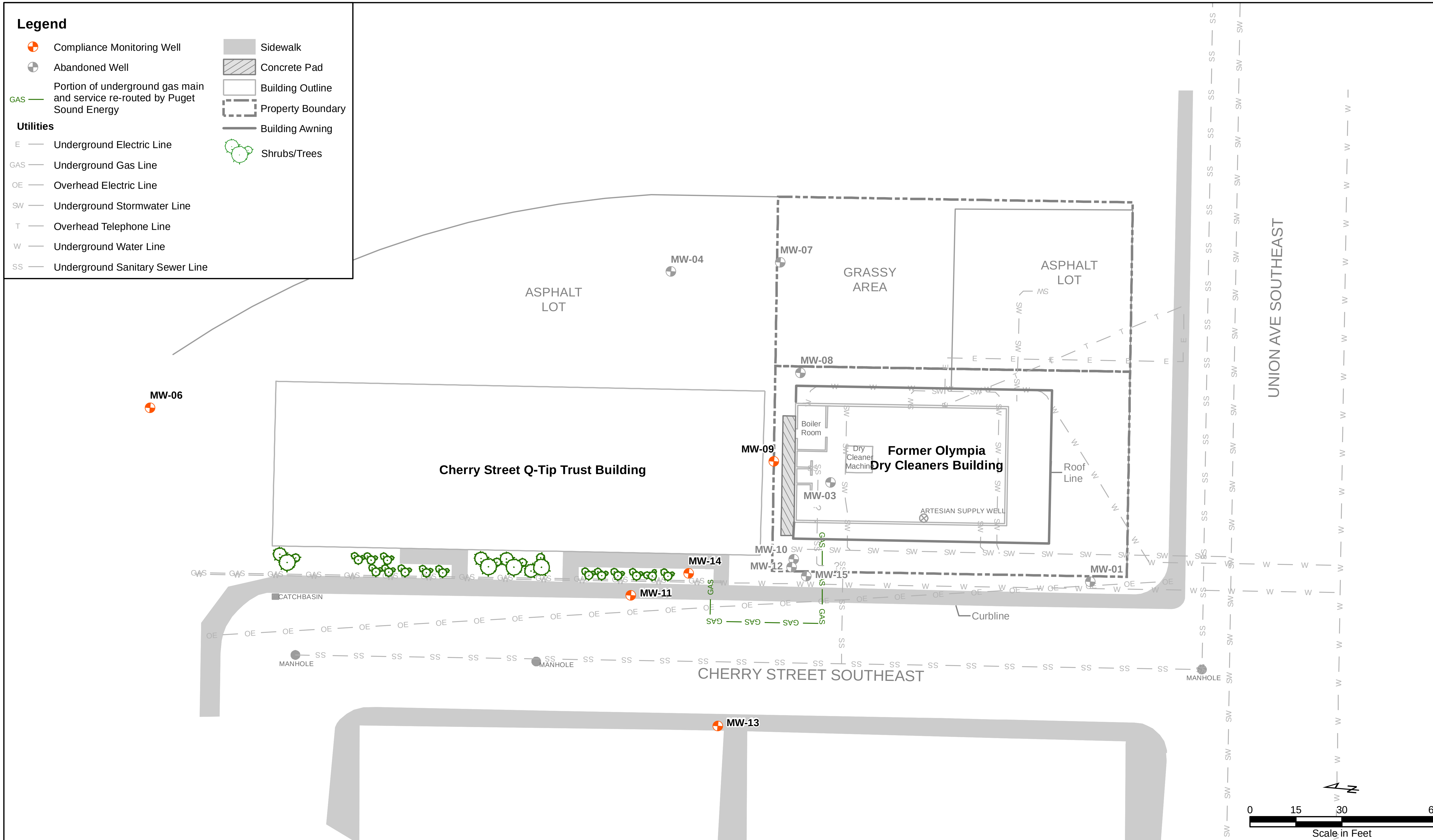

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Compliance Monitoring Plan
Former Olympia Dry Cleaners Site
Olympia, Washington

Figure 1.2
Site Features

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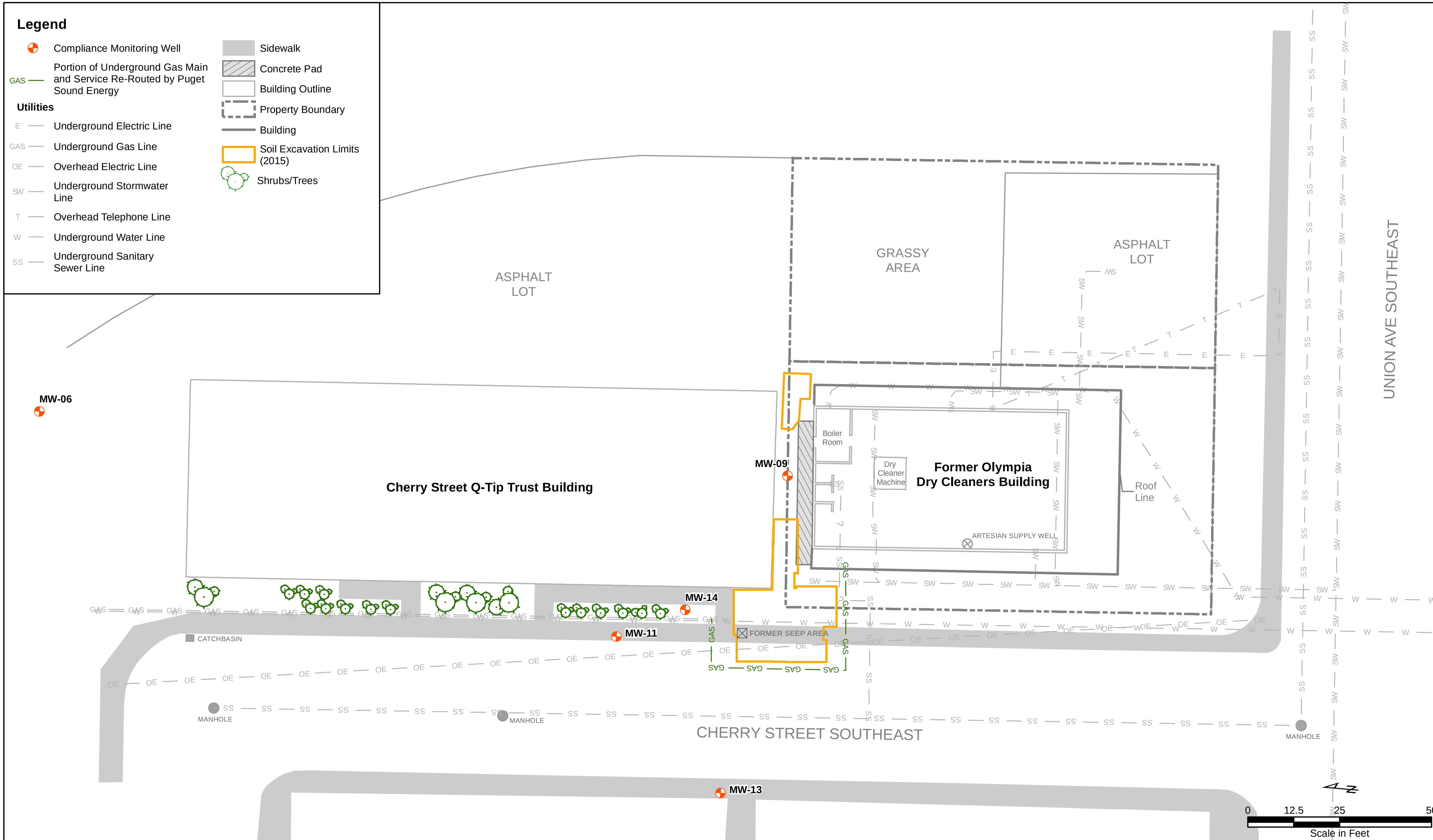

