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December 11, 2012

Mr. Scott Rose, L.G.
Washington State Department of Ecology
Toxics Cleanup Program – Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Re: 1,2&O Cleaners Site, 513 South Meridian St, Puyallup, VCP No. SW0646

Dear Mr. Rose:

On behalf of Coastline Law Group, I am enclosing one hardcopy of a Remedial Investigation (RI) Data Gap Work Plan for the aforementioned 1,2&O Cleaners Site (Site). The purpose of submitting this document is to obtain your written concurrence that the planned path forward addresses the outstanding issues you have outlined for the Site, and that this path forward meets the substantive requirements of the Model Toxics Control Act (MTCA) for completing an RI at this Site.

As you know, a significant amount of activities have been conducted at the Site to date, including submittal of a RI/Feasibility Study (FS) Report in 2008 and submittal of a supplemental Site Investigation Report in 2011. Your 2008 opinion letter in response to the 2008 RI/FS Report and 2012 email comments on the 2011 Site Investigation Report indicated that further remedial action was necessary. Specifically, you had several comments related to RI data gaps. As summarized in the attached table, many of your 2008 and 2012 comments have been addressed. However, a couple RI data gaps have not been completely addressed. Thus, the intent of the enclosed RI Data Gap Work Plan is to address those remaining RI data gaps. The attached response to comment table presents the current status or planned action in response to your 2008 and 2012 comments. The attached figure from the RI Data Gap Work Plan presents a summary of the proposed RI data gap sampling locations.

Once the remaining RI data gaps are filled pursuant to the RI Data Gap Work Plan, PIONEER Technologies Corporation will prepare a revised RI/FS Report for this Site in accordance with Washington Administrative Code (WAC) 173-340-350.

If you have questions about the enclosed plan or the planned path forward, please contact me at 360-570-1700.

Respectfully,

Troy Bussey Jr., P.E. (WA, CA), L.G. (WA), L.HG. (WA)
Senior Professional Engineer

Enclosures:
Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email
Figure 1-2: Site Detail and Sampling Locations
Remedial Investigation Data Gap Work Plan

cc: Ms. Kim Seely, Coastline Law Group (electronic copy)

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Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
October 2, 2008	1. Characterization of the Site	1.1	There is not enough information to convincingly conclude that the HVOC contamination in the northwest portion of the shopping center property is from a separate source and, if it is, that it is not commingled with the release from the dry cleaners. Page 14 of the July 2007 report indicates that "delineation of concentrations of HVOCs in groundwater to the north of Source Area #1 will likely be complicated due to commingling with the HVOC plume associated with Source #2". This statement suggests there is a second source and that they are commingled. Investigations conducted since this time did not collect sufficient additional data to suggest commingling is not occurring. If indeed there is a separate source (whether it is associated with the former BP facility or other facility) and the plumes are commingled, then contamination associated with the separate source and the dry cleaners would be considered one Site. According to Figure 5 of the May 2008 report, the only data points located between the inferred extent of contamination for Source Areas #1 and #2 are soil borings P-1, P-2, and P-4. These were shallow soil borings advanced 1 to 2 feet into groundwater. Soil samples were collected using a hand trowel and packed into a 4-ounce jar, which is not an ideal collection method for HVOCs. Soil samples should have been collected consistent with EPA Method 5035. Groundwater samples were collected from the top 1 to 2 feet of the saturated zone, which is not where HVOCs have a tendency to accumulate. As a result, additional investigation is warranted to support the theory that there are two plumes that are not commingled. It may be beneficial to have another monitoring well off the northwest corner of the building near P-4.	As documented previously (e.g., Pacific Crest Environmental 2008, 2009a, 2009b, 2011, 2012), there are a number of compelling lines of evidence that suggest the presence of a "Source #2" that has produced a second halogenated volatile organic compounds (HVOC) plume that is separate from the HVOC plume emanating from the former 1,2&O Cleaners floor drain. These compelling lines of evidence include (1) the consistent measured direction of groundwater flow towards the southwest, (2) tetrachloroethylene (PCE) results from the 2007 passive soil gas survey, (3) the general lack of HVOC detections in groundwater sample locations between the two suspected plumes (i.e., MW-6, P-2, P-1, P-4, and MW-9), (4) the known PCE release at the former British Petroleum (BP) Site, and (5) the relative concentration distribution of PCE and its degradation byproducts along the axis from source area to southwestern distal extent for each of the two suspected plumes. However, PIONEER Technologies Corporation (PIONEER) agrees that existing soil and/or groundwater data is not sufficient to conclusively determine that "Source #2" exists. Potential issues with the "Source #2" hypothesis include: (1) the lack of HVOC detections in BP monitoring wells (MWs) in the northwestern corner of the Village Fair property, (2) the lack of an obvious off-property source area besides the former BP Site, (3) the lack of soil and groundwater data in the suspected location of "Source #2", and (4) the inherent limitations associated with the semi-quantitative passive soil gas data. There are other plausible hypotheses besides the "Source #2" hypothesis that could account for the HVOC concentrations observed at the Site. For instance, it is possible that a one-time groundwater flow direction to the northwest could have distributed some HVOC mass to the area near MW-1 and MW-5. As a result, installation and sampling of a new MW is proposed to more definitively prove or disprove the "Source #2" hypothesis. As discussed previously, the groundwater samples collected from P-1, P-2, and P-4 at depths of approximately 8 to 13 feet below ground surface (bgs) were representative groundwater samples (Pacific Crest Environmental 2009a). The Washington State Department of Ecology (Ecology) accepted this response (Pacific Crest Environmental 2009b). Per Ecology's request, MW-9 was installed near P-4, and soil and groundwater samples were collected from MW-9 (Pacific Crest Environmental 2011). HVOCs were not detected in MW-9 soil or groundwater, with the exception of minor detections (less than screening levels) for PCE and cis-1,2-dichloroethylene (cis-DCE) in a soil sample collected near the groundwater interface and cis-DCE in the groundwater sample.	Yes. Installation and sampling of a new MW (MW-10) is proposed in the enclosed RI Data Gap Work Plan. The proposed MW-10 location is shown in the attached Figure 1-2. The MW-10 location is intended to be as near as possible to the suspected location of "Source #2" along the suspected centerline of the second HVOC plume.

Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
October 2, 2008	1. Characterization of the Site	1.2	According to the soil vapor survey results for tetrachloroethylene (PCE), a hot spot is located beneath the dry cleaner and a second hot spot is located along the northern property boundary. No soil vapor data points exist between these two hot spots to determine whether there is any connection. Also, only one data point was located along the sewer east of the building where elevated concentrations of PCE were detected in the sewer. Ecology recommends conducting another survey to determine any connection between the two hot spots, and to determine any impacts further along the sewer lateral and the sewer main that runs down 2nd Street.	See response to comment #1.1 regarding the installation and sampling of MW-9 between the two suspected HVOC plumes, as well as the proposed installation and sampling of new MW-10 near the suspected "Source #2". As discussed and resolved previously (Pacific Crest Environmental 2009a, 2009b), Ecology agreed that there is no need to conduct further soil gas sampling activities. Likewise, the sewer lateral located east of the building has been adequately characterized with passive soil gas results from four sampling locations, and soil and groundwater results from MW-3, B-2, P-3, MW-4, and B-4 (Pacific Crest Environmental 2009a, 2009b).	Yes. As discussed in response to comment #1.1, installation and sampling of a new MW (MW-10) is proposed in the enclosed RI Data Gap Work Plan. No additional investigation work related to a passive soil gas survey or characterization of the sewer lateral is necessary in accordance with the response to comment.
		1.3	No soil borings or monitoring wells were advanced in the area of the hot spot along the northern property boundary. This area should be further investigated to support the theory of a second HVOC source.	See response to comment #1.1.	Yes. See response to comment #1.1.

Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
October 2, 2008	1. Characterization of the Site	1.4	Ecology is not convinced that the vertical extent of contamination has been sufficiently defined. A 6- to 12-inch silt layer is hardly a formidable confining layer for a release of HVOCs. In addition, the concentrations of cis-1,2-dichloroethylene (DCE) detected in borings SB-10 and SB-11 suggest that HVOCs have penetrated this layer in some capacity. Additional deeper borings and/or monitoring wells should be advanced closer to the source area to determine whether the deeper silty sand unit noted on the cross-section has been impacted. These borings should be advanced to the next confining layer to determine whether dense non-aqueous phase liquid (DNAPL) is present. Furthermore, at least one additional monitoring well should be advanced downgradient of boring SB-11 to be able to monitor the toe of the plume.	PIONEER agrees that the silt layer encountered from approximately 16 to 17.5 feet bgs in SB-11 and approximately 17.5 to 19.5 feet bgs in SB-12 is not a significant aquitard. Furthermore, this silt layer may or may not be continuous across the Site. In other words, the shallowest groundwater bearing zone most likely does not stop at a depth of approximately 16 to 17.5 feet bgs as implied in the previously submitted cross-section (Pacific Crest Environmental 2008, 2011), but rather likely extends to a depth of approximately 25 feet bgs (Pacific Crest Environmental 2008, 2011). Therefore, it is not surprising that cis-DCE was detected at concentrations of 22 ug/L and 11 ug/L in the groundwater samples collected from 20 to 24 feet bgs in SP-10 and SP-11, respectively. That said, vertical migration from the groundwater bearing zone encountered at approximately five to 25 feet bgs to a deeper aquifer is not a concern at this Site for the following reasons: • There appears to be a more significant silt unit starting at a depth of approximately 25 feet bgs that extends down to the maximum depth explored of approximately 32 feet bgs (Pacific Crest Environmental 2008, 2011). • The vertical extent of HVOC impacts has been delineated with groundwater data collected from SB-9 through SB-13. No HVOCs were detected in the deepest interval sampled in any of these borings (28 to 32 feet bgs), with the exception of minor detections of cis-DCE at concentrations slightly greater than the reporting limit and two orders of magnitude less than its groundwater cleanup level. • HVOC concentrations in groundwater decrease with depth in (1) the source area (i.e., the HVOC groundwater concentrations in SB-6 and SB-7 were generally lower in the 12 to 16 feet bgs interval than the 8 to 12 feet bgs interval), and (2) the distal portion of the plume(s) (i.e., the HVOC groundwater concentrations in SB-9 through SB-13 were lower in the 28 to 32 feet bgs interval than the 12 to 16 feet bgs or 20 to 24 feet bgs intervals). • As discussed previously, the source area (i.e., soil and groundwater results in SB-06 and SB-07) does not appear to have enough source strength to have produced dense non-aqueous phase liquid (DNAPL) at the Site (Pacific Crest Environmental 2009a). Per Ecology request, MW-8 was installed downgradient of SB-11, and soil and groundwater samples were collected from MW-8 (Pacific Crest Environmental 2011). HVOCs were not detected in MW-8 soil or groundwater samples.	No. Additional action is unnecessary in accordance with the response to comment.

Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
October 2, 2008	1. Characterization of the Site	1.5	According to the boring logs, monitoring wells MW-1 through MW-4 have a screened interval of at least 15 feet. Well construction details for MW-5 through MW-7 were not provided; however, according to cross-sections, they appear to contain at least 10 feet of screen or more. Such long screens make it difficult to accurately determine the vertical distribution of contaminants due to the mixing that may occur in the screened interval. Grab groundwater samples were collected at intervals in soil borings SB-6 through SB-13; however, no information was provided regarding the depths at which the groundwater samples from the monitoring wells were collected. Please provide this information. You also might want to consider collecting groundwater samples from different depths along the screened interval to better define the vertical distribution of contaminants. Furthermore, as an alternative to long screen lengths on any additional wells you may install, you might consider installing multi-level wells.	This comment has been fully resolved (Pacific Crest Environmental 2009a, 2009b). The vertical distribution of HVOCs in groundwater has been characterized (Pacific Crest Environmental 2008, 2011) and groundwater samples from MWs have been collected with minimal mixing and a consistent intake depth (Pacific Crest Environmental 2009a, 2009b). Furthermore, screen lengths of up to 16 feet (which are the longest screens at this Site) are not unreasonable for this Site given (1) the limited nature and extent of HVOC impacts, (2) the groundwater sampling approaches used at the Site, (3) common screen lengths at a variety of MTCA sites, and (4) the fact that a significant portion of the screen for MWs with screens longer than 10 feet are located in the vadose zone. MW construction logs for MW-5 through MW-7, which have screen lengths of 13 feet, were provided to Ecology (Pacific Crest Environmental 2009a, 2009b). MW-8 and MW-9 were installed with 10-foot-long screens (Pacific Crest Environmental 2011). In accordance with the attached RI Data Gap Work Plan, (1) MW-10 will be installed with a 10-foot-long screen, and (2) future groundwater samples will be collected with minimal mixing and a consistent intake depth.	No. Additional action is unnecessary in accordance with the response to comment.
		1.6	Only two rounds of groundwater and water elevation data from all seven wells appear to have been collected since 2006. For a Site as complex as this with the potential for seasonal fluctuations in contaminant concentrations and groundwater flow direction, groundwater monitoring should be occurring quarterly.	Since Ecology issued this comment, one comprehensive groundwater monitoring (GWM) event was conducted for MW-1 through MW-9 in October 2009. Water level measurements and groundwater samples were also collected from MW-4 and MW-7 in June 2011. In addition, a comprehensive GWM event is proposed for MW-1 through MW-10 in the enclosed RI Data Gap Work Plan. Although the existing and proposed GWM events do not provide enough data to recommend no further action, the data collected from the existing and proposed GWM events (along with the groundwater data collected from direct-push borings and groundwater flow direction data from the adjacent BP site) are expected to be sufficient to characterize the nature and extent of HVOC impacts so that groundwater remedial alternatives can be evaluated in the Feasibility Study (FS). Additional long-term groundwater monitoring will most likely be a component of the recommended alternative in the FS. This issue was resolved to Ecology's satisfaction (Pacific Crest Environmental 2009b).	Yes. One comprehensive GWM of MW-1 through MW-10 is proposed in the enclosed RI Data Gap Work Plan.

Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
October 2, 2008	1. Characterization of the Site	1.7	According to the May 2008 report, indoor air wasn't sampled directly because of potential releases of HVOCs from the on-going dry cleaning operation. What about indoor air in the other businesses potentially impacted by the plume? Indoor air samples should be collected from the other businesses in the shopping center, especially those adjacent to the dry cleaner, to ensure that workers are not being exposed to organic vapors.	Since 2009, Bloch Properties has voluntarily operated a sub-slab depressurization system that was voluntarily installed in the former 1,2&O Cleaners suite in 2008. Indoor air samples were collected in 2009 from the two suites immediately adjacent to the former 1,2&O Cleaners, even though those samples were likely biased by the ongoing dry cleaning operations at the time of sampling (Pacific Crest Environmental 2011, 2012). HVOC concentrations in the indoor air of the adjacent suites when 1,2&O Cleaners was operating were less than indoor air cleanup levels for commercial/industrial workers (Pacific Crest Environmental 2011, 2012). In other words, conditions were protective of human health since no children were living or working in any suites and the measured indoor air concentrations did not pose an unacceptable risk for adults working in the adjacent suites. Now that dry cleaning operations have ceased (so that there is less of a bias caused by indoor air background sources), a more comprehensive vapor intrusion (VI) evaluation is proposed in the enclosed RI Data Gap Work Plan.	Yes. A comprehensive VI multimedia (i.e., groundwater, soil gas, indoor air, and ambient air) sampling event is proposed in the enclosed RI Data Gap Work Plan.
		1.8	In accordance with WAC 173-340-7490, a Terrestrial Ecological Evaluation (TEE) needs to be completed for the Site. Since the contamination exists beneath the building and paved parking lot, it is likely that the Site would qualify for exclusion. If so, please fill out the TEE Exclusion form and submit it to Ecology. The form can be found on our website at http://www.ecy.wa.gov/biblio/ecy090300.html.	As documented previously, the Site qualifies for an exclusion from a Terrestrial Ecological Evaluation (TEE) in accordance with Washington Administrative Code (WAC) 173-340-7491(1)(c)(i) since there is less than 1.5 acres of contiguous undeveloped land within 500 feet of the Site (Pacific Crest Environmental 2009a). Thus, no further action is necessary for the potential terrestrial ecological pathway. Ecology accepted this TEE exclusion (Pacific Crest Environmental 2009b).	No. Additional action is unnecessary in accordance with the response to comment.
		1.9	In accordance with WAC 173-340-840(5) and Ecology Toxics Cleanup Program Policy 840 (Data Submittal Requirements), data generated for Independent Remedial Actions shall be submitted simultaneously in both a written and electronic format. For additional information regarding electronic format requirements, see the website http://www.ecy.wa.gov/eim. Be advised that according to the policy, any reports containing sampling data that are submitted to Ecology for review are considered incomplete until the electronic data has been entered. Please ensure that data generated during on-Site activities is submitted pursuant to this policy. Data must be submitted to Ecology in this format for Ecology to issue a No Further Action determination. Please be sure to submit all soil and groundwater data collected to date, as well as any future data, in this format. Data collected prior to August 2005 (effective date of this policy) is not required to be submitted; however, you are encouraged to do so if it is available. Be advised that Ecology requires up to two weeks to process the data once it is received.	Pacific Crest Environmental submitted data collected between August 2005 and June 2009 (i.e., February 2006 groundwater data, June 2006 soil data, July 2006 groundwater data, February 2007 groundwater data, and December 2007 soil and groundwater data) to Ecology's Environmental Information Management System (EIMS) (Pacific Crest Environmental 2009a) as acknowledged by Ecology (Pacific Crest Environmental 2009b). It is unclear whether or not data collected from July 2009 through 2011 (i.e., September 2009 indoor air data, October 2009 soil and groundwater data, and June 2011 groundwater data) have been submitted to EIMS. If the data collected from July 2009 through 2011 have not been previously submitted to EIMS, available data will be submitted as necessary. Data collected during the 2012 Interim Cleanup Action and data collected pursuant to the enclosed RI Data Gap Work Plan will be submitted to EIMS.	Yes. Data collected during the 2012 Interim Cleanup Action and data collected pursuant to the enclosed RI Data Gap Work Plan will be submitted to EIMS. If the data collected from July 2009 through 2011 have not been previously submitted to EIMS, available data will be submitted as necessary.

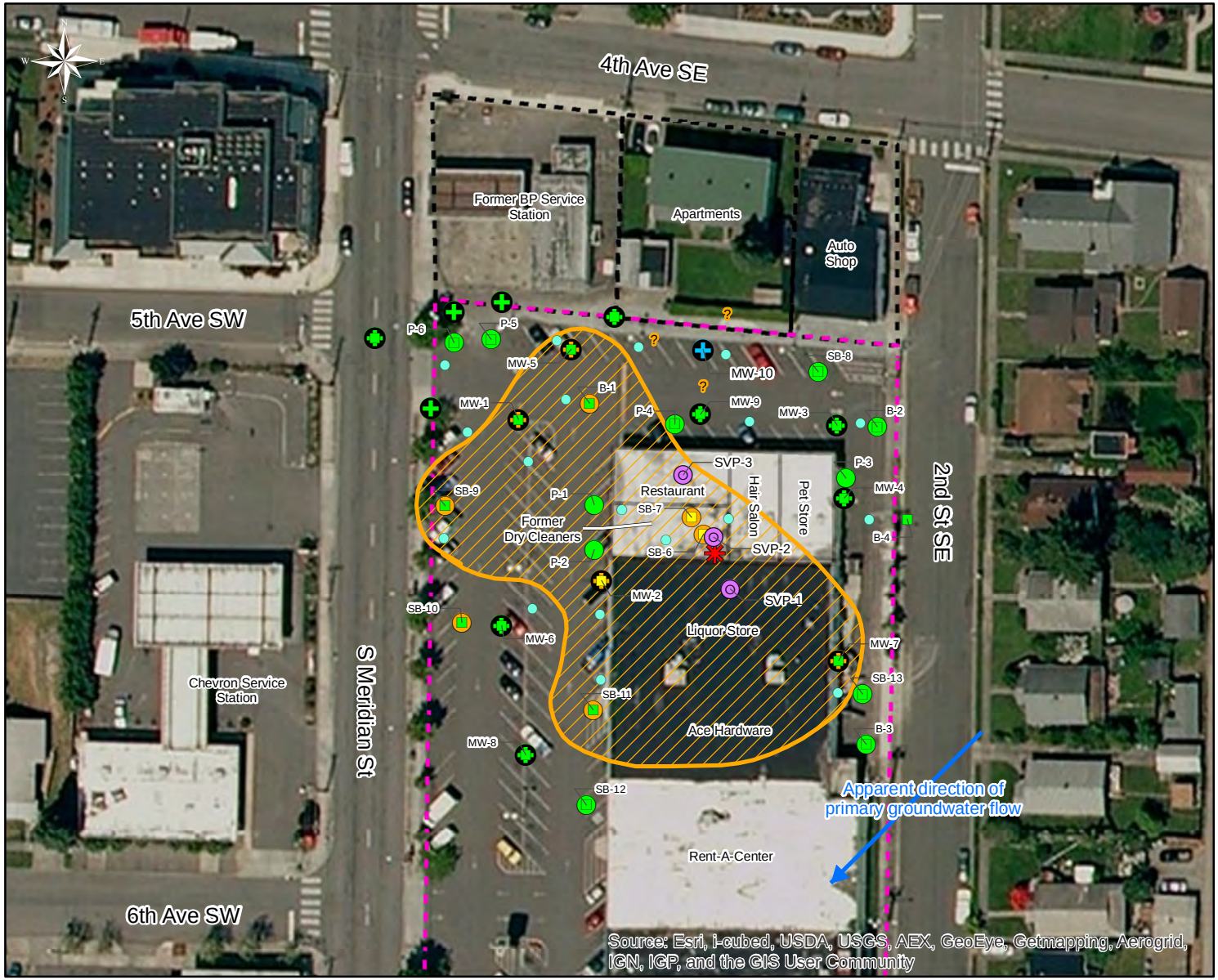
Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
October 2, 2008	2. Establishment of Cleanup Standards	2a – Cleanup levels	Ecology has determined the cleanup levels you established for the Site meet the substantive requirements of MTCA; however, the points of compliance do not. Method A cleanup levels for unrestricted land use and protection of groundwater are being used to determine soil and groundwater compliance at the Site. For contaminants, such as cis-DCE, where Method A values do not exist, Method B values are being used.	Comment noted.	Yes. Cleanup levels will be proposed in a revised RI/FS Report.
		2b – Point of Compliance	Standard points of compliance for soil and groundwater are being applied to the Site and are defined as all soil and groundwater throughout the Site. Groundwater compliance through the Site would be determined using monitoring wells. As noted above, at least one additional monitoring well needs to be installed downgradient of boring SB-11 to monitor the downgradient toe of the plume. Additional monitoring wells should be installed on the northern portion of the Site to further support the theory of a second HVOC source that is not commingled with the dry cleaner release.	MW-8 was installed downgradient of boring SB-11 as requested by Ecology (see response to comment #1.4). MW-9 was installed and MW-10 is proposed to evaluate the "Source #2" hypothesis (see response to comment #1.1).	Yes. See response to comment #1.1.
	3. Selection of Cleanup Action		Ecology has determined that the cleanup action you proposed for the Site does not meet the substantive requirements of MTCA. The cleanup selected for the Site is soil vapor extraction and enhanced anaerobic bioremediation. While this cleanup alternative may be a viable option for addressing contamination at the Site, the extent of contamination has not been adequately defined as described earlier. As a result, selection of a final cleanup action would be premature at this time until it can be determined what the extent of contamination is, and whether the release from the dry cleaner is commingled with another Site. However, if you choose to do so, it would be acceptable to implement the selected remedy as an interim action in an effort to initiate cleanup in the source area and other known impacted areas of the Site while the remedial investigation is completed.	Comment noted.	Yes. A revised RI/FS Report will be submitted to Ecology following completion of the sampling and analysis proposed in the enclosed RI Data Gap Work Plan.

