

Lakewood Plaza Cleaners/Ponders Corner Groundwater Monitoring Results, April 2022



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Abstract

This data summary report presents water quality results for groundwater samples collected in April 2022 at the former Lakewood Plaza Cleaners site in Lakewood, WA. The site, listed on the National Priorities List (NPL) as Lakewood Ponders Corner, was added to the NPL due to chlorinated solvent contamination impacting municipal supply wells operated by the Lakewood Water District. The contamination was caused by improper waste disposal at the former cleaners. Groundwater monitoring has been conducted at this site since 1985. The Washington State Department of Ecology's (Ecology's) groundwater sampling program at the site has been ongoing since the early 1990s.

The U.S. Environmental Protection Agency selected the remedial option of installation and operation of wellhead treatment systems on the Lakewood Water District's municipal supply wells H1 and H2. This remedial activity is ongoing. The purpose of Ecology's monitoring program is to evaluate the effectiveness of wells H1 and H2 in containing and treating contaminated groundwater.

In April 2022, Ecology collected groundwater samples from five monitoring wells and Lakewood Water District's municipal well, H1.

Tetrachloroethene (PCE) concentrations continue to exceed (not meet) the project cleanup level of 5 micrograms per liter ($\mu\text{g/L}$) in three wells (MW-20B, MW-16A, LPMW-2). Well MW-20B had a PCE concentration of 179 $\mu\text{g/L}$. The concentration of PCE in MW-16A was 65.5 $\mu\text{g/L}$. Well LPMW-2 had a PCE concentration of 9.56 $\mu\text{g/L}$.

PCE was detected in H1 at an estimated concentration of 0.71 $\mu\text{g/L}$, below the cleanup level of 5 $\mu\text{g/L}$.

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Background

Site History

In 1981, the U.S. Environmental Protection Agency (EPA) first detected volatile organic compound (VOC) contamination in two Lakewood Water District production wells. The affected production wells, H1 and H2, are located at 5612 New York Ave. SW, in Lakewood (Figure 1), adjacent to Interstate-5 in Pierce County (EPA 1983). Contaminants found in the wells included the chlorinated solvent tetrachloroethene (PCE) and its degradation products trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE).

The EPA identified the former Lakewood Plaza Cleaners as the source of the contamination. Lakewood Plaza Cleaners was a laundry facility that performed dry cleaning until the mid-1980s and other laundry services into the early 1990s. The former dry-cleaning facility was located across Interstate 5, approximately 800 feet north of the production wells (Figure 1). Improper waste disposal at the cleaners, including PCE dumped into on-site septic tanks and dry-cleaning sludge disposed of on the ground surface, was the cause of groundwater contamination (EPA 1983). In 1982, the Lakewood Plaza Cleaners site was added to the National Priorities List (NPL) under the site name Lakewood/Ponders Corner. Rainier Lighting and Electric Supply is the current occupant of the former Lakewood Plaza Cleaners facility. The site is listed on Ecology's Confirmed and Suspected Contaminated Sites List under the name Lakewood Ponders Corner, cleanup site ID 735.

In 1983, the EPA began remedial activities at the Lakewood Plaza Cleaners site. Remediation activities included:

1. Installation of air-strippers at Lakewood Water District production wells to treat groundwater.
2. Removal and off-site disposal of contaminated soils and sludge from the source area.
3. Vapor extraction treatment of contaminated soils associated with the septic field from 1988 to 1989 (EPA 2017b).

In 1993, the EPA determined that remediation of the contaminated soil was complete. In 1996, the EPA removed the soils component of the site from the NPL (EPA 1996).

Since the early 1990s, the Washington State Department of Ecology (Ecology) has had an active role at the Lakewood Plaza Cleaners site. In 1991, Ecology began semi-annual groundwater compliance monitoring at the site. In 1997, Ecology assumed responsibility for the operation and maintenance of the remedial actions, while the Lakewood Water District performs the routine operation and maintenance of the air-stripping treatment system. The purpose of Ecology's sampling is to produce groundwater quality data for use in evaluating the effectiveness of Lakewood water supply wells H1 and H2 to contain, remove, and treat the groundwater contaminated by Plaza Cleaners.

Air-stripping treatment of groundwater pumped by wells H1 and H2 continues because groundwater cleanup levels for PCE of 5 µg/L have not been consistently achieved for pre-treatment production well samples.

Hydrogeologic Setting

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

Table 1. Well construction details.

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

bgs: below ground surface.