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Olympia, Washington

Figure 3.1
Source Removal Areas and
Compliance Monitoring Well Locations

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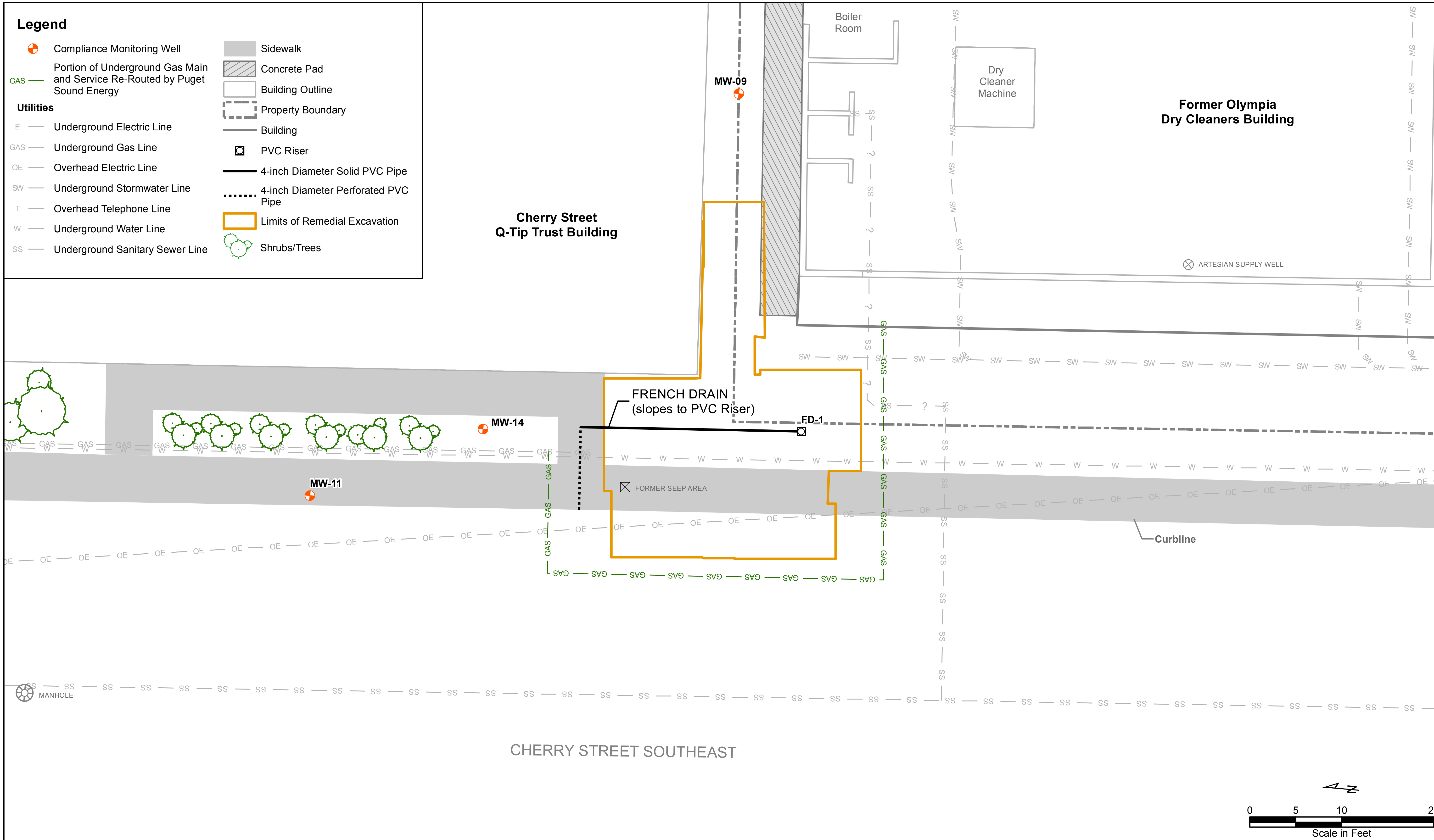

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Figure 3.2
French Drain Layout and Seep Monitoring Location

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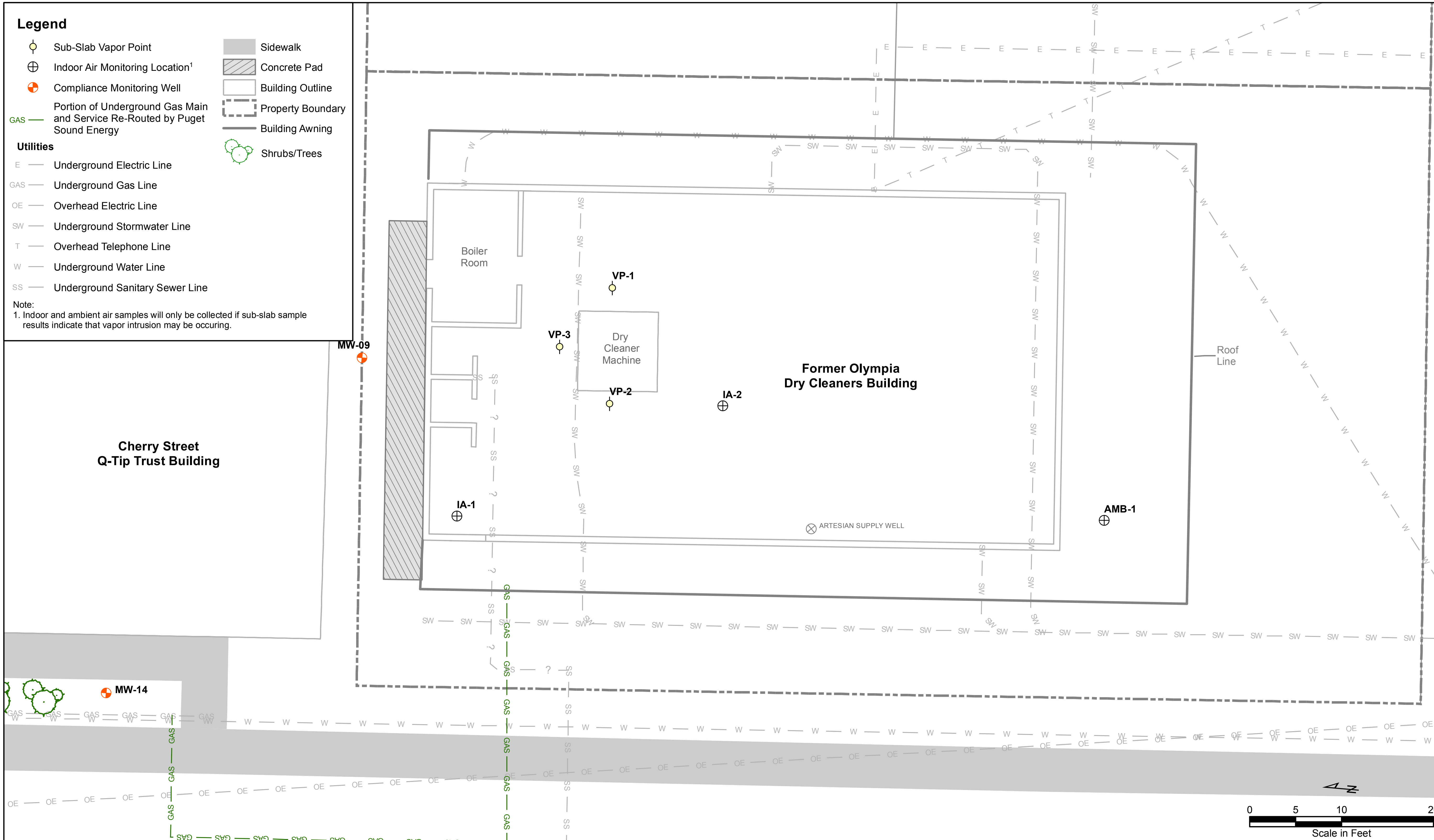