Responses to Comments in October 2, 2008 Opinion Letter and January 27, 2012 Email

Comment Date	Comment Category	Comment No.	Ecology Comment	Response to Comment	Additional Action Planned?
January 27, 2012	N/A	4.1	In Section 4.3, regarding the alleged unknown HVOC source, the report concludes that "this release is not associated with the 1, 2, and O Cleaners but has migrated onto the Village Fair Property from an upgradient, unconfirmed source". While I appreciate the additional data, the report provides no explanation as to how the data was interpreted to reach this conclusion. **What is it about the data collected to date that tells us that there is a second HVOC plume on the property, that it is from a separate source, and that it is not commingled with the 1,2,&O Cleaners release?** The issue of commingling (or lack thereof) was not mentioned anywhere that I could tell. If I had my druthers, I'd love to see a handful of other data points to help drive this argument home, so I need you folks to convince me that your conclusion is sound based on the data collected to date. As you can imagine, this is an extremely odd and rare situation to have two HVOC plumes on one property from separate sources that are not commingled, particularly when the second source can't be identified. Please provide further rationale to support your conclusion.	See response to comment #1.1.	Yes. See response to comment #1.1.
		4.2	Your results of the indoor air sampling indicate the presence of PCE in indoor air above MTCA cleanup levels; however, it was concluded that it was not likely a result of vapor intrusion. While that may be the case, the fact remains that tenants in the building are being exposed to elevated PCE in the air. What, if anything, is being done to mitigate this? Ecology may need to coordinate with the State Department of Health.	See response to comment #1.7.	Yes. See response to comment #1.7.

References:
Pacific Crest Environmental 2008. Remedial Investigation/Feasibility Study Report. Village Fair Shopping Center, 611 South Meridian, Puyallup, Washington. May 23.
Pacific Crest Environmental 2009a. Response Letter to Washington State Department of Ecology regarding 1,2&0 Cleaners Site. May 21.
Pacific Crest Environmental 2009b. Summary of June 10th, 2009 Meeting with Washington State Department of Ecology regarding 1,2&0 Cleaners Site. June 19.
Pacific Crest Environmental 2011. Site Investigation Report. 1,2&0 Cleaners, Village Fair Shopping Center, 611 South Meridian Street, Puyallup, Washington, Facility/Site No. 84471944. December 27.
Pacific Crest Environmental 2012. Personal communication between Bill Carroll (Pacific Crest) and Scott Rose (Ecology). Subject Line: RE: 1,2&0 Cleaners – Dec 2011 Site Investigation Report comments. March 14.
Washington State Department of Ecology 2008. Regulatory Opinion Letter on Proposed Cleanup of the 1,2&0 Cleaners Site. 611 S. Meridian Street, Puyallup WA. October 2.
Washington State Department of Ecology 2012. Personal communication between Scott Rose (Ecology) and Kim Seely (Coastline Law Group). Subject Line: RE: 1,2&0 Cleaners – Dec 2011 Site Investigation Report comments. January 27.



Legend[1]

Proposed Sample Locations

- Monitoring Well MW-10
- Soil Vapor Probes (SVPs)[2]

Groundwater MWs Analyzed for VOCs[3][4][5]

- Concentration of PCE, TCE, cis-DCE, or VC exceeds groundwater screening level
- Concentration of PCE, TCE, cis-DCE and VC less than groundwater screening level

Direct-Push GW Samples Analyzed for VOCs[3][6]

- Concentration of PCE, TCE, cis-DCE, or VC exceeds groundwater screening level
- Concentration of PCE, TCE, cis-DCE and VC less than groundwater screening level

Soil Samples Analyzed for VOCs[3][6][7]

- Concentration of PCE, TCE, cis-DCE or VC exceeds soil screening level for the leaching to groundwater pathway
- Concentration of PCE, TCE, cis-DCE, and VC less than soil screening levels for the leaching to groundwater pathway

Other Features

- Passive Soil Gas Probe Sampling Location
- Former floor drain, location of soil/drain removal and in-situ chemical oxidation

Site/Boundaries

- Estimated Extent of VOCs in Groundwater (Site Boundary)[8]
- Village Fair Property Boundary
- Adjacent Property Boundaries

Notes:

[1]Locations of all features are approximate.
[2]An indoor air sample will also be collected from within each unit where SVPs are installed. An upwind ambient air sample will be collected concurrently with soil gas and indoor air samples.
[3]For this evaluation, detected soil and groundwater concentrations (Pacific Crest Environmental 2011) were compared to screening levels presented in Appendix B.
[4]A monitoring well location that has been sampled more than once was considered to have a screening level exceedance if a screening level exceedance has been replicated in two or more sampling events.
[5]Five unlabeled monitoring wells are shown in the northwest corner of the site; these are associated with the adjacent former BP service station.
[6]A sample location was considered to have a screening level exceedance if there was an exceedance in any of the sampled depth intervals.
[7]There have been no exceedances of direct contact soil screening levels for an unrestricted land use scenario.
[8]The site boundary was defined by soil and groundwater screening level exceedances. Monitoring well data was prioritized over direct-push groundwater data. This investigation is intended to resolve the site boundary areas with question marks.

0 50 100 Feet

PIONEER TECHNOLOGIES CORPORATION

Site Detail and Sampling Locations
Remedial Investigation Data Gap Work Plan
1,2&O Cleaners Site

Figure 1-2

Remedial Investigation Data Gap Work Plan

1,2&O Cleaners Site
513 S. Meridian Street
Puyallup, Washington
Voluntary Cleanup Program No. SW0646

PREPARED FOR:

COASTLINE LAW GROUP, PLLC

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TACOMA, WA 98402

PREPARED BY:

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DECEMBER 2012

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

Acronym	Explanation
CFR	Code of Federal Regulations
Cis-DCE	cis-1,2-Dichloroethylene
Ecology	Washington State Department of Ecology
ft	feet
GW	Groundwater
GWM	Groundwater monitoring
HASP	Health and Safety Plan
MNA	Monitored Natural Attenuation
MW	Monitoring well
PCE	Tetrachloroethylene
PDB	Passive Diffusion Bag
PIONEER	PIONEER Technologies Corporation
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
RI/FS	Remedial Investigation / Feasibility Study
RL	Reporting Limit
SAP	Sampling and Analysis Plan
SIM	Selected Ion Monitoring
Site	1,2&O Cleaners Site
SVP	Soil Vapor Probe
TCE	Trichloroethylene
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
Work Plan	RI Data Gap Work Plan

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SECTION 1 – INTRODUCTION

1.1 Purpose

The purpose of this Remedial Investigation (RI) Data Gap Work Plan (Work Plan) is to present proposed investigation methods for conducting an RI Data Gap Investigation at the 1,2&O Cleaners Site (Site). Following completion of the investigation activities described in this report, an RI/Feasibility Study (RI/FS) Report will be prepared for the Site.

1.2 Site Description

The Site is located on the approximately 3.4-acre Village Fair property at 513 S. Meridian Street in downtown Puyallup, Washington (see Figure 1-1). The property consists of an approximately 55,000 square feet commercial building and an asphalt parking lot. Various commercial businesses are located within the suites of the main commercial building. There was a historic release of tetrachloroethylene (PCE) to soil and groundwater under the building suite operated by the former 1,2&O Cleaners, which was a former dry cleaning business. The PCE release was associated with a corroded pipe under a floor drain in the 1,2&O Cleaners suite. It has been postulated that there may have been a separate release of PCE to groundwater from the property immediately north of the Village Fair property (Pacific Crest 2008, Pacific Crest 2011). The approximate extent of PCE and PCE degradation byproducts (trichloroethylene [TCE], cis-1,2-dichloroethylene [cis-DCE], and vinyl chloride [VC]) in groundwater at concentrations exceeding groundwater screening levels is shown in Figure 1-2. This extent is the Site boundary.

1.3 Regulatory Context

The Site is being addressed through the Washington State Department of Ecology's (Ecology's) Voluntary Cleanup Program (VCP) as described in Washington Administrative Code (WAC) 173-340-515. The VCP number for the Site is SW0646. The most recent Ecology VCP opinion letter for the Site was issued in 2008 (Washington State Department of Ecology 2008) after a draft RI/FS Report (Pacific Crest 2008) was submitted to Ecology.

1.4 Context for RI Data Gap Work Plan

A number of significant investigation and evaluation activities have been completed at the Site, including submittal to Ecology of a draft RI/FS Report (Pacific Crest 2008) and a supplemental investigation report (Pacific Crest 2011). Based on Site activities and correspondence with Ecology since the 2008 opinion letter, the only remaining RI data gaps at the Site are (1) installation and sampling of an additional monitoring well (MW) to determine if there is a second PCE source north of the Village Fair property, and (2) collection of additional multimedia data to confirm that the potential vapor intrusion pathway is not a concern. The sampling and analyses proposed in this Work Plan are designed to completely address both data gaps. In addition, a comprehensive groundwater monitoring (GWM) event is proposed in this Work Plan to obtain (1) current constituent concentrations in groundwater and (2) groundwater parameters to evaluate monitored natural attenuation (MNA) as a potential remedial technology.

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SECTION 2 – SAMPLING AND ANALYSIS PLAN

2.1 Project Roles and Responsibilities

The project team for this sampling and analysis plan (SAP) includes representatives from PIONEER Technologies Corporation (PIONEER), a to-be-determined Washington licensed driller, Anatek Labs, Air Toxics, and a to-be-determined Washington licensed surveyor. Table 2-1 shows anticipated roles and responsibilities for this project in the foreseeable future.

2.2 Pre-Mobilization Coordination

Before the commencement of field work, PIONEER will (1) subcontract with a Washington licensed driller, (2) coordinate with the laboratories regarding key elements of the SAP / Quality Assurance Project Plan (QAPP), (3) call the Washington Call Before You Dig phone number, (4) perform a private utility locate, (5) coordinate work with all subcontractors, and (6) obtain all necessary equipment and supplies.

Before installing the MW, the licensed driller will ensure that applicable notices of intent and associated fees are submitted to Ecology's Water Resources Program.

2.3 Drilling and Soil Sampling and Analysis

A new MW to be designated as MW-10 will be installed as a "centerline" MW near the suspected source of the suspected second plume to determine if there is a separate plume. The location of the proposed MW-10 is shown in Figure 1-2. The actual MW location may need to be adjusted in the field based on obstructions and access issues, although none are expected. A driller licensed in Washington State per Chapter 173-162 WAC will complete the drilling and MW installation activities in accordance with WAC 173-160 Part II.

During drilling of the MW-10 borehole, a continuous sample core will be collected with a split-barrel sampler or equivalent methodology. A photoionization detector equipped with a 10.6 eV lamp will be used as a field screening tool for potential volatile organic compound (VOC) impacts in the borehole sample core. A soil sample will be collected in accordance with United States Environmental Protection Agency (USEPA) Method SW846-5035A from the vadose zone soil sample interval with the highest measured concentration on the photoionization detector. That soil sample will be analyzed for PCE, TCE, cis-DCE, and VC by USEPA Method SW846-8260B. In addition, a soil sample collected from an unimpacted portion of the vadose zone will be analyzed for total organic carbon (TOC) by USEPA Method 9060m. Table 2-2 presents the number of primary and field quality control (QC) samples and target analytes for soil samples collected under this Work Plan. Table 2-3 presents the sample containers, preservatives, and holding times for these soil analyses. Sample containers will be provided by the laboratory.

2.4 Monitoring Well Installation and Development

Following drilling of the MW-10 borehole, a MW consisting of thread-coupled, flush-joint, 2-inch diameter polyvinyl chloride (PVC) casing, 10 feet of 10-slot PVC screen, and a sand filter pack placed at

least one-foot above the top of the screen will be constructed within the borehole. The MW screen will be placed at or near the bottom of the borehole so the screened interval straddles the depth at which groundwater was encountered. Based on existing MWs at the Site (see Table 2-4), MW-10 will likely be screened between five and 15 feet below ground surface. The MW will be sealed in accordance with WAC 173-160-450. In general, this standard calls for installing a bentonite plug above the top of the filter pack, filling the borehole annulus from the bentonite plug to near the land surface with bentonite or cement, and then installing a concrete surface seal. A flush-mount surface completion and surface monument is planned.

