Savannah River NUCLEAR SOLUTIONS℠

Effectiveness Monitoring Report (EMR) for the P-Area Groundwater (PAGW) Operable Unit (OU) Zero Valent Iron Permeable Reactive Barrier (ZVI-PRB) Removal Action (U)

April 2024 through March 2025

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SAVANNAH RIVER SITE • AIKEN, SOUTH CAROLINA

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LIST OF ABBREVIATIONS AND ACRONYMS

~	approximately
1,1-DCE	1,1-dichloroethylene
1Q19	first quarter of 2019
1Q20	first quarter of 2020
1Q22	first quarter of 2022
1Q23	first quarter of 2023
1Q24	first quarter of 2024
1Q25	first quarter of 2025
2Q20	second quarter of 2020
2Q23	second quarter of 2023
2Q24	second quarter of 2024
3Q20	third quarter of 2020
3Q22	third quarter of 2022
3Q24	third quarter of 2024
4Q20	fourth quarter of 2020
4Q21	fourth quarter of 2021
4Q22	fourth quarter of 2022
4Q24	fourth quarter of 2024
ac	acre
amsl	above mean sea level
cis-DCE	cis-1,2-dichloroethylene
cm	centimeter
cm/yr	centimeter per year
cVOC	chlorinated volatile organic compound
DO	dissolved oxygen
DOC	dissolved organic carbon
EMP	Effectiveness Monitoring Plan
EMR	Effectiveness Monitoring Report
ft	feet/foot
ft/d	feet per day
ft/ft	feet per feet
ft/yr	feet per year
GSI	GSI Environmental Inc.
ha	hectare
HPIT	Hydraulic Pulse Interference Testing
IDW	investigation-derived waste
in.	inch
in./yr	inch per year
kg/yr	kilograms per year
km	kilometer
LAZ	Lower Aquifer Zone
m	meter
MCL	maximum contaminant level
m/d	meter per day

MDL	maximum detection limit
mg/L	milligram per liter
mi	mile
mV	millivolt
m/yr	meters per year
NTC	non-time critical
NTU	Nephelometric Turbidity Units
ORP	oxidation-reduction potential
OU	Operable Unit
PAGW	P-Area Groundwater
PAOU	P-Area Operable Unit
PCE	tetrachloroethylene
PDI	Pre-Design Investigation
PQL	practical quantification limit
PRB	permeable reactive barrier
P-RBC	P-Reactor Building Complex (105-P)
PSA	potential source area
RA	removal action
RADP	Removal Action Design Plan
RAO	Removal Action Objective
RAR	Removal Action Report
RSER/EE/CA	Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis
SAP	Sampling and Analysis Plan
SCDES	South Carolina Department of Environmental Services [1]
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
TCCZ	Tan Clay Confining Zone
TCE	trichloroethylene
TOC	total organic carbon
trans-DCE	trans-1,2-dichloroethylene
UAZ	Upper Aquifer Zone
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
UTRA	Upper Three Runs Aquifer
VC	chloroethylene (vinyl chloride)
WSRC	Washington Savannah River Company, LLC
ZVI	zero-valent iron
µg/L	microgram per liter

[1] South Carolina Department of Environmental Services (SCDES) was known as South Carolina Department of Health and Environmental Control prior to July 1, 2024.

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1.0 INTRODUCTION

The P-Area Groundwater (PAGW) Operable Unit (OU) encompasses approximately (~) 2,226 hectares (ha) (5,500 acres [ac]) of groundwater beneath Savannah River Site's (SRS) P Area. Groundwater in the PAGW OU is contaminated with chlorinated volatile organic compounds (cVOCs), primarily trichloroethylene (TCE), and tritium. With approval from the United States Environmental Protection Agency (USEPA) and the South Carolina Department of Environmental Services (SCDES[2]), the United States Department of Energy (USDOE) conducted a non-time critical (NTC) removal action (RA) at the PAGW OU.

Field activities in support of the PAGW OU NTC RA were completed on January 14, 2020, in accordance with the approved Removal Action Design Plan (RADP) (Savannah River Nuclear Solutions, LLC [SRNS] 2019). The NTC RA consisted of emplacing ~672 metric tons (741 U.S. tons) of zero-valent iron (ZVI) to construct an 80.5 meter (m) (264 feet [ft]) long permeable reactive barrier (PRB) with an average thickness greater than 10.2 centimeters (cm) (4 inches [in.]), as detailed in the Removal Action Report (RAR) (SRNS 2020). Baseline sampling was conducted in March of 2019 and effectiveness monitoring began in February 2020 following construction of the ZVI-PRB. Effectiveness monitoring is being conducted in accordance with the approved Effectiveness Monitoring Plan (EMP) for the PAGW OU NTC RA (SRNS 2019). This Effectiveness Monitoring Report (EMR) is the fifth of five annual reports to document performance and effectiveness of the NTC RA technology and is the final stand-alone EMR for the PAGW OU ZVI-PRB. This final annual EMR summarizes the final year of monitoring as well as proposes future reporting of the ZVI-PRB performance in the biennial PAGW OU groundwater report. The reporting frequency will be reevaluated with the Core Team (i.e., representatives from SCDES, USEPA, and USDOE) in future scoping for the PAGW OU.

Historical data, including field parameter data, are available in Appendix A of ZVI-PRB EMRs for previous years. Consistent with SRS EMRs, data presented in this report are for one year of data, collected from April 2024 (second quarter of 2024 [2Q24]) through March 2025 (first quarter of 2025

[2] South Carolina Department of Environmental Services (SCDES) was known as South Carolina Department of Health and Environmental Control prior to July 1, 2024.

[1Q25]) (Appendix A). Monitoring well network hydrographs are presented in Appendix B. Time-series plots that depict the historical data for key constituents are provided in Appendix C of this report.

2.0 OPERABLE UNIT DESCRIPTION AND HISTORY

P Area is located in the central portion of the SRS ~4.0 kilometers (km) (2.5 miles [mi]) east-southeast of the geographic center of the SRS and ~6.4 km (4 mi) west of the nearest site boundary (Figure 1). P Area consists of a closed nuclear reactor building complex and several surface OUs and structures that were previously characterized and identified as sources of soil and groundwater contamination (Washington Savannah River Company, LLC [WSRC] 2006).

The P Area surface units identified as posing a risk to human health, the environment, and contributing to groundwater contamination were remediated as part of the P-Area Operable Unit (PAOU), including the P-Area Reactor Building Complex (P-RBC) (105-P) (SRNS 2008). Remedial actions associated with surface units included in the PAOU have been completed and are documented in the PAOU Post Construction Report (SRNS 2012c). In particular, one surface unit, potential source area (PSA)-3A, was determined to be the source of TCE plumes discharging to Steel Creek. PSA-3A was remediated in 2011 and remedial goals were met using soil vapor extraction enhanced with soil fracturing and In-Situ Chemical Oxidation injection.

Groundwater beneath P Area was impacted due to reactor and facility operations between 1954 and 1991. The PAGW OU hydro-conceptual model was established for the purposes of groundwater modeling and encompasses the groundwater beneath P Area, northwest to Steel Creek, northeast toward PAR Pond and SRS Road F, and southeast to Meyers Branch (Figure 2). Groundwater plumes are present in the PAGW OU Upper Aquifer Zone (UAZ) and Lower Aquifer Zone (LAZ) of the Upper Three Runs Aquifer (UTRA). Localized impact to the Gordon Aquifer Unit (below the UTRA and separated by the Gordon Confining Unit) is currently only observed at the P-Area Reactor Seepage Basins.

2.1 Physiographic Setting

Topography of the PAGW OU ranges from 101 m (330 ft) above mean sea level (amsl) near P Area to 57.9 m (190 ft) amsl at the downstream end of Meyers Branch and Steel Creek. The area near the P-RBC is higher in elevation than the surrounding land. Surface drainage on the west side of the

P-RBC is to the west, towards Steel Creek. Surface drainage on the east side of the P-RBC drains to unnamed tributaries that drain to PAR Pond. Surface drainage on the south side drains to wetlands and unnamed tributaries to Meyers Branch.

2.2 Hydrogeologic Setting

A detailed description of the hydrostratigraphy of the PAGW OU can be found in the 2013 Sampling and Analysis Plan (SAP) for the PAGW OU (SRNS 2013). The groundwater encompassed by the PAGW OU is in the Floridan aquifer system. The aquifer of interest for this NTC RA is the UTRA, which is subdivided into the UAZ and the LAZ which are separated by a leaky, semi-confining aquitard, the Tan Clay Confining Zone (TCCZ). The near-surface groundwater in P Area is isolated by PAR Pond to the east, Steel Creek to the west, and Meyers Branch to the south and east.

The 30-year average (1994 - 2024) rainfall for SRS is 120 centimeter per year (cm/yr) (47.3 inches per year [in./yr]). P Area received 142 cm (56.1 in.) of rainfall in 2024 based on data from the 100-P rain gauge (Figure 3). The P-RBC area is a zone of local groundwater recharge, therefore a portion of rainfall in the area translates to shallow groundwater by moving vertically downward (WSRC 2008). Regionally, UAZ water levels have remained very consistent from 2Q24 to 1Q25. Rainfall in 2024 (142 cm [56.1 in.]) was greater than the SRS average (120 cm/yr [47.3 in./yr]) based on the 100-P rain gauge. During 1Q25, the rainfall total was 23.5 cm (9.24 in.) based on the 100-P rain gauge, which is lower than average (31.0 cm [12.2 in.]) for this period. Since baseline water elevation measurements in 2019, water elevations have decreased on average by ~1.5 m (5 ft) at the ZVI-PRB monitoring wells. The synchronous water level trends are reflected in ZVI-PRB monitoring wells, as demonstrated on hydrographs in Appendix B.

2.3 Nature and Extent of Contamination

The nature and extent of contamination was investigated for the PAGW OU using groundwater monitoring wells, direct-push technology, and surface water samples (SRNS 2013 and SRNS 2018b). Groundwater contamination associated with cVOCs is primarily exhibited in a narrow band north of the P-RBC extending west to Steel Creek, where impact is known, and east towards an unnamed tributary to PAR Pond. Several areas in the P Area facility area were determined to be PSAs for the cVOC plumes, primarily tetrachloroethylene (PCE) and TCE. TCE contamination originating from P Area impacts the PAGW OU and follows groundwater flow in the UAZ and LAZ of the UTRA,

shown in Figure 4 and Figure 5, respectively. It should be noted that the TCE groundwater plume iso-contours depicted in Figure 4 and Figure 5 are based on 1Q25 groundwater monitoring well data and data collected from the 2018 SAP Addendum investigation (SRNS 2018b). The groundwater plumes were updated with 2025 PAGW OU Long-Term Monitoring well and surface water reporting data (reported in the 2025 data summary table letter report for the PAGW OU [USDOE 2026]). The data collected during the 2018 SAP Addendum were comprehensive and were retained to illustrate the extent and magnitude of TCE contamination in the low permeability zones in the distal area downgradient of the ZVI-PRB (SRNS 2018b). In the UAZ, groundwater flows west-southwest from the P-RBC toward Steel Creek as shown on Figure 4. The UAZ TCE plume impacts surface water in Steel Creek around surface water station SC-03.

The UAZ and LAZ groundwater plumes from the P-RBC to Steel Creek has been divided into three sections: the source area, the neck area, and the distal area (Figures 4 and 5). The source area encompasses the portion of the plumes where the source initially impacts groundwater and is upgradient of the ZVI-PRB and centered northwest of the P-RBC within the P Area facility area. The neck area (located to the west just outside of the P Area facility) represents a buried geologic feature in the UAZ and upper LAZ that contains large cobblestones in a sandy-clay matrix, promoting a narrowed zone of preferential groundwater flow, and thus creating a narrowing of the groundwater plumes and ideal placement of the ZVI-PRB. The plumes then begin to expand in the distal area as they reach further toward Steel Creek. The distal area is where a large amount of mass is now concentrated and is largely bound up in low-permeability sediments in the subsurface, as determined by investigation as part of the 2018 SAP Addendum (SRNS 2018b). These low-permeability sediments continue to diffuse cVOC mass into groundwater, thereby impacting groundwater concentrations and plume movement and ultimately impacting Steel Creek.

Maximum contaminant level (MCL) exceedances in groundwater occur over an area of ~8.5/12.6 ha (20.9/31.2 ac) for TCE in the UAZ/LAZ, respectively (Figure 4 and Figure 5). PCE and cis-1,2-dichloroethylene (cis-DCE) plumes present in the UAZ and LAZ are contained within the TCE plume area as described and shown in the SAP Addendum (SRNS 2018b). Table 1 lists the maximum reported concentrations in the first half of 2019 for TCE, PCE, and cis-DCE in the UAZ and LAZ within the three sections prior to implementation of the PAGW OU NTC RA. Due to the highly aerobic nature of SRS groundwater, incomplete degradation of PCE/TCE is occurring as evident by buildup

of cis-DCE and no detection of other degradation byproducts. Surface water in Steel Creek is impacted by discharges of TCE-contaminated groundwater above the MCL of 5 micrograms per liter (µg/L). The area of impact is localized to the upper section of the creek at surface water location SC-03 (Figure 4) and confirmed through characterization completed as part of the 2018 SAP Addendum (SRNS 2018b). Surface water stations are sampled annually in the first quarter, and the maximum TCE concentrations in Steel Creek were observed at 28.3 µg/L in 2013 (surface water station SC-03).

The Core Team determined the PAGW OU contamination warranted a NTC RA to reduce cVOC mass flux. Installation of a ZVI-PRB to intersect TCE plume(s) in the neck area was chosen as the preferred method in the *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U)* (SRNS 2018a). The selected NTC RA was presented to the public in the *Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the P-Area Groundwater Operable Unit (U)* (USDOE 2018). The Removal Action Objective (RAO), as presented in the PAGW OU Action Memorandum, is to protect human health and the environment by reducing the mass and down-gradient transport of the PAGW OU TCE groundwater plume. As stated in the Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA), a TCE mass flux reduction of 80% should be sufficient to achieve the MCL in Steel Creek over time (SRNS 2018a).

In support of the PAGW OU NTC RA, a Pre-Design Investigation (PDI) was performed in the neck area of the TCE plumes to confirm site lithology, hydrogeologic, geochemical characteristics, and confirm extent of cVOC contamination as it relates to design, construction, and performance of the ZVI-PRB. During the RSER/EE/CA process, the assumption was that both the UAZ and LAZ TCE plumes would be targeted with the ZVI-PRB (SRNS 2018a). Data from the PDI indicated that TCE concentrations in the LAZ were lower than in the UAZ and that groundwater flow direction of the LAZ was much more northerly than what was expected (SRNS 2019). Considering that the LAZ groundwater flow direction would lead to inefficient capture of the TCE plume by the ZVI-PRB proposed, and the TCE concentration data which showed ~95% of the TCE mass was present in the UAZ, focus was placed on constructing a ZVI-PRB to target the UAZ TCE plume only. However, during ZVI-PRB installation, hydraulic fracturing of the UAZ and the underlying TCCZ resulted in ZVI propagating into the top of the LAZ. This did not diminish the overall performance of the ZVI-PRB on its effectiveness in removing cVOCs from the UAZ, rather placement of ZVI in the upper

portion of the LAZ has aided in the treatment of cVOCs that were identified in the LAZ as part of the PDI.

2.4 Removal Action Implementation and Monitoring Goals

Design and construction details for the final design are provided in the RADP and the RAR for the PAGW OU NTC RA (SRNS 2019 and SRNS 2020). ZVI injections were completed on December 11, 2019, with the emplacement of ~672 metric tons (741 US tons) of ZVI. ZVI was mixed with hydroxypropylguar prior to injection to produce a viscous solution able to be injected into the subsurface. Additionally, sodium chloride was added to the solution to increase the conductivity of the injected solution and allowed for resistance mapping of the injections. Details of the mix and injections are provided in the RADP (SRNS 2019). The completed ZVI-PRB is estimated to be 80.5 m (264 ft) long and has a cross-sectional area of 2,140 square meters (23,040 square feet) intersecting groundwater flow in the UAZ (Figure 6). Figure 6 is a North-South cross-section of the ZVI-PRB trace (Figure 7) and soil concentrations for the plume are based on soil plug samples collected from soil cores collected along the ZVI-PRB trace as part of the PDI. There are high cVOC concentrations entrained within the low-permeability sediments of the area, which are reflected in soil plug samples. However, monitoring wells are typically screened in more permeable zones to ensure samples can be collected and therefore groundwater samples sometimes don't provide the full picture of cVOC mass and distribution in the subsurface. Field activities were completed with closure of the injection wells on January 14, 2020.

Groundwater monitoring in support of the PAGW OU NTC RA was planned to begin the first month following implementation and follow the frequency outlined in the EMP, as summarized in Table 2. The monitoring plan approved in the RADP with EMP (SRNS 2019) provides results that allow for assessment of the ZVI-PRB technology's effectiveness in destruction of cVOCs. A key component of assessment is four in-wall monitoring wells, which provide direct results from the center of the implemented technology. The takeaways from this assessment provide useful insight into the technology's potential applicability for future actions on site, or at other sites within the USDOE Complex. The primary focus of the EMP will be to assess performance of the PAGW OU NTC RA in meeting the RAO. This EMR is the fifth of five planned reports on the performance and effectiveness of the ZVI-PRB NTC RA (SRNS 2019).

The implemented ZVI-PRB is anticipated to reduce the mass flux of TCE through the neck area of the PAGW OU TCE plume by at least 80% in order to meet the RAO. This is assessed through the monitoring of cVOC concentrations over time in 26 monitoring wells identified in the EMP for performance monitoring (Figure 7). ZVI is a recognized technology for reducing high level cVOCs (e.g., PCE and TCE) to harmless end-products without the build-up of harmful intermediates, such as cis-DCE, trans-1,2-dichloroethylene (trans-DCE), and chloroethene (vinyl chloride [VC]). In addition to TCE and PCE, degradation by-products are also monitored.

Important geochemical and field measurements are monitored to assess geochemical changes in the target zone. The high reducing potential of ZVI presents the favorable possibility of flipping conditions from aerobic to anaerobic and reducing conditions and producing a reducing front capable of traveling down-gradient over time. An anaerobic, reducing environment is conducive to the potential formation of natural anaerobic microbial activity, which are often heavy consumers of organic compounds, including the targeted contaminant TCE. The presence of guar that was used to inject the ZVI provided a reliable carbon source aiding in further destruction of cVOCs. The presence of a reducing environment in the UAZ of the PAGW OU is measured by oxidation-reduction potential (ORP). Negative ORP values indicate a reducing environment, with higher negative numbers indicating the strength of the reducing agents in groundwater. In an environment with promising conditions for anaerobic microbes, the presence of intermediate cVOC degradation products are indicators of natural biodegradation, as ZVI is not anticipated to form significant concentrations of intermediates (Arnold and Roberts 2000).

Additional analytes were selected to provide data on the health of the ZVI-PRB. Nitrate, calcium, and sulfate are commonly occurring constituents in groundwater and are found in detectable concentrations within the UAZ of the UTRA in the PAGW OU. In literature, at the interface between groundwater and ZVI, nitrate has been observed to interact with the ZVI and result in a lessened reactivity, and therefore a decreased performance, known as passivation (Ritter, Odziemkowski, and Gillham 2002; Mishra and Farrell 2005). A decrease in nitrate concentrations down-gradient of the ZVI-PRB may indicate consumption of nitrate by ZVI, and therefore may be indicative of passivation. Additionally, sulfate and calcium ions in a reducing, high pH environment more readily precipitate out of solution. Precipitation within the ZVI-PRB leads to a decreased performance as the porosity, and therefore the retention time within the barrier, will decrease. This reduces the contact time of

cVOCs with ZVI, and therefore reduces the potential for complete degradation. However, based on the treatability study performed during the PDI for the ZVI-PRB, it was concluded that it was unlikely, unless conditions changed, that the ZVI-PRB would exhibit reduced effectiveness due to passivation and/or precipitation. Over time and under normal circumstances it is expected that ZVI will lose some of its reactivity as the available reactive sites on the ZVI surface are consumed, however this is not expected to significantly impact the PAGW OU ZVI-PRB in the near future.

2.5 PAGW OU NTC RA Monitoring Network

As outlined in the RADP with EMP (SRNS 2019), the PAGW OU NTC RA monitoring network includes 26 monitoring wells. Table 2 provides construction details for the monitoring network and Figure 7 shows the locations for each monitoring point. Eight of the monitoring wells (PRW001C/DL/DU, PRW003C/DL/DU, and P003U/L) are located to the east of the ZVI-PRB and 14 wells (PRW002C/DL/DU, PRW004C/DL/DU, PRW005DL/DU, PRW006C/DL/DU, PRW007DL/DU, and P002U) are located to the west. The P003 well cluster is located farther to the east of the ZVI-PRB than the other wells and is considered a background monitoring well for monitoring in support of the PAGW OU RA EMP.

A baseline analysis was completed at 15 of the monitoring well locations in March of 2019 prior to construction of the ZVI-PRB. Baseline results are presented in Table 3. Baseline results do not include data from the PRW005, PRW006, or PRW007 well clusters because these monitoring wells were installed after installation of the ZVI-PRB and therefore were not sampled during baseline conditions. Figure 8 presents baseline TCE results at the ZVI-PRB monitoring locations. Comparisons of baseline contaminant concentrations with monitoring well results east and west of the ZVI-PRB allows for assessment of the NTC RA performance in reducing TCE groundwater concentrations. In addition to the 22 monitoring wells on either side of the ZVI-PRB, four ZVI injection wells were retrofit with 2.5 cm (1 in.) diameter monitoring wells (PIW001D, PIW002D, PIW003D, and PIW004D). The “in-wall” monitoring wells (i.e., wells located within the ZVI-PRB) present a key perspective, allowing for assessment of the conditions within the barrier itself. The approved EMP for the PAGW OU NTC RA outlined the analytes and frequency to be followed for the 26 monitoring wells as shown in Table 2 and Figure 7 (SRNS 2019).

For the four in-wall monitoring wells, the approved EMP for the PAGW OU NTC RA proposed sampling bimonthly for the first quarter, monthly sampling for the second quarter, and quarterly sampling for the remainder of the five-year monitoring plan. This frequency was proposed with intentions of observing rapid changes in geochemical parameters initially, then to tracking these parameters over time. All other monitoring wells, with the exception of the PRW006 cluster, are sampled quarterly. The PRW006 well cluster is set farther west of the ZVI-PRB and is sampled annually. Groundwater sampling activities associated with the ZVI-PRB may generate aqueous investigation-derived waste (IDW). Aqueous IDW may consist of decontamination rinses, well purge water, and sample residues. As discussed in the EMP (SRNS 2019), IDW generated during sampling activities will be managed in accordance with the *SRS Investigation-Derived Waste Management Plan* (WSRC 2013).