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Compliance Monitoring Plan
Former Olympia Dry Cleaners Site
Olympia, Washington

Figure 4.1
Proposed Vapor Intrusion Monitoring Locations

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1/5/2016

Former Olympia Dry Cleaners Site

Compliance Monitoring Plan

Appendix A
Sampling and Analysis Plan/ Quality Assurance Project Plan

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List of Abbreviations and Acronyms

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COC	Chemical of concern
DCE	Dichloroethene

Acronym/ Abbreviation	Definition
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
LCS	Laboratory control sample
MS	Matrix spike
MSD	Matrix spike duplicate
PCE	Tetrachloroethene
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
Site	Former Olympia Dry Cleaners Site
TCE	Trichloroethene
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound

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1.0 Project Description

The Former Olympia Dry Cleaners Site (the Site) is located at 606 Union Avenue Southeast in Olympia, Washington and is currently operated as Howard's Prestige Cleaners, a dry cleaning location. It includes a portion of the property located adjacent to the north (the Cherry Street Q-Tip Trust Property), and a portion of the Cherry Street Southeast right-of-way. The Site covers approximately 3,700 square feet.

The Site has been occupied by dry cleaning operations since 1970. Historically, these dry cleaning operations used solvents including trichloroethene (TCE) and tetrachloroethene (PCE). In 2006, following the discovery of PCE contamination in site soil, an interim action was completed to remove the contaminated soil. However, residual PCE concentrations as great as 96 milligrams per kilogram remain in soils. Groundwater seeping to the surface was also discovered during the Interim Action, and a Seep Collection and Treatment system was installed at the Site to prevent this seep of contaminated water from entering stormwater drains.

A Cleanup Action Plan to address the remaining soil contamination at the Site was completed in June 2014 by the Washington State Department of Ecology (Ecology). This plan included additional excavation of the remaining accessible contaminated soil from the northwest corner of the property in the vicinity of the previous Interim Action, as well as from a shallower area in the northeast corner of the property. The excavation activities were completed between July and September 2015 by Floyd|Snider.

The Compliance Monitoring Plan (CMP) describes post-excavation monitoring activities to be performed to evaluate the effectiveness of the Remedial Action including collection of groundwater and seep samples, and vapor intrusion monitoring. This Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) presents the specific field protocols and field and laboratory quality assurance/quality control (QA/QC) procedures associated with the compliance monitoring to be performed at the Site.

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2.0 Project Organization and Responsibility

The various management responsibilities of key project personnel are defined below.

2.1 MANAGEMENT RESPONSIBILITIES

Lynn Grochala—Floyd|Snider Project Manager

The Project Manager will have overall responsibility for project implementation and be responsible for maintaining QA on this project and ensuring that the CMP objectives are met. The Project Managers will perform the following:

- Approve the SAP/QAPP.
- Coordinate access for field activities.
- Monitor project activity and quality.
- Provide overview of field activities to Ecology.
- Provide technical representation of project activities at meetings.

2.2 QUALITY ASSURANCE RESPONSIBILITIES

Chell Black—Floyd|Snider Data Manager

The Data Manager will be responsible for the data validation of all sample results from the analytical laboratories and entering the data into a database. Additional responsibilities include the following:

- Reviewing laboratory reports.
- Loading analytical data to Ecology's Environmental Information Management (EIM) database.
- Advising on data corrective action procedures.
- QA/QC on analytical data reports.
- Database management and queries.

2.3 LABORATORY RESPONSIBILITIES

Fremont Analytical of Seattle Washington, an Ecology-accredited laboratory will perform analytical services in support of the CMP work activities.

Laboratory Project Manager

Michael Ridgeway, the Laboratory Project Manager will be responsible for the following:

- Coordinating laboratory analyses with Floyd|Snider.
- Reviewing and approving final analytical reports.
- Scheduling sample analyses.
- Overseeing data review.

2.4 FIELD RESPONSIBILITIES

Kristin Andersen—Floyd|Snider Field Lead

The Field Lead will be responsible for leading and coordinating the day-to-day activities in the field. The Field Lead will report directly to the Floyd|Snider Project Manager. Specific responsibilities include the following:

- Coordinating with the Floyd|Snider Project Manager.
- Coordinating and managing field and laboratory responsibilities, including sampling.
- Documenting and reviewing field data including field measurement data.
- Adhering to the work schedule.
- Coordinating and overseeing subcontractors.
- Preparing data summary reports.

Certain field activities, such as groundwater sample collection, may also be performed by Will Rutherford of ADESA, LLC. The Floyd|Snider Project Manager or Field Lead would facilitate coordination as necessary.

3.0 Laboratory Quality Assurance Objectives

The objective of this section is to specify laboratory data QA objectives for field sampling and laboratory analyses. Specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventative maintenance of field/laboratory equipment, and corrective action are described in subsequent sections of this SAP/QAPP.

3.1 LABORATORY DATA QUALITY ASSURANCE OBJECTIVES

The quality of analytical data generated is assessed by the frequency and type of internal QC checks developed for analysis type. Laboratory results will be evaluated against QA objectives by reviewing results for analysis of method blanks, matrix spikes (MS), duplicate samples, laboratory control samples (LCS), calibrations, performance evaluation samples, and interference checks as specified by the specific analytical methods. Data quality objectives are summarized in Table A.1.

3.2 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, precision is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through MS/matrix spike duplicate (MSD) samples for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples at a minimum laboratory duplicate frequency of 1 per laboratory analysis group or 1 in 20 samples, whichever is more frequent per matrix analyzed, as practical. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria.