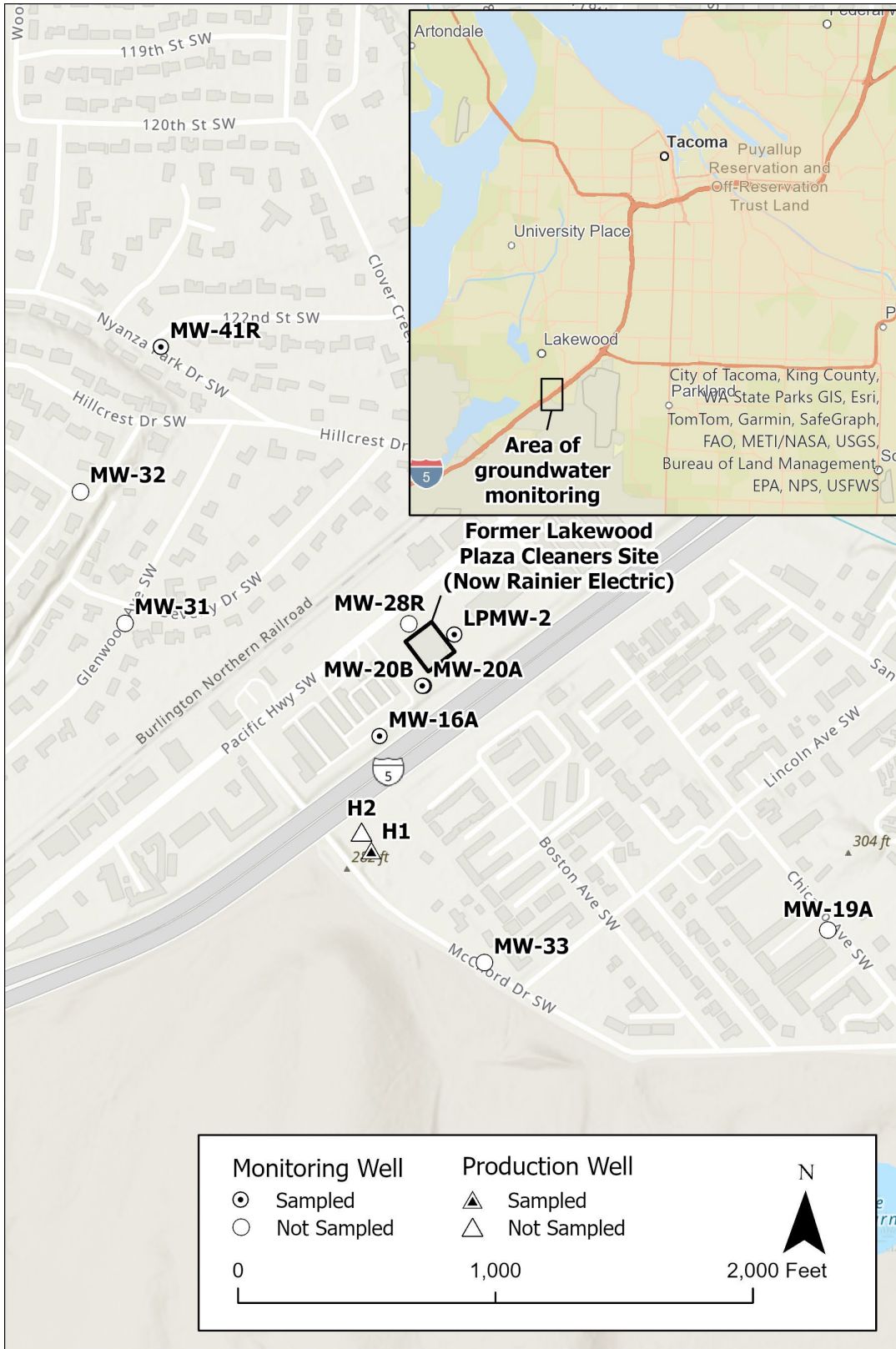


Figure 1. Locations of the Lakewood Plaza Cleaners site, project monitoring wells, and the Lakewood Water District supply wells.

The two relatively shallow wells screened in the Steilacoom Gravel and Vashon Till units are located near the contaminant source area. The Steilacoom Gravel is composed of permeable Vashon recessional sand and gravel deposits. This is the uppermost unit underlying the site, typically encountered up to a depth of about 30 feet below ground surface (bgs). The Steilacoom gravels, which are typically unsaturated, contain an area of perched groundwater in the immediate vicinity of the former Plaza Cleaners and near the production wells H1 and H2 (EPA 1985a).

Underlying the Steilacoom Gravel is the Vashon Till, which consists of semi-confining silt and clay-rich layers that contain lenses of clean gravel. This unit, which is highly variable in thickness, is typically encountered from about 30 to 75 feet bgs. Within the project area, the Vashon Till is thickest to the north and west of the former Plaza Cleaners site; the unit thins and possibly pinches out to the southeast of the production wells H1 and H2 (USACE 2012).

Within the Vashon Till is at least one gravel lens present beneath the former Plaza Cleaners site; this lens appears to be large in its lateral extent. This permeable interval appears to be hydraulically interconnected with the Steilacoom Gravel (EPA 1985b).

The remaining wells are screened in the highly permeable sands and gravels of the deeper Advance Outwash deposits, the primary water supply aquifer for the area. This unit is typically 75 to 110 feet bgs. Regional groundwater flow in the Advance Outwash is generally to the west-northwest toward Gravelly Lake. The horizontal hydraulic conductivity in the Advance Outwash ranges from 400 to 2000 feet per day, with linear flow velocities reaching up to 100 feet per day (USACE 2012). The production wells H1 and H2, which are to the south of the dry cleaner site, create a capture zone (Figure 1), influencing groundwater flow directions in the area when the wells are pumping (EPA 2017a).

Ongoing monitoring and review

Since 1985, groundwater monitoring has been conducted at this site. In accordance with the EPA policy and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA § 121(42 U.S.C. Section 9621)) and the National Contingency Plan, five-year reviews are required on projects where cleanup goals have not been achieved. Seven five-year reviews for the Lakewood Plaza Cleaners/Ponders Corner site have been completed: In 1992, 1997, 2007, 2017, and 2022, the EPA conducted five-year reviews. In 2002, Ecology conducted a five-year review. In 2012, the U.S. Army Corps of Engineers (USACE) conducted a five-year review.

In 2016, the EPA conducted a study to address questions raised during the 2012 five-year review regarding (1) the fate of contaminants in the low-permeability Vashon Till and (2) the effectiveness of groundwater captured by wells H1 and H2 (USACE 2012). The EPA's study included groundwater sampling and hydraulic monitoring from April to November 2016. A primary goal of the study was to assess the ability of H1 and H2 to capture contaminated groundwater when wells H1 and H2 are operating in a non-continuous manner (EPA 2017a).

The EPA study found that contrary to the existing conceptual site model, the vertical hydraulic gradient was upward from the Advance Outwash deposits to the Vashon Till during the April

through November study period. During the wetter months of December through March, the EPA hypothesizes that the vertical gradient reverses to downward from the Vashon Till to the Advance Outwash. Regional groundwater flow is to the northwest, towards Gravelly Lake.

In the seventh five-year review (EPA 2022), the EPA found that the site remedies are performing as intended. The air stripping treatment system on the Lakewood Water District production wells was replaced in 2020. The EPA reported that both supply wells H1 and H2 are operated simultaneously on a continuous schedule. Continuous pumping of the supply wells alleviates a primary concern of the sixth five-year review (EPA 2017b), which found that hydraulic control cannot be maintained at all times without continuous pumping.