Monitoring results are presented in Section 3.0 and discussed in Section 4.0. The complete data sets are presented in the appendices. Appendix A tabulates monitoring data from 2Q24 to 1Q25 for all regular samples collected for monitoring in accordance with the PAGW OU NTC RA EMP. Field notes are recorded by groundwater samplers in special cases, such as when a well pumps dry during purging, turbidity does not stabilize below threshold for sending some samples, etc. When field notes are present for the reported data, the field notes are defined by alphanumeric codes which are presented in a “Field Conditions” column of Table A and explained below the table. For the 2Q24 to 1Q25 reporting period, there were two stations with field conditions reported for the data. For the 2Q24 sample at station PRW004DU, the sampler input code “X,” which indicates the well pumped dry and samples were collected once the well recovered. This monitoring well did not pump dry in the 2Q24 sampling event and it was determined the code was inadvertently added to the Field Conditions. For the third quarter of 2024 (3Q24) sample at station PRW004C, the code “T” was input in the Field Conditions automatically due to turbidity stabilized above 20 Nephelometric Turbidity Units (NTUs). Turbidity stabilized at 23.1 NTU at PRW004C in the 3Q24 sampling event, which is slightly above 20 NTU and is not likely to have impacted results for the samples analyzed at PRW004C in the 3Q24. Appendix B presents hydrographs of water levels at the PAGW OU NTC RA monitoring wells from 2018 to present. Appendix C consists of time-series plots for select constituents from 2018 to present of the outlined analytes for the EMP to support the PAGW OU NTC RA.

3.0 MONITORING RESULTS AND DEVIATIONS

Data reported in this EMR were collected in accordance with the *Removal Action Design Plan (RADP) with Effectiveness Monitoring Plan (EMP) for the P-Area Groundwater (PAGW) Operable Unit (OU)* (SRNS 2019). All data collected conform to the approved *Area Completion Projects Quality Assurance Project Plan for Environmental Data Collection and Management* (SRNS 2012b). Only groundwater data is collected in support of monitoring at the PAGW OU ZVI-PRB and is sent to SCDES certified laboratories for analyses. The data quality level for permanent groundwater monitoring well stations and field duplicate samples is Verified and Validated level data (SRNS 2012a and SRNS 2012b).

3.1 Deviations from the Monitoring Plan

Monitoring wells included in the PAGW OU NTC RA were sampled and analyzed as outlined in the RADP with EMP, with no deviations between 2Q24 to 1Q25 (SRNS 2019). Monitoring results from 2Q24 to 1Q25 are tabulated in Appendix A.

The 3Q24 sampling event was performed in August 2024, however multiple samples did not arrive at the laboratory within the temperature required for non-metal analyses. The sampling event was repeated in September 2024 to ensure all required analyses were completed in 3Q24. Both sample event datasets are presented in Appendix A matrix tables.

Ethane and methane results for some monitoring wells in the November 2024 sampling event (fourth quarter of 2024 [4Q24]) and ferric iron for PIW series wells in the 3Q24 and 4Q24 sampling events were rejected due to exceedance of hold time requirements for respective analyses. Impacts of the rejected results are not expected to be significant, as ethane, methane, and ferric iron results remain consistent between quarterly sampling events.

3.2 Upper Aquifer Zone

3.2.1 Groundwater Elevation Measurements and Groundwater Flow Direction

Hydrographs for UAZ monitoring wells of the EMP are presented in Appendix B. Water elevations remained consistent throughout the 2Q24 to 1Q25. Regional water elevations and the potentiometric surface for the UAZ are presented in Figure 9 using regional 1Q25 synchronous water level data. The

regional groundwater flow direction in the UAZ is to the west towards Steel Creek. Hydraulic conductivity was calculated to be 10.59 meters per day (m/d) (34.76 feet per day [ft/d]) for the UAZ within the ZVI-PRB area through Hydraulic Pulse Interference Testing (HPIT) (SRNS 2019). The hydraulic gradient was calculated between PMW005DL and PGW026DL as 0.0121 feet per feet (ft/ft). Using an estimated effective porosity of 0.2 for the UAZ in P Area (SRNS 2019), the resulting regional groundwater flow velocity is 233.2 meters per year (m/yr) (765.3 feet per year [ft/yr]).

In Figure 10, focus is placed on the ZVI-PRB localized area within the UAZ potentiometric surface. In the vicinity of the ZVI-PRB, the hydraulic gradient is estimated between PMW005DL and PRW006DU to get 0.0031 ft/ft. This results in an estimated groundwater flow velocity of 60.9 m/yr (199.7 ft/yr). Groundwater flow velocity in the vicinity of the ZVI-PRB is much slower than the flow velocity for the UAZ to the west towards Steel Creek. The slower groundwater flow velocity can be attributed to the location of the ZVI-PRB near P Area, close to the groundwater divide. The variability in the UAZ potentiometric surface near the ZVI-PRB does not indicate significant localized slowing of groundwater flow and is consistent with regional groundwater elevation changes across P Area. In the vicinity of the ZVI-PRB, upgradient groundwater is flowing towards/into the permeable barrier.

Groundwater depth measurements are not included in Appendix A for the P00 series monitoring wells due to the diameter of the monitoring well and size of the installed pump, which does not allow access of a groundwater tape for measurement.

3.2.2 Chlorinated Volatile Organic Compounds

In accordance with the EMP for the PAGW OU NTC RA (SRNS 2019), all monitoring wells were sampled and analyzed quarterly for select cVOCs, including PCE, TCE, cis-DCE, trans-DCE, 1,1-dichloroethylene (1,1-DCE), and VC. Between 2Q24 and 1Q25, 97 samples were collected and analyzed for cVOCs at the PAGW UAZ EMP wells. Results above the practical quantification limit (PQL) were detected in low frequency for trans-DCE (three [3] detections) and VC (one [1] detection). There were no detections above the PQL for 1,1-DCE, and the maximum estimated result (J qualification) was 0.73 J µg/L. The maximum detected results between 2Q24 and 1Q25 were 5.07 J µg/L for trans-DCE (maximum result above PQL was 1.17 µg/L) and 1.27 µg/L for VC (Appendix A).

For the PAGW OU NTC RA, the primary constituent is TCE. Baseline concentrations are summarized in Table 3 for all cVOCs in the UAZ and LAZ prior to installation of the ZVI-PRB. To better understand the effect of the ZVI-PRB, baseline concentrations from wells located east and west of the ZVI-PRB and in-wall wells are compared to 1Q25 results in Table 4.

Data from east of the ZVI-PRB are upgradient and were intended to provide influent groundwater conditions, unimpacted by the ZVI-PRB. However, because of the proximity of the PRW001 cluster to the ZVI-PRB, the data reported for key indicators appear to show influence from the ZVI-PRB relative to baseline conditions. For instance, chloride, dissolved organic carbon (DOC), ethane, methane, and total organic carbon (TOC) are all elevated. This is primarily due to the impact of the ZVI-PRB on groundwater surrounding this well cluster. Field data from this well cluster also support the relative impact the ZVI-PRB is having on groundwater as illustrated by the low ORP and dissolved oxygen (DO) results (Appendix A). West of the ZVI-PRB, the data indicates impact of the NTC RA on groundwater as shown by increases in TCE degradation by-products (e.g., cis-DCE and ethane) as well as increases in chloride, iron, and methane. The data also indicates elevated levels of TCE remain, which is not unexpected. As cVOCs are removed by the ZVI-PRB from groundwater, “clean” groundwater moves through higher permeability material downgradient of the ZVI-PRB, and TCE is diffused from low permeable sediments through “back diffusion” into groundwater. Back diffusion is a phenomenon where cVOCs, such as TCE, have adsorbed into low permeability sediments and seeks equilibrium with the “clean” groundwater front that leaves the treatment area. A concentration gradient then persists that promotes TCE diffusion into groundwater from the low permeability sediments (Parker et al. 2008). This phenomenon is beneficial, as it results in more TCE mass being removed from the subsurface, but it is also likely to result in elevated TCE results in monitoring wells west of the ZVI-PRB for some time until significant cVOC mass has diffused out of the low permeable sediments and the equilibrium groundwater TCE concentration is thus decreased. Therefore, data from the in-wall monitoring wells provide the best indication of the effect the technology is having on groundwater as it passes through the ZVI-PRB. The primary contaminants are mostly not detected and there are elevated concentrations of the end by-products, chloride, ethane, and ethylene. Downgradient results are harder to evaluate and must be done so with consideration of influence from back diffusion. Estimating a timeline for the effects of back-diffusion is very difficult and would require high resolution characterization of the subsurface soil within the contaminant plume (Parker et al. 2008).

Trichloroethylene

For the UAZ, 1Q25 TCE results are presented in Figure 11. TCE concentrations in the background monitoring wells P003U and P003L were 610 µg/L and 4,130 µg/L, respectively. TCE concentrations in eastern UAZ monitoring wells ranged from 0.79 J to 1,170 µg/L in 1Q25, with the maximum detection at PRW003DL. In western UAZ monitoring wells, TCE ranged from 0.52 J to 276 µg/L, with the maximum at PRW007DU. The second highest TCE result in western UAZ monitoring wells was 192 µg/L, recorded at PRW004DL. TCE time-series plots are presented in Appendix C, Figures C.33 to C.46.

The concentration of TCE in groundwater monitoring wells west of the ZVI-PRB with baseline data (P002U, PRW002 and PRW004 clusters) has generally decreased compared to baseline (Figure 12). Rebounding of TCE concentrations have been observed, with the most significant peaks at PRW004DL in fourth quarter of 2021 (4Q21) and again in 1Q25 and at PRW004DU in second quarter of 2023 (2Q23). Rebounding at PRW004DL and at PRW004DU approached or exceeded baseline TCE concentrations. Rebounding TCE concentrations were not lasting at all wells, with most decreasing down to or below 10 µg/L in 1Q25 data. One exception is PRW004DL, which has increased over the last two years to 192 µg/L in 1Q25, but remains below the baseline result of 254 µg/L. Although TCE rebounding is observed at PRW004DL, degradation is occurring as evidenced by presence of degradation products (e.g., cis-DCE and ethane). TCE concentrations in the remaining monitoring well clusters west of the ZVI-PRB (PRW005, PRW006, and PRW007 clusters) are presented in Figure 13. Concentrations have remained steady below the MCL (5 µg/L) at PRW005DL and PRW005DU, with an exception in third quarter of 2022 (3Q22), where both wells increased to 9.25 µg/L and 14.8 µg/L, respectively. A second exception at PRW005DL and PRW005DU was observed in 3Q24, where both wells increased to 33.0 µg/L and 17.0 µg/L, respectively. It is noted that the 3Q24 results were from the resample event that was mobilized due to temperature exceedances in the initial 3Q24 sampling event. Initial 3Q24 sample results for TCE at PRW005DL and PRW005DU were 0.74 µg/L and non-detect, respectively, which is consistent with previous quarterly results. TCE concentrations have remained below the MCL (5 µg/L) at PRW006DU since first quarter of 2022 (1Q22), with a 1Q25 result of 3.33 µg/L. TCE concentrations have a decreasing trend at PRW006DL and PRW007DU since sampling began in third quarter of 2020 (3Q20). TCE

concentrations at PRW007DL have remained above the MCL since sampling began in 3Q20, and had a 1Q25 result of 30.7 µg/L.

The four in-wall monitoring wells (PIW series) were sampled for TCE starting in second quarter of 2020 (2Q20), post-completion of the ZVI-PRB (Appendix Figures C.36 – C.39). Initially, TCE results in the in-wall monitoring wells were low, with only 3 of 12 sample results in 2020 above the PQL and a maximum of 5.03 µg/L (PIW003D in fourth quarter of 2020 [4Q20]). TCE concentrations at PIW001D, PIW002D, and PIW004D remained below detection for all 15 samples collected between 2Q24 and 1Q25. TCE at in-wall monitoring well PIW003D was detected above the PQL for all five samples from 2Q24 to 1Q25, with a maximum detection of 10.0 µg/L (3Q24). The maximum result of the in-wall monitoring wells (10.0 µg/L) is 99.1% lower than the maximum 1Q25 result east of the ZVI-PRB (1,170 µg/L). The in-wall monitoring wells are located within the ZVI-PRB, therefore, the detected results are located in the middle of the barrier and further degradation of detected cVOCs is likely to occur before groundwater exits the ZVI-PRB.

Tetrachloroethylene and Cis-1,2-Dichloroethylene

From 2Q24 to 1Q25, 22 of 97 samples collected for the UAZ EMP wells reported PCE detections above the method detection limit (MDL). All PCE results from 2Q24 to 1Q25 were below the maximum PCE baseline of 5.15 µg/L and the MCL of 5 µg/L. The maximum PCE detection in the UAZ ZVI-PRB monitoring wells, was 3.70 µg/L at PRW001DU, east of the ZVI-PRB.

Cis-DCE was detected above the MDL in 68 of 97 samples collected from UAZ EMP wells between 2Q24 and 1Q25. In the 1Q25 sampling event, the maximum UAZ result for cis-DCE was 457 µg/L at background monitoring well P003L. The maximum 1Q25 result east of the ZVI-PRB, excluding the background wells, was 147 µg/L at PRW003DL. The maximum 1Q25 result west of the ZVI-PRB was 63.3 µg/L at P002U. West of the ZVI-PRB, cis-DCE concentrations have increased from baseline and remained steady ranging between 0.70 and 63.3 µg/L in the 1Q25 sampling event. The presence of cis-DCE and ethane west of the ZVI-PRB indicates conditions support further degradation of TCE and PCE. Cis-DCE time-series plots are presented in Appendix C, Figures C.5 to C.18, for the PAGW OU NTC RA monitoring wells.

Out of the four in-wall monitoring wells, PIW003D is the only monitoring well with consistent detections of cis-DCE. Concentrations in the two most recent sampling events were 40.6 µg/L and 60.6 µg/L (4Q24 and 1Q25, respectively). Cis-DCE concentrations in P003U and P002U decreased slightly from July 2007 until monitoring began post-construction of the ZVI-PRB. P003L remained steady around the detection limit over the same time. Concentrations increased significantly in P003L during the baseline (892 µg/L), decreased slightly until 1Q22 (382 µg/L), increased to around baseline concentrations with a first quarter of 2023 (1Q23) result of 720 µg/L, and have gradually decreased again with a 1Q25 result of 457 µg/L. Cis-DCE concentrations at P003U have consistently remained around 10 µg/L, with a 1Q25 result of 9.3 µg/L. This is a slight decrease from a baseline result of 13.3 µg/L. Concentrations in P002U have increased since completion of the ZVI-PRB, with a 1Q25 result of 63.3 µg/L compared to the baseline result of 28.4 µg/L.

3.2.3 Geochemical Analyses

Samples collected in support of the ZVI-PRB monitoring were analyzed for select geochemical analytes in line with the approved EMP, summarized in Table 2. During the baseline sampling event, all completed monitoring wells were sampled and analyzed for geochemical analytes in order to establish a baseline for the groundwater. In ongoing sampling events, only the in-wall monitoring wells were sampled for geochemical analyses.

Chloride, Ethylene, and Ethane Results

The breakdown of cVOCs produces end-products such as chloride, ethylene, and ethane. However, because salt (e.g., NaCl) was added to the injected material (e.g., guar and ZVI) to aid in resistivity monitoring during injections, elevated chloride concentrations observed in groundwater downgradient of the ZVI-PRB were initially influenced by salt additions. However, observed trends of chloride concentrations immediately after injection show a significant decrease in concentrations indicating that the salt was being flushed from the area around the monitoring network. More recent increases in chloride concentrations at some well locations could be indicative of reductive dechlorination of the TCE.

The maximum chloride concentration in baseline sampling of the UAZ monitoring wells was 3.64 milligram per liter (mg/L) at PRW002DU. Chloride concentrations in western groundwater

monitoring wells are increasing slightly, with a 1Q25 maximum at PRW002DL of 27.6 mg/L. The maximum background chloride concentration from 2Q24 to 1Q25 was 3.0 mg/L at P003U in 3Q24.

MDLs for ethane and ethylene analyses remained elevated due to laboratory and analytical method capabilities until the 1Q23 sampling event. SRNS is continuing to coordinate with the contracted laboratories to ensure the lowest possible MDLs are achieved, which was 10 µg/L for ethane and ethylene from 4Q21 to fourth quarter of 2022 (4Q22). The corresponding PQL was 25 µg/L. Since 1Q23, laboratories were able to achieve MDLs of 1.0 µg/L or lower for ethane and ethylene, and PQLs of 5.0 µg/L or lower. The only exception from 2Q24 to 1Q25 was in 1Q25, where the MDL and PQL were 10 µg/L and 25 µg/L, respectively for both ethane and ethylene. In UAZ monitoring wells, the maximum baseline ethane result was 0.17 µg/L. Ethane results in background wells have remained below the MDL. For all UAZ results west of the ZVI-PRB in 1Q25, ethane results ranged from 27.0 µg/L to 65.7 µg/L, with the maximum detection at PRW004DU. In-wall monitoring well ethane results ranged from 18.5 µg/L to 130 µg/L in 1Q25, with the maximum detection at PIW003D.

The baseline ethylene concentration in UAZ monitoring wells was 0.55 µg/L. Ethylene was only detected above the MDL in one of 21 UAZ groundwater monitoring wells for 1Q25, due to the elevated MDL of 10 µg/L and a PQL of 25 µg/L. The single 1Q25 ethylene detection was in PIW003D with a result of 49.3 µg/L.

Methane

Methane concentrations remained elevated in the UAZ between 2Q24 and 1Q25. The maximum methane concentration in the baseline sampling was 2,400 µg/L and the 1Q25 background monitoring well results (P003U and P003L) were 97.9 µg/L and non-detect (elevated MDL), respectively. Of the 78 samples collected in the UAZ between 2Q24 and 1Q25, there were 70 detections above the MDL.

In 1Q25, detectable results in the UAZ ranged from 79.6 µg/L to 17,800 µg/L, with the maximum at PRW001DL. In 1Q25, methane concentrations west of the ZVI-PRB are elevated at monitoring wells PRW002DU, PRW002DL, PRW004DU, and PRW007DU (ranging from 8,380 µg/L to 12,700 µg/L). At PRW002DL and PRW004DU, 1Q25 methane concentrations are the highest observed since monitoring began. Methane concentrations remain elevated in the in-wall monitoring wells and ranged from 1,980 µg/L to 10,900 µg/L in 1Q25. PIW003D had the maximum and remains elevated following

ZVI-PRB completion. Elevated methane levels were not unexpected due to ZVI reactivity with cVOCs and anaerobic processes utilizing the food-grade guar material. The elevated methane levels are not expected to negatively impact the performance of the ZVI-PRB.

Nitrate, Sulfate, Calcium, and Iron

Certain cations and anions in groundwater are useful to make assessments of ZVI-PRB health, as well as to assess if anaerobic conditions are present. Nitrate, sulfate, and calcium are analyzed for in-wall monitoring wells only. Nitrate concentrations have decreased to below MDL (0.17 mg/L) in all samples, down from a maximum UAZ baseline concentration of 2.82 mg/L. Sulfate also saw a decrease in concentration with the maximum 1Q25 result of 1.54 mg/L, down from the maximum baseline result of 13.4 mg/L. Total iron concentrations for the in-wall monitoring wells have decreased from a maximum baseline of 741 µg/L to a 1Q25 maximum of 69.5 µg/L at PIW003D. Total iron concentrations in all UAZ monitoring well clusters west of the ZVI-PRB have remained elevated with a 1Q25 maximum of 14,800 µg/L at PRW002DL. The only exceptions were PRW007DL and the PRW006 monitoring well cluster, which had 1Q25 total iron results below MDL (33 µg/L). The PRW006 monitoring well cluster is located farther west of the ZVI-PRB. The decreasing concentrations of nitrate and sulfate in ZVI-PRB monitoring wells are indicators that passivation may be possible, however the insignificant baseline concentrations are favorable indicators that passivation of the ZVI-PRB is not a major concern. This is further supported by the treatability study that was performed as part of the PDI.

Concentrations of calcium have increased significantly from baseline and remain elevated in 1Q25. The maximum calcium concentration in the ZVI-PRB monitoring well baseline event was 4,810 µg/L in the UAZ. The 1Q25 calcium results for in-wall monitoring wells ranged from 37,800 µg/L to 69,700 µg/L. Refer to Section 4.3 of this report for further discussion on calcium.

3.2.4 Field Measurements

In addition to analytes listed in the PAGW OU NTC RA EMP, field measurements are collected during each sampling event and at each sampling location. These measurements are collected to ensure the samples have reached stability and the sample collected is representative of the targeted groundwater. However, the values collected during field measurements are also useful in assessment of conditions

in the aquifer. Field measurements of ORP have significantly decreased from baseline in first quarter of 2019 (1Q19) to 1Q25.

Negative ORP is a favorable condition created by ZVI which promotes reductive dechlorination. During the baseline sampling, the range of UAZ ORP values was +124 millivolts (mV) to +428 mV. In 1Q25, the range of recorded ORP values for in-wall monitoring wells was -315 mV to -279 mV. The range of 1Q25 ORP results in UAZ monitoring wells west of the ZVI-PRB (excluding PRW006 cluster) was -81 mV to +226 mV. At the PRW006 monitoring well cluster further to the west, effects of a reducing front are not obvious, with ORP results consistent within background and baseline results. This is primarily due to the distance of this well cluster from the ZVI-PRB. In reducing conditions, negative ORP values are typically associated with DO results at or below 2.0 mg/L. This was true for the 1Q25 sampling, with the only exception at P002U which had a ORP of -62 mV and a DO measurement of 10.4 mg/L.

Impacts to groundwater pH were observed following the ZVI-PRB installation. During baseline sampling, the maximum pH of the UAZ monitoring wells was 6.5. The range of pH at in-wall monitoring wells for 1Q25 was 10.2 to 10.5. UAZ monitoring wells west of the ZVI-PRB had a slight increase initially, with a maximum pH in first quarter of 2020 (1Q20) of 8.8. The pH in these wells has since returned to near baseline levels with a 1Q25 maximum of 6.6 at PRW002DU. Initially, after installation of the ZVI-PRB the observed increase in pH at monitoring wells west of the ZVI-PRB was primarily associated with installation activities with construction of the ZVI-PRB (i.e., cement grout used during construction of injection wells). However, pH in the in-wall wells remains elevated because these wells are installed within the ZVI-PRB and influenced by ongoing ZVI-groundwater interactions. The primary interaction believed to be affecting pH levels in impacted groundwater is the following half-reaction:

$$2Fe^0 + 4H_2O + 4e^- \rightarrow 2H_2 + 4OH^- + 2Fe^{2+} + 4e^-$$

This interaction produces hydroxide, thus raising the pH. Elevated pH levels associated with ZVI have been well documented at other sites and the elevated levels observed at the PAGW OU ZVI-PRB are consistent with other field scale ZVI installations and not expected to have an impact on ZVI-PRB

performance (Wilkin et al. 2003). For monitoring wells located further west of the ZVI-PRB, pH levels were not significantly affected.

3.3 Lower Aquifer Zone

3.3.1 Groundwater Elevation Measurements and Groundwater Flow Direction

The regional water elevations and potentiometric contours are mapped for the LAZ in Figure 14 using 1Q25 synchronous water level data. Potentiometric contours indicate a north-northwestern groundwater flow direction in the vicinity of the ZVI-PRB, leading to a groundwater divide sending groundwater west to Steel Creek, or east toward P-Area facility area. Using the potentiometric surface, a hydraulic gradient of 0.0112 ft/ft was calculated between PGW020C and PRW003C. The calculated hydraulic conductivity for the LAZ in HPIT testing was 10.82 m/d (35.51 ft/d). Assuming a porosity of 0.2, the groundwater flow velocity toward the ZVI-PRB, flow south to north, was calculated as 221.4 m/yr (726.3 ft/yr) for the LAZ. Groundwater flow in the vicinity of the ZVI-PRB is slower than regional flow in the LAZ, as it approaches a groundwater divide that flows to the west toward Steel Creek and to the east toward P Area (Figure 14).