PIONEER will develop the MW by over pumping with a submersible pump until development water contains no visible sediment or until water quality parameters have stabilized.

2.5 Monitoring Well Survey

A Washington licensed surveyor will survey the vertical elevation and horizontal locations of MW-1 through MW-10, per the new Ecology Electronic Information Management System requirement. The top of casing vertical elevation of each MW will be measured in the North American Vertical Datum of 1988 to an accuracy of 0.01 feet (ft). Horizontal location will be measured to an accuracy of 1 meter. Table 2-4 shows the construction details of existing MWs (MW-1 through MW-9) and the most recent depth-to-water measurements for those MWs. The existing MW locations are shown in Figure 1-2.

2.6 Groundwater Measurement, Sampling, and Analysis

PIONEER will conduct a one-time GWM event at the Site as part of the RI data gap activities. During the GWM event, PIONEER will use an electronic water level indicator to measure the static water level in MW-1 through MW-10. The existing MW locations are shown in Figure 1-2. Static water level readings will be recorded to the nearest 0.01 ft from the top of the MW casing.

During the GWM event, PIONEER will collect groundwater samples from MW-1 through MW-10 using disposable passive diffusion bag (PDB) samplers. PDB samplers will be installed in all MWs following the installation and development of MW-10, and will be allowed to equilibrate with water in the MWs for at least three weeks prior to sample collection. A dedicated string/harness will be used to position the PDB samplers within each MW screen. During the GWM event being conducted as part of the RI Data Gap activities, four PDBs will be placed in each MW to have enough sample volume for all field and laboratory analyses. All four PDB samplers will be placed between approximately one to seven feet above the bottom of the MW screen.

At the conclusion of this GWM event, a single PDB sampler will be placed in each MW for a to-be-determined future GWM event. Each PDB sampler for future GWM events will be positioned approximately two to four feet above the bottom of the MW screen using the dedicated string/harness.

Each groundwater sample will be analyzed for the VOCs PCE, TCE, cis-DCE, and VC by USEPA Method SW846-8260B. Sample containers for VOC analyses will be filled before all other sample containers and will be filled to a positive meniscus to eliminate headspace. Table 2-2 presents the number of primary and field QC samples and target analytes for groundwater samples collected under this Work Plan. Table 2-3 presents the sample containers, preservatives, and holding times for the VOC

groundwater analyses. Sample containers will be provided by the laboratory.

For this one-time GWM event being conducted as part of the RI data gap activities, field and laboratory analyses will be performed to assess the degree of MNA occurring at the Site. Each groundwater sample will be analyzed for ethane, ethene, methane, chloride, nitrate, sulfate, iron (total and dissolved), manganese (total and dissolved), TOC, and alkalinity using the methods presented in Table 2-3. Table 2-3 also presents the sample containers, preservatives, and holding times for these groundwater analyses. Sample containers will be provided by the laboratory. In addition, temperature, conductivity, dissolved oxygen, pH, and oxidation/reduction potential will be measured in the field using a Horiba U22 or similar water quality multimeter and a dedicated volume of water from the PDB samplers.

2.7 Equipment Decontamination Procedures

Non-dedicated soil and groundwater sampling equipment (e.g., water level indicator) will be decontaminated in accordance with the following procedures:

- All non-dedicated equipment will be cleaned before use.
- Following use at each monitoring location, the affected portions of non-dedicated equipment will be scrubbed with potable water containing diluted detergent (e.g., Liquinox) before being sufficiently rinsed with potable water.
- Gloves will be changed before working at each sampling location.

Personal decontamination is discussed in the PIONEER Health and Safety Plan (HASP) for the Site (PIONEER 2012a).

2.8 Soil Gas, Indoor Air, and Ambient Air Sampling and Analysis

Three sub-slab soil vapor probes (SVPs) (SVP-1 through SVP-3) are proposed at the locations shown in Figure 1-2. Actual SVP locations may need to be adjusted in the field based on obstructions, access, and/or slab conditions. The location and condition of significant cracks in the floor slab, penetrating utilities, and the heating and ventilation system will be inspected prior to selecting actual SVP locations. Once the SVPs are installed, the locations of the SVPs inside the buildings will be determined using a measuring tape.

Prior to SVP construction, an area around each SVP location will be cleared of carpet and/or flooring to allow access to the concrete slab. An approximately 1-inch-diameter boring will be advanced through the slab using a hand-powered rotary drill. After completion of the concrete slab boring, the thickness of the slab will be measured, and 1/4-inch-diameter dedicated Teflon tubing will be inserted through the boring to a depth just below the bottom of the slab. The annulus between the tubing and the borehole will be sealed with Sikaflex®, Robert's Sealant®, and/or a similar sealant. The tubing in the SVP will be connected to the sampling canister via a sampling/purging manifold provided by the laboratory.

Prior to soil gas sample collection at each SVP, two separate leak testing procedures will be performed to identify and address any leaks in the sampling/purging manifold. First, a static shut-in test will be performed on the sampling/purging manifold provided by the laboratory to ensure that the manifold fittings are not leaking. The criterion for a satisfactory shut-in test is no decrease of vacuum in the

purging canister over a one minute period. Fittings will be re-assembled and/or tightened as necessary until the shut-in test criterion is satisfied. Second, a tracer compound test will be performed during purging to quantitatively assess potential leaks of ambient air in the SVP sampling train. The tracer compound test procedures include installation of a large shroud/glove box over the SVP, a sampling/purging manifold, a purging canister, and a sampling canister. The shroud/glove box will be sealed to the slab by duct tape, hydrated bentonite, and/or a non-VOC sealant (e.g., Sikaflex®, or Robert's Sealant®) and will remain in place for the duration of purging and sampling (see Figure 2-1). Helium tracer gas will be injected into the shroud/glove box. The helium concentration in both the shroud/glove box and in the sampling train will be quantitatively measured in the field. The criterion for a satisfactory tracer compound test is a helium concentration in the sampling train that does not exceed five percent of the helium concentration in the shroud/glove box. System leaks will be remedied as appropriate until the tracer compound test criterion is satisfied.

One sub-slab soil gas sample will be collected from each SVP. The soil gas sampling event will be conducted during the indoor heating season between late October and early March with the heating system turned on. Soil gas samples will be scheduled as synoptically as possible (within 5 days or less) with groundwater samples being collected during the GWM event.

Prior to collection of a soil gas sample, a minimum of three sampling train volumes of air will be purged through the sampling/purging manifold with a purging canister provided by the laboratory. Purging will not start until at least 30 minutes following SVP installation to allow time for the SVP to equilibrate. Once the shut-in test and tracer compound test are satisfactorily completed and the sampling train has been purged, each soil gas sample will be collected over an approximately eight-hour period, with the flow rate controlled by the intake regulator provided by the laboratory. Sampling will stop when the remaining canister vacuum is approximately five inches of mercury or after ten hours of sampling, whichever occurs first. The final canister vacuum will be recorded on the chain-of-custody.

Indoor air samples will be collected synoptically with the soil gas samples in each of the three suites where SVPs are installed. Indoor air samples will be collected at a breathing height (approximately five feet above ground surface), over an approximately eight-hour period with the flow rate controlled by the intake regulator provided by the laboratory. Sampling will stop when the remaining canister vacuum contains approximately five inches of mercury or after ten hours of sampling, whichever occurs first. The final canister vacuum will be recorded on the chain-of-custody.

In order to estimate ambient air background concentrations during the sampling period, an upwind ambient air sample will be synoptically collected with the soil gas and indoor air samples. The ambient air sampling canister will collect samples over an eight-hour period, with the flow rate controlled by the intake regulator provided by the laboratory. The intake for the ambient air sample will be positioned at breathing height (approximately five feet above ground surface). The wind direction will be determined either by observations immediately prior to sample collection and/or a wind rose generated using wind direction and magnitude readings over the past year from a nearby meteorological station. Sampling will stop when the remaining canister vacuum is approximately five inches of mercury or after ten hours of sampling, whichever occurs first. The final canister vacuum will be recorded on the chain-of-custody.

Soil gas, indoor air and ambient air samples will be analyzed for PCE, TCE, cis-DCE, and VC by USEPA

Method TO-15 Selected Ion Monitoring (SIM). Sample containers will be provided and individually certified clean by the laboratory to the specified reporting limits (RLs). Prior to field mobilization, the initial canister vacuums measured by the laboratory will be verified. A canister with an initial vacuum of less than 25 inches of mercury will be returned to the laboratory in exchange for a replacement canister. Table 2-2 presents the number of primary and QC samples and target analytes for soil gas, indoor air, and ambient air samples collected under this Work Plan. Table 2-3 presents the sample containers, preservatives, and holding times for the soil gas, indoor air, and ambient air analyses.

2.9 Investigation-Derived Waste

The following types of investigation-derived waste will be generated sampling activities and will be handled as follows:

- Soil cuttings from advancing the MW-10 borehole will be placed in sealed and labeled drums, and temporarily stored in a secure area of the Site.
- Development water and decontamination water will be placed in sealed and labeled drums, and temporarily stored in a secure area of the Site.
- Personal protective equipment (e.g., nitrile gloves) and other disposable sampling equipment will be disposed as solid waste in the standard municipal solid waste stream.

All soil and water investigation-derived waste will be characterized and then removed by a licensed waste transporter for off-Site treatment and/or disposal at an appropriate facility.

2.10 Field Recordkeeping

To document this investigation, PIONEER will complete the following forms: Field Checklist, Daily Field Report, Boring Log/MW Installation Form, and Groundwater Monitoring Form. The Field Checklist is used to assist with planning and coordination prior to a field event. The Daily Field Report is used to document field activities on a daily basis (e.g., miscellaneous field notes, soil gas, indoor air, and ambient air sampling notes). The Boring Log/MW Installation Form will be used to record drilling, lithologic (e.g., color, grain size, moisture, detail), MW installation and MW development details. The Groundwater Monitoring Form will be used to record groundwater level measurements, field measurements, and other GWM details. A copy of each form is included in Appendix A.

2.11 Sample Labeling, Handling, and Shipment

Sample labels will clearly indicate the Site location, sample identification, date, time, sampler's initials, parameters to be analyzed, and added preservative (if any). Each sample will be individually labeled. Each sample identification will be unique. Samples which have an associated amount of field QC volume (field duplicates) will have a type code appended to the end of the original sample ID. Sample nomenclature for soil, groundwater, and air samples will be as follows:

- Soil: SO-MW-ID-sample date-top depth-bottom depth
- Groundwater: GW-MW-ID-sample date-top depth-bot depth-(type code)
- Soil Gas: SG-SVP-ID-sample date

- Indoor Air: IA-IA-ID-sample date
- Ambient Air: AA-AA-ID-sample date

Sample packaging and shipping procedures are based on USEPA specifications and United States Department of Transportation regulations as specified in 49 Code of Federal Regulations (CFR) 173.6 and 49 CFR 173.24. Samples will be shipped as environmental samples and not hazardous material. Samples will be shipped express delivery to the laboratory following sample collection using PIONEER standard operating pack and ship procedures (PIONEER 2012b).

2.12 Chain-of-Custody Documentation

Chain-of-custody procedures will be followed to maintain and document sample possession. A sample is considered under a person's custody if it is in that person's physical possession, within visual sight of that person after taking physical possession, secured by that person so that the sample cannot be tampered with, or secured by that person in an area that is restricted to unauthorized personnel.

The originator (the sampler) will complete requested information on the custody record, including signature and date. Original signed custody records listing the samples in the cooler will accompany sample shipments (Note: more than one custody form may be needed per cooler to list all the samples contained in the cooler). The originator of the custody record will retain a copy of the custody record.

SECTION 3 – QUALITY ASSURANCE PROJECT PLAN

3.1 Purpose

The QAPP describes quality assurance measures associated with the field activities in Section 2 to ensure the field and analytical procedures produce acceptable quality data. It should be noted that the brevity of this QAPP is based on the limited nature of field activities being conducted pursuant to this Work Plan. It should also be noted that typical contents of a stand-alone QAPP are not repeated if included elsewhere in this Work Plan.