Field precision will be evaluated by the collection of blind field duplicates at a minimum frequency of 1 per 20 samples. Currently, no performance criteria have been established for field duplicates. Field duplicate precision will, therefore, be screened against a RPD of 75 percent for all samples. However, no data will be qualified based solely on field duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as RPD) increases. The equations used to express precision are as follows:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

RPD = relative percent difference

C_1 = larger of the two observed values

C_2 = smaller of the two observed values

3.3 ACCURACY

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Analytical accuracy may be assessed by analyzing “spiked” samples with known standards (surrogates, LCSs, and/or MS) and measuring the percent recovery. Accuracy measurements on MS samples will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative LCS, MS/MSDs, and surrogate spike recoveries using limits for each applicable analyte. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/C_{sa}$$

Where:

$\%R$ = percent recovery
S = measured concentration in the spiked aliquot
U = measured concentration in the unspiked aliquot
C_{sa} = actual concentration of spike added

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Care will be taken in the design of the sampling program to ensure sample locations are properly selected, sufficient numbers of samples are collected to accurately reflect conditions at the location(s), and samples are representative of the sampling location(s). A sufficient volume of sample will be collected at each sampling location to minimize bias or errors associated with sample heterogeneity.

3.5 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. In order to insure results are comparable, samples will be analyzed using standard U.S. Environmental Protection Agency (USEPA) methods and protocols. Calibration and reference standards will be traceable to certified standards and standard data reporting formats will be employed. Data will also be reviewed to verify that precision and accuracy criteria were achieved and, if not, that data were appropriately qualified.

3.6 COMPLETENESS

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

$$C = \frac{\text{(Number of acceptable data points)} \times 100}{\text{(Total number of data points)}}$$

The data quality objective for completeness for all components of this project is 95 percent. Data that were qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that were qualified as rejected will not be considered valid for the purpose of assessing completeness.

3.7 QUALITY CONTROL PROCEDURES

QC samples will be collected and analyzed as described in this section.

3.7.1 Field Quality Control Procedures

Trip blanks will be included in each cooler containing samples being analyzed for volatile organic compounds (VOCs) to ensure the sample containers do not contribute to any detected analyte concentrations and to identify any artifacts of improper sample handling, storage, or shipping.

3.7.2 Laboratory Quality Control Procedures

Laboratory Quality Control Criteria. Certain samples will be spiked and the recoveries of spiked compounds compared to the QC criteria. Results of the laboratory QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits were exceeded. If control limits are exceeded in the sample group, corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to documented and reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities identified in the standard will be documented.

The following paragraphs summarize the procedures that will be used to assess data quality throughout sample analysis.

Laboratory Duplicates. Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of 1 duplicate will be analyzed per 20 water samples, and a minimum of 1 duplicate will be analyzed per 10 samples for each vapor intrusion media (sub-slab soil gas and indoor air).

Matrix Spikes and Matrix Spike Duplicates. Analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses. A minimum of 1 MS/MSD will be analyzed for every sample group or 1 for every 20 samples, whichever is more frequent. MS/MSD analyses will be performed on project-specific samples (i.e., batch QC using samples from other projects is not permitted).

Laboratory Control Samples. A LCS is a method blank sample carried throughout the same process as the samples to be analyzed, with a known amount of standard added. The blank spike compound recovery assesses analytical accuracy in the absence of any sample heterogeneity or matrix effects.

Surrogate Spikes. All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample result will be corrected for recovery using these values.

Method Blanks. Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for every extraction batch or 1 for every 20 samples, whichever is more frequent.

4.0 Sample Handling and Custody Documentation

Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to the time sample results are reported. Field logbook entries will be completed for each sample collected.

4.1 SAMPLE HANDLING

To control the integrity of the samples during transit to the laboratory and during hold prior to analysis, established preservation and storage measures will be taken. Sample containers will be labeled with the location name/number, sample number, sampling date and time, and required analyses. Field personnel will check all container labels, custody form entries, and logbook entries for completeness and accuracy at the end of each sampling day.

4.2 SAMPLE CHAIN-OF-CUSTODY

Sample labeling and custody documentation will be performed as described in this document. Custody procedures will be used for all samples at all stages in the analytical or transfer process and for all data and data documentation whether in hardcopy or electronic format.

4.3 SAMPLE PRESERVATION

Samples requiring field preservation (i.e., VOCs) will be placed into pre-preserved sample jars containing hydrochloric acid that are supplied by the laboratory. Immediately after the sample jars are filled, they will be placed in the appropriate cooler with a sufficient number of ice packs (or crushed ice) to keep them cool through the completion of that day's sampling and transport to the laboratory.

4.4 SAMPLE SHIPMENT

Field personnel will be responsible for all sample tracking and custody procedures in the field and checking the final sample inventory and maintaining sample custody documentation. At the end of each day, and prior to transfer, custody form entries will be made for all samples. Each shipment of coolers will be accompanied by custody forms; the forms will be signed at each point of transfer and will include sample numbers and requested analyses. Copies of all forms will be retained as appropriate and included as appendices to QA/QC reports to management.

Prior to shipping or delivery of water samples, sample containers will be wrapped and securely packed inside the cooler with ice packs or crushed ice by the field technician or designee. Summa canisters do no need cooling and will be placed inside the delivery box provided by the analytical laboratory. The original, signed custody forms will be transferred with the cooler/box. The cooler/box will be secured and appropriately sealed and labeled for immediate shipping or transport via vehicle. Samples will be picked up by the laboratory at the Floyd|Snider office or delivered to the laboratory under custody following completion of sampling activities.

4.5 SAMPLE RECEIPT

The designated sample custodian at the laboratory will accept custody of the samples and verify that the chain-of-custody form matches the samples received. The laboratory Project Manager will ensure that the custody forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the custody forms. The laboratory will contact the QA Manager immediately if discrepancies are discovered between the custody forms and the sample shipment upon receipt. The Laboratory Project Manager, or designee, will specifically note any coolers that do not contain ice packs or are not sufficiently cold upon receipt.

5.0 Data Reduction, Validation, and Reporting

Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory's QA Manual. QC data resulting from methods and procedures described in this document will also be reported.

5.1 DATA REDUCTION AND REPORTING

The laboratory will be responsible for internal checks on data reporting and will correct errors identified during the QA review. Close contact will be maintained with the laboratories to resolve any QC problems in a timely manner. The analytical laboratories will be required, where applicable, to report the following:

- **Project Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered (actual or perceived) and their resolutions will be documented in as much detail as necessary.
- **Sample Identification Numbers (IDs).** Records will be produced that clearly match all blind duplicate QA samples with laboratory sample IDs.
- **Chain-of-Custody Records.** Legible copies of the custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- **Sample Results.** The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
    - Field sample identification code and the corresponding laboratory identification code:
        - Sample matrix.
        - Date of sample extraction.
        - Date and time of analysis.
        - Weight and/or volume used for analysis.
        - Final dilution volumes or concentration factor for the sample.
        - Identification of the instrument used for analysis.
        - Method reporting and quantitation limits.
    - Analytical results reported with reporting units identified.
    - All data qualifiers and their definitions.
    - Electronic data deliverables.

- **Quality Assurance/Quality Control Summaries.** This section will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results (refer above). No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.
- **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
- **Surrogate Spike Recovery.** All surrogate spike recovery data for organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
- **Matrix Spike Recovery.** All MS recovery data for metals and organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be reported.
- **Matrix Duplicate.** The RPD for all matrix duplicate analyses will be reported.
- **Blind Duplicates.** Blind duplicates will be reported in the same format as any other sample. RPDs will be calculated for duplicate samples and evaluated as part of the data quality review.