3.3.2 Chlorinated Volatile Organic Compounds

During installation of the ZVI injection wells, the bottom expansion joints were installed at the base of the TCCZ to ensure total capture of groundwater in the UAZ. As a result of fracking during the installation of the ZVI-PRB, when keying the ZVI-PRB into the semi-confining TCCZ that separates the UAZ and LAZ, some ZVI was emplaced in the upper part of the LAZ. As a secondary benefit of the ZVI-PRB installation and not captured by the primary objective to treat groundwater in the UAZ, this emplacement provided added benefit by reducing TCE and other cVOCs present in the LAZ. Results from 1Q25 in the LAZ are compared to baseline results in Table 5.

Trichloroethylene

There are five LAZ monitoring wells in the EMP (PRW001C, PRW002C, PRW003C, PRW004C, and PRW006C). TCE concentrations over time in the LAZ monitoring wells are shown in Figure 15. Excluding PRW006C, generally TCE concentrations are decreasing in the LAZ monitoring wells compared to baseline levels. In the LAZ monitoring wells east of the ZVI-PRB (PRW001C and PRW003C), TCE concentrations increased in 2022 and have remained consistent from 2Q23 to most

recent results in 1Q25. The observed increases in 2022 remained below baseline concentrations. West of the ZVI-PRB, concentrations at PRW002C have decreased steadily since installation of the ZVI-PRB with all results between 2Q24 and 1Q25 below the TCE MDL. Following ZVI-PRB construction, PRW004C initially decreased below 1 µg/L in 4Q20 and increased gradually with a first quarter of 2024 (1Q24) result of 9.38 µg/L. TCE concentrations at PRW004C have a decreasing trend from 2Q24 to 1Q25 with a most recent result of 5.76 µg/L. The maximum baseline detection from LAZ monitoring wells for TCE was 664 µg/L at eastern well location PRW003C. In the 1Q25 sampling event, the maximum TCE concentration in the same four LAZ monitoring wells was 35.5 µg/L (PRW003C). Concentrations at PRW006C, located farther west of the ZVI-PRB, increased from 24.3 µg/L in 3Q20 to 110 µg/L in 1Q23, then decreased to 20.9 µg/L in the 1Q25 sample. TCE results for 1Q25 in the LAZ compared to baseline are shown in Figure 16.

Tetrachloroethylene, Cis-1,2-Dichloroethylene, and Chloroethene

For the LAZ, the maximum baseline PCE result was at monitoring well PRW002C with a detection of 1.6 µg/L. From 2Q24 to 1Q25, there were 21 samples collected for LAZ monitoring wells with no detections above the MDL for PCE.

The maximum baseline cis-DCE result for the LAZ was 138 µg/L at PRW003C. Cis-DCE was detected above the MDL at all LAZ monitoring wells from 2Q24 to 1Q25. The maximum cis-DCE result in 1Q25 was 45.5 µg/L at PRW003C. Cis-DCE concentrations in the LAZ monitoring wells are presented over time in Figure 17.

Of the 21 samples collected from LAZ monitoring wells from 2Q24 to 1Q25, no samples were above the MDL for VC.

3.3.3 Geochemical Analyses

Although baseline samples collected in the LAZ to support the ZVI-PRB monitoring were analyzed for the entire geochemical analyte list, post-installation samples were not analyzed for the entire geochemical analyte list in accordance with the EMP (Table 2). However, a select list of geochemical analyses was performed for post-installation samples including total iron, chloride, and dissolved gases (ethane, ethylene, and methane).

For baseline LAZ sampling, iron ranged from 80.1 µg/L to 496 µg/L. In the 1Q25 sampling event, iron results west of the ZVI-PRB at PRW002C and PRW004C were 18,100 µg/L and 3,250 µg/L, respectively. Total iron concentrations in the LAZ initially increased following ZVI-PRB installation, and have followed decreasing trends since, however total iron remains elevated compared to baseline. Total iron farther west at PRW006C increased to above detection with a 1Q25 result of 839 µg/L, which is has now exceeded the baseline total iron concentration observed in the LAZ.

LAZ chloride concentrations in 1Q25 range from 7.68 mg/L to 13.3 mg/L in monitoring wells near the ZVI-PRB. The maximum baseline concentration in the LAZ was 3.03 mg/L. Chloride concentrations are decreasing since an initial spike following completion of the ZVI-PRB, however concentrations remain elevated near the ZVI-PRB compared to baseline. Results from PRW006C, located farther west of the ZVI-PRB, remained consistent with baseline concentrations until 1Q24, when chloride increased to 31.7 mg/L. Chloride has remained elevated with a 1Q25 result of 32.7 mg/L. The increase in the latest sampling event is an indicator of dechlorination occurring at the ZVI-PRB, side-gradient of PRW006C.

Baseline LAZ concentrations for both ethane and ethylene were below 1 µg/L. Except for PRW006C, ethane concentrations remain elevated in the LAZ, ranging from 90.1 µg/L to 483 µg/L in 1Q25. In the 1Q25 sampling event, ethylene results had an elevated MDL (10 µg/L), and therefore only had one reported detection at PRW001C with a result of 120 µg/L. In the 4Q24 sampling event, the MDL was 0.79 µg/L and ethylene results ranged from 2.1 µg/L to 108 µg/L. This supports that ethylene concentrations remain elevated in LAZ monitoring wells at the ZVI-PRB.

Baseline concentrations for methane in the LAZ ranged from 0.64 µg/L to 2.0 µg/L. The 1Q25 results in nearby LAZ monitoring wells ranged from 4,370 µg/L to 8,510 µg/L. Methane concentrations remain elevated in the LAZ monitoring wells near the ZVI-PRB for 1Q25 and are consistent with previously reported trends, with the exception of PRW002C. Methane concentrations in PRW002C have consistently increased from a 1Q22 result of 895 µg/L to a 1Q25 result of 8,510 µg/L. Farther west of the ZVI-PRB at PRW006C, the 1Q25 methane result was 179 µg/L, an increase from all previous results.

3.3.4 Field Measurements

Field measurements taken in the LAZ monitoring wells present evidence of ZVI-PRB effects. In baseline sampling, the range of ORP in the LAZ was +181 mV to +294 mV. In 1Q25, ORP in the LAZ monitoring wells nearby to the ZVI-PRB ranged from -202 mV to -19 mV. ORP results in the LAZ have demonstrated an increase overall from a 1Q23 range of -337 mV to -135 mV. Located further to the west at PRW006C, the ORP in 1Q25 was +192 mV, a decrease from the 1Q24 PRW006C measurement of +301 mV.

In the LAZ monitoring wells, baseline pH values ranged from 5.3 to 7.2. Immediately following ZVI-PRB construction in 1Q20, the maximum pH in the LAZ was 10.5. From 2Q24 to 1Q25, pH remained around baseline levels for LAZ monitoring wells PRW002C, PRW003C, and PRW006C with a range from 4.3 to 6.9. At PRW001C, pH has gradually increased since third quarter of 2021 with a 1Q25 pH of 10.6. At PRW004C, pH ranged from 6.2 in first quarter of 2021 to 6.8 in 1Q22, which was consistent with pH at PRW002C and PRW003C. From 3Q22 to present, pH has increased at PRW004C with a 1Q25 measurement of 8.4. As discussed in Section 3.2.4 for the UAZ, elevated pH levels are associated with groundwater interaction with the ZVI. The elevated pH measurements observed are not expected to have a negative impact on performance of the ZVI-PRB.

4.0 MONITORING PERFORMANCE AND EFFECTIVENESS DISCUSSIONS

4.1 Groundwater Elevation and Flow Path

Groundwater flow across the ZVI-PRB in the UAZ is westerly towards Steel Creek, as expected, with groundwater velocity calculated from PMW005DL to PRW006DU as 60.9 m/yr (199.7 ft/yr) in 1Q25 (Figure 10). After five years of monitoring, impact to the UAZ groundwater potentiometric surface remains minimal. The ZVI-PRB installation does appear to slow groundwater flow west of the ZVI-PRB, as indicated by the potentiometric surface between the PRW001 cluster and the PRW006 cluster. This impact is not expected to affect the ZVI-PRB performance, as the groundwater flow direction was ultimately not impacted, and flow through the ZVI-PRB in the UAZ is supported by the 1Q25 data. Water level elevation measurements across PRW001, PRW002, PRW003, and PRW004 monitoring well clusters show near identical trends from 2018 to 2025 (Appendix B, Figures B-5 through B-8), indicating there is no disruption of flow across the ZVI-PRB.

The 1Q25 LAZ potentiometric surface (Figure 14) indicates a north-northwestern groundwater flow direction in the vicinity of the ZVI-PRB. The 1Q25 LAZ potentiometric surface is consistent with previous potentiometric surfaces reported in past PAGW OU groundwater monitoring reports, including the groundwater divide north of the ZVI-PRB (~79.6 m [261 ft] amsl).

By design, the ZVI-PRB was intended to target the UAZ, and the bottom was intended to key into the TCCZ that splits the UAZ and LAZ. However, due to variability in the TCCZ elevation and the method for ZVI injections, the ZVI-PRB extended through the TCCZ and into the top of the LAZ, at two locations near PIW001D and PIW003D (Figure 6). Therefore, the higher permeability ZVI provides a conduit for groundwater flow between the UAZ and LAZ, which could impact the potentiometric surface in either unit. However, this impact is minimal, due to the nature of the TCCZ, which is understood to be a "leaky," incompetent confining zone, and potentiometric data which indicates little to no head change after ZVI-PRB installation. Additionally, the connection between the UAZ and LAZ created by the ZVI-PRB is not anticipated to increase the extent of contamination, as any groundwater traveling between units will experience an increased contact time with the reductive ZVI media, resulting in enhanced dechlorination of cVOCs in groundwater entering the LAZ. This is supported by the observed decrease in TCE concentrations and indicators of ZVI impacts in LAZ monitoring wells PRW001C, PRW002C, PRW003C, and PRW004C.

4.2 ZVI-PRB cVOC Degradation

Effectiveness of the ZVI-PRB technology is demonstrated best by the in-wall monitoring well TCE results. East of the ZVI-PRB, UAZ TCE concentrations remain elevated, with a 1Q25 maximum of 1,170 µg/L (PRW003DL) and a maximum background concentration of 4,130 µg/L (P003L). The only 1Q25 in-wall TCE detection above the PQL was 5.91 µg/L at PIW003D, which demonstrates greater than 99% reduction in groundwater concentration from 1,170 µg/L. Across the entire ZVI-PRB, the reduction of TCE in the UAZ, based on average 1Q25 concentrations of monitoring wells east of the ZVI-PRB (468 µg/L) and of in-wall monitoring wells (2.23 µg/L; used PQL for non-detects), equates to an estimated TCE reduction greater than 99%. This supports that cVOC contaminant plumes in the source area and neck area have been effectively cut-off from the distal area of the PAGW OU cVOC plume in the UAZ and that a mass flux reduction greater than the RAO of 80% is being achieved, discussed in more detail in Section 4.6. TCE concentrations have varied around the MCL at PIW003D

from 2Q24 to 1Q25, from a low of 1.39 µg/L in 2Q24 and a high of 10.0 µg/L in 3Q24. Out of the four in-wall monitoring wells, PIW003D is screened within the zone of highest contamination based on PDI soil concentrations (Figure 6 and Table 2).

Overall, TCE concentrations are decreasing in UAZ monitoring well clusters west of the ZVI-PRB with few exceptions, PRW004DL and PRW007DL (Figure 11, Figure 12, and Figure 13). Excluding monitoring wells PRW004DL and PRW007DL, TCE concentrations have decreased in all western UAZ monitoring wells since installation of the ZVI-PRB. At monitoring well PRW004DL, TCE initially decreased following ZVI-PRB installation to non-detection in 2Q20, then increased gradually to 72.5 µg/L in 1Q22 before decreasing to 3.10 µg/L in 1Q23. Since 1Q23, TCE has an increasing trend with a maximum TCE result of 192 µg/L in 1Q25. The increasing trend observed at PRW004DL can be attributed to effects of back-diffusion down gradient of the ZVI-PRB. Back diffusion of TCE from the low-permeability sediments will ultimately aid in reduction of cVOC mass in the UAZ that is eventually migrating to the distal area of the plume.

Monitoring well cluster PRW006 is located further from the ZVI-PRB (~39.6 m [130 ft]) than the other western monitoring well clusters. PRW007 monitoring wells are ~12.2 m (40 ft) from the ZVI-PRB centerline, which is double the distance of the other monitoring well clusters. The increase in distance may be enough for back diffusion to slow the observed decrease in TCE concentrations. This is evidenced by the in-wall monitoring wells PIW003D and PIW004D demonstrating almost complete TCE degradation, while PRW007DU and PRW007DL continue to present appreciable TCE concentrations. TCE concentrations at PRW007DU have a gradual decreasing trend since ZVI-PRB construction, with a 1Q25 result of 276 µg/L.

Similarly, PRW006 monitoring wells, located ~39.6 m (130 ft) from the ZVI-PRB have had delayed effect, likely due to the slow groundwater flow velocity and therefore the time allowed for back-diffusion of TCE mass from low-permeability sediments into groundwater. Recent TCE results at the PRW006 monitoring well cluster do suggest reduced concentrations (Figure 13). At PRW006DU, the 1Q22 result was 4.59 µg/L, while the 1Q25 result was 3.33 µg/L. Similarly, monitoring well PRW006DL has shown a decreasing trend from 267 µg/L in 3Q20 to 92.0 µg/L in 1Q25.

Reductive dechlorination by-products, chloride and ethylene, were included in the ZVI-PRB sampling. For P002U, the parent and daughter products of reductive dechlorination are plotted over time in Figure 18. P002U was chosen because it is located in close proximity west of, and centered on, the ZVI-PRB and depicts the best example of expected trends. Chloride concentrations increased following ZVI-PRB completion but have maintained a gradually decreasing trend since 3Q20. An increase in chloride is expected with dechlorination of cVOCs, however the immediate and sharp increase observed may be more related to injection of sodium chloride during ZVI-PRB construction. Ethylene increased slightly from baseline to 1Q20, however a change in available laboratory for dissolved gas analyses led to an elevated MDL (25 µg/L and above) in all results from 2Q20 to 4Q22, and again in 1Q25. From 1Q23 to 4Q24, lower ethylene MDLs were able to be achieved by the laboratory in order to get meaningful results. The only UAZ location with ethylene results above the PQL from 2Q20 to 4Q22 and in 1Q25 was PIW003D. PIW003D remained elevated with a 4Q24 and 1Q25 result of 12.9 µg/L and 49.3 µg/L, respectively. The elevated ethylene result for in-wall monitoring well PIW003D indicates reductive dechlorination by the ZVI-PRB, primarily in the well within the highest zone of TCE contamination (Figure 6).

4.3 ZVI-PRB Health and Longevity

In literature and studies of past ZVI-PRB installations, it is understood that the presence of some geochemical analytes in large concentrations can lead to precipitation within a ZVI-PRB, as well as coating of ZVI media resulting in reduced reactivity, known in literature as passivation (He, Wilson, and Wilkin 2008; Gu et al. 2001; Ritter 2000). Specific analytes of interest include, but are not limited to calcium, nitrate, and sulfate.

Influent concentrations and concentrations within the ZVI-PRB are believed to be low enough to conclude that precipitation and/or passivation of the ZVI-PRB is not a concern (Battelle 2002; Yabusaki et al. 2001; Wilkin, Puls, and Sewell 2003; Gu et al. 2001). Influent concentrations shown to cause short term effects on performance were sulfate concentrations above 1,000 mg/L and nitrate on the order of 120 mg/L. In addition, a treatability study was conducted prior to ZVI-PRB installation to verify the geochemistry of the site groundwater and subsurface would not result in a significant loss in ZVI-PRB performance (SRNS 2019). The following conclusions were made from the treatability study results:

- Geochemistry of site groundwater, site soils, and ZVI material are favorable for extended long-term performance;
- No observation of mineral precipitation causing loss in reactivity towards cVOCs; and
- No expectation of precipitation/clogging causing a significant loss in permeability, and therefore performance.

Calcium concentrations have increased significantly, from a maximum UAZ baseline of 4,810 ug/L to a 1Q25 maximum of 69,700 µg/L for in-wall monitoring wells. The significant spike in calcium concentration is most likely related to the amount of grout used to complete the injection wells for ZVI-PRB construction. There were 22 injection wells installed to construct the ZVI-PRB, with all of the annulus space filled with grout to ensure the specialized expansion casings propagated the ZVI fractures correctly. This quantity of grout cement is likely to leach calcium due to the high pH levels created by the ZVI. The volume of grout used accounts for only 1.48% of the total volume of ZVI injected, therefore the performance of the ZVI-PRB is not anticipated to be significantly impacted by the resulting calcium levels. Calcium concentrations up-gradient and down-gradient of the ZVI-PRB are near baseline levels, therefore it is likely some calcium precipitation is occurring within the ZVI-PRB. However, it is difficult to estimate the level of impact this precipitation will have on the ZVI-PRB performance over time. After five years of monitoring, there are no detrimental impacts observed in UAZ potentiometric surfaces and groundwater flow through the ZVI-PRB, indicating precipitation within the ZVI-PRB is not a concern at this time.

Based on the results of the treatability study and observations of other ZVI-PRB applications (SRNS 2019), the longevity of the ZVI-PRB is expected to be at least 25 years, maintaining effectiveness and sufficient performance to meet the RAO.

4.4 ZVI-PRB Reducing Environment

Within the ZVI-PRB, reducing conditions are evidenced by high negative ORP values between -315 and -279 mV in 1Q25. Baseline ORP results in the UAZ ranged from +124 to +428 mV. The results indicate the conditions within the ZVI-PRB have flipped from an oxidizing environment to a reducing environment. The highly reducing environment created by the ZVI promotes reductive dechlorination of cVOCs entering the ZVI-PRB.

The flip to reducing conditions in the aquifer also support natural reductive dechlorination of cVOCs by microbial degradation as the anaerobic conditions extend out from the ZVI-PRB. However, the natural presence of anaerobic microbial species which degrade cVOCs is not guaranteed. General conditions that can support anaerobic microbial activity capable of cVOC degradation include:

- Depleted DO, nitrate, and sulfate
- Elevated ferrous iron, manganese, methane, ethylene, ethane, chloride, and alkalinity
- Negative ORP
- Substrate availability (TOC/DOC concentrations)
- Presence of cVOCs
- pH range between ~6-8

Based on the results from 1Q25 sampling, evidence exists of conditions in the vicinity of the ZVI-PRB that may support further microbial degradation of cVOCs (i.e., reducing conditions, increasing and/or elevated TOC and methane). Abiotic reductive dechlorination via interaction with ZVI is supported by the multiple lines of evidence presented in this report as the primary mechanism for degradation of cVOCs. There is limited evidence of microbial anaerobic degradation in the ZVI-PRB monitoring well results, such as build-up of cis-DCE and methane. However, it is noted that the highest cis-DCE concentrations are observed east of the ZVI-PRB, at monitoring well P003L (457 µg/L in 1Q25), which is likely related to previous Savannah River National Laboratory studies of biostimulation upgradient of the ZVI-PRB. The buildup of methane and potential microbial activity is not believed to play a significant role in cVOC degradation or to result in any performance reduction of the ZVI-PRB.

The reducing conditions created by the ZVI also result in alkaline groundwater (pH > 9.5) as evident by the in-wall monitoring wells. West of the ZVI-PRB between 2Q24 and 1Q25, pH remained within a range of 4.4 to 6.6 in the UAZ, consistent with baseline pH values. The primary source of elevated pH levels in the ZVI-PRB is associated with the reaction of ZVI and water:

$$2Fe^0 + 4H_2O + 4e^- \rightarrow 2H_2 + 4OH^- + 2Fe^{2+} + 4e^-$$

Secondary to this process, leaching of cement grout used to construct injection wells could also be contributing to the increased pH levels, however the contribution is assumed to be significantly less by comparing the volume of grout in the injection wells to the volume of ZVI injected. Volumetrically, the total amount of grout for each of the 22 injection wells accounts for only 1.48% of the total ZVI volume injected. Therefore, even though leaching of the grout could be occurring, high groundwater pH is primarily attributed to groundwater interactions with ZVI.

4.5 ZVI-PRB Impact on the LAZ

The ZVI-PRB design intended injection wells to key into the TCCZ as a means of hydraulic control, however the potential for penetration into the LAZ was recognized and therefore LAZ monitoring was retained in the EMP.

Groundwater elevation measurements and potentiometric surface mapping for the LAZ indicate there is not a significant impact from the ZVI-PRB (Figure 14). Changes to the groundwater flow direction in the vicinity of the ZVI-PRB are consistent with regional potentiometric shifts and are believed to be due to natural variations in LAZ groundwater potentiometric elevations. The LAZ groundwater flow direction at the ZVI-PRB is more northerly based on the 1Q25 potentiometric surface, and therefore groundwater flow does not intersect the ZVI-PRB perpendicularly but instead flows parallel to the barrier trace.

Monitoring results for TCE in the LAZ indicate a decrease in concentrations since installation of the ZVI-PRB, with TCE decreasing from a baseline maximum of 664 µg/L to a 1Q25 maximum of 35.5 µg/L (Figure 16). The drop in TCE concentrations, combined with the flip in ORP values from high positive to negative (-202 mV to -19 mV in PRW001C to PRW004C), are indications of the ZVI-PRB impacts on groundwater geochemistry in the LAZ. The observed impacts to the LAZ at this time are beneficial, demonstrating TCE degradation, which was not expected from the ZVI-PRB since it was primarily designed to target the UAZ. This is further supported by significant 4Q24 ethylene concentrations in PRW001C and PRW002C of 108 µg/L and 13.9 µg/L, respectively. In 1Q25, ethylene was detected at 120 µg/L at PRW001C (non-detect at PRW002C due to elevated MDLs in 1Q25). Ethylene concentrations at this level are a strong indicator of reductive dechlorination by ZVI.

4.6 TCE Mass Flux Reduction in the UAZ

As defined in the RSER/EE/CA for the PAGW OU, the RAO for the NTC RA is to reduce the TCE mass in the groundwater plume so that the mass flux to Steel Creek will ultimately be reduced in order to reach the MCL in the stream. It was estimated that a TCE mass flux of 80% or greater should achieve the MCL in Steel Creek (SRNS 2018a). Mass flux was estimated at three transects in the ZVI-PRB area (Figure 19), utilizing version 2.01 of the Mass Flux Toolkit developed by GSI Environmental Inc. (GSI). GSI developed the toolkit to provide a user-friendly excel spreadsheet toolkit to estimate mass flux for the Strategic Environmental Research and Development Program and the Environmental Security Technology Certification Program of the United States Department of Defense (Farhat and Newell 2011).

Three transects in the neck area of the PAGW OU TCE plume were identified to make comparisons of TCE mass flux and evaluate the RAO (Figure 19). Transect 1 crosses the 1Q25 TCE plume delineation across P003U and P003L, background monitoring wells to the ZVI-PRB. This transect provides a UAZ TCE mass flux estimate coming into the system, unimpacted by the ZVI-PRB. Transect 2 is located up-gradient of the ZVI-PRB, across the PRW001 and PRW003 UAZ monitoring well pairs. This transect provides mass flux estimates just before flowing into the ZVI-PRB. It is expected that Transect 1 and Transect 2 will have similar TCE mass flux results as they are both up-gradient of the ZVI-PRB and are ~14 m (45 ft) apart, however, observed impacts on TCE concentrations at PRW001DU and PRW001DL may reduce the calculated mass flux at transect 2. Transect 3 is located down-gradient of the ZVI-PRB, between PRW002, PRW004, and PRW007 UAZ well pairs and P002U. This transect does not pass directly across each monitoring well, therefore distances along the transect for each well were approximated. Transect 3 provides a conservative TCE mass flux flowing out of the ZVI-PRB and is the primary calculation used for comparison and for mass flux reduction, not accounting for any back diffusion from downgradient aquifer sediments.