3.2 Field Quality Control Samples

The following field QC samples will be collected and analyzed:

- One groundwater field duplicate will be collected and analyzed for VOCs.
- One trip blank provided by the project laboratory will be submitted for VOC analysis for each batch of VOC groundwater samples.

3.3 Laboratory Quality Control

The project laboratories will be responsible for conducting laboratory quality control procedures and reporting laboratory quality control results in accordance with laboratory standard operating procedures. At a minimum the project laboratories will perform and report the following laboratory quality control analyses once per batch of VOC soil, groundwater, and soil gas/indoor air/ambient air samples for select constituents (e.g., standard USEPA Contract Laboratory Program constituents): method blank, blank spike, matrix spike, and matrix spike duplicate. The laboratory will perform and report results of surrogate recovery for every sample. Expectations for laboratory control limits are shown in Table 3-1.

3.4 Laboratory Target Reporting Limits

Table 3-2 presents a comparison of target RLs for analyses of PCE, TCE, cis-DCE, and VC in soil, groundwater, and soil gas/indoor air/ambient air with applicable screening levels. Screening level calculations are presented in Appendix B. As shown in Table 3-2, the target RLs are less than or equal to the screening levels.

3.5 Data Quality Review

Data quality will be reviewed by PIONEER following receipt of the analytical data from the laboratories. Project data and quality control data (e.g., lab quality control results, actual RLs, holding times) will be reviewed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity. Corrective action for field or laboratory procedures will be taken as necessary.

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SECTION 4 - REFERENCES

Pacific Crest Environmental 2008. Remedial Investigation/Feasibility Study Report. Village Fair Shopping Center. 611 South Meridian, Puyallup, Washington. May.

Pacific Crest Environmental 2011. Site Investigation Report 1,2&O Cleaners. Village Fair Shopping Center. 611 South Meridian Street, Puyallup, Washington. Facility Site No. 84471944. December.

PIONEER Technologies Corporation 2012a. PIONEER Health and Safety Plan for the 1,2&O Cleaners Site. Village Fair Building Complex. 513 S. Meridian Street, Puyallup, Washington. July.

PIONEER Technologies Coporation 2012b. PIONEER Standard Operating Procedure for Sample Handling and Shipping. August.

United States Environmental Protection Agency 2011. Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990-2005): A Compilation of Statistics for Assessing Vapor Intrusion. June.

Washington State Department of Ecology 2008. Opinion Letter on Proposed Cleanup of the 1,2&O Cleaners. 611 S. Meridian Street, Puyallup, Washington. Facility/Site No.: 84471944. VCP No.: SW0646.

Washington State Department of Ecology 2012. Toxics Cleanup Program's Cleanup Levels and Risk Calculations (CLARC) database, https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx, accessed September.

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Tables

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Table 2-1: Project Roles and Responsibilities

Project Role	Name and Phone Number	Responsibilities
PIONEER Principal	Chris Waldron (360) 570-1700	• Reviews Project Manager's work
PIONEER Project Manager	Troy Bussey (360) 570-1700	• Communicates and coordinates with client and Ecology • Oversees preparation of planning and reporting documents • Oversees completion of fieldwork • Oversees implementation of site-specific health and safety plan
PIONEER Site Safety Officer Staff Scientist	Stacy Munson (360) 570-1700	• Supports project manager with preparation of planning and reporting documents • Implements site-specific health and safety plan • Coordinates and oversees completion of all field work • Develops monitoring well and collects samples
Licensed Driller	To be determined	• Installs monitoring well
Analytical Laboratories	Anatek Labs, Inc. (800) 943-2839	• Analyzes soil and groundwater samples
	Air Toxics, Ltd. (800) 985-5955	• Analyzes soil gas, indoor air, and ambient air samples
Licensed Surveyor	To be determined	• Surveys location and vertical elevation of all monitoring wells

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Table 2-2: Summary of Proposed Samples

Activity	Media	Primary Samples	Field QC Samples	Target Analytes
Installation of MW-10	Soil[1]	1	None	PCE, TCE, cis-DCE, VC
	Soil[1]	1	None	TOC
Synoptic Groundwater Sampling Event and Vapor Intrusion Investigation	Groundwater	10	1 Field Duplicate 1 Trip Blank [2]	PCE, TCE, cis-DCE, VC, Ethane, Ethene, Methane, Chloride, Nitrate, Sulfate, Iron (Total & Dissolved), Manganese (Total & Dissolved), TOC, Alkalinity
	Soil Gas	3	None	PCE, TCE, cis-DCE, VC
	Ambient Air	1	None	PCE, TCE, cis-DCE, VC
	Indoor Air	3	None	PCE, TCE, cis-DCE, VC

Notes:

[1] VOC constituents (PCE, TCE, cis-DCE, and VC) will be sampled from the vadose zone soil interval with the highest observed PID reading. TOC will be sampled from unimpacted vadose zone soil.

[2] The groundwater field duplicate and groundwater trip blank samples will only be analyzed for PCE, TCE, cis-DCE, and VC.

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Table 2-3: Constituents, Sample Containers, Preservation, and Holding Times

Media	Constituent	Analytical Method	Sample Container	Preservation	Extraction Holding Time (days)	Analysis Holding Time (days)
Soil	PCE, TCE, cis-DCE, VC	USEPA Method SW846-8260B	2 x 40 mL VOA & one 8 oz. jar	-Methanol in each VOA [(1)] -Place on ice to cool to 4°C +/- 2°C).	14	14
	Total Organic Carbon	USEPA Method 9060m	4 oz or 8 oz glass jar	-Place on ice to cool to 4°C +/- 2°C).	14	14
Soil Gas, Indoor Air, and Ambient Air	PCE, TCE, cis-DCE, VC	USEPA Method TO-15 SIM	6-L evacuated SUMMA® Canister [(2)]	None	N/A	30
Groundwater	PCE, TCE, cis-DCE, VC	USEPA Method SW846-8260B	2 x 40 mL VOA	-HCl preservative in each VOA. -No headspace in container. -Place on ice to cool to 4°C +/- 2°C).	N/A	14
	Ethane Ethene Methane	RSK 175M (GC/FID)	2 x 40 mL VOA	-HCl preservative in each VOA. -Place on ice to cool to 4°C +/- 2°C).	N/A	14 days
	Chloride Nitrate Sulfate	USEPA Method 300.0	250 mL HDPE jar	-Place on ice to cool to 4°C +/- 2°C).	N/A	48 hrs for nitrate 28 days for chloride/sulfate
	Iron & Manganese (Total and Dissolved)	USEPA Method SW846-6010B	250 mL HDPE jar	-Place on ice to cool to 4°C +/- 2°C).	N/A	6 months
	Total Organic Carbon	Standard Method 5310B	40 mL VOA	-HCl preservative in VOA. -Place on ice to cool to 4°C +/- 2°C).	N/A	28 days
	Alkalinity	Standard Method 2320	250 mL HDPE jar	-Place on ice to cool to 4°C +/- 2°C).	N/A	7 days

Notes:

[(1)] VOC soil samples will be collected and prepared in accordance with USEPA Method SW846-5035.

[(2)] Equipped with Swagelok ¼-inch stainless steel bellows valve, brass cap, particulate filter, and vacuum gauge on each canister. A regulator will be set for 8-hour sample collection.

HCl: Hydrochloric acid

HDPE: High-density polyethylene plastic

N/A: Not applicable

VOA: Volatile organic analysis vial (40 mL)

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Table 2-4: Summary of Construction Details for Existing Monitoring Wells

Monitoring Well (MW)	MW Diameter (inches)	Depth to Top of Screen (feet bgs)	Depth to Bottom of Screen (feet bgs)	Recent Depth to Groundwater (feet)[1]
MW-1	2.0	2.5	18.5	6.81
MW-2	2.0	2.5	18.5	8.36
MW-3	2.0	2.5	18.5	7.41
MW-4	2.0	2.5	18.5	6.72
MW-5	2.0	3.5	16.5	6.78
MW-6	2.0	3.5	16.5	6.74
MW-7	2.0	3.5	16.5	5.15
MW-8	2.0	7	17	6.45
MW-9	2.0	7	17	7.82

Notes:

bgs: below ground surface

[1] Depth to groundwater measurement (below the measuring point) taken during the October 5, 2009 monitoring event.

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Table 3-1: Laboratory Control Limits

Constituent/Media	Analytical Method	LCS	MS/MSD		Surrogates
		%R	%R	RPD	%R
Soil Sample VOCs[(1)]	USEPA Method SW846-8260B	70 – 130	60 – 140	< 25%	70 - 130
Groundwater Sample VOCs[(1)]	USEPA Method SW846-8260B	70 – 130	60 – 140	< 25%	70 - 130
Soil Gas, Indoor Air and Ambient Air Sample VOCs[(1)]	USEPA Method TO-15	75 – 125	75 – 125	< 30%	70 - 130

Notes:

LCS: Laboratory Control Sample (also known as blank spike)

MS/MSD: Matrix Spike/Matrix Spike Duplicate

%R: Percent Recovery

RPD: Relative Percent Difference

[(1)]Analyzed for Tetrachloroethylene, Trichloroethylene, cis-1,2-Dichloroethylene, and Vinyl Chloride only.

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Table 3-2: Target Reporting Limits

Media/Analytical Method	Constituent	Unrestricted Land Use Screening Level [1]	Commercial/Industrial Land Use Screening Level [1]	Target Reporting Limit [2]
Soil samples by USEPA Method SW846-8260B	Tetrachloroethylene Trichloroethylene Cis-1,2-Dichloroethylene Vinyl Chloride	480 mg/kg / 0.054 mg//kg 12 mg/kg / 0.033 mg/kg 160 mg/kg / 0.080 mg/kg 0.67 mg/kg / 0.0018 mg/kg	21,000 mg/kg / 0.054 mg/kg 1,800 mg/kg / 0.033 mg/kg 7,000 mg/kg / 0.080 mg/kg 88 mg/kg / 0.0018 mg/kg	0.005 mg/kg 0.005 mg/kg 0.005 mg/kg 0.005 mg/kg
Groundwater samples by USEPA Method SW846-8260B	Tetrachloroethylene Trichloroethylene Cis-1,2-Dichloroethylene Vinyl Chloride	5.0 ug/L 5.0 ug/L 16 ug/L 0.29 ug/L	N/A N/A N/A N/A	1 ug/L 1 ug/L 1 ug/L 0.2 ug/L
Soil gas samples by USEPA Method TO-15 SIM	Tetrachloroethylene Trichloroethylene Cis-1,2-Dichloroethylene Vinyl Chloride	96 ug/m3 3.7 ug/m3 No value 2.8 ug/m3	580 ug/m3 29 ug/m3 No value 120 ug/m3	0.14 ug/m3 0.11 ug/m3 0.079 ug/m3 0.026 ug/m3
Indoor air and ambient air samples by USEPA Method TO-15 SIM	Tetrachloroethylene Trichloroethylene Cis-1,2-Dichloroethylene Vinyl Chloride	9.6 ug/m3 0.37 ug/m3 No value 0.28 ug/m3	58 ug/m3 2.9 ug/m3 No value 12 ug/m3	0.14 ug/m3 0.11 ug/m3 0.079 ug/m3 0.026 ug/m3

Notes:

N/A: Not applicable

Screening levels presented to two significant figures

[1] See Appendix B for calculation of the screening levels. For soil screening levels, the first value is for the direct contact pathway, and the second value is for the leaching to groundwater pathway.

[2] It may not be possible to achieve these target reporting limits (e.g., samples that require dilution before analysis). For instance, in the case of soil gas, indoor air, and ambient air samples, it would not be unexpected if actual reporting limits were approximately twice the target reporting limits.