5.2 DATA VALIDATION

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

A data quality review of the analytical data will follow USEPA National Functional Guidelines in accordance with the QAPP limits (USEPA 2013a and b). All chemical data will be reviewed with regard to the following:

- Chain of custody/documentation
- Sample preservation and holding times
- Instrument performance (calibration, tuning, sensitivity)
- Method blanks
- Reporting limits
- Surrogate recoveries
- MS/MSD recoveries
- LCS recoveries
- Laboratory and field duplicate RPDs

The data validation summary report will be presented as an appendix to the data reports. Validated data will be entered into the project database and uploaded to Ecology's EIM system.

6.0 Corrective Actions

Corrective action procedures are described in this section.

6.1 CORRECTIVE ACTION FOR FIELD SAMPLING

Field personnel will be responsible for correcting field errors in sampling or documenting equipment malfunctions during the field sampling effort and will be responsible for resolving situations in the field that may result in non-compliance with the SAP/QAPP. All corrective measures will be immediately documented in the field logbook. Substantial deviations from the CMP will be reported immediately to the Floyd|Snider Project Manager, who will then report the deviation to Ecology.

6.2 CORRECTIVE ACTION FOR LABORATORY ANALYSES

The laboratory is required to comply with their Standard Operating Procedures. The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SAP/QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

If any QC sample exceeds the project-specified control limits, the analyst will identify and correct the anomaly before continuing with the sample analysis. The analyst will document the corrective action taken in a memorandum submitted to the Floyd|Snider Data Manager. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and/or re-extraction) will be submitted with the data package.

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7.0 Field Sampling Procedures

This section describes the specific protocols that will be used to collect groundwater, seep, and vapor intrusion samples as specified in the CMP.

7.1 GROUNDWATER AND SEEP SAMPLING PROTOCOL

Low-flow sampling of the monitoring wells will be conducted. Floyd|Snider's standard guideline for low-flow groundwater sampling (included as Attachment A.1) provides general details regarding field procedures, sample collection, decontamination, and field documentation for groundwater sample collection. Site-specific details regarding sample collection that are not described in Attachment A.1 are included in this section.

Seep water sample(s) that are collected from the French drain sample access port will be collected in a somewhat different manner. The collection pipe will be purged fully using a submersible or peristaltic pump to ensure fresh water flow into the pipe so that stagnant water is not collected. If other seep(s) are observed that require sample collection, sample collection methods and locations will be dependent on the location(s) and flow rate of the seep and so cannot be specified at this time.

7.1.1 Monitoring Locations and Frequency

The groundwater monitoring network includes five downgradient wells (MW-6, MW-09, MW-11, MW-13, and MW-14); these compliance monitoring wells are shown on Figure 3.1 of the CMP. Quarterly groundwater monitoring will occur for the first year following the cleanup action, and will be initiated within 30 days of Ecology's approval of the CMP. Depending on the results, the monitoring frequency will be reduced to semi-annual, and eventually to annual.

A French drain was installed in the previous seep area for the purpose of sample collection and as a contingency for future seep treatment, if warranted. Refer to Figure 3.2 of the CMP for the location of the French drain and sample access location (FD-1).

A seep water sample will be collected from the seep standpipe (FD-1) during the first groundwater monitoring event to establish baseline post-excavation water quality data for the seep. A minimum of one confirmatory sample will be collected per quarter, along with the well samples to establish seep concentrations. Additional samples may be collected to facilitate treatment design requirements, if warranted.

7.1.2 Sample Nomenclature

The sample naming format that will be used for the groundwater and seep samples is: "Location ID—month/day/year of collection." For example, a groundwater sample collected from MW-6 that was collected on September 1, 2015, would be labeled MW-6-090115. QA/QC samples, such as field duplicates, will be named according to the location where they were collected.

7.1.3 Laboratory Analysis

Groundwater and seep samples will be analyzed for the site-specific chemicals of concern (COCs) by USEPA Method 8260B. Site COCs include PCE, TCE, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, 1,1-DCE, and vinyl chloride.

Field water quality parameters will also be measured in groundwater during each monitoring event and will include dissolved oxygen, oxidation reduction potential, conductivity, turbidity, and pH.

7.2 SUB-SLAB VAPOR SAMPLING METHODS AND PROCEDURES

The sub-slab vapor sampling will be completed in general accordance with Ecology's *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action* (Ecology 2009). General details regarding field procedures, sample collection, and field documentation for sub-slab vapor monitoring are included in the following sections. The sub-slab vapor sampling will be initiated within 45 days of Ecology's approval of the CMP, which is estimated to be some time in early 2016.

7.2.1 Monitoring Locations

Three sub-slab vapor points will be installed within the Howard's Prestige Cleaners building: one to the north of the former dry cleaner machine, one to the east of the former dry cleaner machine, and one to the west of the former dry cleaner machine. The approximate locations are depicted on Figure 4.1 of the CMP.

Minor adjustments to the proposed sample locations may be made, as appropriate, based on operations occurring in the building at the time of sampling and accessibility.

7.2.2 Soil Vapor Point Installation

The three vapor points will be installed just beneath the slab at each location. A small-diameter hole (1 to 2 inches) will be drilled through the slab using a roto-hammer, or similar coring devise. Vapor points will be constructed using an AMS® stainless steel mesh vapor implant connected to rigid polyethylene tubing, or similar. The hole will subsequently be backfilled with coarse sand around the implant screen and sealed with bentonite or VOC-free hydraulic cement. Vapor points will be allowed to cure and stabilize for a minimum of 30 minutes prior to purging.

7.2.3 Soil Vapor Sample Collection

Soil vapor points must be purged prior to sample collection. The purge volume is the volume of air occupying the sample collection tubing and the annular space around the vapor collection probe, a default of three purge volumes will be removed before sampling each location. Soil vapor points will be purged using an SKC® hand pump and will be field screened for VOCs with a photoionization detector (PID) prior to sample collection. Vapor samples will then be collected into 1-liter Summa canisters. Field duplicates shall be collected by using a T-splitter at the point of sample collection to divide the sample steam into two separate sample containers.

7.2.4 Leak Testing

Care will be taken during sampling to avoid sample break-through from the surface of the slab. Helium or other acceptable tracer gas will be used following probe installation to assess break-through. Briefly, the tracer gas will be expressed from a pressurized tank into a shroud surrounding the head of the soil vapor probe. A mini-pump will be used to fill a Tedlar bag through the installed soil vapor probe. A portable detector will then be used to analyze the contents of the Tedlar bag for helium or other tracer gas. Tracer gas concentrations within the shroud should ideally range between 10 and 50 percent by volume. If the concentration of tracer gas in the Tedlar bag sample from the sub-slab vapor point is greater than 10 percent of the concentration of the shroud in two successive Tedlar bag samples, the vapor point seal and valve should be inspected for leaks. If a leak cannot be remedied then the vapor point may require repair or replacement.

7.2.5 Sample Nomenclature

The sample naming format that will be used for the soil vapor samples is: "Station ID—month/day/year of collection," where a soil vapor sample is referenced as "SV." For example, a soil vapor sample collected from location SV-1 that was collected on September 1, 2015, would be labeled SV-1-090115.

7.2.6 Laboratory Analysis

All sub-slab samples will be delivered to Fremont Analytical, Inc. in Seattle, Washington for analysis by USEPA Method TO-15 (SCAN).