Due to significant updates in the understanding of concentrations and delineations of the UAZ TCE plume in the neck area of the PAGW OU, and changes in the upgradient TCE plume, the project team has calculated TCE mass flux for comparison using the 1Q25 data and plume delineation only. Figure 19 depicts the transects and data used for calculations. For the GSI mass flux toolkit, inputs included an UAZ aquifer thickness of 19.8 m (65 ft) (Figure 6), groundwater flow velocity of 60.9 m/yr

(199.7 ft/yr), concentration data along each transect, and distance between each concentration point (well or concentration contour). The mass flux toolkit calculates geometric means using linear interpolation of the TCE concentrations along each transect and applies it to the entire aquifer thickness. The TCE concentration grid is then multiplied by the groundwater flow rate and summed to calculate a TCE mass flux in grams per day or kilograms per year (kg/yr). Transect 1 and transect 2 had similar mass flux calculations of 47.9 kg/yr and 43.0 kg/yr, respectively (Table 6). The difference between the two mass flux values (10.2% reduction) is due to the impacts on PRW001DU and PRW001DL for transect 2. The TCE mass flux calculated at transect 3 is 5.60 kg/yr. This results in a mass flux reduction of 88.3% from transect 1 to transect 3. Mass flux results indicate the ZVI-PRB has achieved the RAO of reducing TCE mass flux in the neck area by greater than 80%. The results also emphasize that the ZVI-PRB is effectively cutting off the source area TCE plume from the distal area. This is beneficial to the overall impact of the PAGW OU TCE plume on Steel Creek due to the significant mass of TCE that exists up-gradient of the ZVI-PRB. Currently, data does not suggest the ZVI-PRB is having an obvious impact on surface water cVOC concentrations in Steel Creek after five years of monitoring. This is to be expected as groundwater flow is slow at the ZVI PRB and there was a significant amount of cVOC mass entrained in the low-permeability sediments downgradient of the ZVI-PRB prior to installation. Therefore, performance of the ZVI-PRB is best assessed by monitoring wells in the vicinity of the ZVI-PRB.

A major limitation to this approach for calculating mass flux is the available data across the TCE plume at each transect. TCE concentrations are estimated across the entire aquifer thickness based on one screen depth at each monitoring well or based on the estimated plume contour. Although this limitation impacts the accuracy of mass flux calculations, the approach was used consistently between the three transects and therefore provides a useful comparison.

5.0 SUMMARY AND RECOMMENDATIONS

The PAGW OU NTC RA was completed in January 2020 with the construction of an 80.5 m (264 ft) long ZVI-PRB, designed to intersect groundwater flow in the UAZ of the UTRA to degrade cVOCs, primarily TCE. The RAO for the PAGW OU NTC RA is to protect human health and the environment by reducing the mass and down-gradient transport of the PAGW OU TCE groundwater plume. A TCE mass flux reduction of 80% was determined to be sufficient to meet the RAO.

After five years of effectiveness monitoring of ZVI-PRB performance, the effectiveness in the immediate vicinity of the ZVI-PRB is highlighted by the following results:

- Groundwater elevation data and potentiometric surfaces for the UAZ and LAZ indicate that the ZVI-PRB is having minimal impact to groundwater flow, as it was designed. Therefore, there is not strong evidence that contaminated groundwater is significantly by-passing the ZVI-PRB.

- Up-gradient monitoring well clusters PRW001 and PRW003, as well as background monitoring wells P003U and P003L, demonstrate that significant TCE mass persists in the source area of the plume. It is expected that this mass will migrate into and be remediated by the ZVI-PRB, preventing it from contributing to the distal area plume and future impact to Steel Creek.

- To the west of the ZVI-PRB in the UAZ, TCE concentrations are overall following a decreasing trend. However, because of back diffusion of TCE into the groundwater front leaving the ZVI-PRB, it will take some time before an overall impact on TCE concentrations in the distal area will be realized.

- ORP results for the in-wall wells indicate a strong reductive environment is present, extending to the west in the UAZ monitoring wells. The reductive environment is favorable for promoting additional reductive biodegradation of TCE in conjunction with the abiotic cVOC degradation by emplaced ZVI. However, monitoring for biodegradation (microbial populations or types) has not been completed and is not planned for the PAGW OU.

- The installed ZVI-PRB also beneficially impacts the LAZ, evidenced by observed reducing conditions, reduced TCE concentrations, and elevated ethylene concentrations.

- In-wall monitoring well results indicate a TCE concentration reduction greater than 99% is achieved. In addition, a ZVI-PRB TCE mass flux reduction is estimated at 88.3% between transect 1 and transect 3 in the UAZ of the PAGW OU (Figure 19). These reductions exceed the RAO of 80% mass flux reduction in the UAZ for the NTC RA.

After five years of monitoring, the data provides strong evidence of the ZVI-PRB's performance in reducing cVOC concentrations in groundwater that flows through the emplaced material, demonstrated best by the in-wall monitoring wells. Mass flux calculations support the TCE concentration data, that the ZVI-PRB reduces mass flux by greater than 80%. However, these impacts are localized and significant changes in PRW006 UAZ wells have not been observed, nor have impacts in the distal area of the UAZ TCE plume. Monitoring of Steel Creek TCE concentrations at SC-03 have demonstrated a decrease over the last three years, from 25.8 µg/L in 1Q23 to 12.5 µg/L in 1Q25 (Figure 20). Based on down-gradient TCE data and distal area data, it is unlikely that the *recent* decrease of TCE concentrations in Steel Creek at SC-03 are the result of the ZVI-PRB, but more likely related to natural attenuation processes. Monitoring wells located down-gradient of the ZVI-PRB and in close proximity demonstrate that a clean groundwater front leaves the barrier and flows down-gradient. However, the delayed impact to further down-gradient monitoring well concentrations demonstrates that back-diffusion and the role that low-permeability zones in the UAZ play is significant. This phenomenon has been described in literature, and the persistence of high groundwater concentrations due to low-permeability zones in a remediated aquifer can last for years to decades (Parker et al. 2008).

Data analyzed in support of the ZVI-PRB monitoring show continued degradation of cVOCs in the ZVI-PRB and impact to down-gradient monitoring wells. However, change in the concentrations between sampling events are not significant enough to warrant continued quarterly sampling frequency at this time. SRS recommends continued analytical monitoring for cVOCs, degradation end-products, and ZVI-PRB health indicators as part of the annual PAGW OU long-term monitoring sampling, sampled in first quarter of each year. SRS recommends reporting on the ZVI-PRB performance and health in the biennial PAGW OU groundwater monitoring report.

6.0 REFERENCES

Arnold, W. A., and A. L. Roberts, 2000. *Pathways and Kinetics of Chlorinated Ethylene and Chlorinated Acetylene Reaction with Fe(0) Particles,* Environmental Science and Technology, 34: 1794-1805.

Battelle, 2002. *Evaluation the Longevity and Hydraulic Performance of Permeable Reactive Barriers at the Department of Defense Sites,* Columbus, Ohio: Battelle Press.

Farhat, S. K., and C. J. Newell, 2011. *Mass Flux Toolkit to Evaluate Groundwater Impacts, Attenuation, and Remediation Alternatives – User's Manual*, Version 2.0, August, 2011, GSI Environmental Inc., Newfields, NH.

Gu, B., L. Liang, J. Zhou, and D. Phillips, 2001. *In Situ Microbial Investigation of a Fe(0) Reactive Barrier,* Proceedings, American Chemical Society National Meeting, San Diego, California, April 1-5, 2001, 41(1): 1173-80.

He, Y. T., J. T. Wilson, and R. T. Wilkin, 2008. *Transformation of Reactive Iron Minerals in a Permeable Reactive Barrier (Biowall) Used to Treat Tetrachloroethene in Groundwater,* Environmental Science and Technology, 42(17): 6690-96.

Mishra, D., and J. Farrell, 2005. *Understanding Nitrate Reactions with Zero-Valent Iron Using Tafel Analyses and Electrochemical Impendence Spectroscopy,* Environmental Science and Technology, 39(2): 645-50.

Parker, B. L., S. W. Chapman, and M. A. Guilbeault, 2008. *Plume persistence caused by back diffusion from thin clay layers in a sand aquifer following TCE source-zone hydraulic isolation*, Journal of Contaminant Hydrology, 102: 86-104.

Ritter, K, 2000. *A Study of the Reduction of Nitrate and the Effect of Nitrate on the Reduction of Trichloroethylene (TCE) by Connelly Granular Iron,* M.S. Thesis, University of Waterloo, Ontario, Canada.

Ritter, K., M. S. Odziemkowski, and R. W. Gillham, 2002. *An In Situ Study of the Role of Surface Films on Granular Iron in the Permeable Iron Wall Technology,* Journal of Contaminant Hydrology, 55: 87-111.

SRNS, 2008. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study (CMS/FS) for the P-Area Operable Unit (U),* WSRC-RP-2007-4032, Revision 1.2, December 2008, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012a. *Analytical Data Validation Report (U),* Area Completion Projects Administrative Procedures Manual C1, ER-AP-303, Revision 4, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012b. *Area Completion Projects Programmatic Quality Assurance Project Plan for Environmental Data Collection and Management*, ERD-AG-2005-00001, Revision 5, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2012c. *Post-Construction Report (PCR) for the P-Area Operable Unit (U),* SRNS-RP-2011-01582, Revision 1, July 2012, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2013. *Sampling and Analysis Plan for the P-Area Groundwater Operable Unit (U),* SRNS-RP-2011-01284, Revision 1, September 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2018a. *Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis for Trichloroethylene Plumes Discharging to Steel Creek in P-Area Groundwater Operable Unit (NBN) (U),* SRNS-RP-2017-00372, Revision 1, March 2018, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2018b. *Sampling and Analysis Plan Addendum for the P-Area Groundwater Operable Unit (U),* SRNS-RP-2018-00261, Revision 1, August 2018, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2019. *Removal Action Design Plan (RADP) with Effectiveness Monitoring Plan (EMP) for the P-Area Groundwater (PAGW) Operable Unit (OU),* SRNS-RP-2019-00105, Revision 1, July 2019, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

SRNS, 2020. *Removal Action Report for the P-Area Groundwater Operable Unit Non-Time Critical Removal Action,* SRNS-RP-2020-00021, Revision 1, November 2020, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

USDOE, 2018. *Action Memorandum and Responsiveness Summary for the Non-Time Critical Removal Action for the P-Area Groundwater Operable Unit (U),* SEMS Number: 81, ARF-021660, May 29, 2018, Department of Energy Savannah River Operations Office, P.O. Box A, Aiken, SC.

USDOE, 2026. *P-Area Groundwater (PAGW) Operable Unit Data Summary Tables for April 2024 through March 2025,* SEMS Number: 81, ARF-025324, February 24, 2026, Department of Energy Savannah River Operations Office, P.O. Box A, Aiken, SC.

Wilkin, R. T., R. W. Puls, and G. W. Sewell, 2003. *Long-Term Performance of Permeable Reactive Barriers Using Zero-Valent Iron: Geochemistry and Microbiological Effects,* Ground Water, 41(4): 493-503.

WSRC, 2006. *Remedial Investigation (RI) Work Plan for the P-Area Operable Unit (U),* WSRC-RP-2005-4081, Revision 1.1, September 2006, Washington Savannah River Company, LLC, Savannah River Site, Aiken, SC.

WSRC, 2008. *RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study (CMS/FS) for the P-Area Operable Unit (U),* WSRC-RP-2007-4032, Revision 1.2, December 2008, Washington Savannah River Company, LLC, Savannah River Site, Aiken, SC.

WSRC, 2013. *SRS Investigative Derived Waste Management Plan*, WSRC-RP-94-1227, Revision 9, November 2013, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

Yabusaki, S., K. Centrell, B. Sass, and C. Steefel, 2001. *Multicomponent Reactive Transport in an In Situ Zero-Valent Iron Cell,* Environmental Science and Technology, 36(7): 1493-1503.

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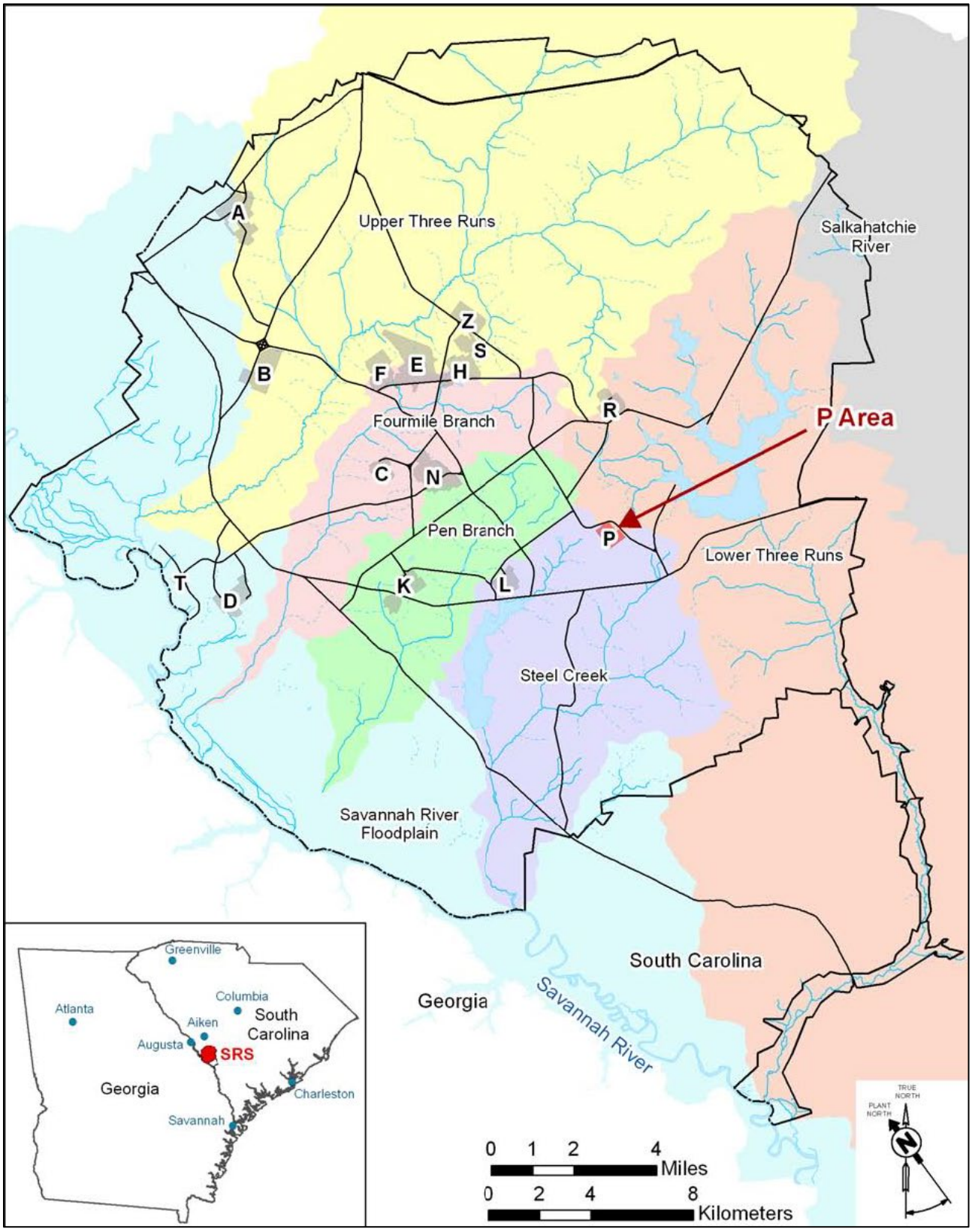


Figure 1. Location of P Area at the Savannah River Site

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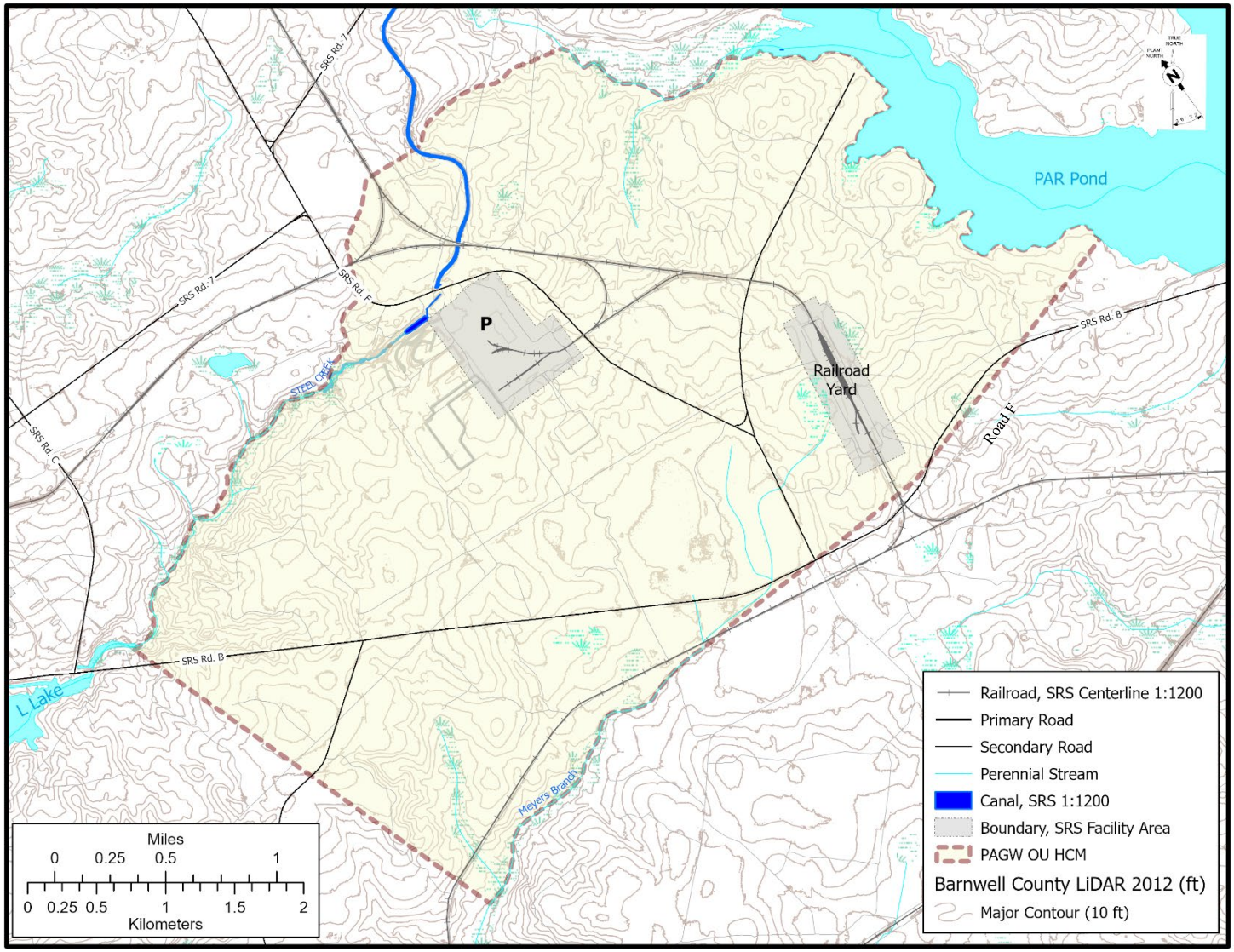


Figure 2. P-Area Groundwater Operable Unit Hydro-Conceptual Model Boundary Map

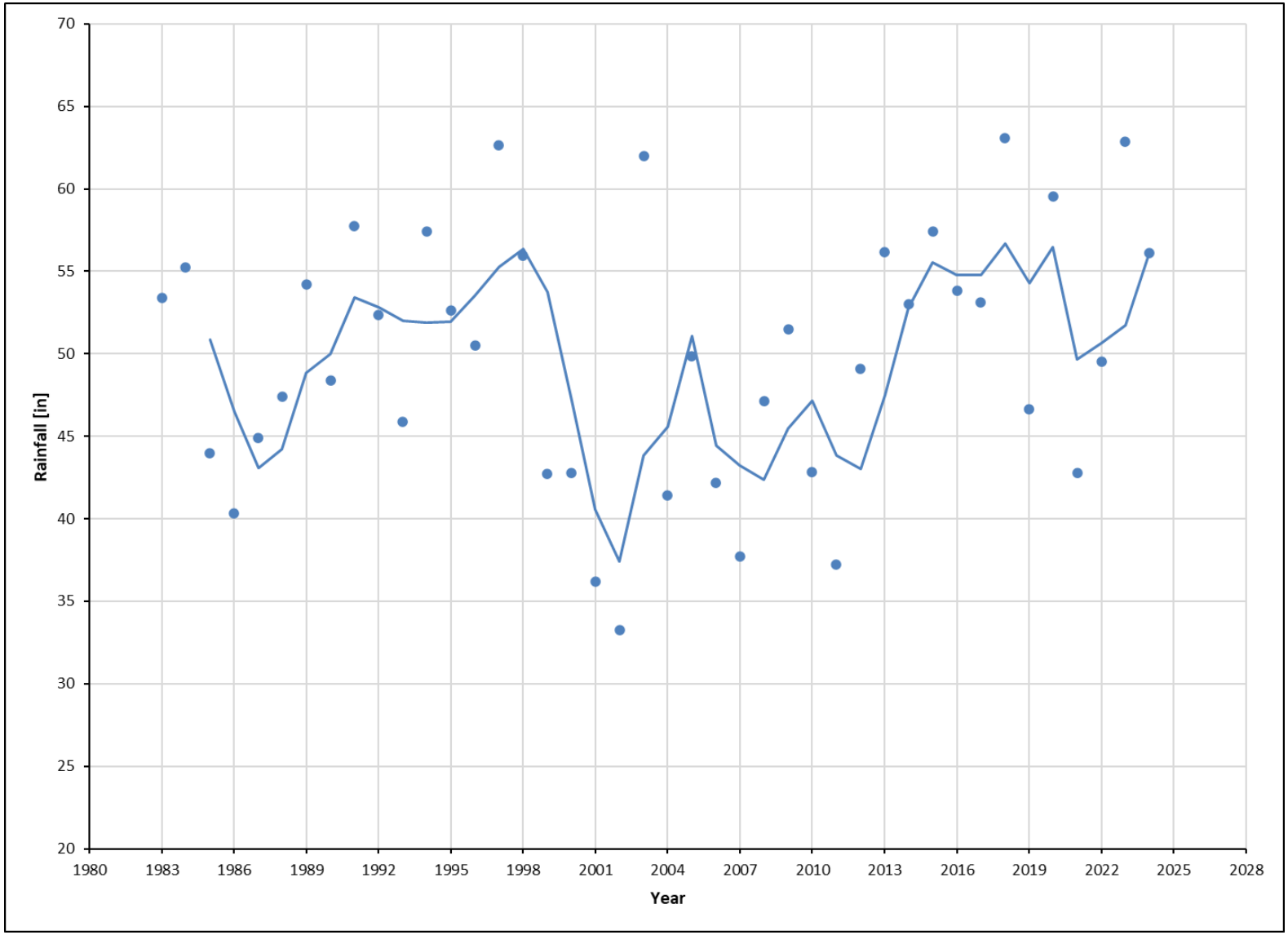


Figure 3. Total Annual Rainfall at 100-P Rain Gauge with a 3-Year Moving Average Trendline