The EPA continues to recommend the installation of a new monitoring well west of MW-16A at the corner of Pacific Highway Southwest and New York Avenue Southwest to determine whether contaminants are migrating beyond the capture zone of wells H1 and H2 (EPA 2017b, 2022).

Because the cleanup goals have not been achieved at the Lakewood Plaza Cleaners/Ponders Corner site, remediation and monitoring of the groundwater is ongoing under a long-term response action.

Data collected by Ecology and the associated monitoring reports for this project are available at Ecology's Environmental Information Management (EIM) website [EIM Database.²](#) Search Study ID: LAKEWOOD.

Methods and Results

In April 2022, Ecology sampled groundwater from the two shallow (LPMW-2, MW-20B) and four deep (MW-16A, MW-20A, MW-41R, H1) wells to evaluate volatile organics in groundwater at the Lakewood Plaza Cleaners/Ponders Corner site (Figure 2).

Ecology sampled the Lakewood Plaza Cleaners monitoring wells in accordance with Standard Operating Procedure (SOP) EAP078 (Ecology 2023). Prior to sampling, wells were purged through a continuous flow cell until field parameters (pH, temperature, specific conductance, dissolved oxygen, and oxidation-reduction potential) stabilized, as specified in SOP EAP078 (Ecology 2023). Stabilized field parameters collected during the 2022 sampling are presented in Table 2.

A stainless-steel bladder pump was used to purge and sample all monitoring wells. The pump was decontaminated, and a new bladder was installed between each well.

Municipal well H1 was operating at the time of the April 2022 sampling. The sample for well H1 was collected from a tap before any water treatment in accordance with Ecology's SOP EAP077 (Ecology 2020).

² <https://www.ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database>

Table 2. April 2022 field data.

Well ID	Groundwater Elevation (feet, NAVD88)	pH (std. units)	Specific Conductivity ($\mu\text{S}/\text{cm}$)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)
MW-16A	246.67	6.9	223	4.0	110
MW-20A	256.61	7.6	219	3.1	96
MW-20B	258.35	6.4	232	6.4	119
MW-41R	247.73	6.7	184	3.2	112
LPMW-2	259.25	6.4	284	7.3	128
H1	—	6.3 EST	183 EST	8.6 EST	90 EST

EST: Measurement value reported is estimated.

Samples were collected in clean laboratory-supplied bottles and submitted for analysis of volatile organic compounds (VOCs). All analyses were performed by Ecology's Manchester Environmental Laboratory. Analytical results for VOCs of concern (PCE, TCE, and cis-1,2-DCE) are presented in Table 3 and Figure 2. Results reported below the method reporting limit (1 $\mu\text{g}/\text{L}$) are automatically qualified as estimates.

Table 3. April 2022 analytical results.

Well ID	PCE	TCE	Cis-1,2-DCE
MW-16A	<u>65.5</u>	0.85J	0.65J
MW-16A (duplicate)	<u>63.3</u>	0.89J	0.69J
MW-20A	0.49J	1U	1U
MW-20B	<u>179</u>	2.94	3.49
MW-41R	1U	1U	1U
LPMW-2	<u>9.56</u>	1U	1U
H1	0.71J	1U	1U
<i>Project Cleanup Level^a</i>	5	5	70

PCE: tetrachloroethene.

TCE: trichloroethene.

U: The analyte was not detected at or above the reported result.

J: The analyte was positively identified. The associated numerical result is an estimate.

Bold: The analyte was positively identified.

Bold and Underlined: Values are greater than project cleanup levels.

^a Project Cleanup Levels are based on the Federal Maximum Contaminant Levels.

Quality control samples collected in the field consisted of a blind field duplicate collected from well MW-16A. The relative percent difference (RPD) for PCE in MW-16A was 3.4%. The RPD is not calculated for estimated results. The duplicate data meet the laboratory data quality objective (DQO) of 30% for this analysis.