7.3 INDOOR AIR SAMPLING METHODS AND PROCEDURES

Indoor air sampling may be necessary if the results of the sub-slab monitoring indicate that there is a potential for vapor intrusion. General details regarding field procedures, sample collection, and field documentation for indoor air monitoring are included in the following sections.

Summa canisters (6-liter) will be used to collect the indoor air and outdoor ambient air samples. Summa canisters are designed such that light-sensitive or halogenated VOCs will not degrade or adhere to the inner surface of the canister. All Summa canisters will be certified clean by the laboratory prior to use. A flow regulator will be placed between the probe and the Summa canister to ensure that the canister is filled evenly over an 8-hour time period (morning to afternoon), ensuring representative samples are collected throughout a work shift. These indoor and outdoor (ambient) air samples will be collected during normal business hours to assess conditions during the period of time when the building is occupied and the greatest potential for human exposure exists.

7.3.1 Monitoring Locations and Frequency

If necessary, two indoor air samples will be collected in the former Olympia Dry Cleaner building (currently Howard's Prestige Cleaners) and one ambient (outdoor) sample will be collected during a monitoring event. Indoor samples would be collected from the northern portion of the building closest to the former source areas and from the main work area in the central portion of the building. The ambient sample would be collected from outside the south/southwest corner of the former Olympia Dry Cleaner building, under the roof awning. The approximate locations are depicted on Figure 4.1 of the CMP.

Minor adjustments to the proposed sample locations may be made, as appropriate, based on visual inspections of the contents and operations occurring in the building at the time of sampling. Sample locations will be relocated to avoid any possible interference from potential VOC sources within the building; significant re-locations will be communicated to Ecology prior to sample collection.

Indoor air monitoring will occur in the Former Olympia Dry Cleaner Building, if necessary, based on the phased vapor assessment approach described in Section 4.1 of the CMP. If indoor air sampling is necessary, then the initial round of indoor air sampling would be completed within 2 weeks of obtaining the sub-slab vapor results (estimated late winter/early spring 2016). If the results of indoor air sampling indicate concentrations of site COCs are not present in indoor air or are present at concentrations less than the cleanup levels and PCE and/or TCE sub-slab concentrations have not increased to levels greater than the 2011 measured concentrations, then additional evaluation of indoor air will not be necessary. If necessary, a second indoor air monitoring event would occur approximately 2 months after the first, and would occur in spring 2016.

7.3.2 Indoor Air Sample Collection

Summa canisters will be used at each indoor air sampling location. Summa canisters will be field-checked for vacuum pressure with a laboratory-supplied pressure gauge prior to use. All canisters used will have initial pressures greater than -25 inches of mercury and will be fitted with a flow restrictor calibrated for sample collection at a rate of approximately 10 milliliters per minute to achieve an 8-hour sample collection time.

To collect indoor air samples, the Summa canisters will be staged 3 to 6 feet above floor level to collect indoor air samples that represent the breathing zone. Indoor air samples will be collected by opening the Summa canister valve for approximately 8 hours. Field duplicates shall be collected by using a T-splitter at the point of sample collection to divide the sample steam into two separate sample containers. Following sample collection, the Summa canister valve will be closed and sealed with a laboratory-supplied brass Swagelok cap. Beginning and ending times and canister pressures will be recorded on Chain-of-Custody Forms and sample labels. The Summa canister should optimally have a remaining vacuum of -5 inches of mercury total pressure or less; residual vacuum should remain in the canister after sampling. If the final canister vacuum is less than -0.1 inches of mercury (or positive pressure), the sample may be flagged at the laboratory, and, depending on the results, re-testing may be recommended.

7.3.3 Outdoor Air Sample Collection

Outdoor (ambient) air samples will not be collected within 24 hours of a significant rain event, which, for the purposes of this compliance monitoring, is defined as greater than or equal to 0.3 inches of rain within a 24-hour period. Weather data will be collected on the day of air sample collection to assess meteorological conditions that could affect sample collection and analytical results.

Summa canisters will be used for outdoor air sampling locations. The Summa canisters will be field-checked for vacuum pressure with a laboratory-supplied pressure gauge, prior to use. All canisters will have initial pressures greater than -25 inches of mercury and will be fitted with a flow restrictor calibrated for sample collection at a rate of approximately 10 milliliters per minute to achieve an 8-hour sample collection time. After sample collection is complete, the Summa canister should optimally have a remaining vacuum of -5 inches of mercury total pressure; residual vacuum should remain in the canister after sampling. Outdoor sample collection will begin before indoor air sample collection begins to account for the travel of outdoor air to indoor spaces.

7.3.4 Sample Nomenclature

The sample naming format that will be used for the indoor samples is: "Station ID—month/day/year of collection," where an indoor air sample is referenced as "IA" and outdoor/ambient sample is referenced as "Amb." For example, an indoor air sample collected from location IA-1 that was collected on September 1, 2015, would be labeled IA-1-090115. Consistent locations should be assigned the same station number (i.e., IA-1 sampled twice in the same location should both be referred to as IA-1), where as if a new location is needed, it should be given a new and unique designation (i.e., if IA-1 cannot be reproduced and the location is moved, it should be assigned a new location such as IA-4).

7.3.5 Collection of Weather Data

Weather data will be collected on the day of indoor/outdoor air sample collection to assess meteorological conditions that could affect sample collection and analytical results. The weather data to be collected include: wind speed, wind direction, temperature, relative humidity, barometric pressure, and precipitation. These data will be obtained from sources in the area of the Site that collect and post this information for the general public. Data regarding recent precipitation events will be obtained from the Olympia Airport or other appropriate gauging location.

7.3.6 Laboratory Analysis

All Summa canisters will be delivered to Fremont Analytical in Seattle, Washington for analysis of VOCs by Modified USEPA Method TO-15-SIM (Selective Ion Monitoring) using gas chromatography/mass spectrometry. This method allows for lower detection limits for the compounds of interest. If Ecology directs that Short-Term Exposure Limit (STEL) monitoring is necessary, then a 21-day average sample shall be collected using a passive sampler (for example, a Radiello™ charcoal passive sampler).

8.0 References

U.S. Environmental Protection Agency (USEPA). 2013a. *National Functional Guidelines for Inorganic Superfund Data Review*. EPA-540-R-013-001. October.

_____. 2013b. *National Functional Guidelines for Superfund Organic Data Review.* EPA-540-R-014-002. October.

Washington State Department of Ecology (Ecology). 2009. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Actions*. Draft. October.