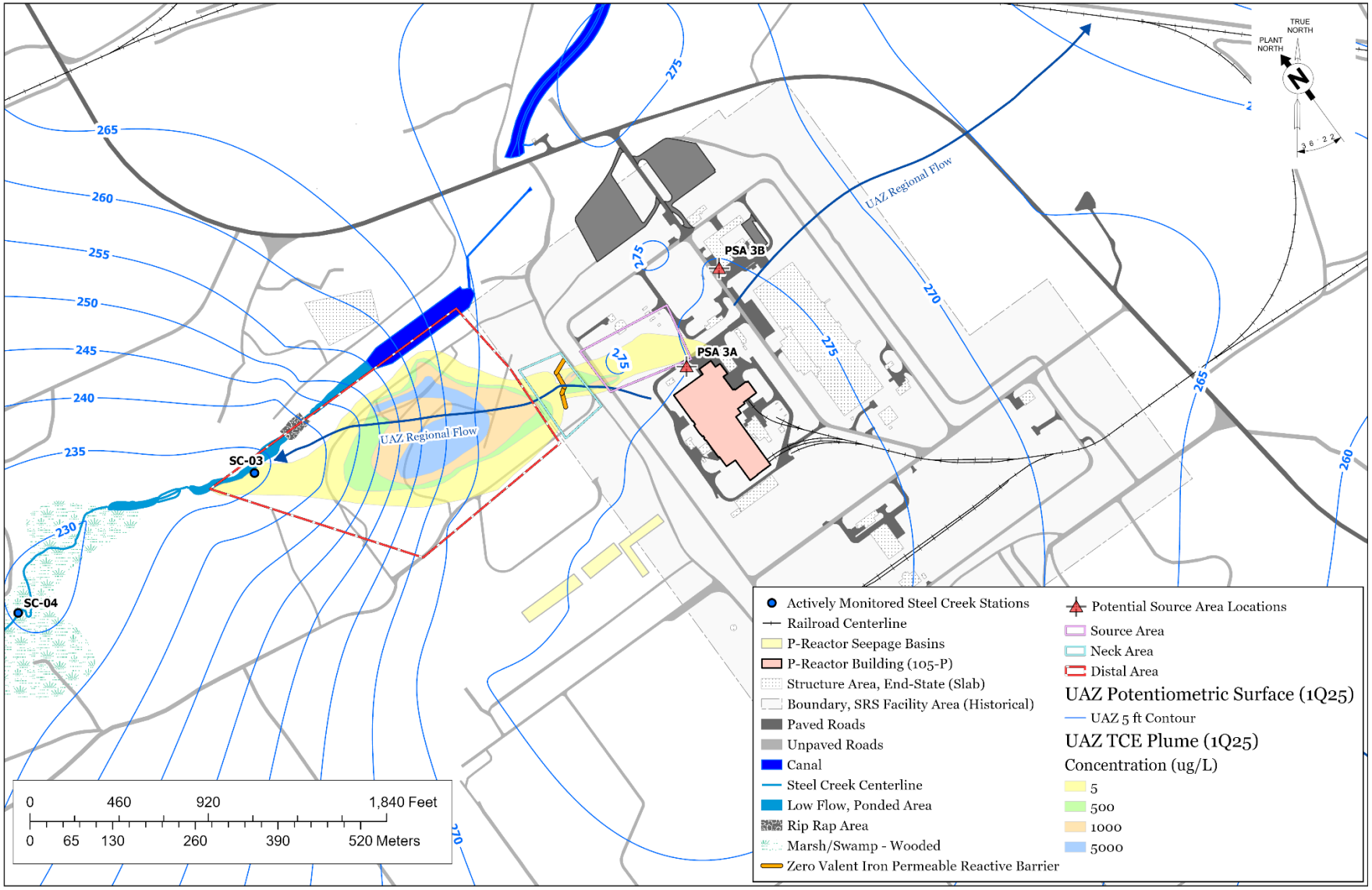


Figure 4. Trichloroethylene Plume Map for the Upper Aquifer Zone of the Upper Three Runs Aquifer (2018/2025 Data)

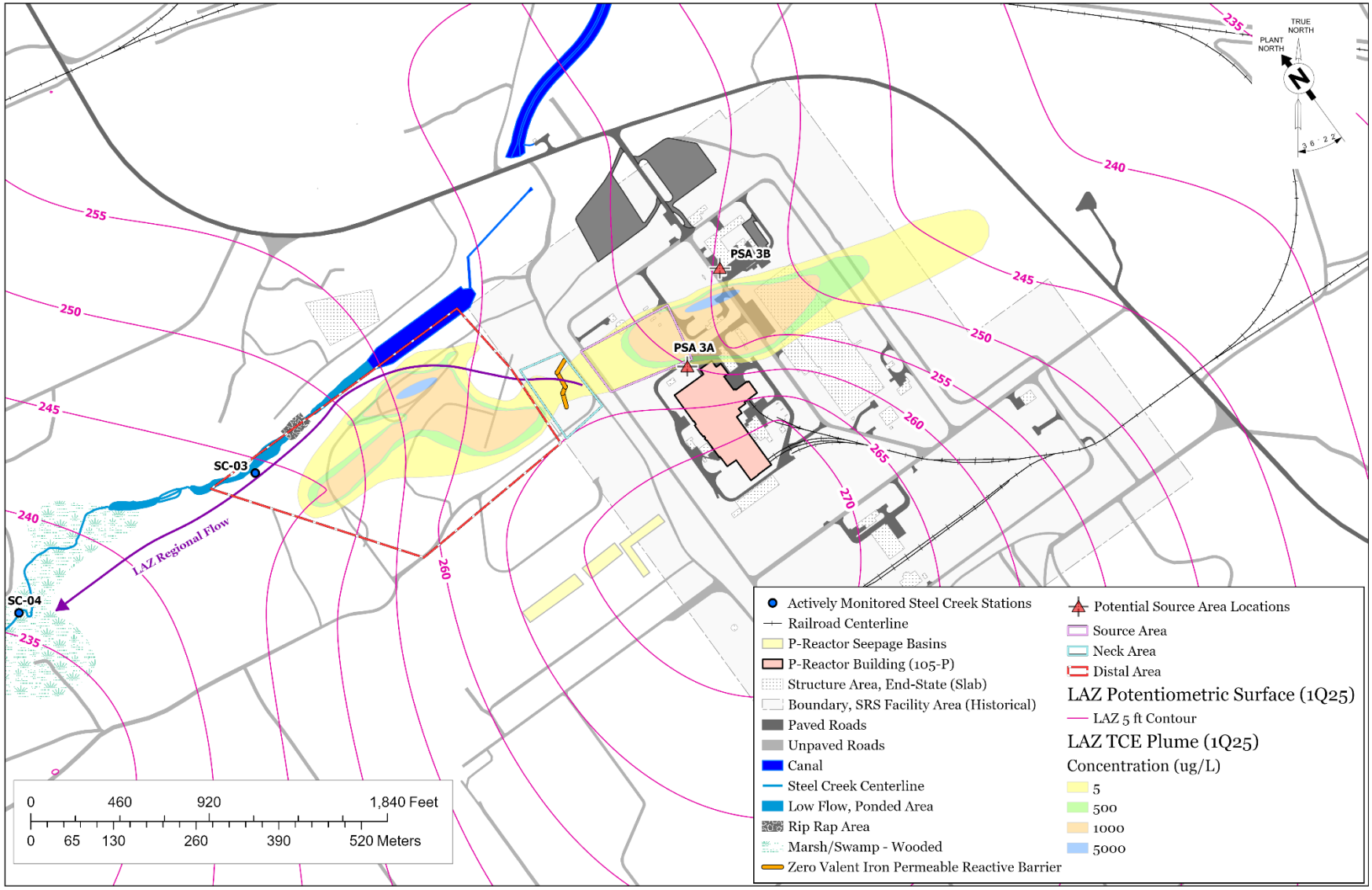


Figure 5. Trichloroethylene Plume Map for the Lower Aquifer Zone of the Upper Three Runs Aquifer (2018/2025 Data)

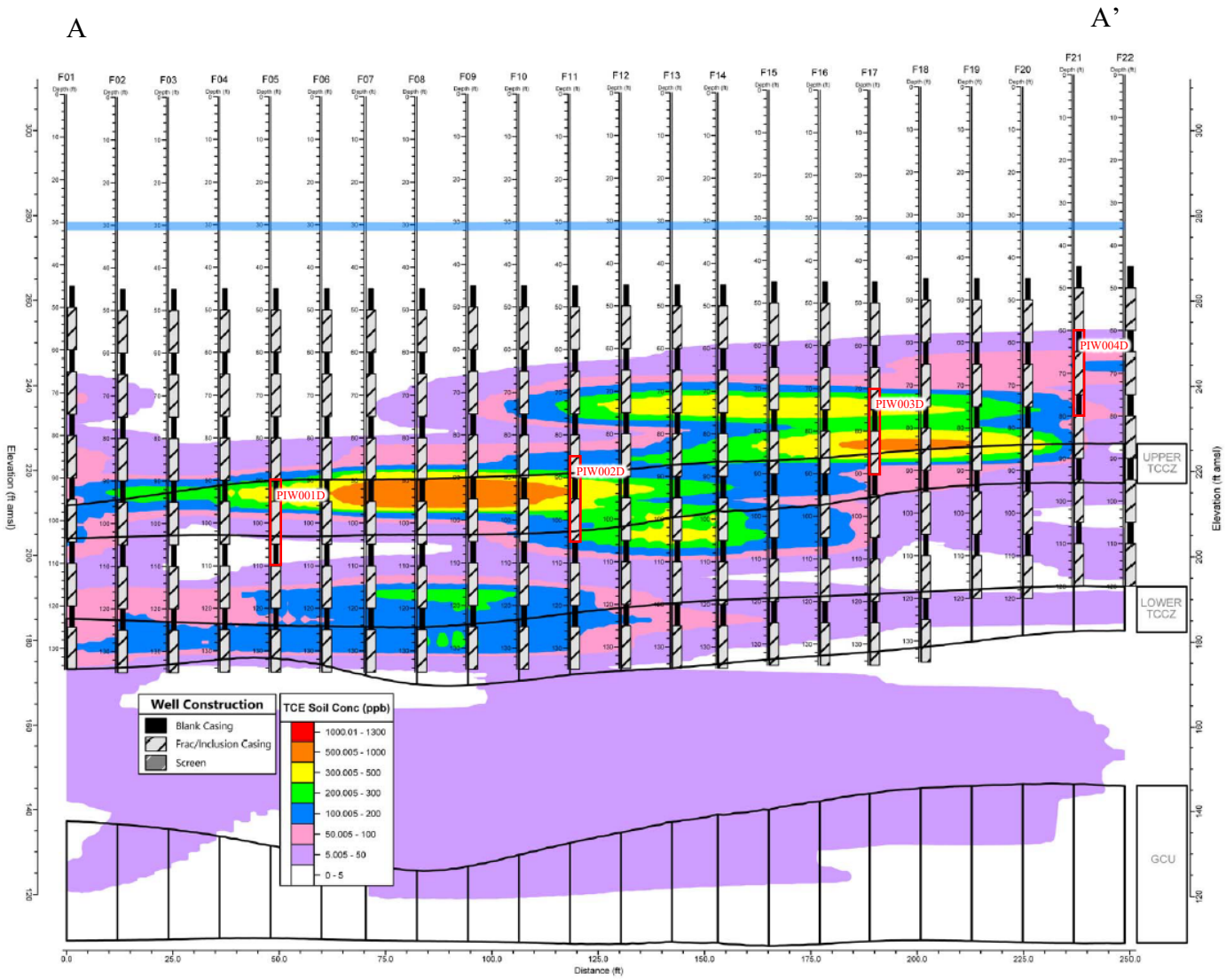


Figure 6. TCE Plume North-South Cross-Section with ZVI-PRB Injection Wells (2020)

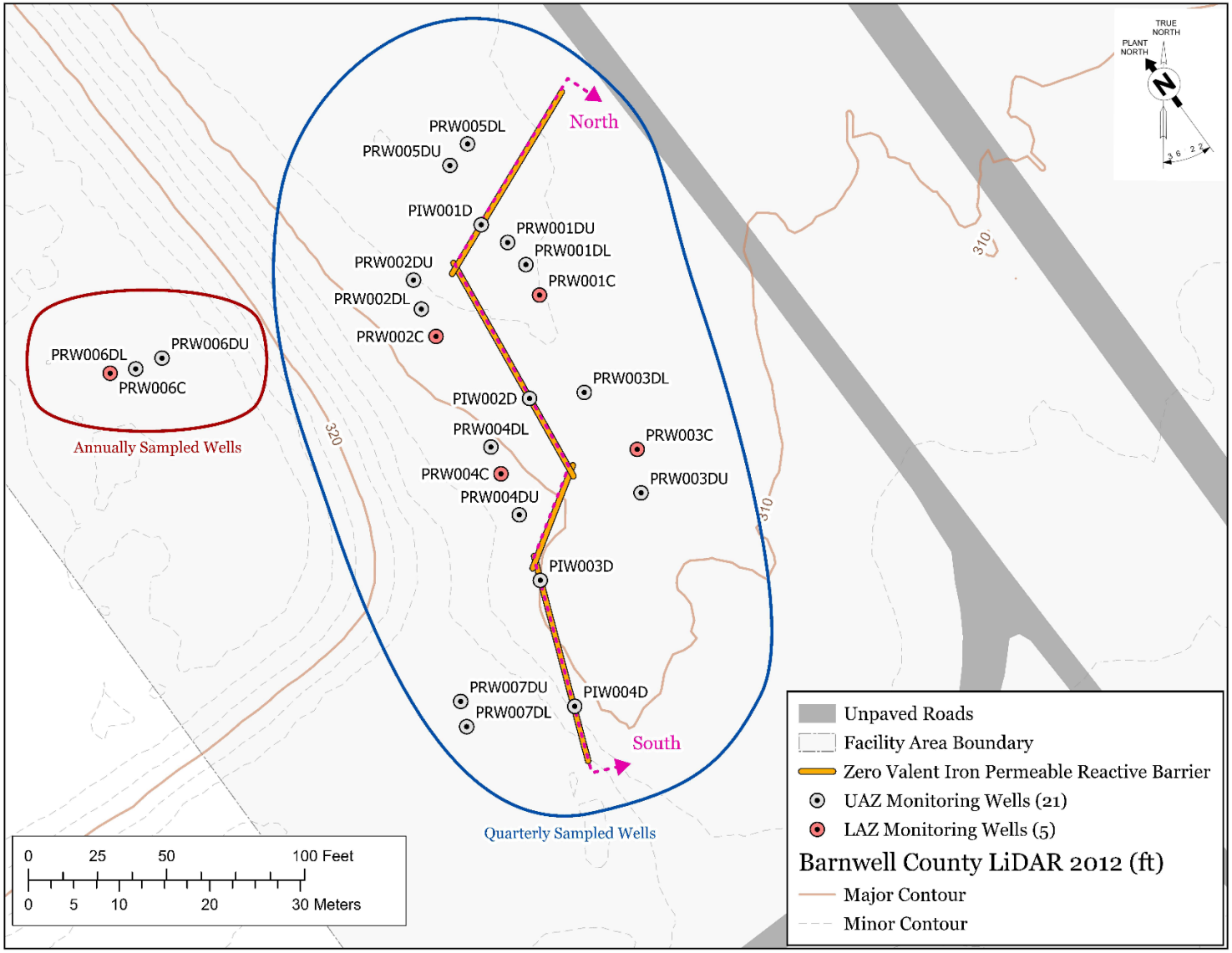


Figure 7. Effectiveness Monitoring Plan Locations

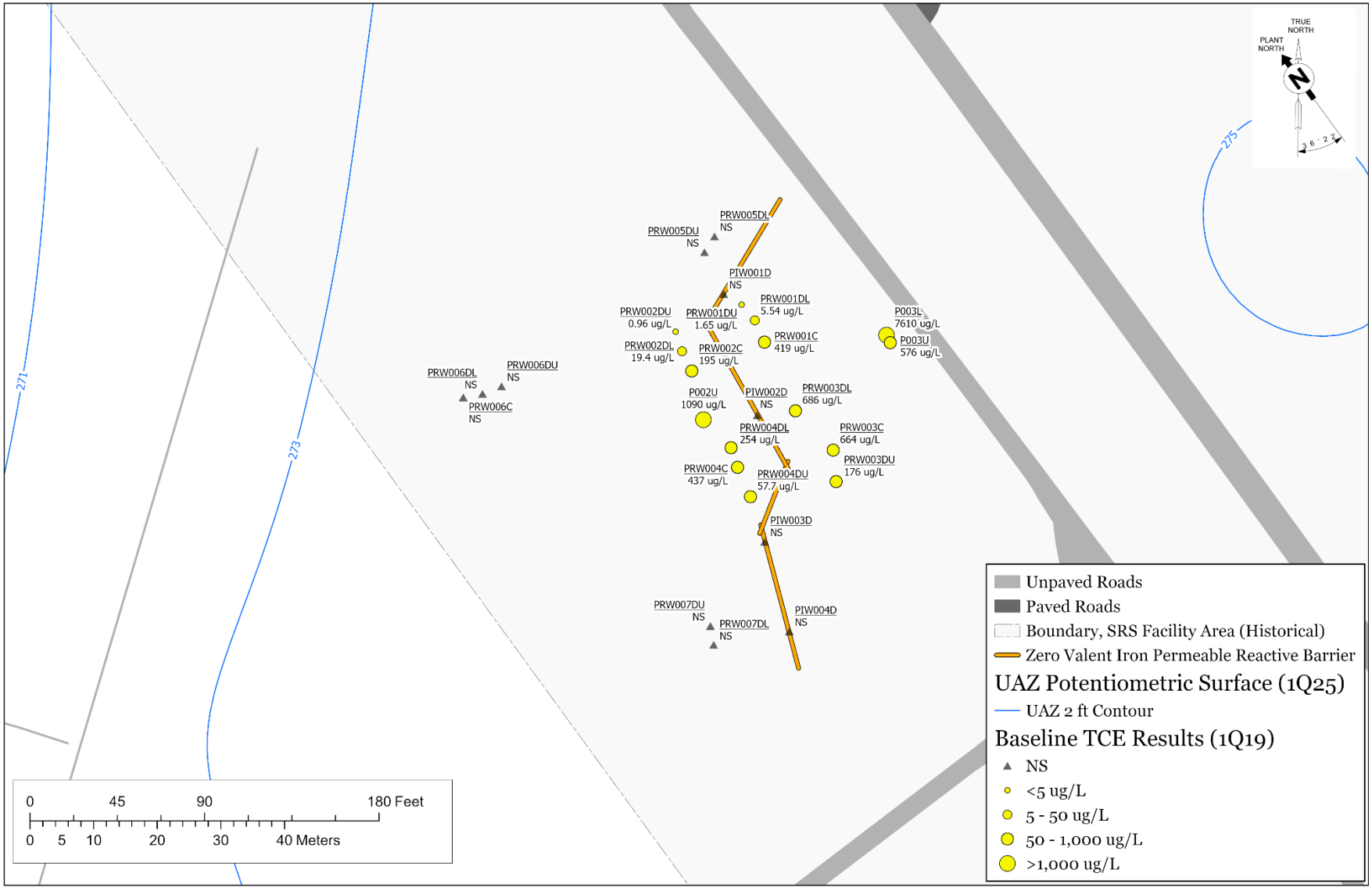


Figure 8. Baseline Concentrations of TCE in the PAGW OU EMP Monitoring Wells

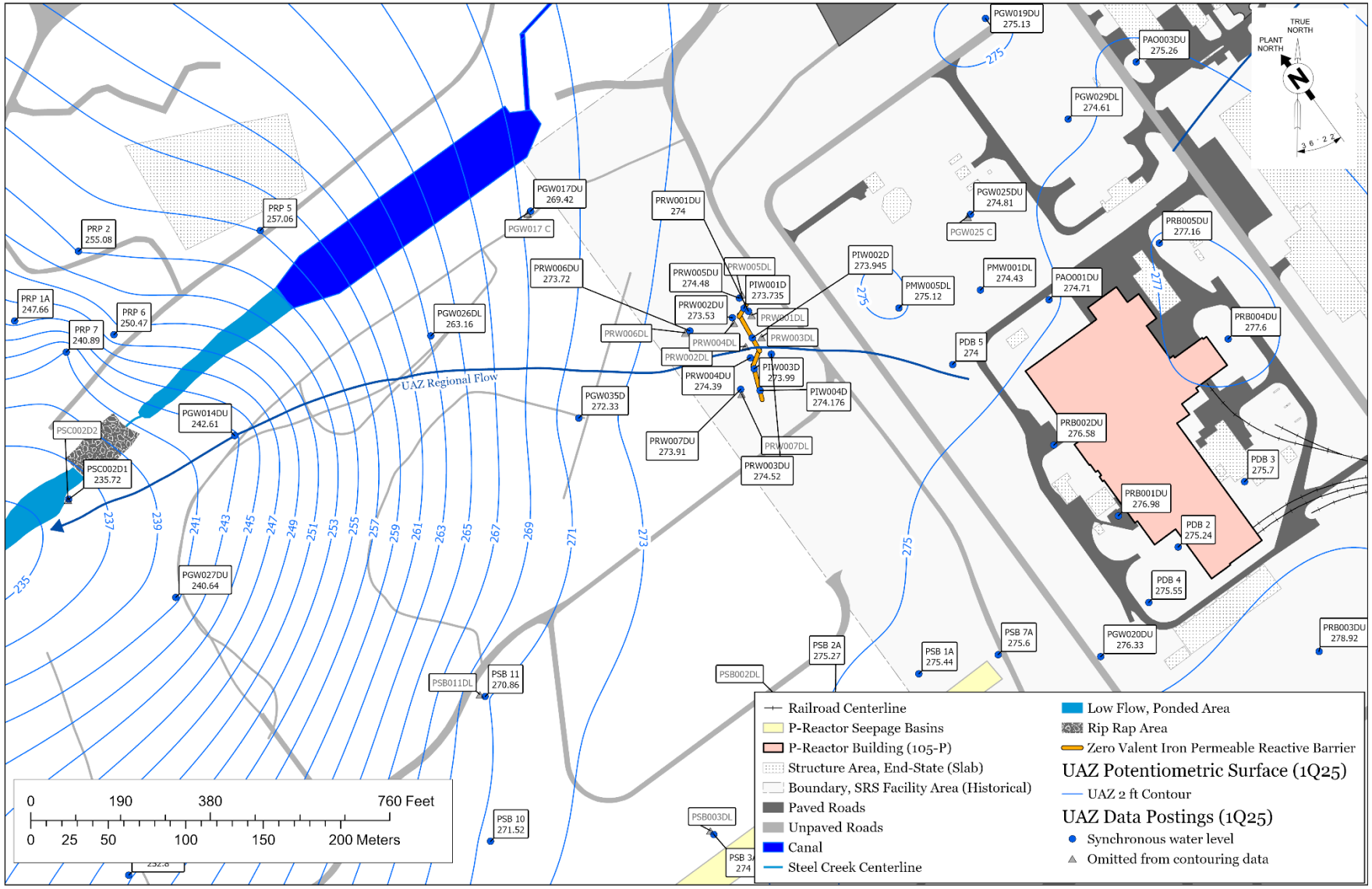


Figure 9. Regional UAZ Groundwater Elevations and Flow Direction (1Q25)