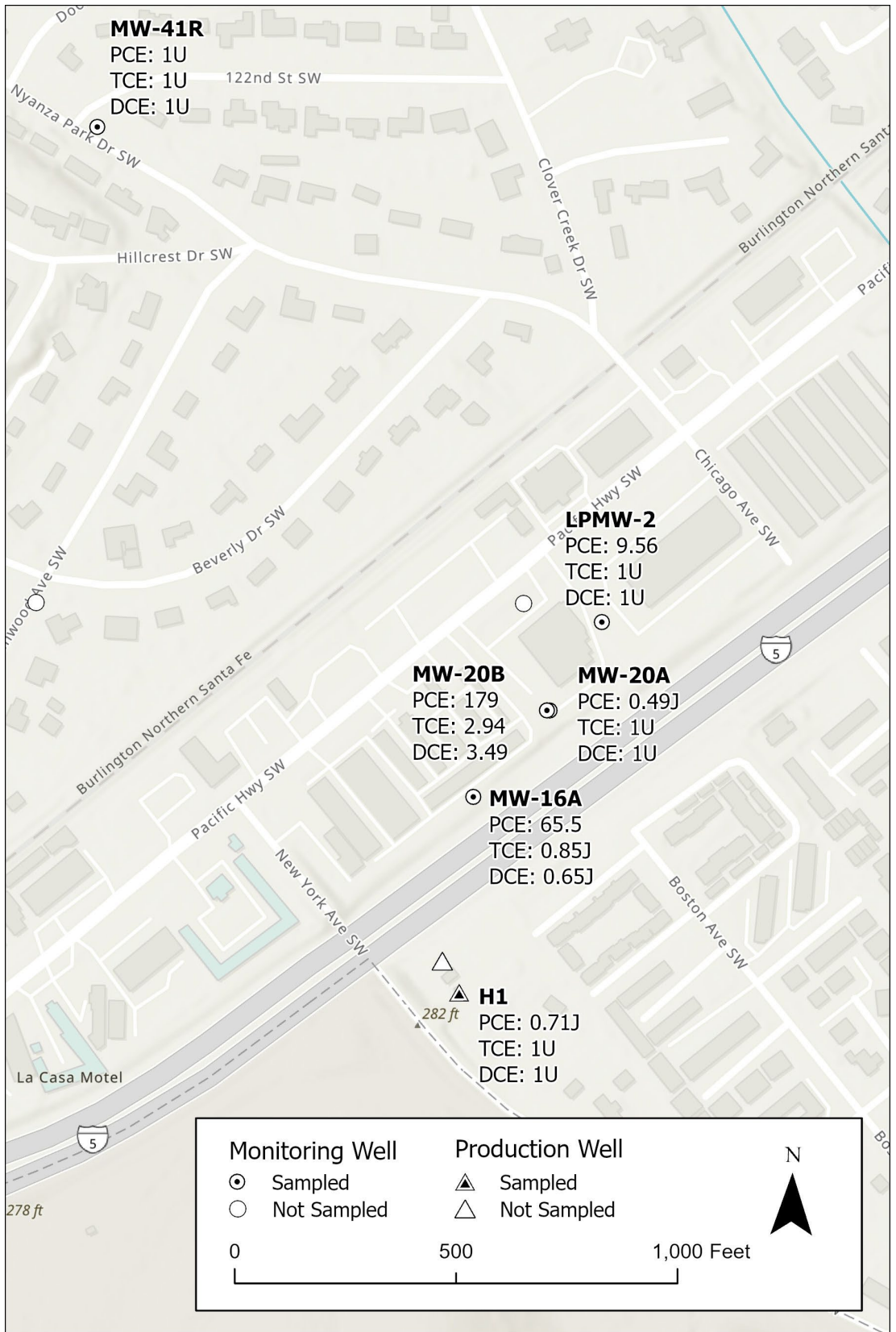


Figure 2. Contaminant concentrations ($\mu\text{g/L}$) in samples from April 2022.

The laboratory data quality control and quality assurance results indicate that the analytical performance was good and the results are usable as qualified.

PCE concentrations in wells MW-16A and MW-20B continued to far exceed (not meet) the cleanup level of 5µg/L (Table 3). Both wells contained detectable concentrations of TCE and cis-1,2-DCE below the cleanup limits. In MW-16A, TCE and cis-1,2-DCE concentrations were detected below the reporting 1 µg/L reporting limit.

PCE concentration in well LPMW-2 also exceeded the cleanup level. TCE and cis-1,2-DCE were not detected (Table 3). This well is near the former Lakewood Plaza Cleaners septic system, which was a source of the site’s contamination.

PCE was detected in the sample taken from municipal well H1 before treatment at a concentration below the reporting limit (Table 3).

Vinyl chloride was not detected in any of the sampled wells during this sampling event. Although the reporting limit was 1 µg /L, the method detection limit was 0.04 µg /L. Vinyl chloride has not been detected in any of the samples collected by Ecology since taking over the monitoring in 1991.

Long-term VOC data for wells monitored during the Lakewood Plaza Cleaners/Ponders Corner project are presented in Tables A-1 – A-13. Figure 3 shows PCE concentration data from 1991 through 2022 for wells MW-16A, which is a deeper downgradient well in relation to the source area, and well MW-20B, which is a shallower well that is closer to the source.

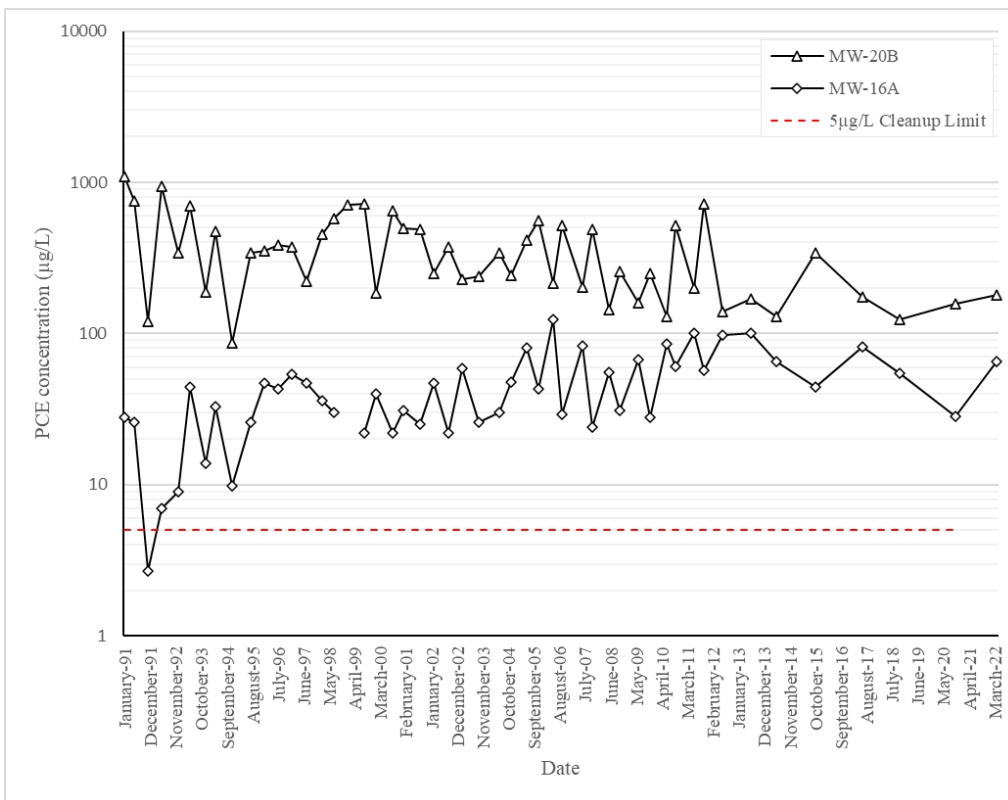


Figure 3. PCE concentrations (µg/L) over time in wells MW-16A and MW-20B.