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Former Olympia Dry Cleaners Site

Compliance Monitoring Plan

Appendix A
Sampling and Analysis Plan/
Quality Assurance Project Plan

Table

Table A.1
Compliance Sample Analysis Criteria

Data Quality Assurance Criteria				
Media	**Method**	**Precision (Relative Percent Difference)**	**Accuracy (Percent Difference from Standard)**	**Completeness (Percentage of Data Validated)**
Groundwater/Seep	USEPA Method 8260B	0–20%	+ /- 50%	95%
Soil Gas	USEPA Method TO-15-SCAN	0–30%	+ /- 30%	95%
Indoor Air	USEPA Method TO-15-SIM	0–30%	+ /- 30%	95%

Analytical Requirements				
Media	**Method**	**Container Type**	**Preservative**	**Holding Time**
Groundwater/Seep	USEPA Method 8260B	3 Glass VOA vials with PTFE Septum[1]	HCl and cool to ≤4 °C	14 days to analyze
Soil Gas	USEPA Method TO-15-SCAN	1 Summa Canister (1-liter)	None	30 days to analyze
Indoor Air	USEPA Method TO-15-SIM	1 Summa Canister (6-liter)	None	30 days to analyze

Detection and Reporting Limits						
	Groundwater (µg/L)		**Sub-Slab Soil Gas (ppbv)**		**Indoor Air (µg/m³)**	
Chemical of Concern	**Method Detection Limit**	**Reporting Limit/PQL**	**Method Detection Limit**	**Reporting Limit/PQL**	**Method Detection Limit**	**Reporting Limit/PQL**
PCE	0.051	1	0.0106	0.3	0.044	0.34
TCE	0.17	0.5	0.00634	0.2	0.020	0.091
cis-1,2-DCE	0.087	1	0.0108	0.2	0.0082	0.080
trans-1,2-DCE	0.063	1	0.0108	0.2	0.0023	0.024
1,1-DCE	0.039	1	0.0124	0.2	0.0037	0.036
Vinyl chloride	0.061	0.2	0.0146	0.2	0.0037	0.22

Note:
1 No head space in sample container.

Abbreviations:

°C Degrees Celsius
DCE Dichloroethene
HCl Hydrochloric acid
µg/L Micrograms per liter
µg/m³ Micrograms per cubic meter
PCE Tetrachloroethene
ppbv Parts per billion by volume
PQL Practical Quantitation Limit
PTFE Polytetrafluoroethylene
TCE Trichloroethene
VOA Volatile organic analyte

Former Olympia Dry Cleaners Site

Compliance Monitoring Plan

Appendix A
Sampling and Analysis Plan/ Quality Assurance Project Plan

Attachment A.1
F|S Standard Guideline: Low-Flow Groundwater Sample Collection

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F|S STANDARD GUIDELINE

Low-Flow Groundwater Sample Collection

DATE/LAST UPDATE: August 2015

These procedures should be considered standard guidelines and are intended to provide useful guidance when in the field, but are not intended to be step-by-step procedures, as some steps may not be applicable to all projects.

All field staff should be sufficiently trained in the standard guidelines for the sampling method they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work. When possible, the project-specific Sampling and Analysis Plan should contain any expected deviations and should be referenced in conjunction with these standard guidelines.

1.0 Scope and Purpose

This standard guideline provides details necessary for collecting representative groundwater samples from monitoring wells using low-flow methods. These guidelines are designed to meet or exceed guidelines set forth by the Washington State Department of Ecology (Ecology). Low-Flow sampling provides a method to minimize the volume of water that is purged and disposed from a monitoring well, and minimizes the impact that purging has on groundwater chemistry during sample collection.

2.0 Equipment and Supplies

Groundwater Sampling Equipment and Tools:

- For wells with head less than 25 feet:
  - Peristaltic pump with fully-charged internal battery or standalone battery and appropriate connectors

- For wells with head greater than 25 feet:
  - Bladder pump and controller, as well as an air cylinder, or air compressor (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)

    OR
  - Low-flow submersible pump and controller (with extension cord if near an electrical outlet; with battery and appropriate connectors or generator if not near an outlet)
- Multi-parameter water quality meter
- Water level meter
- Poly tubing
- Silicone tubing
- Filters (if field filtering)
- Tools for opening wells (1/2-inch, 9/16-inch, and 5/8-inch sockets, ratchet, screwdriver)
- Well keys
- Tube cutters, razor blade, or scissors
- 5-gallon buckets and clamp
- Paper towels
- Bailer or pump to drain well box if full of stormwater
- Hammer
- Alconox (or similar decontamination solution), deionized water, spray bottles
- Tape measure
- Trash bags

Lab Equipment:

- Sample jars/bottles
- Coolers
- Chain-of-Custody Forms
- Labels
- Ice
- Ziploc bags

Paperwork:

- Field notebook with site maps
- Table of well construction details and/or well logs, if available
- Sampling forms
- Purge water plan
- Rite-in-the-Rain pens, paper, and permanent markers
- Site-Specific Health and Safety Plan (HASP)
- Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) (including tables of analytes and bottle types)

Personal Protective Equipment (PPE):

- Boots/waders
- Safety vest
- Safety glasses
- Rain gear
- Nitrile gloves
- Work gloves

3.0 Standard Procedures

Low-Flow groundwater sampling consists of purging groundwater within the well casing at a rate equal to or less than the flow rate of representative groundwater from the surrounding aquifer into the well screen. The flow rate will depend on the hydraulic conductivity of the aquifer and the drawdown, with the goal of minimizing drawdown within the monitoring well. Field parameters are monitored during purging and groundwater samples are collected after field parameters have stabilized. Deviations from these procedures should be approved by the Project Manager and fully documented.

3.1 CALIBRATION OF WATER QUALITY METERS

All multi-parameter water quality meters to be used will be calibrated prior to each sampling event. Calibration procedures are outlined in each instrument’s specific user manual.

3.2 MONITORING, MAINTENANCE, AND SECURITY

Prior to sampling, depth to water and total depth measurements will be collected and recorded for accessible monitoring wells onsite (or an appropriate subset for larger sites). Check for an existing measuring point (notch or visible mark on top of casing). If a measuring point is not observed, a measuring point should be established on the north side of the casing. The conditions of the well box and bolts will also be observed and deficiencies will be recorded on the sampling forms or logbook (i.e., missing or stripped bolt). The following should also be recorded:

- Condition of the well box, lid, bolts, locks, and gripper cap, if deficiencies
- Condition of gasket if deficient and if water is present in the well box
- Note any obstructions or kinks in the well casing
- Note any equipment in the well casing, such as transducers, bailers, or tubing
- Condition of general area surrounding the well, such as subsidence, potholes, or if the well is submerged within a puddle.

Replace any missing or stripped bolts, and redevelop wells if needed.

3.3 LOW-FLOW PURGING METHOD AND SAMPLING PROCEDURES

Groundwater samples will be collected using low-flow purging and sampling procedures consistent with Ecology guidelines and the U.S. Environmental Protection Agency (USEPA) standard operating procedures (USEPA 1996). The following describes the Low-Flow purging and sampling procedures for collecting groundwater samples using a peristaltic pump. If the water level is greater than 20 feet below ground surface (bgs), Grundfos or Geotech submersible pumps or bladder pumps can be used since their pumping rates can be adjusted to low-flow levels.

- Place the peristaltic pump and water quality equipment near the wellhead. Slowly lower new poly tubing down into the well casing approximately to the middle of the well screen. If the depth of the well screen is not known, lower the tubing to the bottom of the well, making sure that the tubing has not been caught on the slotted well casing, and then raise the tubing 3 to 5 feet off the bottom of the casing. Document the estimated depth of the tubing placement within the well. Connect the tubing to the peristaltic pump using new flex tubing and connect the discharge line to the flow-through cell of the water quality meter. The discharge line from the flow cell should be directed to a bucket to contain the purged water.
- If using a low-flow submersible pump, connect the pump head to dedicated or disposable tubing. If using a bladder pump, connect both the air intake and water discharge ports to decontaminated or disposable tubing, using the manufacturer's instructions to ensure a secure connection. Lower the pump with tubing into the well as described above and connect the water discharge tubing directly to the flow-through cell.
- Measure the depth to water to the nearest 0.01 foot with a decontaminated water level meter and record the information on a sampling form.
- Start pumping the well at a purge rate of 0.1 to 0.2 liters per minute and slowly increase the rate. Purge rate is adjusted using a speed control knob or arrows on peristaltic and low-flow submersible pumps. The purge rate for bladder pumps is controlled by the air compressor, which first pressurizes the pump chamber in order

to compress the flexible bladder and force water through the discharge line, and then vents the chamber in order to allow the bladder to refill with water.