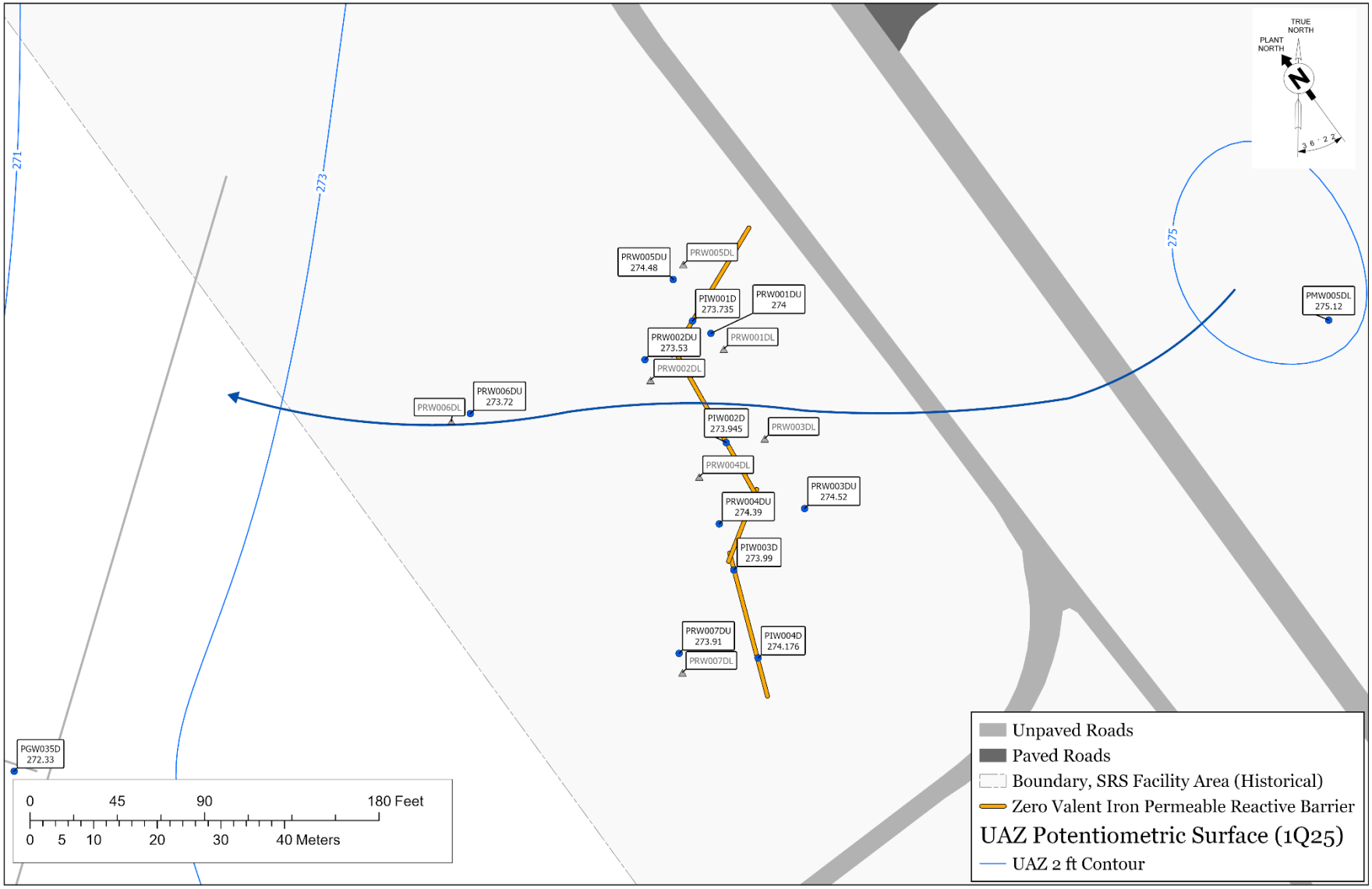


Figure 10. UAZ Water Elevations for 1Q25 at PAGW OU RA EMP Monitoring Wells

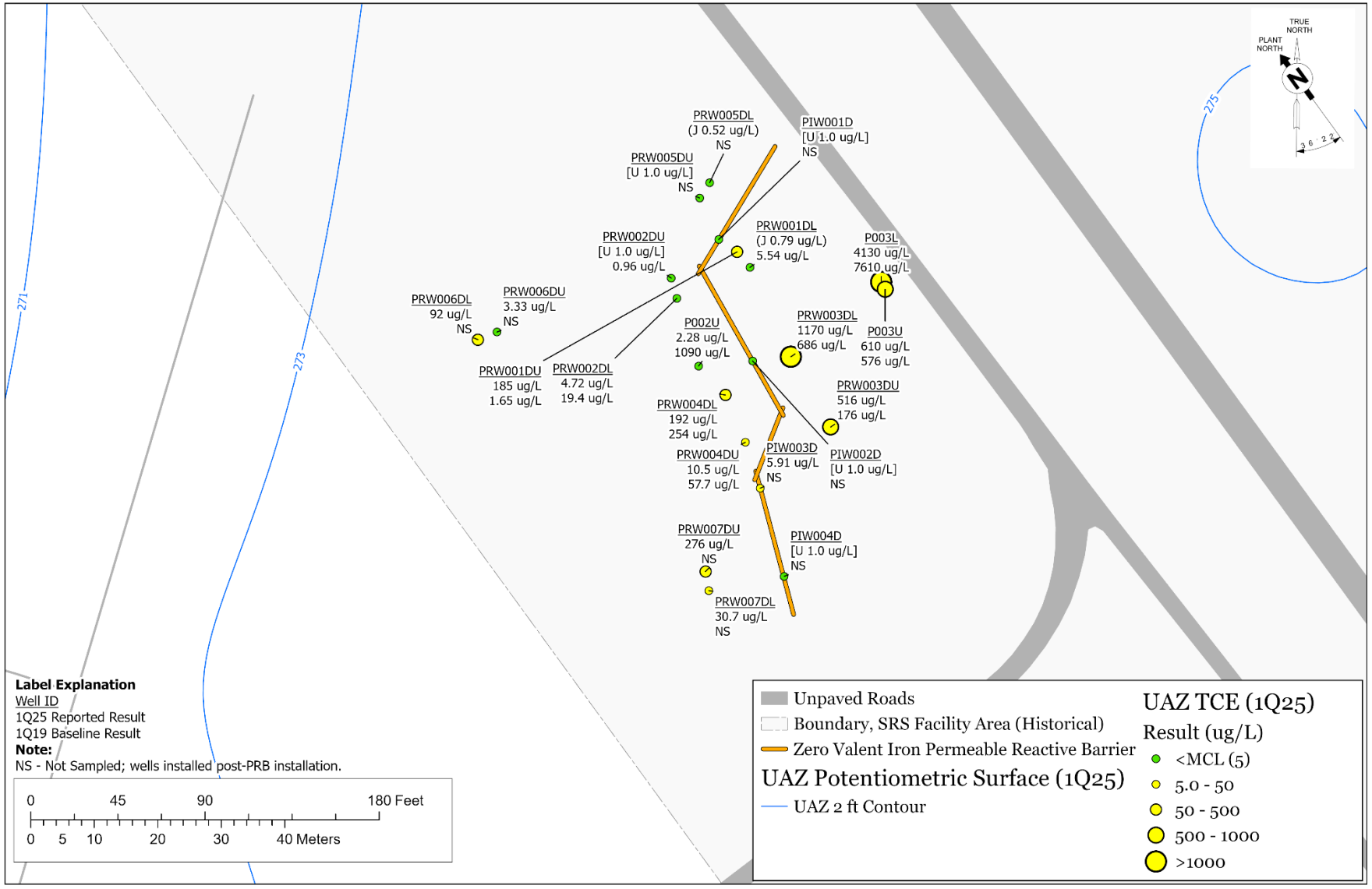


Figure 11. TCE Results for ZVI-PRB UAZ Monitoring Wells Sampled in 1Q25

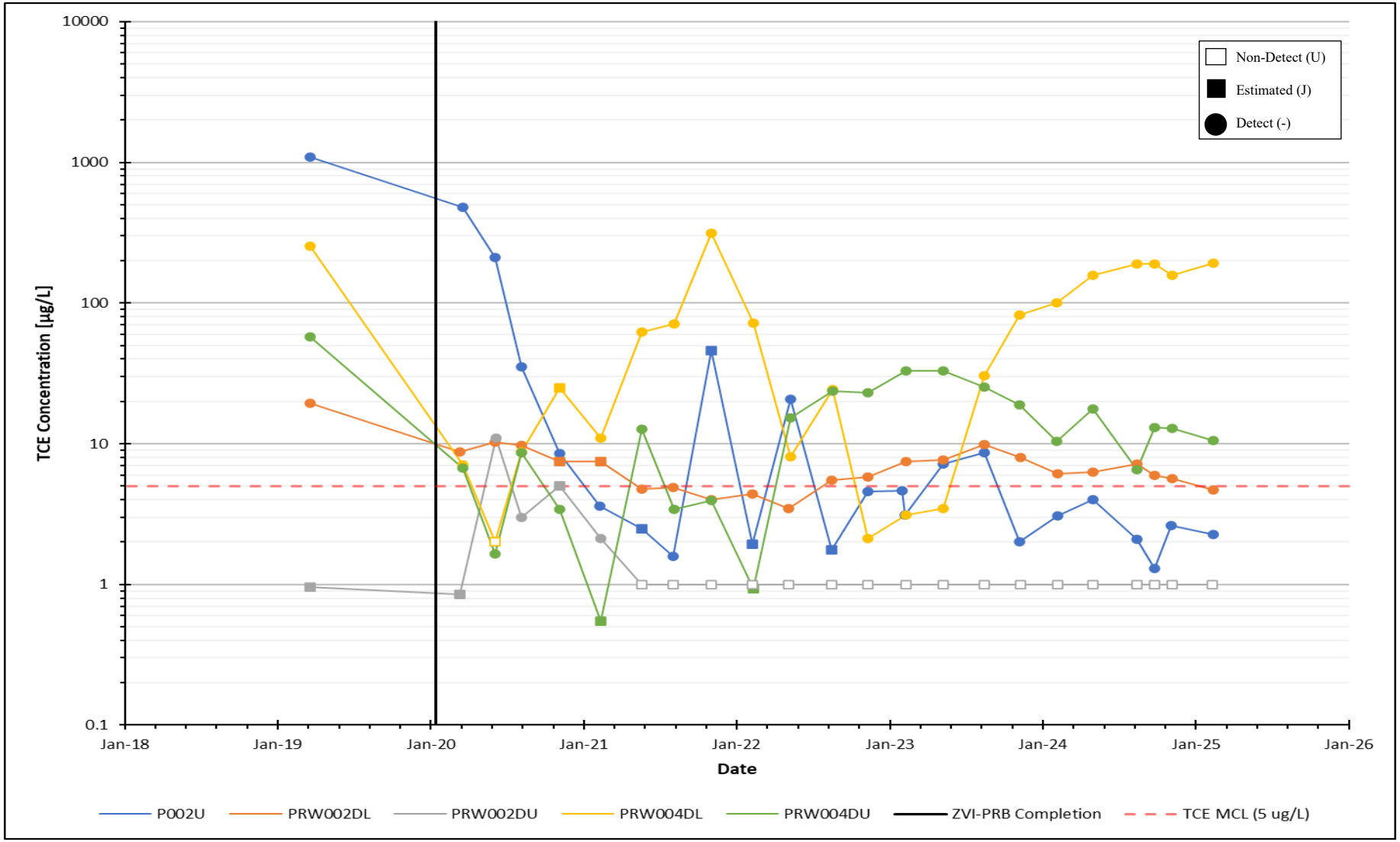


Figure 12. Time-Series Plot for TCE at UAZ Monitoring Well Clusters for P002U, PRW002, and PRW004

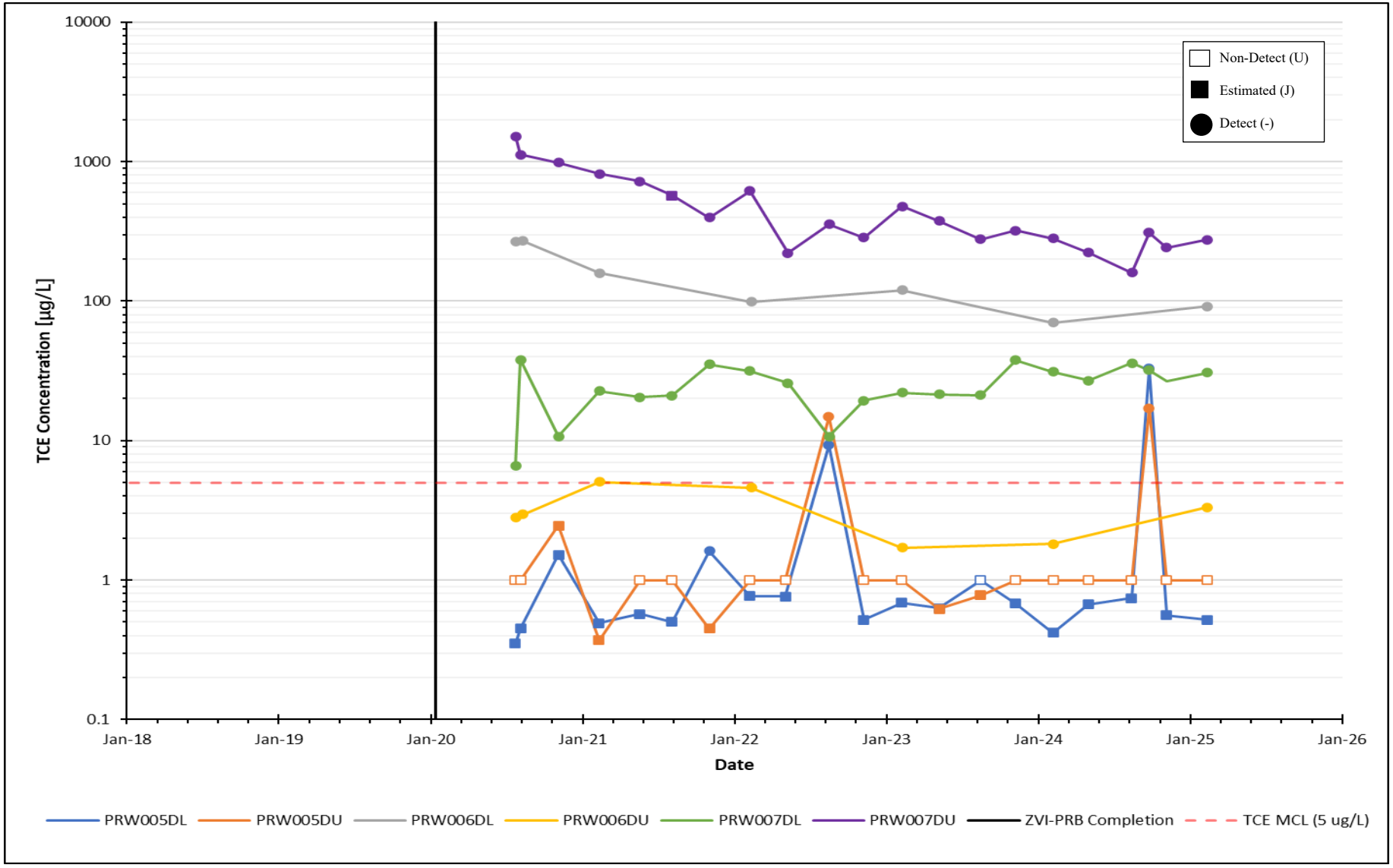


Figure 13. Time-Series Plot for TCE at UAZ Monitoring Well Clusters for PRW005, PRW006, and PRW007

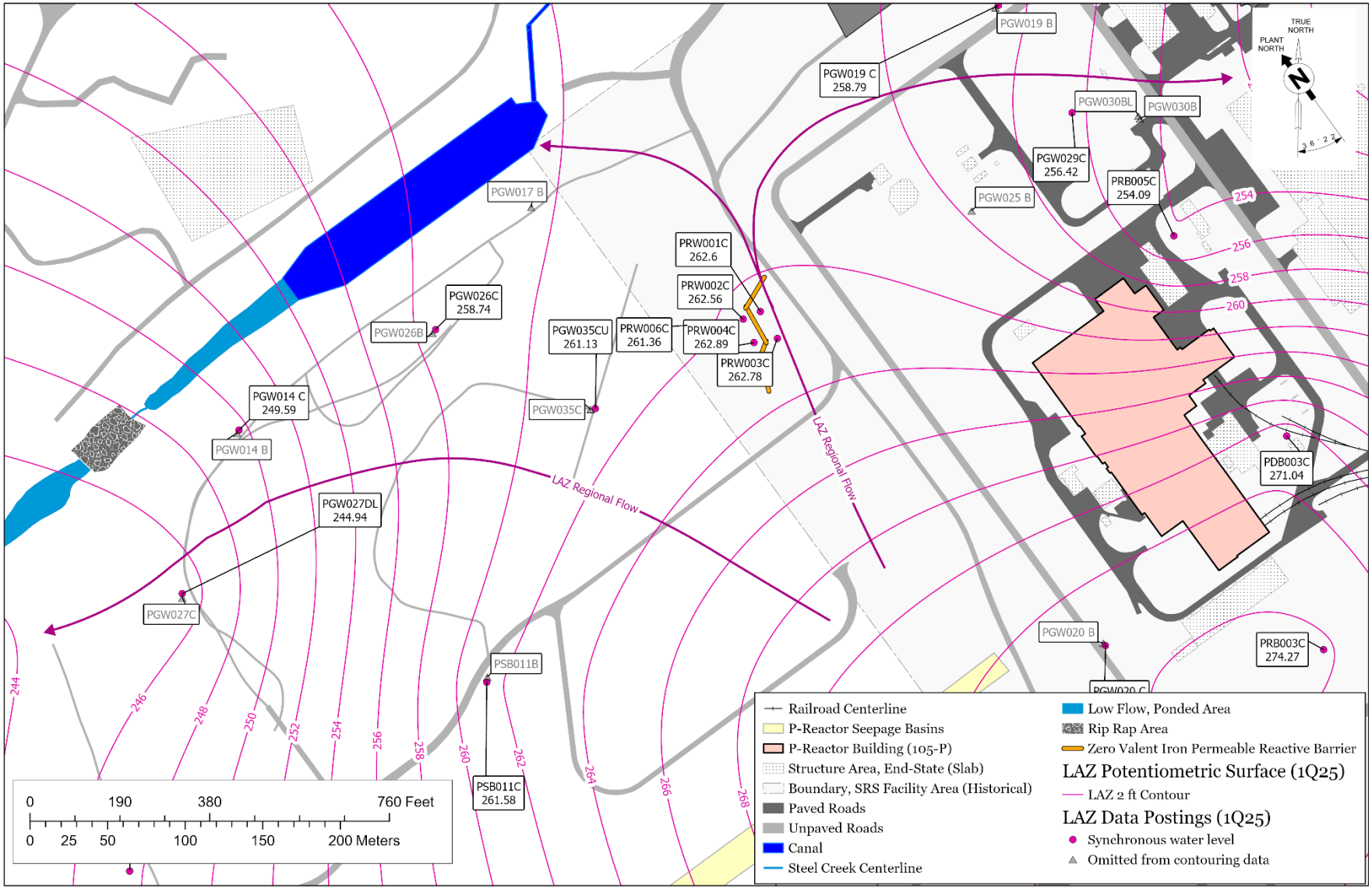


Figure 14. Regional LAZ Groundwater Elevations and Flow Direction (1Q25)

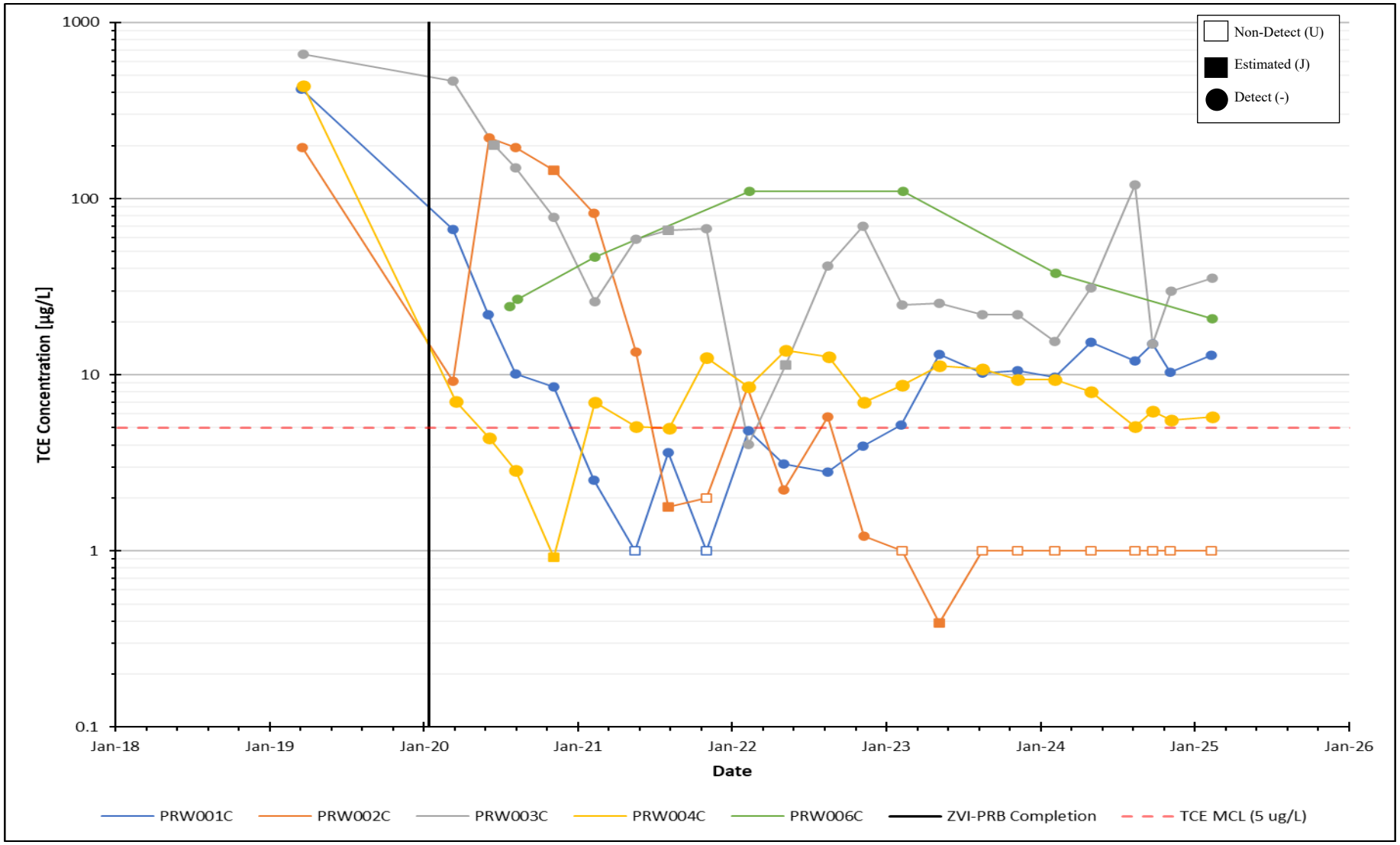


Figure 15. Time-Series Plot for TCE at LAZ Monitoring Wells of the PAGW OU NTC RA EMP