Discussion and Conclusions

Groundwater near the former Lakewood Plaza Cleaners site has PCE concentrations higher than the project cleanup level of 5 µg/L. In wells MW16-A and MW-20B, PCE concentrations far exceed (do not meet) the cleanup level. These wells contained detectable concentrations of TCE and cis-1,2-DCE below the respective cleanup limits of 5 µg/L and 70 µg/L. Additionally, PCE was detected in well LPMW-2 above the 5 µg/L cleanup limit; TCE and cis-1,2-DCE were not detected in LPMW-2.

Water level data from wells MW-20A and MW-20B (Table 2) indicate that the vertical groundwater gradient during the April 2022 sample was downward from the Vashon Till to the Advance Outwash. During the previous sampling event in October 2020, the vertical groundwater gradient was upward from the Advance Outwash to the Vashon Till. In October 2018, there was no significant vertical gradient. Hydraulic data collected by the EPA (EPA 2017a, 2017b) show that, at least in the relatively dry months of April to November, the vertical groundwater gradient in the vicinity of MW-16A and MW-20B is upward from the Advance Outwash to the Vashon Till.

The EPA hypothesized that the vertical gradient reverses when aquifer recharge occurs during the wetter months of December to March. Ecology's recent water level measurements support the hypothesized seasonal reversals in hydraulic gradients.

Data from wells MW-16A and MW-20B were analyzed with the Mann-Kendall trend test using ProUCL Software. For 1991 through 2022, the Mann-Kendall trend analysis identifies a trend of decreasing PCE concentrations in well MW-20B and increasing PCE concentrations in well MW-16A.

Well LPMW-2 is the only monitoring well completed within the Steilacoom Gravel in the monitoring plan. PCE is consistently detected in LPMW-2, with the most recent results from 2018 and 2022 above the cleanup level. Low water levels adversely affect this well, especially in the fall. In October 2018, LPMW-2 was sampled with a peristaltic pump due to a low water level. In October 2020, this well was not sampled due to insufficient volume of water in the well.

Supply well H1 was operating during the 2022 sampling. PCE was detected at an estimated concentration of 0.71 µg/L, below the reporting limit of 1 µg/L. The PCE concentrations in groundwater samples from supply wells H1 and H2 have not been higher than the cleanup level since June 2011.

Recommendations

- 1. Install new monitoring wells to better characterize the site.** The EPA has recommended installing a new monitoring well to the west (regionally downgradient) of MW-16A. The proposed location for this new monitoring well is at the corner of Pacific Highway Southwest and New York Avenue Southwest. The recommended completion depth for this well is 115 feet, similar to that of MW-16A. The now decommissioned monitoring well MW-21 was located near the same intersection. Samples from MW-21 had PCE concentrations of about 2 µg/L before the well was decommissioned in 1996.

Additional shallow monitoring wells will provide an understanding of conditions in the Steilacoom Gravel and Vashon Till. The groundwater monitoring plan currently includes only one monitoring well in either of these geologic units. Additionally, low water levels may hinder Ecology's ability to sample the lone well in the Steilacoom Gravel (LPMW-2). New monitoring wells installed within these units near the contaminant source will help to define the current state of groundwater contamination above the Advance Outwash.

- 2. Determine the vertical hydraulic gradient over an entire year.** The hydraulic study conducted by the EPA (EPA 2017a) found that the vertical hydraulic gradient in the vicinity of Lakewood Plaza Cleaners is upwards from the Advance Outwash to the Vashon Till for at least part of the year. The water level information presented in this report backs up the EPA hypothesis that the gradient reverses during the wet season. However, a longer study (at least one full year) to collect hydraulic data at the former Lakewood Plaza Cleaners site will better determine the timing and magnitude of seasonal reversals in the vertical hydraulic gradient.
- 3. Continue sampling existing monitoring wells according to the monitoring plan.** Because groundwater contamination in the vicinity of Lakewood Plaza Cleaners continues to far exceed the 5 µg/L cleanup level for PCE, ongoing groundwater monitoring is needed to gauge the effectiveness of the cleanup strategy.

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Appendix A.

The tables in this appendix summarize groundwater quality results from supply and monitoring wells, as well as groundwater levels in monitoring wells, for the Lakewood Plaza Cleaners/Ponders Corner site collected by Ecology since 1991. Groundwater levels are given as depth below the top of the well casing. Project Cleanup Levels are based on Federal Maximum Contaminant Levels. The following qualifiers, symbols, and abbreviations are used in the tables:

- U: The analyte was not detected at or above the reported result.
- J: The analyte was positively identified. The associated numerical result is an estimate.
- UJ: The analyte was not detected at or above the reported estimated result.
- NJ: The analyte has been tentatively identified. The associated numerical result is an estimate.
- E: The concentration of the associated value exceeds the known calibration range.
- —: Not Measured or Not Sampled
- PCE: Perchloroethene
- TCE: Trichloroethene
- Cis-1,2-DCE: Cis-1,2-dichloroethene
- **Bold:** The analyte was positively identified.
- **Shade:** Values are greater than project cleanup levels (see Table A-1).

Table A-1. Project cleanup levels (µg/L)

PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
5	5	70	0.2

Table A-2. Summary of sample results (µg/L) in wells H1 or H2 from July 1995 to April 2022.