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Figures

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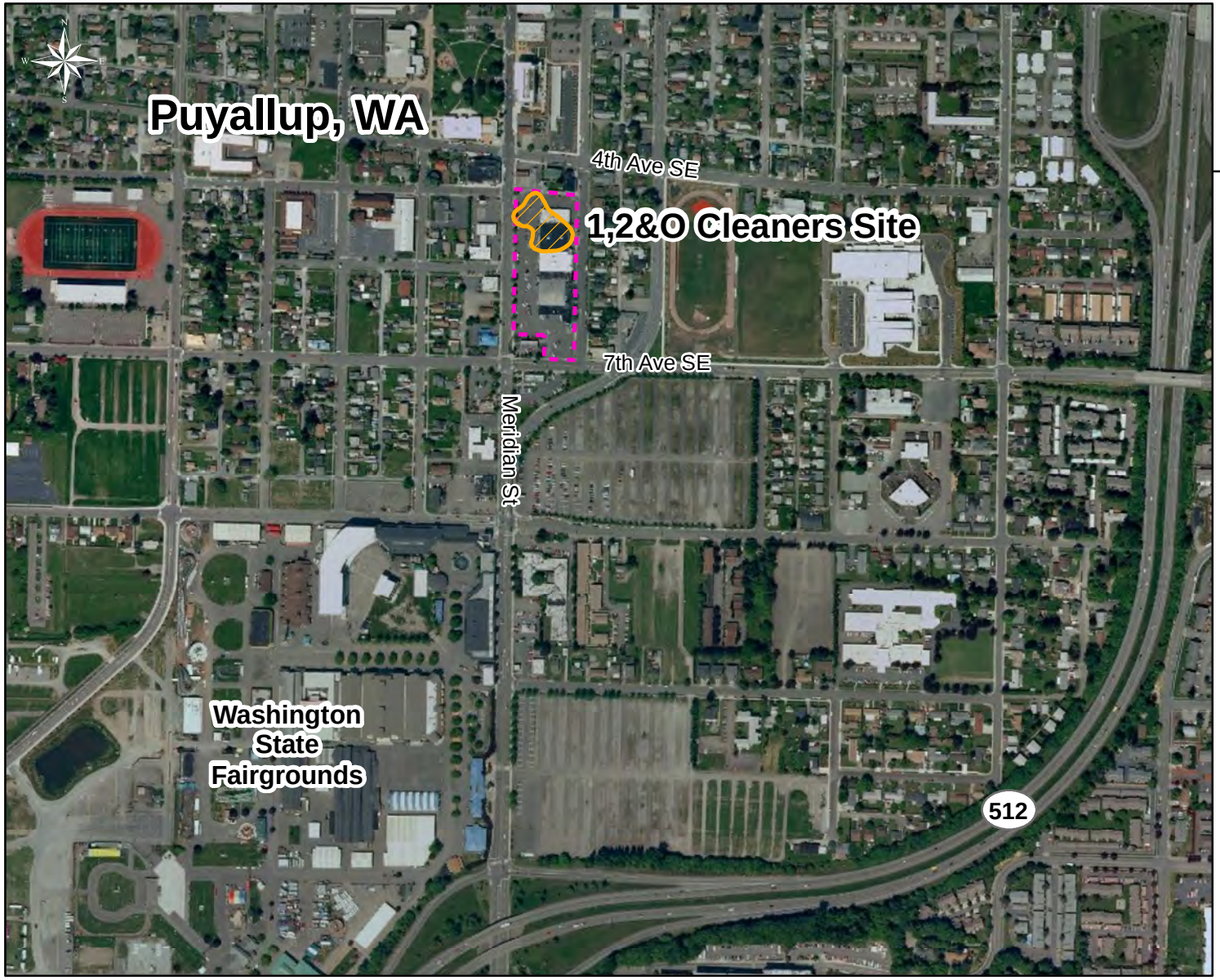

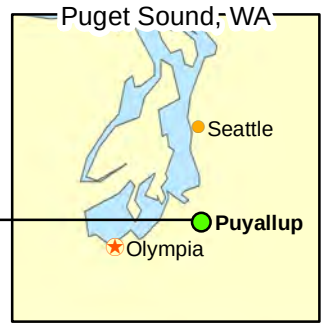

Legend

- Site Boundary
- Village Fair Property Boundary

0 500 1,000 Feet

PIONEER TECHNOLOGIES CORPORATION

Site Location
Remedial Investigation Data Gap Work Plan
1,2&O Cleaners Site

Figure 1-1

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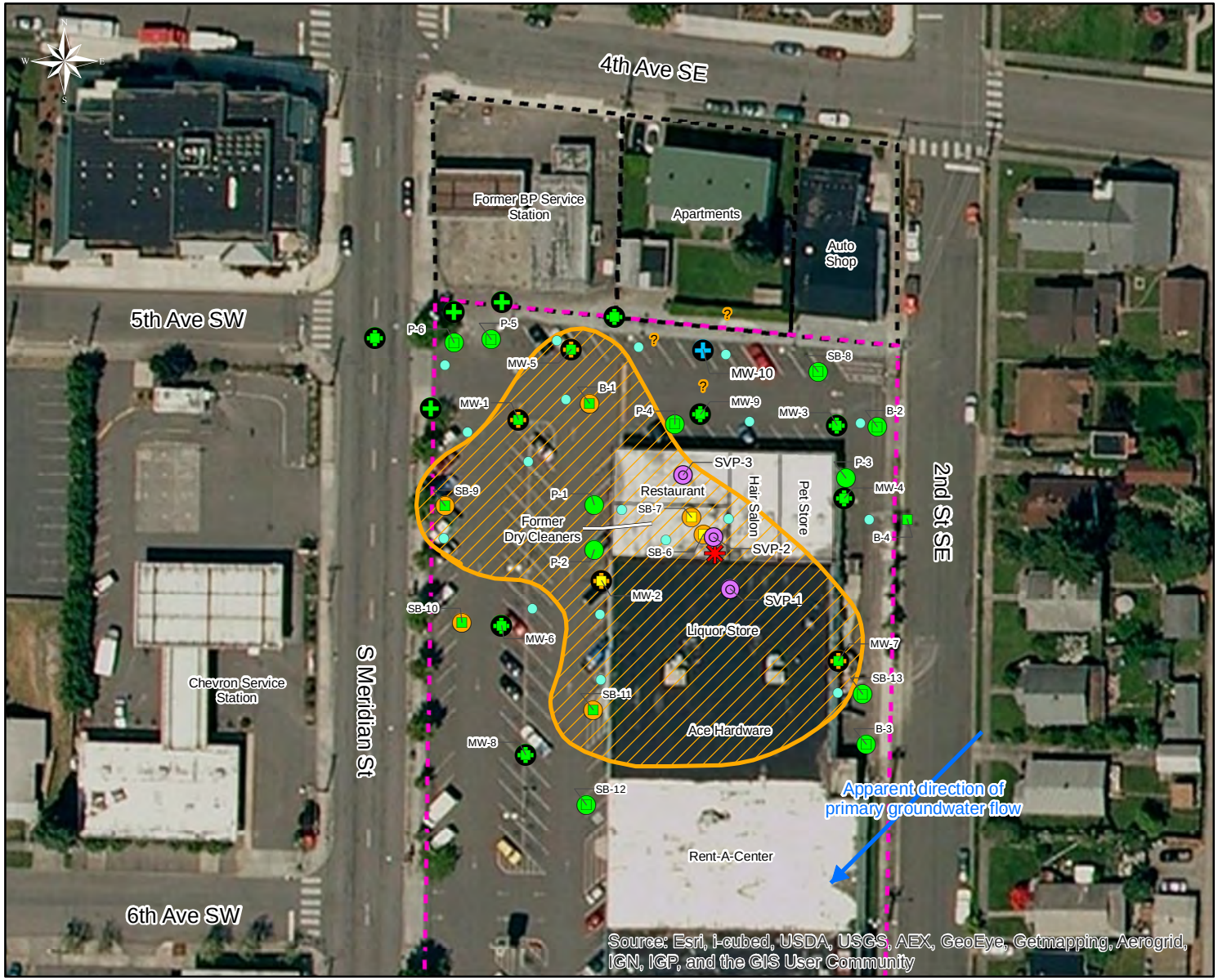

Legend[1]

Proposed Sample Locations

- Monitoring Well MW-10
- Soil Vapor Probes (SVPs)[2]

Groundwater MWs Analyzed for VOCs[3][4][5]

- Concentration of PCE, TCE, cis-DCE, or VC exceeds groundwater screening level
- Concentration of PCE, TCE, cis-DCE and VC less than groundwater screening level

Direct-Push GW Samples Analyzed for VOCs[3][6]

- Concentration of PCE, TCE, cis-DCE, or VC exceeds groundwater screening level
- Concentration of PCE, TCE, cis-DCE and VC less than groundwater screening level

Soil Samples Analyzed for VOCs[3][6][7]

- Concentration of PCE, TCE, cis-DCE or VC exceeds soil screening level for the leaching to groundwater pathway
- Concentration of PCE, TCE, cis-DCE, and VC less than soil screening levels for the leaching to groundwater pathway

Other Features

- Passive Soil Gas Probe Sampling Location
- Former floor drain, location of soil/drain removal and in-situ chemical oxidation

Site/Boundaries

- Estimated Extent of VOCs in Groundwater (Site Boundary)[8]
- Village Fair Property Boundary
- Adjacent Property Boundaries

Notes:

[1]Locations of all features are approximate.
[2]An indoor air sample will also be collected from within each unit where SVPs are installed. An upwind ambient air sample will be collected concurrently with soil gas and indoor air samples.
[3]For this evaluation, detected soil and groundwater concentrations (Pacific Crest Environmental 2011) were compared to screening levels presented in Appendix B.
[4]A monitoring well location that has been sampled more than once was considered to have a screening level exceedance if a screening level exceedance has been replicated in two or more sampling events.
[5]Five unlabeled monitoring wells are shown in the northwest corner of the site; these are associated with the adjacent former BP service station.
[6]A sample location was considered to have a screening level exceedance if there was an exceedance in any of the sampled depth intervals.
[7]There have been no exceedances of direct contact soil screening levels for an unrestricted land use scenario.
[8]The site boundary was defined by soil and groundwater screening level exceedances. Monitoring well data was prioritized over direct-push groundwater data. This investigation is intended to resolve the site boundary areas with question marks.

0 50 100 Feet

PIONEER TECHNOLOGIES CORPORATION

Site Detail and Sampling Locations
Remedial Investigation Data Gap Work Plan
1,2&O Cleaners Site

Figure 1-2

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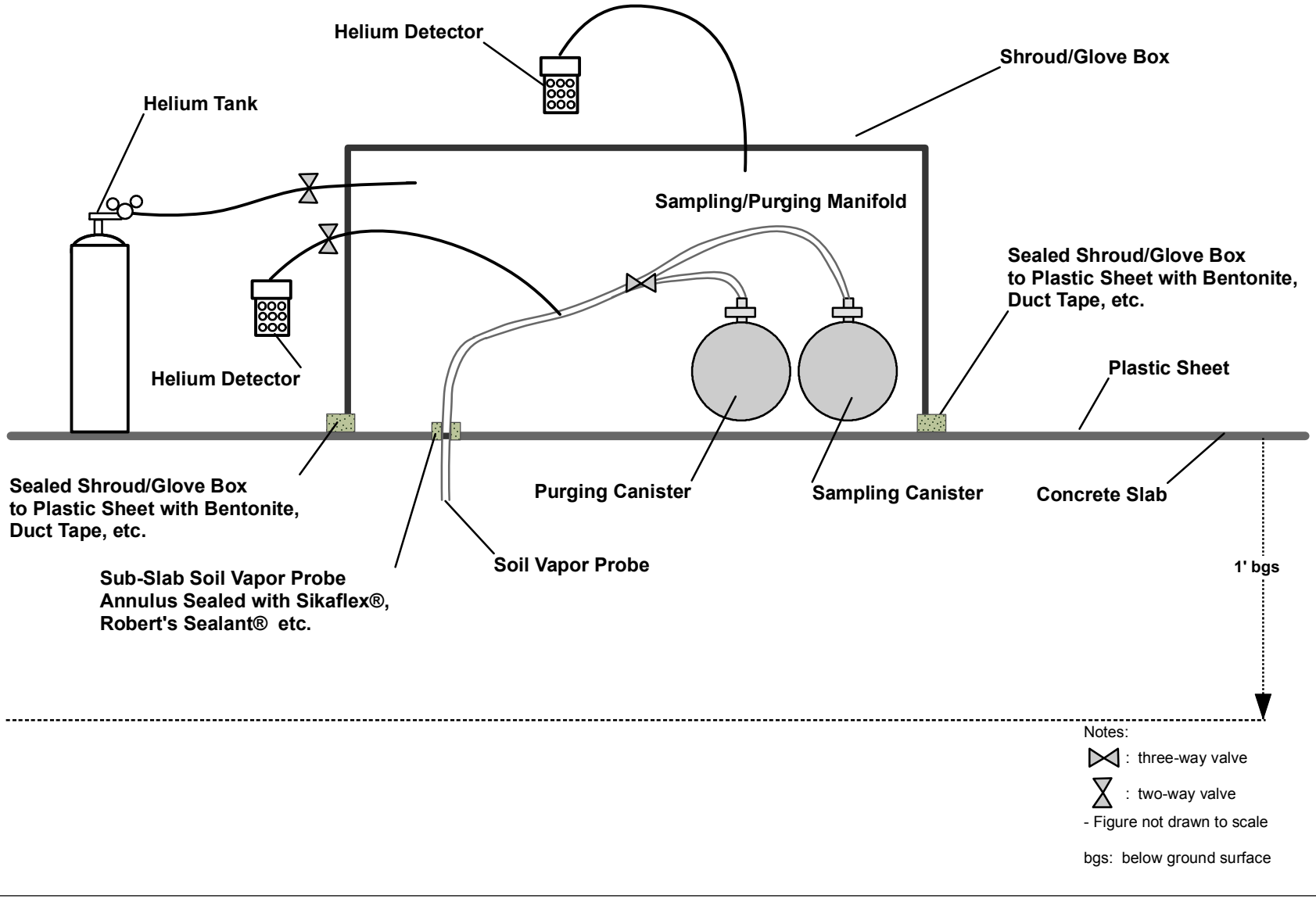