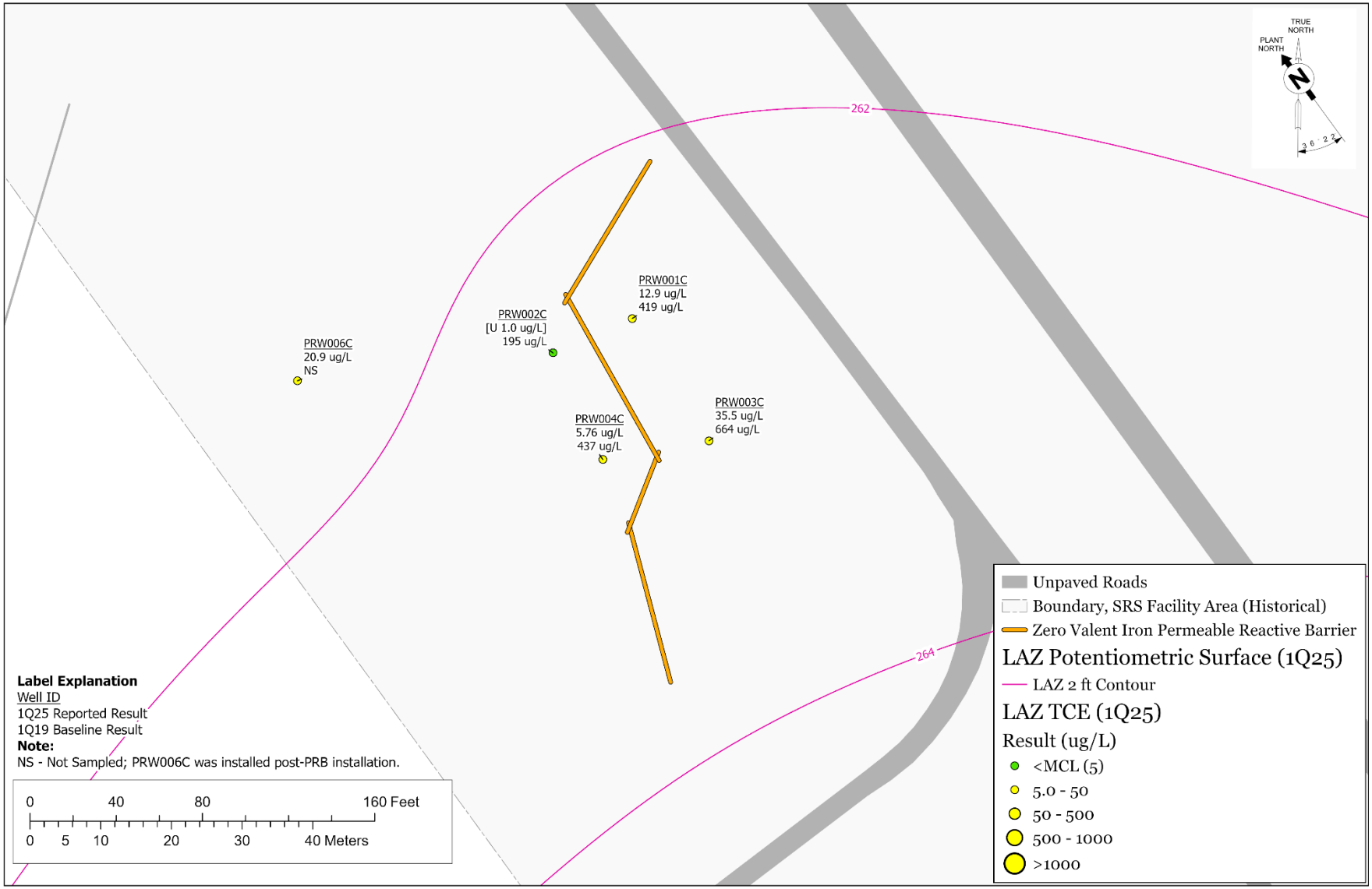


Figure 16. TCE Results for ZVI-PRB LAZ Monitoring Wells Sampled in 1Q25

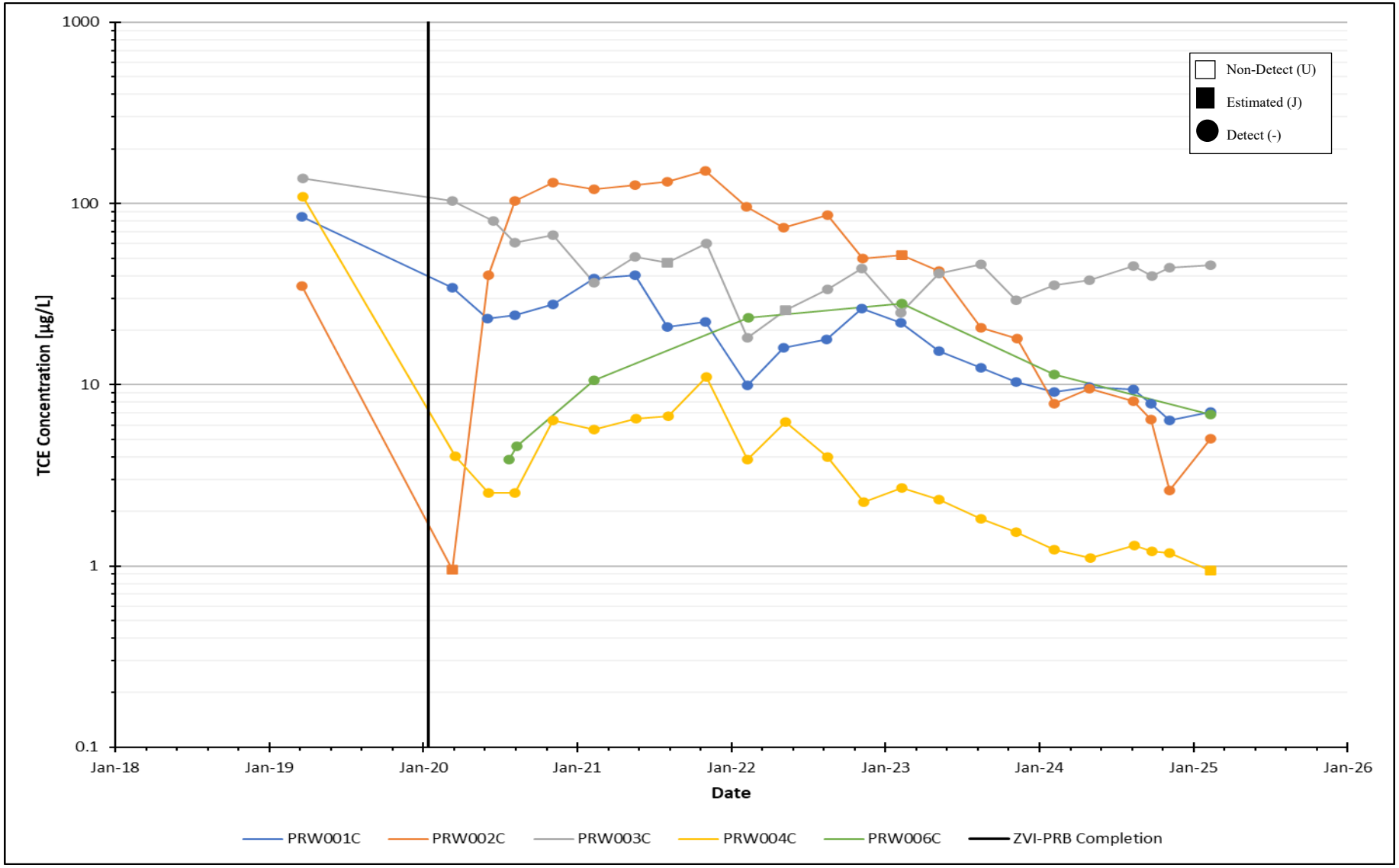


Figure 17. Cis-DCE Concentration Over Time for LAZ Monitoring Wells

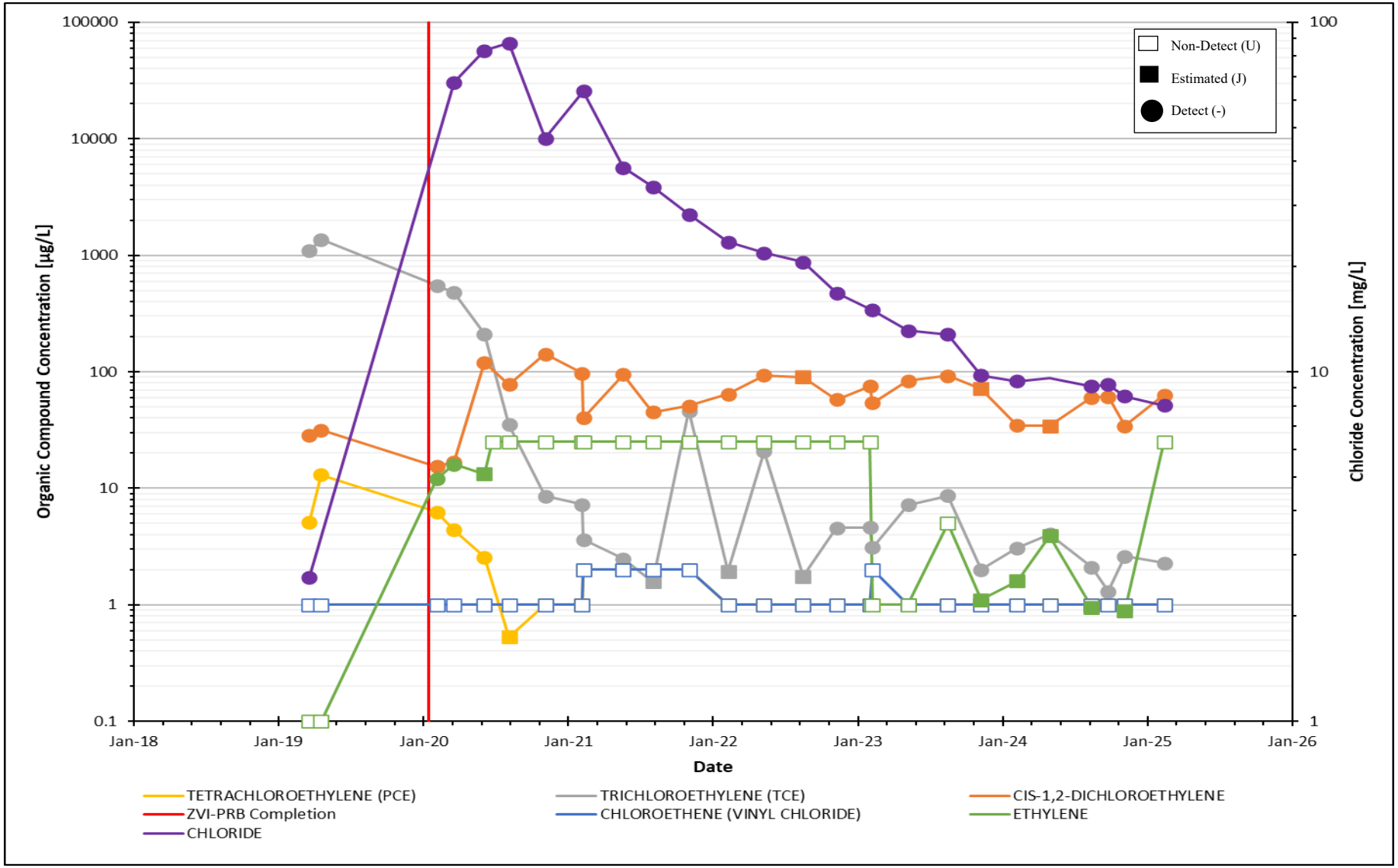


Figure 18. CVOC Degradation at P002U

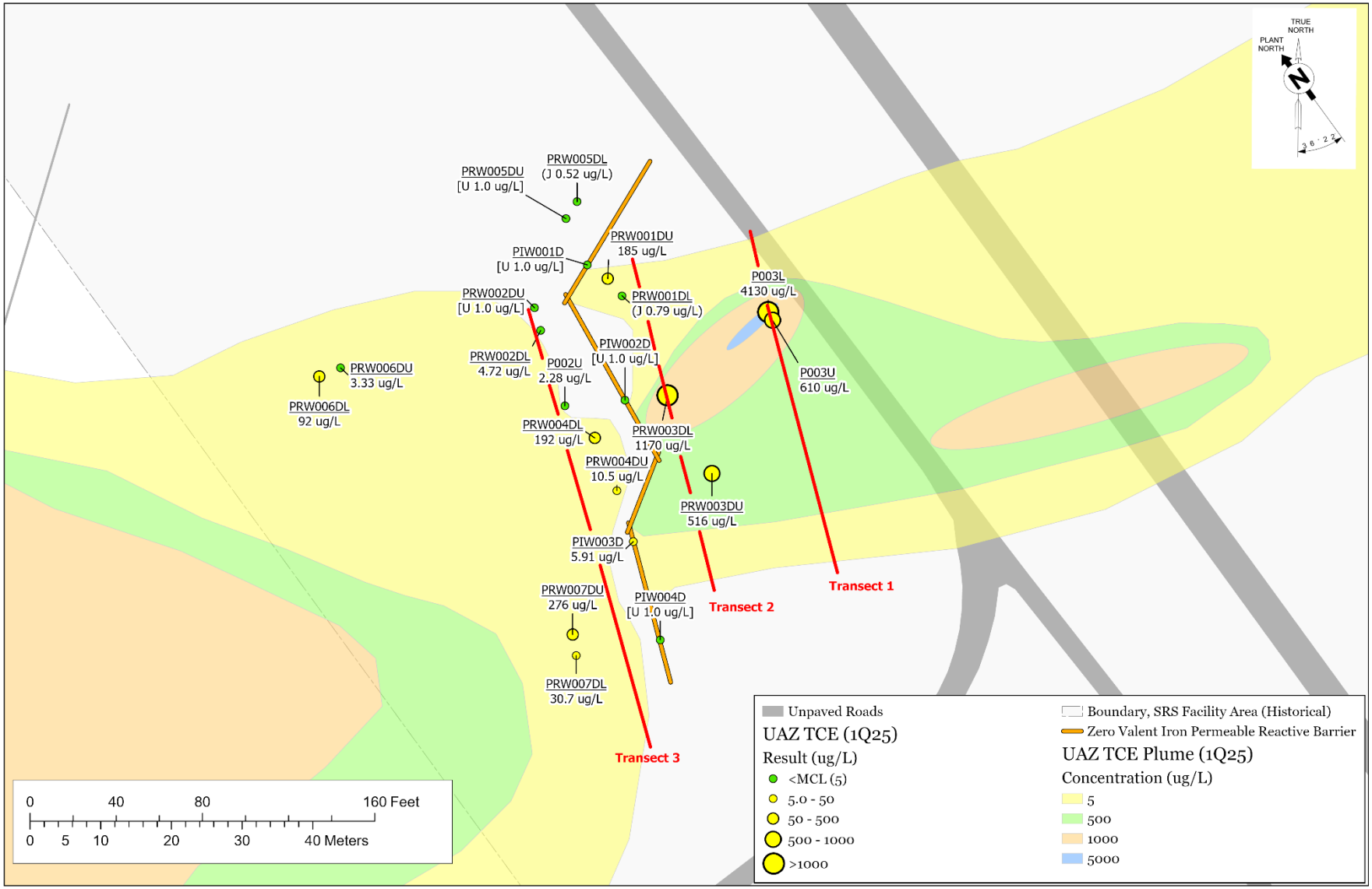


Figure 19. Mass Flux Transect Map of the PAGW OU UAZ TCE Plume (1Q25 Data)

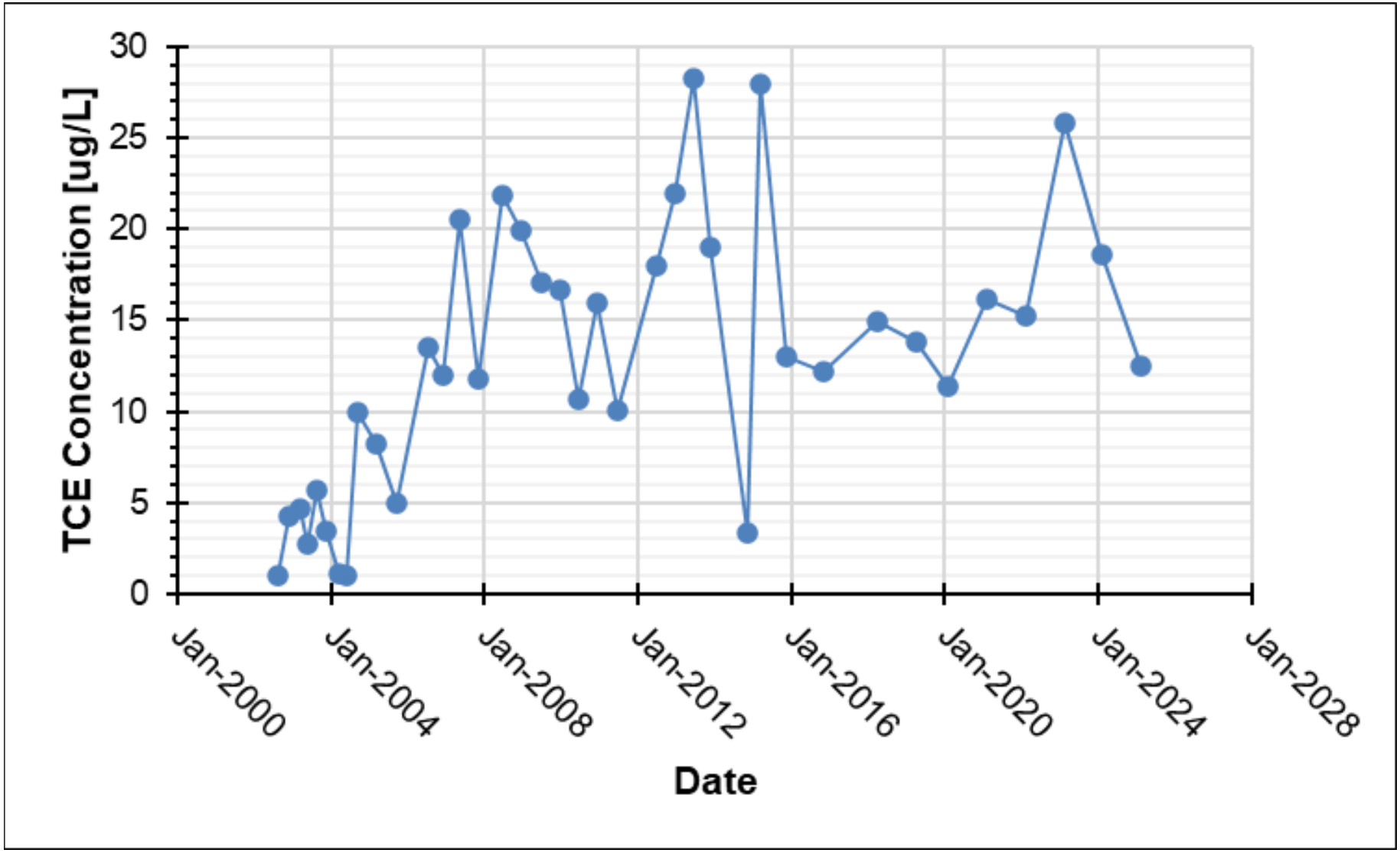


Figure 20. Steel Creek Station SC-03 TCE Concentration

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Table 1. Maximum Concentrations of PCE, TCE, and cis-DCE in the Three Plume Areas

Contaminant	MCL *[µg/L]*	Sample Event	Maximum Concentration in UAZ *[µg/L]*			Maximum Concentration in LAZ *[µg/L]*		
			Source Area	Neck Area	Distal Area	Source Area	Neck Area	Distal Area
PCE	5	1Q19	80.6	13.0	1.32	4.85	1.77	17
		1Q25	350	3.70	14.3	3.99	ND [1.0]	9.61
TCE	5	1Q19	2,150	7,730	6,320	5,180	(791)	5,560
		1Q25	5,540	1,170	5,010	4,250	35.5	6,660
cis-DCE	70	1Q19	195	892	(300)	69.0	138	168
		1Q25	489	147	185	74.1	45.5	170

MCL – maximum contaminant level
ND – no detections; practical quantitation limit in brackets.
Parentheses indicate estimated values (J-qualified data).