Date	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
7/1995	9	0.3 J	1 U	1 U
1/1996	8.4	0.2 J	0.2 J	2 U
7/1996	0.1 J	1 U	1 U	1 U
1/1997	18	0.4 J	0.4 J	1 U
7/1997	8.8	0.3 J	0.6 J	1 U
2/1998	11	0.4 J	0.3 J	1 U
7/1998	9.8	1 U	0.1 J	1 U
1/1999	1.5	1 U	1 U	1 U
8/1999	5.2	0.2 J	1 U	1 U
1/2000	10	2 U	1 U	1 U
8/2000	8.7	0.03 J	1 U	1 U
1/2001	11	0.2 J	1 U	1 U
8/2001	6.8	0.2 J	1 U	1 U
2/2002	12	0.2 J	0.2 J	1 UJ
8/2002	6.1	1 U	1 U	1 U
2/2003	1.3	1 U	1 U	1 U
9/2003	6.4	0.2 NJ	1 U	5 U
6/2004	7.9	0.2 J	0.1 J	1 U
11/2004	2.6	1 U	1 U	5 U
6/2005	14	0.3 J	1 U	2 U
11/2005	6.4	1 U	1 U	2 U
5/2006	7.3	0.2 J	1 U	5 U
9/2006	4.8	1 U	1 U	2 U
6/2007	5.2	2 U	2 U	2 U
10/2007	3.8	1 U	1 U	2 U
5/2008	9.6	1 U	1 U	1 U
10/2008	5.1	1 U	1 U	1 U
6/2009	6.8	1 U	1 U	1 U
6/2010	4.3	1 U	1 U	1 U
6/2011	5.9	1 U	1 U	1 UJ
10/2011	1.4	1 U	1 U	2 U
6/2012	5.2	1 U	1 U	1 U
6/2013	4.9	1 U	1 U	1 U
5/2014	2.9	1 U	1 U	1 U
10/2015	1.8	0.2 J	1 U	1 U
6/2017	3 J	1 U	1 U	1 UJ
10/2018	1 U	1 U	1 U	1 U
10/2020	3.13	1 U	1 U	1 U
4/2022	0.71 J	1 U	1 U	1 U

Table A-3. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-16A from January 1991 to April 2022.

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

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
6/2012	33.37	98	1.3	2.4	1 U
6/2013	34.81	100	1.3	2.6	1 U
5/2014	28.8	65	1.1	1.3	1 U
10/2015	42.5	44	0.5 J	0.6 J	1 U
6/2017	34.54	82 J	0.82 J	1.3	1 UJ
10/2018	36.71	55	0.73 J	0.99 J	1 U
10/2020	45.37	28.4 J	0.44 J	0.78 J	1 U
4/2022	33.83	65.5	0.85 J	0.65 J	1 U

Table A-4. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-20A from January 1991 to April 2022.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	31.74	1 U	1 U	1 U	1 U
5/1991	29.93	0.4 J	1 U	1 U	1 U
11/1991	37.77	0.4 NJ	1 U	1 U	1 U
5/1992	35.75	0.5 J	1 U	1 U	1 U
12/1992	37.17	0.8 J	1 UJ	1 UJ	1 UJ
5/1993	30.87	10 U	10 U	10 U	10 U
12/1993	37.82	0.3 J	1 U	1 U	1 U
4/1994	33.27	0.4	0.2 U	0.2 U	1 U
11/1994	38.30	0.3 J	1 U	1 U	1 U
7/1995	34.51	0.4 J	1 U	1 U	1 U
1/1996	27.89	0.2 J	1 U	1 U	2 U
7/1996	33.02	0.4 J	1 U	1 U	1 U
1/1997	18.45	0.4 J	1 U	1 U	1 U
7/1997	30.78	0.3 J	1 U	2 U	1 U
2/1998	25.50	0.4 J	1 U	1 U	1 U
7/1998	34.68	0.6 J	1 U	1 U	1 U
1/1999	25.02	1 U	2 U	1 U	1 U
8/1999	35.57	0.8 J	2 U	1 U	1 U
1/2000	26.68	0.2 NJ	2 U	1 U	1 U
8/2000	36.53	0.1 J	2 U	1 U	1 U
1/2001	32.92	0.2 J	1 U	1 U	1 U
8/2001	36.23	1 U	2 U	1 U	1 U
2/2003	27.73	1 U	1 U	1 U	1 U
9/2003	37.27	0.1 J	1 U	1 U	5 U
6/2004	34.58	0.2 J	1 U	1 U	1 U
11/2004	31.88	0.3 J	1 U	1 U	5 U
6/2005	30.15	1 U	1 U	1 U	2 U
11/2005	31.98	1 U	1 U	1 U	2 U

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
5/2006	29.22	1 U	1 U	1 U	5 U
9/2006	36.19	1 U	1 U	1 U	2 U
6/2007	30.54	2 U	2 U	2 U	2 U
10/2007	35.02	2 U	1 U	1 U	2 U
5/2008	31.33	1 U	1 U	1 U	1 U
10/2008	36.32	1 U	1 U	1 U	1 U
6/2009	29.07	1 U	1 U	1 U	1 U
11/2009	31.10	0.6 J	1 U	1 U	1 U
6/2010	26.90	1 U	1 U	1 U	1 U
10/2010	31.69	2 U	1 U	1 U	1 U
6/2011	26.18	1 U	1 U	1 U	1 UJ
10/2011	32.57	1 U	1 U	1 U	2 U
6/2012	27.70	1 U	1 U	1 U	1 U
6/2013	29.52	1 U	1 U	1 U	1 U
5/2014	24.02	1 U	1 U	1 U	1 U
10/2015	35.58	0.2 J	1 U	1 U	1 U
6/2017	28.85	1 U	1 U	1 U	1 UJ
10/2018	31.98	1 U	1 U	1 U	1 U
10/2020	37.27	1 U	1 U	1 U	1 U
4/2022	25.79	0.49 J	1 U	1 U	1 U

Table A-5. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-20B from January 1991 to April 2022.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	33.94	1100	18	33	1 U
5/1991	30.57	752	16	30	1 U
11/1991	40.99	120	2.6 J	6.7	1 U
5/1992	38.57	940	13	32	1 U
12/1992	40.57	340 J	14 J	20 J	5 UJ
5/1993	32.48	700	12	21	10 U
12/1993	41.38	187	50 U	8.2 J	50 U
4/1994	35.49	472	8.6 J	12.6	50 U
11/1994	41.12	86	50 U	3 J	50 U
7/1995	36.48	340	8.4	17	1 U
1/1996	27.90	353	7.2	15	2 U
7/1996	33.15	387	7.6	15	1 U
1/1997	15.60	373	100 U	6.4 J	100 U
7/1997	30.31	222	4	6.4	1 U
2/1998	25.28	456	7 J	12	10 U
7/1998	35.78	575	10	23	1 U
1/1999	27.14	708	5.2	12	1 U