- A good rule of thumb is to pressurize to 10 psi + 0.5 psi/foot of tubing depth and begin with 4 discharge/refill cycles per minute; using greater air pressure and accelerating the pump cycles will increase the purge rate.

- Check the water level. If the water level is dropping, lower the purge rate. Maintain a steady flow with no or minimal drawdown (less than 0.33 feet according to USEPA 2002). Maintaining a drawdown of less than 0.33 feet may not be feasible depending on hydrogeological conditions. If possible, measure the discharge rate of the pump with a graduated cylinder or use a stopwatch when filling sampling jars (500 milliliters [mL] polyethylene or glass ambers) to estimate the rate. When purging water through a flow cell, the maximum flow rate for accurate water quality readings is about 0.5 liters per minute (L/minute).
- Monitor and record water quality parameters every three to five minutes after one tubing volume (including the volume of water in the flow cell) has been purged.
  - One foot of ¼-inch interior diameter tubing holds about 10 mL of water, and flow-through cells typically hold less than 200 mL of water; one volume should be purged after about 5 minutes at a flow rate of 0.1 L/minute.
- Water-quality indicator parameters that will be monitored and recorded during purging include:
  - pH
  - Specific conductivity
  - Dissolved oxygen
  - Temperature
  - Turbidity
  - Oxidation reduction potential (ORP)
- Purging will continue until temperature, pH, turbidity, and specific conductivity are approximately stable (when measurements are within 10 percent) for three consecutive readings, or 30 minutes have elapsed. Because these field parameters (especially dissolved oxygen and ORP) may not reach the stabilization criteria, collection of the groundwater sample will be based on the professional judgment of field personnel at the time of sampling.
- The water sample can be collected once the criteria above have been met.
- If drawdown in the well cannot be maintained at 0.33 feet or less, reduce the flow or turn off the pump for 15 minutes and allow for recovery. If the water quality parameters have stabilized, and if at least two tubing volumes and the flow cell volume have been purged, then sample collection can proceed when the water level has recovered and the pump is turned back on. This should be noted on the sampling form.

- To collect the water sample, maintain the same pumping rate. After the well has been purged and the sample bottles have been labeled, the groundwater sample will be collected by directly filling the laboratory-provided bottles from the pump discharge line prior to passing through the flow cell. All sample containers should be filled with minimum disturbance by allowing the water to flow down the inside of the bottle or vial. When collecting a volatile organic compound (VOC) sample, fill to the top to form a meniscus over the mouth of the vial prior to placing the cap to eliminate air bubbles. Be careful not to overflow preserved bottles/pre-cleaned Volatile Organic Analyte (VOA) vials.
- If sampling for filtered metals, collect these samples last and fit an in-line filter at the end of the discharge line. Take note of the flow direction arrow on the filter prior to fitting. A minimum of 0.5 to 1 liter of groundwater must pass through the filter prior to collecting the sample.
- Sample labels will clearly identify the project name, sampler's initials, sample location and unique sample id, analysis to be performed, date, and time. After collection, samples will be placed in a cooler maintained at a temperature of approximately 4 to 6 degrees Celsius (°C) using ice. Chain-of-Custody Forms will be completed. Upon transfer of the samples to the laboratory, the Chain-of-Custody Form will be signed by the persons transferring custody of the sample containers to document change in possession.
- When sample collection is complete at a designated location, remove and properly dispose of the non-dedicated tubing. In most cases, this waste is considered solid waste and can be disposed of as refuse. Close and lock the well.

4.0 Decontamination

All reusable equipment that comes into contact with groundwater should be decontaminated using the processes described in this section prior to moving to the next sampling location.

Water Level Meter: The water level indicator and tape will be decontaminated between sampling locations and at the end the day by spraying the entire length of tape that came in contact with groundwater with an Alconox (or similar)/clean water solution followed by a thorough rinse with distilled or deionized water.

Water Quality Sensors and Flow-Through Cell: Distilled water or deionized water will be used to rinse the water quality sensors and flow-through cell. No other decontamination procedures are recommended since they are sensitive equipment. After the sampling event, the water quality meters will be cleaned and maintained according to the specific manual.

Submersible Pump (if applicable: Decontaminating the pump requires running the pump in three progressively cleaner grades of water.

1. Fill a bucket with approximately 4 gallons or more to sufficiently cover the pump of an Alconox (or similar)/clean water solution. Place the pump and the length of the

power cord (if applicable) that was in contact with water into the bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

2. Fill a second bucket containing approximately 4 gallons or more to sufficiently cover the pump of clean water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.
3. Fill a third bucket with approximately 4 gallons or more to sufficiently cover the pump of distilled or deionized water. Place the pump and cord into this bucket and run the pump for approximately two minutes or until the volume of water in the bucket has been exhausted.

Bladder Pump: Clean the inside and outside of the pump body with an Alconox (or similar)/clean water solution, followed by a thorough rinse with distilled or deionized water. The outside of the air supply line that came in contact with groundwater may also be cleaned with Alconox (or similar) solution and re-used; bladders and water discharge lines must be replaced after each sample is collected.

5.0 Investigation-Derived Waste (IDW)

Unless otherwise specified in the project work plan, water generated during groundwater sampling activities will be contained, transported, disposed of in accordance with applicable laws, and stored in a designated area until transported off-site for disposal.

The approach to handling and disposal of these materials for a typical cleanup site is as follows. For IDW that is containerized, such as purge water, 55-gallon drums (or other smaller sized drums) approved by the Washington State Department of Transportation will be used for temporary storage pending profiling and disposal. Each container holding IDW will be sealed and labeled as to its contents (e.g., “purge water”), the dates on which the wastes were placed in the container, the owner’s name and contact information for the field person who generated the waste, and the site name.

IDW containerized within drums will be characterized relative to applicable waste criteria using data from the sampling locations whenever possible. Material that is designated for off-site disposal will be transported to an off-site facility permitted to accept the waste. Manifests will be used, as appropriate for disposal.

Disposable sampling materials and incidental trash such as paper towels and PPE used in sample processing will be placed in heavy-duty garbage bags or other appropriate containers and disposed of as trash in the municipal collection system.

6.0 Field Documentation

Groundwater sampling activities will be documented in field sampling forms and/or field notebooks, and Chain-of-Custody Forms. Information recorded will, at a minimum, include personnel present (including subcontractors or client representatives), purpose of field event, weather conditions, sample collection date and times, sample analytes, depths to water, water quality parameters, well box/lid conditions, amount of purged water generated, and any deviations from the SAP. Photographs of damaged well casings or well boxes should be taken.

7.0 References

USEPA. 1996. Low-Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revision 2. Region 1. July 30, 1996.

_____. 2002. Groundwater Sampling Guidelines for Superfund and CAR Project Managers. Office of Solid Waste and Emergency Response. EPA 542.S-02-001. May 2002.