PIONEER TECHNOLOGIES CORPORATION

Soil Gas Sampling - Leak Detection System
Remedial Investigation Data Gap Work Plan
1,2&O Cleaners Site

Figure 2-1

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Appendix A

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PIONEER TECHNOLOGIES CORPORATION (PTC)
FIELD CHECKLIST

Project/Task Name: _____ Site Location: _____

Requested By / Date: _____ Work Deadline: _____

SERVICES REQUESTED	COMPLETED
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO
_____	☐ YES ☐ NO

ADDITIONAL STANDARD INSTRUCTIONS	COMPLETED		COMPLETED
☐ Review Docs: _____	☐ YES ☐ NO	☐ Health & Safety Meeting	☐ YES ☐ NO
☐ Agency NOI / Utility Locate / Concrete Coring	☐ YES ☐ NO	☐ Call PM from Site	☐ YES ☐ NO
☐ Coordinate Access: _____	☐ YES ☐ NO	☐ Draw Site Map _____	☐ YES ☐ NO
☐ Coordinate Sub / Equip: _____	☐ YES ☐ NO	☐ Cuttings / Purge Water Characterization & Disposal	
☐ Purchase / Rent Equip: _____	☐ YES ☐ NO	☐ Potential HW _____	☐ YES ☐ NO
☐ Client/Agency Coordination: _____	☐ YES ☐ NO	☐ Non-Haz _____	☐ YES ☐ NO
☐ Calibrate Equipment: _____	☐ YES ☐ NO	☐ Background _____	☐ YES ☐ NO

_____

_____

SAMPLING REQUIREMENTS

☐ Field Testing: _____

☐ Lab Testing: _____ Laboratory: _____

☐ Lab Testing: _____ Laboratory: _____

☐ Lab Testing: _____ Laboratory: _____

FIELD SUPPLIES NEEDED

☐ Site Map ☐ Camera ☐ Survey Equip / GPS ☐ Vehicle

☐ Std Field Equip (keys, forms, SAP, HASP, PPE, decon, tools)

☐ Drilling Equip (PID, references, knife, baggies, tape)

☐ Soil Equip (SS bowls, spoon/shovel, hand auger, pick, sieves)

☐ GWM (pump, tubing, gen., compres., bailers, rope/string, PDB)

☐ Pump / Slug Test Equip (GWM Equip, slug, stopwatch)

☐ Water Level Indicator / Interface Probe

☐ Water Quality Meter _____ ☐ Field Test Kits _____

☐ Sample Kit / Cooler / COC / Ice _____

☐ IDW: ☐ Drums _____ ☐ 5-gal buckets _____

☐ Other: _____

☐ Other: _____

PIONEER TECHNOLOGIES CORPORATION (PTC)
DAILY FIELD REPORT

Date:_____ Site Location: _____ Site Arrival Time: _____ Site Departure Time :_____

WEATHER
TEMPERATURE
WIND

Clear Sun	Overcast	Drizzle	Rain	Snow
To 32	32-50	50-70	70-85	85 Up
Calm	Med.	Strong	Severe	

PEOPLE PRESENT ON-SITE

NAME	ASSOCIATION	TIME ON-SITE AND OFF-SITE

NOTES ON WORK COMPLETED

SIGNATURE:_____ DATE:_____

PIONEER TECHNOLOGIES CORPORATION (PTC)
BORING LOG FORM

GENERAL INFORMATION			
Boring/MW ID		Drilling Co.	
Project/Site Name		Lisc. Driller	
Field Professional		Drilling Method	
Start Date/Time		Drill Rig	
Stop Date/Time		Drill Bit	

LOCATION SKETCH

North Arrow

SAMPLE COLLECTION

Time	Sample Depth (ft) From	Sample Depth (ft) To	Sampling Method	SPT Blows per 6 in.	% Recov.	Contacts or GW?	Localized Soil/Rock Description	Containerized From	Containerized To	PID (ppm)	Sent to Lab?
				/ /							
				/ /							
				/ /							
				/ /							
				/ /							
				/ /							
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				/ /							

GENERALIZED DESCRIPTION OF SOIL/ROCK ENCOUNTERED IN BORING

Depth of Boring From	Depth of Boring To	USCS/ Rock Ty	Generalized Soil or Rock Description

Typical soil desc: USCS Color, sand grain size, SECONDARY modifier, PRIMARY grain size, tertiary constituents, (stiffness/density), (moisture), detail, [geologic interpretation

Typical rock desc: Rock Type Color, grain description, ROCK TYPE, (strength), (state of weathering), (moisture), detail and bedding, [geologic formation

OTHER RELEVANT INFORMATION

Casing Info (e.g., type, diameter, depths, casing reduction):

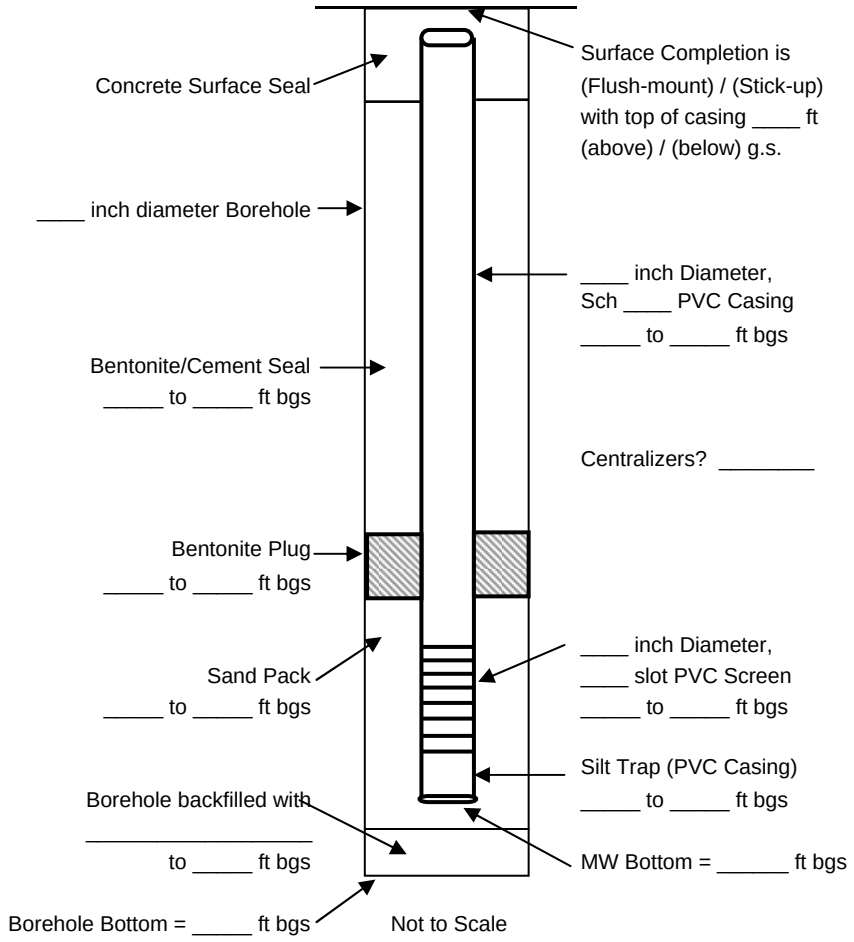
Groundwater Encountered (e.g., time, depth, quantity, casing position):

Misc. (e.g., drilling rate, drill cuttings, rig decon, etc.):

PIONEER TECHNOLOGIES CORPORATION (PTC)
MW INSTALLATION FORM

MW ID _____ Installation Start Date/Time _____ Installation Stop Date/Time _____

CONSTRUCTION DETAILS



MATERIALS USED

____	Sacks of _____	Sand
____	Sacks of _____	Cement
____	Sacks of Bentonite Pellets	
____	Sacks of Powdered Bentonite	
____	Sacks of Grout	
____	Feet of _____	-inch dia PVC Casing
____	Feet of _____	-inch dia PVC Screen

WELL PROTECTION AND IDENTIFICATION

- ☐ Well Cap
- ☐ Locking Steel Cover (Stick-up)
- ☐ Bollards (Stick-up)
- ☐ Lock
- ☐ Agency Well Tag No. _____
- ☐ Top of Casing Ref Pt. = _____

WELL DEVELOPMENT

	Following Well Construction	Following Well Development
Depth To Water (ft below TOC)		
Total Well Depth (ft below TOC)		

Development Start Date/Time _____ Development Stop Date/Time _____

Development Method _____ Development Water Discharged to _____

Elapsed Time (min)	pH	Flowrate (gpm)	Sp. Cond. (mS/cm)	Turb (NTU)	D.O. (mg/L)	Temp (oC)	Comments on TSS/Color

Total Gallons Removed _____

Additional Remarks

PIONEER TECHNOLOGIES CORPORATION (PIONEER)
GROUNDWATER MONITORING FORM

Stabilization:

SWL < 0.33 ft | Turb ± 10%
pH ± 0.1 | DO ± 0.3 mg/L
SC, Temp ± 3% | ORP ± 10 mV

SITE NAME: ____________________ **FIELD TECHNICIAN(S):** ____________________ **DATE:** ____________________

WELL INFO				DTW				PURGING											SAMPLE COLLECTION		PURGE WATER	
										Stabilization												
Well ID	Total Depth (ft)	Screen Interval (ft)	Current Condition (e.g., seal, cover, cap, casing, lock)	Time	Depth to NAPL (ft)	Depth to Water (ft)	NAPL Thick. (ft)	Pump Type	Intake Depth (ft)	Elaps. Time (min)	Flow Rate (L/min)	SWL (ft)	pH	Spec. Cond. (mS/cm)	Turb (NTU)	D.O. (mg/L)	Temp (^{o}C)	ORP (mV)	Time	Field Kit Results / General Comments	Vol (gal)	Disposal / Storage Comments

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Appendix B

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Table B-1: Calculation of Direct Contact Soil Screening Levels for Unrestricted Land Use Scenario

Constituent	Standard Method B Soil Formula Value for Carcinogens with Direct Contact Pathway and Unrestricted Land Uses [(1)] (mg/kg)	Standard Method B Soil Formula Value for Non-carcinogens with Direct Contact Pathway and Unrestricted Land Uses [(1)] (mg/kg)	Resulting Soil Screening Level for Direct Contact Pathway in an Unrestricted Land Use Scenario[(2)] (mg/kg)
Tetrachloroethene	4.8E+02	4.8E+02	4.8E+02
Trichloroethene	1.2E+01	4.0E+01	1.2E+01
cis-1,2 Dichloroethene	No Value	1.6E+02	1.6E+02
Vinyl Chloride	6.7E-01	2.4E+02	6.7E-01

Notes:

CLARC = Cleanup Levels and Risk Calculation

No Value = No value exists or value has not been researched for constituent

Screening Levels presented with two significant figures.