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
8/1999	37.18	722	8.4 J	16 J	1 U
1/2000	27.87	184	6	13	1 U
8/2000	38.39	648	200 U	100 U	100 U
1/2001	33.88	493	6.6 J	12	10 U
8/2001	37.67	486	8.2	18	100 U
2/2002	23.50	248	200 U	100 U	100 UJ
8/2002	37.92	371	8.5	16	1 U
2/2003	26.60	230	100 U	100 U	100 U
9/2003	39.49	239	5.4 J	12	50 U
6/2004	35.76	344	6.5 J	15	10 U
11/2004	32.36	241	6.7	13	5 U
6/2005	29.06	413	6.6	12	5 U
11/2005	32.58	555	6.4	11	2 U
5/2006	27.56	216	4.2	6.6	5 U
9/2006	39.00	518	5.6	11	2 U
6/2007	29.64	204	4.4	7.8	2 U
10/2007	36.9	491	7.5	15	2 U
5/2008	30.65	143	5.5	12	1 U
10/2008	37.48	258	4.5	9	1 U
6/2009	28.24	160	4.1	7.4	1 U
11/2009	32.04	250	4.7	9.6	1 U
6/2010	25.86	130	3.7	6.3	1 U
10/2010	31.79	520	5.8	10	1 U
6/2011	23.39	200	3.5	5.6	1 UJ
10/2011	33.18	720	4.8	7.9	2 U
6/2012	26.85	140	3.3	5.7	1 U
6/2013	29.00	170	3.9	7	1 U
5/2014	21.80	130	2.1	3	1 U
10/2015	36.91	340	5.4	12	1 U
6/2017	27.71	174 J	2.9	4.5	1 UJ
10/2018	31.59	124	1.8	2.7	1 U
10/2020	38.86	157	4.34	6.73	1 U
4/2022	23.65	179	2.94	3.49	1 U

Table A-6. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-27 from January 1991 to October 2011.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	—	1 U	1 U	1 U	1 U
5/1991	—	1 U	1 U	1 U	1 U
11/1991	—	1 U	1 U	1 U	1 U
5/1992	—	1 U	1 U	1 U	1 U
12/1992	—	1 UJ	1 UJ	1 UJ	1 UJ
5/1993	—	10 U	10 U	10 U	10 U
12/1993	—	1 U	1 U	1 U	1 U
4/1994	—	0.2 U	0.2 U	0.2 U	1 U
11/1994	—	1 U	1 U	1 U	1 U
7/1995	—	1 U	1 U	1 U	1 U
1/1996	—	1 U	1 U	1 U	2 U
7/1996	—	1 U	1 U	1 U	1 U
1/1997	—	1 U	1 U	1 U	1 U
7/1997	—	1 U	1 U	1 U	1 U
2/1998	—	1 U	1 U	1 U	1 U
7/1998	—	0.05 J	1 U	1 U	1 U
1/1999	—	1 U	2 U	1 U	1 U
8/1999	—	1 U	2 U	1 U	1 U
1/2000	—	1 U	2 U	1 U	1 U
8/2000	—	1 U	2 U	1 U	1 U
1/2001	—	1 U	1 U	1 U	1 U
8/2001	—	1 U	2 U	1 U	1 U
2/2002	—	1 U	2 U	1 U	1 UJ
8/2002	—	1 U	2 U	1 U	1 U
2/2003	—	1 U	1 U	1 U	1 U
9/2003	—	1 U	1 U	1 U	5 U
6/2004	—	1 U	1 U	1 U	1 U
11/2004	—	1 U	1 U	1 U	5 U
6/2005	—	1 U	1 U	1 U	2 U
11/2005	—	1 U	1 U	1 U	2 U
5/2006	—	1 U	1 U	1 U	5 U
9/2006	34.20	1 U	1 U	1 U	2 U
6/2007	28.95	2 U	2 U	2 U	2 U
10/2007	33.31	2 U	1 U	1 U	2 U
5/2008	29.91	1 U	1 U	1 U	1 U
10/2008	34.42	1 U	1 U	1 U	1 U
6/2009	28.35	1 U	1 U	1 U	1 U
11/2009	29.05	1 U	1 U	1 U	1 U
6/2010	26.62	1 U	1 U	1 U	1 U
6/2011	25.58	1 U	1 U	1 U	1 UJ
10/2011	31.58	1 U	1 U	1 U	2 U

Table A-7. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well LPMW-2 from May 2006 to April 2022.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
5/2006	22.62	9.9	1 U	1 U	5 U
6/2007	23.99	4.8	1 U	1 U	2 U
5/2008	24.90	2.5	1 U	1 U	1 U
6/2009	22.48	4.1	1 U	1 U	1 U
11/2009	22.81	11	1 U	1 U	1 U
6/2010	21.60	4.4	1 U	1 U	1 U
10/2010	25.27	5	1 U	1 U	1 U
6/2011	20.07	3.2	1 U	1 U	1 UJ
6/2012	22.27	2.4	1 U	1 U	1 U
6/2013	22.90	2.2	1 U	1 U	1 U
5/2014	19.22	2.7	1 U	1 U	1 U
6/2017	22.87	5.7	1 U	1 U	1 U
10/2018	23.89	19	1 U	1 U	0.2 U
10/2020	—	—	—	—	—
4/2022	20.71	9.56	1 U	1 U	1 U