[(1)] Value from CLARC (Ecology 2012).

[(2)] Most stringent of carcinogenic and non-carcinogenic values.

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Table B-2: Calculation of Direct Contact Soil Screening Levels for Commercial/Industrial Land Use Scenario

Constituent	Standard Method C Soil Formula Value for Carcinogens with Direct Contact Pathway and Commercial/Industrial Land Uses [1] (mg/kg)	Standard Method C Soil Formula Value for Non-carcinogens with Direct Contact Pathway and Commercial/Industrial Land Uses [1] (mg/kg)	Resulting Soil Screening Level for Direct Contact Pathway in a Commercial/Industrial Land Use Scenario[2] (mg/kg)
Tetrachloroethene	6.3E+04	2.1E+04	2.1E+04
Trichloroethene	2.8E+03	1.8E+03	1.8E+03
cis-1,2 Dichloroethene	No Value	7.0E+03	7.0E+03
Vinyl Chloride	8.8E+01	1.1E+04	8.8E+01

Notes:

CLARC = Cleanup Levels and Risk Calculation

No Value = No value exists or value has not been researched for constituent

Screening Levels presented with two significant figures.

[1] Value from CLARC (Ecology 2012).

[2] Most stringent of carcinogenic and non-carcinogenic values.

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Table B-3: Calculation of Groundwater Screening Levels and Soil Screening Levels for the Leaching to Groundwater Pathway

	Determining Groundwater Screening Level						Physiochemical Properties			Soil-to-Groundwater Calculations		
Constituent	MTCA Method A Cleanup Level [1] (ug/L)	Standard Method B Formula Value for Carcinogen [1] (ug/L)	Standard Method B Formula Value for Non-Carcinogen [1] (ug/L)	MCL [1] (ug/L)	Resulting Groundwater Screening Level (ug/L)	Notes	Henry's Law Constant (Hcc) [1] (unitless)	Organic Carbon Partitioning Coefficient (Koc) [1] (L/kg)	Aqueous Solubility [1] (mg/L)	Soil Concentration Protective of Target Groundwater Concentration [2] (mg/kg)	Soil Saturation Concentration [3] (mg/kg)	Resulting Soil Screening Level for Leaching to Groundwater [4] (mg/kg)
Tetrachloroethene	5.0E+00	2.1E+01	4.8E+01	5.0E+00	5.0E+00	Used Method A/MCL	7.5E-01	2.7E+02	2.0E+02	5.4E-02	1.1E+02	5.4E-02
Trichloroethene	5.0E+00	5.4E-01	4.0E+00	5.0E+00	5.0E+00	Used Method A/MCL	4.2E-01	9.4E+01	1.1E+03	3.3E-02	3.6E+02	3.3E-02
cis-1,2 Dichloroethene	--	--	1.6E+01	7.0E+01	1.6E+01	MCL adjusted down to hazard index of 1 in accordance with WAC 173-340-720(7)(b)	1.7E-01	3.6E+01	3.5E+03	8.0E-02	8.8E+02	8.0E-02
Vinyl Chloride	2.0E-01	2.9E-02	2.4E+01	2.0E+00	2.9E-01	Adjusted towards MCL in accordance with WAC 173-340-720(7)(b)	1.1E+00	1.9E+01	2.8E+03	1.8E-03	8.8E+02	1.8E-03 [5]

Notes:

-- = No data available

CLARC = Cleanup Levels and Risk Calculations

MCL = Maximum Contaminant Level

MTCA = Model Toxics Control Act

PQL = Practical quantitation limit

WAC = Washington Administrative Code

Screening levels presented with two significant figures.

[1] Values from CLARC (Ecology 2012).

[2] Calculated in accordance with WAC 173-340-747(1).

[3] Calculated by substituting aqueous solubility value for target groundwater concentration * dilution factor in equation 747-1 (Ecology 2001a)

[4] Most stringent of soil concentration protective of target groundwater concentration and soil saturation concentration.

[5] Value would need to be adjusted up to PQL per WAC 173-340-740(5)(c) if used as basis for a cleanup level.

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Table B-4: Assumptions Used in Calculation of Indoor Air Screening Levels

Non-Carcinogenic Screening Level (ug/m^3) [1]	$= \frac{RfDi * ABW * UCF * HQ * AT}{ED * EF * BR * ABS}$
Carcinogenic Screening Level (ug/m^3) [1]	$= \frac{Risk * ABW * AT * UCF}{CPFi * BR * ABS * ED * EF}$

Equation Input Parameters			**Non-Carcinogen Values**		**Carcinogen Values**	
Abbreviation	**Parameter**	**Units**	**Unrestricted Land Use Scenario**	**Commercial/ Industrial Land Use Scenario [2]**	**Unrestricted Land Use Scenario**	**Commercial/ Industrial Land Use Scenario [2]**
RfDi	Reference dose (inhalation)	mg/kg-day	Chemical-specific	Chemical-specific	N/A	N/A
HQ	Hazard quotient	unitless	1	1	N/A	N/A
CPFi	Carcinogenic potency factor (inhalation)	kg-day/mg	N/A	N/A	Chemical-specific	Chemical-specific
Risk	Acceptable cancer risk level	unitless	N/A	N/A	0.000001	0.00001
ABW	Average body weight	kg	16	70	70	70
AT	Averaging time	years	6	20	75	75
BR	Breathing rate	m^3/day	10	20	20	20
EF	Exposure frequency	days/365 days	1	0.68	1	0.68
ED	Exposure duration	years	6	20	30	20
ABS	Inhalation absorption fraction	unitless	1	1	1	1
UCF	Unit Conversion Factor	ug/mg	1,000	1,000	1,000	1,000

Toxicity Values		**Source from IRIS [3]**		**Converted for use in Calculations**	
Cas No.	**Analyte**	**Reference Concentration (inhalation) (RfCi) (mg/m^3)**	**Unit Risk (inhalation) (URi) (ug/m^3)$^{-1}$**	**Reference Dose [4] (inhalation) (mg/kg-day)**	**Carcinogenic Potency Factor [4] (inhalation) (kg-day/mg)**
127-18-4	Tetrachloroethylene	0.040	0.00000026	0.011	0.00091
79-01-6	Trichloroethylene	0.0020	0.0000041	0.00057	0.014[5]
156-59-2	cis-1,2-Dichloroethylene	--	--	--	--
75-01-4	Vinyl Chloride	0.10	4.4E-06 / 8.8E-06 [6]	0.029	0.015 / 0.031 [6]

Notes:

--: No value available

IRIS: Integrated Risk Information System

MTCA: Model Toxics Control Act

USEPA: United States Environmental Protection Agency

WAC: Washington Administrative Code

[1] These equations are Model Toxics Control Act (MTCA) air quality Equations 750-1 and 750-2.

[2] These are exposure assumptions for an adult worker. Exposure parameters wre obtained from MTCA Equations 750-1 and 750-2 except the values for hazard quotient, acceptable cancer risk level, average body weight, and breathing rate are from WAC 173-340-750(4)(b)(ii). The value for exposure duration is from WAC 173-340-745(5)(b)(iii). A standard adult worker exposure frequency of 250 days per year was assumed.

[3] Most recent toxicity information available was obtained from USEPA's Integrated Risk Information System (IRIS) in February 2012. Values for tetrachloroethylene, trichloroethylene and vinyl chloride had been updated prior to completion of this workplan, and were used in this work plan.

[4] Calculations used to convert Reference Concentrations to Reference Doses and Unit Risks to Carcinogenic Potency Factors are as follows:

$$RfDi = \frac{RfCi * BR(adult)}{BW(adult)} \qquad CPFi = \frac{URi * BW(adult) * 1{,}000}{BR(adult)}$$

[5] The value shown in this table is the CPFi value presented in IRIS for trichloroethylene, and is used in this Work Plan for calculation of commercial/industrial air cleanup levels. In September 2012, MTCA released guidance on calculation of trichloroethylene air cleanup levels using three seperate CPFi values. This MTCA guidance was used to calculate unrestricted land use air cleanup levels for trichloroethylene that are presented in this Work Plan.

[6] As of February 2012, MTCA guidance presents two air unit risk / CPFi values for vinyl chloride. Use of the 1.6E-02 CPFi is intended for use only where it is determined that children and pregnant women will not be exposed, and is used in this evaluation to determine a commercial/industrial screening level. The 3.1E-02 CPFi is used in this evaluation to determine an unrestricted land use screening level. Both values are presented in this table, and resulting screening levels are presented in Table A-5.

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Table B-5: Combining Carcinogenic and Non-Carcinogenic Values to Determine Indoor Air Screening Levels [1]

		Unrestricted Land Use Scenario			Commercial/Industrial Land Use Scenario		
Cas No.	Analyte	Non-Carcinogen Indoor Air Screening Level (ug/m^3)	Carcinogen Indoor Air Screening Level (ug/m^3)	Resulting Unrestricted Land Use Indoor Air Screening Level [2] (ug/m^3)	Non-Carcinogen Indoor Air Screening Level (ug/m^3)	Carcinogen Indoor Air Screening Level (ug/m^3)	Resulting Commercial/Industrial Land Use Indoor Air Screening Level [2] (ug/m^3)
127-18-4	Tetrachloroethylene	18	9.6	9.6	58	210	58
79-01-6	Trichloroethylene	0.91	0.37 [3]	0.37 [3]	2.9	13	2.9
156-59-2	cis-1,2-Dichloroethylene	--	--	--	--	--	--
75-01-4	Vinyl Chloride	46	0.28	0.28	160	12	12

Notes:

--: No toxicity information was available for cis-1,2-Dichloroethylene, therefore no screening levels were calculated.

Screening levels presented with two significant figures.

[1] All screening levels calculated in accordance with Table B-4, unless otherwise noted.

[2] The lower of the non-carcinogen and carcinogen indoor air screening levels.

[3] This value is presented in the September 2012 MTCA Guidance for trichloroethylene air cleanup levels. This value will likely be adjusted up to indoor air or ambient air background per WAC 173-340-750(5)(c) if used as basis for a cleanup level. In June 2011 the United States Environmental Protection Agency calculated the 90th percentile indoor air background concentration for trichloroethylene at 2.1 ug/m^3 (USEPA 2011).

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Table B-6: Combining Carcinogenic and Non-Carcinogenic Values to Determine Sub-Slab Soil Gas Screening Levels [1]

		Unrestricted Land Use Scenario			Commercial/Industrial Land Use Scenario		
Cas No.	Analyte	Non-Carcinogen Sub-Slab Soil Gas Screening Level (ug/m^3)	Carcinogen Sub-Slab Soil Gas Screening Level (ug/m^3)	Resulting Unrestricted Land Use Sub-Slab Soil Gas Screening Level [2] (ug/m^3)	Non-Carcinogen Sub-Slab Soil Gas Screening Level (ug/m^3)	Carcinogen Sub-Slab Soil Gas Screening Level (ug/m^3)	Resulting Commercial/Industrial Land Use Sub-Slab Soil Gas Screening Level [2] (ug/m^3)
127-18-4	Tetrachloroethylene	180	96	96	580	2,100	580
79-01-6	Trichloroethylene	9.1	3.7	3.7	29	130	29
156-59-2	cis-1,2-Dichloroethylene	--	--	--	--	--	--
75-01-4	Vinyl Chloride	460	2.8	2.8	1,600	120	120

Notes:

--: No toxicity information was available for cis-1,2-Dichloroethylene, therefore no screening levels were calculated.

Screening levels presented with two significant figures.

[1] A default soil gas to indoor air vapor attenuation factor of 0.1 was applied to the indoor air screening levels presented in Table B-5 to determine the corresponding sub-slab soil gas screening levels shown in this table.

[2] The lower of the non-carcinogen and carcinogen soil gas screening levels.