Table A-8. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-19A from May 1991 to October 2020.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
11/1991	43.40	1 U	0.5 NJ	1 U	1 U
12/1992	42.80	1 UJ	1 UJ	1 UJ	1 UJ
12/1993	43.00	1 U	0.4 J	1 U	1 U
4/1994	38.62	0.2 U	0.5	0.2 U	1 U
7/1995	39.42	1 U	0.4 J	1 U	1 U
7/1997	35.94	1 U	0.3 J	2 U	1 U
8/1999	40.37	1 U	0.4 J	1 U	1 U
8/2001	41.18	1 U	0.3 J	1 U	1 U
9/2003	42.69	1 U	0.4 NJ	1 U	5 U
6/2005	35.26	1 U	0.6 J	1 U	2 U
6/2007	35.00	2 U	1.2 J	2 U	2 U
6/2009	34.59	1 U	1 U	1 U	1 U
10/2011	38.41	1 U	0.4 J	1 U	2 U
6/2017	33.58	1 U	1 U	1 U	1 U
10/2020	42.42	1 U	0.39 J	1 U	1 U

Table A-9. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-31 from May 1991 to October 2020.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	—	1 J	1 U	1.9 J	1 U
5/1991	—	0.6 J	1 U	2	1 U
11/1991	—	0.9 NJ	1 U	2.2 J	1 U
5/1992	—	0.8 J	1 U	1	1 U
12/1992	—	0.5 J	1 UJ	0.9 J	1 UJ
5/1993	—	10 U	10 U	10 U	10 U
12/1993	—	0.8 J	1 U	1.2 J	1 U
4/1994	—	0.7	0.2 U	1	1 U
11/1994	—	0.8 J	1 U	1	1 U
7/1995	—	0.6 J	1 U	0.5 J	1 U
1/1996	—	0.6 J	1 U	0.7 J	2 U
7/1997	—	0.9 J	1 U	0.9 J	1 U
8/1999	—	0.9 J	2 U	0.4 J	1 U
8/2001	—	0.4 J	2 U	0.3 J	1 U
9/2003	—	0.5 J	1 U	0.1 NJ	5 U
6/2005	—	0.5 J	1 U	1 U	2 U
6/2007	—	1.6 J	2 U	2 U	2 U
10/2011	38.05	0.7 J	1 U	1 U	2 U
6/2017	34.61	0.7 J	1 U	1 U	1 U
10/2020	41.95	0.97 J	1 U	1 U	1 U

Table A-10. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-32 from May 1991 to October 2020.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	60.1	1 J	1 U	1.1 J	1 U
5/1991	58.66	1	1 U	2	1 U
11/1991	64.71	0.6 NJ	1 U	0.6 J	1 U
5/1992	62.54	0.7 J	1 U	1	1 U
12/1992	64.67	0.7 J	1 UJ	0.5 J	1 UJ
5/1993	60.03	10 U	10 U	10 U	10 U
12/1993	65.02	0.7 J	1 U	0.6 J	1 U
4/1994	61.44	0.7	0.2 U	0.6	1 U
11/1994	65.63	0.6 J	1 U	0.5 J	1 U
7/1995	62.31	0.7 J	1 U	0.5 J	1 U
1/1996	57.2	0.8 J	1 U	0.6 J	2 U
8/2000	63.08	0.8 J	2 U	1 U	1 U
6/2005	59.41	1.4	1 U	1 U	2 U
6/2010	57.93	1.8	1 U	1 U	1 U
6/2017	58.18	1.4	1 U	1 U	1 U
10/2020	64.57	1.28	1 U	1 U	1 U

Table A-11. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-33 from July 1995 to October 2020.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
7/1995	—	1 U	1 U	1 U	1 U
7/1996	—	1 U	1 U	1 U	1 U
7/1997	—	1 U	1 U	2 U	1 U
7/1998	—	1 U	1 U	1 U	1 U
8/1999	—	1 U	2 U	1 U	1 U
8/2000	—	1 U	2 U	1 U	1 U
8/2001	—	1 U	2 U	1 U	1 U
8/2002	—	1 U	1 U	1 U	1 U
9/2003	—	1 U	1 U	1 U	5 U
6/2005	—	1 U	1 U	1 U	2 U
5/2006	—	1 U	1 U	1 U	5 U
6/2007	—	2 U	2 U	2 U	2 U
5/2008	—	1 U	1 U	1 U	1 U
6/2009	—	1 U	1 U	1 U	1 U
6/2010	—	1 U	1 U	1 U	1 U
10/2011	34.83	1 U	1 U	1 U	2 U
6/2013	31.41	1 U	1 U	1 U	1 U
10/2015	38.18	1 U	0.2 J	1 U	1 U
6/2017	29.95	1 U	1 U	1 U	1 UJ
10/2020	40.12	1 U	1 U	1 U	1 U

Table A-12. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-40 from January 1991 to October 2011.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	32.76	1 U	1 U	1 U	1 U
11/1991	37.65	1 U	1 U	1 U	1 U
12/1992	36.60	1 UJ	1 UJ	1 UJ	1 UJ
12/1993	37.83	1 U	1 U	1 U	1 U
4/1994	34.20	0.2 U	0.2 U	0.2 U	1 U
7/1995	35.25	1 U	1 U	1 U	1 U
8/2000	37.82	1 U	2 U	1 U	1 U
6/2005	34.3	1 U	1 U	1 U	2 U
10/2011	35.98	1 U	1 U	1 U	2 U

Table A-13. Summary of water levels (ft. below measuring point) and sample results (µg/L) in monitoring well MW-41 from January 1991 to June 2010.

Date	Water Level	PCE	TCE	Cis-1,2-DCE	Vinyl Chloride
1/1991	28.45	1 U	1 U	1 U	1 U
5/1991	27.26	1 U	1 U	1 U	1 U
11/1991	32.29	1 U	1 U	1 U	1 U
5/1992	30.36	1 U	1 U	1 U	1 U
12/1992	31.49	1 UJ	1 UJ	1 UJ	1 UJ
5/1993	27.95	10 U	10 U	10 U	10 U
12/1993	32.90	1 U	1 U	1 U	1 U
4/1994	29.40	0.2 U	0.2 U	0.2 U	1 U
7/1995	30.17	1 U	1 U	1 U	1 U
1/1996	25.87	1 U	1 U	1 U	2 U
8/2000	30.98	1 U	2 U	1 U	1 U
6/2005	28.42	1 U	1 U	1 U	2 U
6/2010	26.69	1 U	1 U	1 U	1 U