Table 2. Effectiveness Monitoring Plan Well Details

Station ID	Role/ Location	EMP Analytes	Sampling Frequency	Aquifer Zone	UTM NAD27 Coordinates		Screen Interval *[ft bgs]*
					Northing	Easting	
PRW001DU	East/ Upgradient	1	Quarterly	UAZ	445596.3162	3676631.902	81.64 – 91.64
PRW001DL	East/ Upgradient	1	Quarterly	UAZ	445598.3731	3676629.427	109.78 – 119.67
PRW001C	East/ Upgradient	1	Quarterly	LAZ	445599.9071	3676626.031	146 – 156
PRW002DU	West/ Downgradient	1	Quarterly	UAZ	445585.9390	3676627.649	80.66 – 90.66
PRW002DL	West/ Downgradient	1	Quarterly	UAZ	445586.9572	3676624.563	107.21 – 117.21
PRW002C	West/ Downgradient	1	Quarterly	LAZ	445588.4929	3676621.475	148.06 – 158.06
PRW003DU	East/ Upgradient	1	Quarterly	UAZ	445611.1735	3676604.102	61.82 – 71.82
PRW003DL	East/ Upgradient	1	Quarterly	UAZ	445604.7647	3676615.225	94.85 – 104.85
PRW003C	East/ Upgradient	1	Quarterly	LAZ	445610.6833	3676609.033	136.58 – 146.58
PRW004DU	West/ Downgradient	1	Quarterly	UAZ	445597.7006	3676601.714	64.91 – 74.91
PRW004DL	West/ Downgradient	1	Quarterly	UAZ	445594.6377	3676609.430	111.45 – 121.45
PRW004C	West/ Downgradient	1	Quarterly	LAZ	445595.6558	3676606.345	144.38 – 154.38
PRW005DU	West/ Downgradient	1	Quarterly	UAZ	445590.1508	3676640.252	86 – 96
PRW005DL	West/ Downgradient	1	Quarterly	UAZ	445591.9763	3676642.705	108 – 118
PRW006DU	West/ Downgradient	1	Annually	UAZ	445558.1963	3676619.181	90 – 100
PRW006DL	West/ Downgradient	1	Annually	UAZ	445555.3423	3676617.965	120 – 130
PRW006C	West/ Downgradient	1	Annually	LAZ	445552.4918	3676617.365	160 – 170
PRW007DU	West/ Downgradient	1	Quarterly	UAZ	445591.1164	3676581.425	65 – 75
PRW007DL	West/ Downgradient	1	Quarterly	UAZ	445591.8774	3676578.649	100 – 110
P002U	West/ Downgradient	1	Quarterly	UAZ	445590.2617	3676613.766	87.5 – 92.5
P003U	Background	1	Quarterly	UAZ	445619.5780	3676625.921	84.3 – 89.3
P003L	Background	1	Quarterly	UAZ	445619.0672	3676627.156	113.6 – 118.6
PIW001D	In Wall	1, 2	Quarterly	UAZ	445593.7400	3676634.072	90 – 110
PIW002D	In Wall	1, 2	Quarterly	UAZ	445599.0687	3676614.949	85 – 105
PIW003D	In Wall	1, 2	Quarterly	UAZ	445600.2528	3676595.233	70 – 90
PIW004D	In Wall	1, 2	Quarterly	UAZ	445604.3150	3676581.044	60 – 80

ft bgs – feet below ground surface

1 Volatile Organic Compounds: tetrachloroethylene (PCE), trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-DCE), trans-1,2-dichloroethylene (trans-DCE), chloroethene (vinyl chloride [VC]), and 1,1-dichloroethylene (1,1-DCE)

2 Geochemical Analyses: Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Total Dissolved Solids (TDS), alkalinity, chloride, nitrate-nitrite as nitrogen, sulfate, sulfide, methane, ethane, ethylene, phosphate, calcium, iron, ferrous iron (Fe^{2+}), ferric iron (Fe^{3+}), potassium, manganese, magnesium, sodium

Table 3. Baseline Concentrations for cVOCs and Geochemical Analytes

		UAZ		LAZ	
Analyte	Units	Range	Location of Maximum	Range	Location of Maximum
PCE	µg/L	0.34 – 5.15	P002U	0.65 – 1.60	PRW002C
TCE	µg/L	0.96 – 7610	P003L	195 – 664	PRW003C
cis-DCE	µg/L	0.45 – 892	P003L	35.0 – 138	PRW003C
trans-DCE	µg/L	0.54 – 15.3	P003L	1.08 – 2.84	PRW003C
1,1-DCE	µg/L	1.96[A]	P003L	ND (1.0)[B]	
VC	µg/L	1.10[A]	P003L	ND (1.0)[B]	
Alkalinity	mg/L	2.00 – 38.4	PRW004DL	6.00 – 40.8	PRW001C
Calcium	µg/L	536 – 4810	PRW001DL	804 – 13500	PRW001C
Chloride	mg/L	2.11 – 3.64	PRW002DU	2.20 – 3.03	PRW003C
DOC	µg/L	461 – 683	P002U	410 – 531	PRW002C
Ethane	µg/L	0.12 – 0.17	P003L	0.12 – 0.14	PRW002C
Ethylene	µg/L	0.11 – 0.55	PRW003DU	0.15 – 0.25	PRW002C
Ferric Iron	µg/L	ND (500)[B]		ND (500)[B]	
Ferrous Iron	µg/L	870[A]	PRW004DU	ND (500)[B]	
Total Iron	µg/L	104 – 852	P003L	80.1 – 496	PRW002C
Magnesium	µg/L	341 – 1360	PRW003DU	237 – 312	PRW003C
Manganese	µg/L	4.72 – 174	PRW004DU	55.1 – 262	PRW002C
Methane	µg/L	0.93 – 2400	PRW003DU	0.64 – 2.0	PRW002C
Nitrate	mg/L	0.217 – 2.82	PRW003DU	0.448 – 0.856	PRW003C
Phosphate	µg/L	45 – 89	PRW002DL	76 – 97	PRW002C
Potassium	µg/L	255 – 16800	PRW004DL	929 – 2810	PRW001C
Sodium	mg/L	2.00 – 14.4	PRW001DL	3.37 – 9.88	PRW004C
Sulfate	µg/L	533 – 13,400	PRW001DL	828 – 8,120	PRW003C
TDS	µg/L	4,290 – 65,700	PRW004DU	18,600 – 111,000	PRW001C
TOC	µg/L	362 – 595	PRW004DU	354 – 463	PRW001C

[A] Only one detection above the method detection limit (MDL)

[B] All results were non-detect; practical quantitation limit (PQL) in parenthesis

Reported baseline values are from the following monitoring wells:

- UAZ: P002U, P003U, P003L, PRW001DU, PRW001DL, PRW002DU, PRW002DL, PRW003DU, PRW003DL, PRW004DU, PRW004DL
- LAZ: PRW001C, PRW002C, PRW003C, PRW004C

Table 4. Baseline Concentration Comparison with Most Recent Results for UAZ (1Q25)

		East of ZVI-PRB [A]		West of ZVI-PRB [A]		In-Wall [A]
Analyte	Units	Baseline	1Q25	Baseline	1Q25	1Q25
PCE	µg/L	0.34 – 1.43	3.70 [B]	0.70 – 5.15	1.00 – 2.93	ND (1) [C]
TCE	µg/L	1.65 – 686	0.79 – 1,170	0.96 – 1,090	0.52 – 276	5.91 [B]
cis-DCE	µg/L	0.45 – 47.5	0.44 – 147	2.08 – 28.4	0.70 – 63.3	60.6 [B]
trans-DCE	µg/L	0.57 [B]	ND (20) [C]	0.54 [B]	ND (5) [C]	ND (1) [C]
1,1-DCE	µg/L	ND (1) [C]	ND (20) [C]	ND (1) [C]	ND (5) [C]	ND (1) [C]
VC	µg/L	ND (1) [C]	ND (20) [C]	ND (1) [C]	ND (5) [C]	1.27 [B]
Alkalinity	mg/L	5.80 – 37	2.9 – 113	2.20 – 38.4	1.7 – 60	91.8 – 160
Calcium	µg/L	1,190 – 4,810	NS [D]	850 – 2,230	NS [D]	37,800 – 69,700
Chloride	mg/L	2.82 – 3.18	2.62 – 48.9	2.11 – 3.64	2.35 – 27.6	8.85 – 22.6
DO	mg/L	4.59 – 7.53	1.1 – 3.1	2.75 – 9.24	0.3 – 10.4	0.5 – 1.2
DOC	µg/L	460 – 640	2,300 – 6,540	490 – 680	386 – 7,830	14,000 – 25,200
Ethane	µg/L	0.12 [B]	29.9 [B]	ND (0.1) [C]	27.0 – 65.7	18.5 – 130
Ethylene	µg/L	0.55 [B]	ND (25) [C]	0.11 [B]	ND (25)	49.3 [B]
Ferric Iron	µg/L	ND (50) [C]	NS [D]	ND (50) [C]	NS [D]	ND (100) [C]
Ferrous Iron	µg/L	ND (50) [C]	NS [D]	870 [B]	NS [D]	ND (50) [C]
Total Iron	µg/L	53.3 – 178	NS [D]	148 – 741	1,510 – 14,800	45.0 – 69.5
Magnesium	µg/L	341 – 1,360	NS [D]	376 – 1,070	NS [D]	11.2 – 258
Manganese	µg/L	9.10 – 24.1	NS [D]	5.07 – 174	NS [D]	1.11 – 43.8
Methane	µg/L	0.93 – 2,400	2,820 – 17,800	1.90 – 600	79.6 – 12,700	1,980 – 10,900
Nitrate	mg/L	0.22 – 2.82	NS [D]	0.28 – 2.60	NS [D]	ND (0.25) [C]
ORP	mV	177 – 334	-72 – 118	124 – 388	-81 – 237	-315 – -279
Phosphate	µg/L	50 – 70	NS [D]	40 – 90	NS [D]	ND (50) [C]
Potassium	µg/L	255 – 11,000	NS [D]	556 – 16,800	NS [D]	660 – 1,360
Sodium	mg/L	2.63 – 14.4	NS [D]	3.24 – 12.2	NS [D]	4.70 – 9.64
Sulfate	mg/L	0.53 – 13.4	NS [D]	0.59 – 6.22	NS [D]	0.311 – 1.54
TDS	µg/L	40,000 – 47,100	NS [D]	4,290 – 65,700	NS [D]	166,000 – 296,000
TOC	µg/L	360 – 530	540 – 5,510	380 – 600	524 – 7,380	15,600 – 30,700

[A] Wells included in each set are:

East of ZVI-PRB: PRW001DU, PRW001DL, PRW003DU, PRW003DL
West of ZVI-PRB: P002U, PRW002DU, PRW002DL, PRW004DU, PRW004DL (Baseline and 1Q25)
PRW005DU, PRW005DL, PRW006DU, PRW006DL, PRW007DU, PRW007DL (1Q25 Only)
In-Wall: PIW001D, PIW002D, PIW003D, PIW004D

[B] Only one value reported above method detection limit (MDL).

[C] No detections; Maximum practical quantitation limit (PQL) reported in parenthesis.

[D] Not sampled.

Table 5. Baseline Concentration Comparison with Most Recent Results for LAZ (1Q25)

Analyte	Units	East of ZVI-PRB [A]		West of ZVI-PRB [A]	
		Baseline	1Q25	Baseline	1Q25
PCE	µg/L	0.65 – 1.15	ND (1) [B]	0.86 – 1.6	ND (1) [B]
TCE	µg/L	419 – 664	12.9 – 35.5	195 – 437	5.76 – 20.9
cis-DCE	µg/L	84.1 – 138	7.11 – 45.5	35.0 – 109	0.94 – 6.87
trans-DCE	µg/L	2.13 – 2.84	0.95 [C]	1.08 – 2.63	ND (1) [B]
1,1-DCE	µg/L	ND (1) [B]	ND (1) [B]	ND (1) [B]	ND (1) [B]
VC	µg/L	ND (1) [B]	ND (1) [B]	ND (1) [B]	ND (1) [B]
Alkalinity	mg/L	9.6 – 40.8	26.1 – 41.8	3.0 – 6.8	1.9 – 33.9
Chloride	mg/L	2.20 – 3.03	7.68 – 10.4	2.32 – 2.39	11.2 – 32.7
DO	mg/L	4.25 – 4.82	0.6 – 1.5	3.55 – 5.70	1.60 – 2.10
DOC	µg/L	410 – 426	2,540 – 14,400	480 – 531	3,200 – 14,500
Ethane	µg/L	0.12 [C]	90.1 – 483	0.14 [C]	20.1 – 285
Ethylene	µg/L	0.15 – 0.18	120 [C]	0.25 [C]	ND (25) [B]
Total Iron	µg/L	80.1 – 188	NS [D]	361 – 496	839 – 18,100
Methane	µg/L	0.64 – 1.7	4,370 – 6,310	2.0 [C]	179 – 8,510
ORP	mV	290 – 294	-202 – -150	181 – 230	-104 – 192
TOC	µg/L	382 – 463	620 – 13,900	350 – 430	1,140 – 13,400

[A] Wells included in each set are:
East of ZVI-PRB: PRW001C and PRW003C (Baseline and 1Q25)
West of ZVI-PRB: PRW002C, PRW004C (Baseline and 1Q25)
PRW006C (1Q25 Only)

[B] No detections; Maximum practical quantitation limit (PQL) reported in parenthesis.

[C] Only one value reported above method detection limit (MDL).

[D] Not sampled.

Table 6. Mass Flux Calculation Results

Transect	Distance from Source (ft) [A]	TCE Mass Flux (kg/yr) [B]	TCE Mass Flux Reduction (%) [C]
Transect 1 - Background	580	47.9	-
Transect 2 - Upgradient	625	43.0	10.2%
Transect 3 - Downgradient	675	5.60	88.3%

A Distance from PSA-3A.

B TCE mass flux calculated by multiplying the cross-sectional area of the plume transect by groundwater flow velocity and geometric mean TCE groundwater concentrations across the transect using 1Q25 plume delineations and well data.

C Percent TCE mass flux reduction compared to background mass flux (Transect 1).

ft - feet

kg/yr - kilogram per year

% - percent

APPENDIX A

PAGW OU RA EMR Analytical Data 2024-2025

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Table A. PAGW OU RA EMR Monitoring Well Data 2Q24 - 1Q25

			Field Data																														VOC					
			SAMPLE COLLECTION DATE	AIR TEMPERATURE	FLOW RATE	OXIDATION/REDUCTION POTENTIAL	OXYGEN	PH	SPECIFIC CONDUCTANCE	TURBIDITY	WATER TEMPERATURE	DEPTH TO WATER	SYNCHRONOUS MEASUREMENT DATE	SYNCHRONOUS WATER ELEVATION	SAMPLING EVENT WATER ELEVATION	Constituent	FIELD CONDITIONS	CALCIUM	CHLORIDE	DISSOLVED ORGANIC CARBON	ETHANE	ETHYLENE	FERRIC IRON	FERROUS IRON	IRON	MAGNESIUM	MANGANESE	METHANE	NITRATE-NITRITE AS NITROGEN	POTASSIUM	SODIUM	SULFATE	SULFIDE	TOTAL ALKALINITY (AS CACO3)	TOTAL DISSOLVED SOLIDS	TOTAL ORGANIC CARBON	TOTAL PHOSPHATES (AS P)	1,1-DICHLOROETHYLENE	CHLOROETHENE (VINYL CHLORIDE)	CIS-1,2-DICHLOROETHYLENE	TETRACHLOROETHYLENE (PCE)	TRANS-1,2-DICHLOROETHYLENE	TRICHLOROETHYLENE (TCE)
			day-month-yea	degC	gal/min	mV	mg/L	umiless	uS/cm	NTU	degC	ft	day-month-yea	ft	ft			ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Station	**Well Use**	**Aquifer Zone**						12								**GWPS**								14000		430		10									7	2	70	5	100	5
P002U	Monitoring Well	UAZ_UTRAU	30-Apr-2024	24	0.2	-77.3	7.03	6.5	107	7	20.7	0.1	NS	NS	313.41		No Comments	NS	[9.58]	7750	42.9	[3.9]	NS	NS	10200	NS	NS	6550	NS	NS	NS	NS	NS	NS	NS	7520	NS	<EQL (1)	<EQL (1)	[34.4]	<EQL (1)	<EQL (1)	4.03
			12-Aug-2024	24	0.1	-36	9.9	5.9	105	4.9	21.3	0	NS	NS	313.51		No Comments	NS	9.1	NS	5.6	[0.95]	NS	NS	11000	NS	NS	628	NS	NS	NS	NS	NS	NS	NS	6800	NS	<EQL (1)	<EQL (1)	60	<EQL (1)	<EQL (1)	2.1
			23-Sep-2024	22	0.1	-26	10.18	5.9	103	6.3	20.7	40	NS	NS	273.51		No Comments	NS	9.2	6400	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	6600	NS	<EQL (1)	<EQL (1)	61	<EQL (1)	<EQL (1)	1.3
			04-Nov-2024	16	0.1	-58	9.3	6.3	105	4.2	20.1	0	NS	NS	313.51		No Comments	NS	8.5	6860	[5.9]	[0.89]	NS	NS	10900	NS	NS	[522]	NS	NS	NS	NS	NS	15	NS	6410	NS	<EQL (1)	<EQL (1)	34.4	<EQL (1)	<EQL (1)	2.61
			12-Feb-2025	6	0.1	-62	10.4	6	102	3.1	18.3	0	NS	NS	313.51		No Comments	NS	8.01	6870	[12]	<EQL (25)	NS	NS	10700	NS	NS	2150	NS	NS	NS	NS	NS	21	NS	6910	NS	<EQL (1)	<EQL (1)	63.3	<EQL (1)	<EQL (1)	2.28
P003L	Monitoring Well	UAZ_UTRAU	30-Apr-2024	16	0.1	256	3.6	4.4	25	3.8	18.5	0	NS	NS	312.7		No Comments	NS	2.31	<EQL (1000)	<EQL (5)	[1]	NS	NS	NS	NS	NS	[6.5]	NS	NS	NS	NS	NS	NS	NS	<EQL (1000)	NS	<EQL (100)	<EQL (100)	508	<EQL (100)	<EQL (100)	4890
			12-Aug-2024	26	0.1	150	6.1	4.9	27	4.1	14.1	0	NS	NS	312.7		No Comments	NS	[2.5]	NS	<EQL (1.8)	<EQL (1.6)	NS	NS	NS	NS	NS	[4.1]	NS	NS	NS	NS	NS	NS	NS	[430]	NS	<EQL (50)	<EQL (50)	530	<EQL (50)	<EQL (50)	4800
			24-Sep-2024	23	0.1	204	11.7	4.7	24	15	21	0	NS	NS	312.7		No Comments	NS	[2.5]	1400	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	[910]	NS	<EQL (50)	<EQL (50)	370	<EQL (50)	<EQL (50)	3100
			04-Nov-2024	20	0.1	260	11.2	4.7	22	6	20.6	0	NS	NS	312.7		No Comments	NS	2.18	<EQL (1000)	REJ	[0.88]	NS	NS	NS	NS	NS	REJ	NS	NS	NS	NS	NS	2.7	NS	<EQL (1000)	NS	[0.47]	<EQL (1)	436	<EQL (1)	[5.07]	3360
			12-Feb-2025	7	0.1	223	11.4	4.8	23	7.3	18.7	0	NS	NS	312.7		No Comments	NS	2.16	[498]	<EQL (25)	<EQL (25)	NS	NS	NS	NS	NS	<EQL (25)	NS	NS	NS	NS	NS	2.7	NS	<EQL (1000)	NS	<EQL (50)	<EQL (50)	457	<EQL (50)	<EQL (50)	4130
P003U	Monitoring Well	UAZ_UTRAU	30-Apr-2024	20	0.1	286	10	4.7	35	2.5	19.7	0	NS	NS	312.74		No Comments	NS	2.99	<EQL (1000)	<EQL (5)	[0.82]	NS	NS	NS	NS	NS	[5.6]	NS	NS	NS	NS	NS	NS	NS	<EQL (1000)	NS	<EQL (10)	<EQL (10)	[8.7]	<EQL (10)	<EQL (10)	380
			12-Aug-2024	27	0.1	245	7.9	4.9	35	4	23	0	NS	NS	312.74		No Comments	NS	3	NS	<EQL (1.8)	<EQL (1.6)	NS	NS	NS	NS	NS	12.1	NS	NS	NS	NS	NS	NS	NS	[430]	NS	<EQL (4)	<EQL (4)	12	[2.1]	<EQL (4)	580
			24-Sep-2024	24	0.1	227	10.8	5	38	4.9	21	0	NS	NS	312.74		No Comments	NS	<EQL (3)	1600	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	[840]	NS	<EQL (1)	<EQL (1)	11	1.9	<EQL (1)	560
			04-Nov-2024	21	0.1	256	10.2	4.8	35	2.1	20.7	0	NS	NS	312.74		No Comments	NS	2.81	<EQL (1000)	REJ	[0.97]	NS	NS	NS	NS	NS	[16.6]	NS	NS	NS	NS	NS	[1.3]	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	11.2	1.82	<EQL (1)	397
			12-Feb-2025	8	0.1	306	9.6	4.5	36	0.7	18.6	0	NS	NS	312.74		No Comments	NS	2.65	[343]	<EQL (25)	<EQL (25)	NS	NS	NS	NS	NS	97.9	NS	NS	NS	NS	NS	[0.8]	NS	<EQL (1000)	NS	<EQL (10)	<EQL (10)	[9.3]	<EQL (10)	<EQL (10)	610
PIW001D	Monitoring Well	UAZ_UTRAU	30-Apr-2024	18	0.1	-345	0.6	10.7	408	2.2	20.7	38.8	03-Jul-2024	273.53	274.24		No Comments	57000	16.3	17400	17	[1.7]	<EQL (100)	<EQL (50)	[46.1]	83.4	[1.67]	2530	<EQL (0.25)	1610	6.63	0.592	<EQL (0.1)	135	209000	18100	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			13-Aug-2024	24	0.1	-338	0.8	11	410	1.1	23.8	39	03-Jul-2024	273.53	274.04		No Comments	50000	16	NS	9.6	<EQL (1.6)	REJ	<EQL (50)	[35]	[100]	3.3	[942]	<EQL (0.1)	1700	5.8	<EQL (5)	<EQL (4)	120	210000	18000	110	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			23-Sep-2024	28	0.44	-315	0.4	10.6	283	1.1	25	39.02	03-Jul-2024	273.53	274.02		No Comments	NS	13	16000	NS	NS	NS	NS	NS	NS	NS	NS	<EQL (0.1)	NS	NS	[1]	<EQL (4)	84	150000	21000	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			04-Nov-2024	18	0.1	-287	0.7	10.6	228	0.8	22	39.1	03-Jul-2024	273.53	273.94		No Comments	34300	12	15400	[14.2]	[1.1]	REJ	<EQL (50)	[64.5]	322	66.2	[1390]	<EQL (0.25)	1290	7.84	[0.276]	<EQL (0.1)	89.3	139000	14600	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			10-Feb-2025	14	0.1	-303	0.9	10.2	255	0.5	19.4	39.05	07-Jan-2025	273.74	273.99		No Comments	39000	12	14000	[18.5]	<EQL (25)	<EQL (100)	<EQL (50)	[45]	258	43.8	3550	<EQL (0.25)	1240	6.97	[0.311]	<EQL (0.1)	106	166000	15600	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
PIW002D	Monitoring Well	UAZ_UTRAU	30-Apr-2024	21	0.1	-341.9	0.6	11	541	1.3	21.2	85.1	03-Jul-2024	273.72	229.24		No Comments	61600	19.7	30300	26.5	[1.7]	<EQL (100)	65	147	[19.9]	[3.79]	1460	<EQL (0.25)	1220	13.8	1.23	<EQL (0.1)	137	233000	30700	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			13-Aug-2024	26	0.1	-315	0.5	11	491	1	23	40.43	03-Jul-2024	273.72	273.91		No Comments	54000	19	NS	17.2	[1.3]	REJ	<EQL (50)	[31]	[21]	[0.79]	[809]	<EQL (0.1)	1200	12	[1.6]	<EQL (4)	130	210000	29000	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			23-Sep-2024	25	0.1	-319	0.39	10.8	544	1.4	22.5	40.3	03-Jul-2024	273.72	274.04		No Comments	NS	20	29000	NS	NS	NS	NS	NS	NS	NS	NS	<EQL (0.1)	NS	NS	[1.6]	<EQL (4)	110	230000	35000	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			04-Nov-2024	21	0.1	-317	0.4	10.9	513	0.5	22	40.53	03-Jul-2024	273.72	273.81		No Comments	58800	17.2	31500	[19.7]	[1.4]	REJ	<EQL (50)	[48.8]	[25.3]	[1.23]	[867]	<EQL (0.25)	1080	11.8	1.16	<EQL (0.1)	127	201000	34300	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			10-Feb-2025	15	0.1	-279	1.1	10.5	527	1.1	19.1	40.6	07-Jan-2025	273.95	273.74		No Comments	61200	16.1	24000	29.5	<EQL (25)	<EQL (100)	<EQL (50)	<EQL (100)	[13.5]	<EQL (5)	3740	<EQL (0.25)	1000	9.64	1.54	<EQL (0.1)	134	237000	29200	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
PIW003D	Monitoring Well	UAZ_UTRAU	30-Apr-2024	22	0.1	-334	0.7	10.8	317	1.1	21.3	84.12	03-Jul-2024	275.07	231.31		No Comments	36800	9.48	18300	60.6	20	150	<EQL (50)	160	73.8	12.2	3880	<EQL (0.25)	689	5.21	32.7	<EQL (0.1)	79.6	140000	18500	<EQL (50)	<EQL (1)	<EQL (1)	17.3	<EQL (1)	<EQL (1)	1.39
			13-Aug-2024	27	0.1	-317	1.9	10.7	260	1.5	23.5	42.61	03-Jul-2024	275.07	272.82		No Comments	36000	9.4	NS	103	61.4	REJ	<EQL (50)	[98]	[51]	6.7	[5610]	<EQL (0.1)	[590]	4	[4]	<EQL (4)	75	150000	19000	<EQL (50)	[0.24]	<EQL (1)	100	<EQL (1)	<EQL (1)	10
			23-Sep-2024	23	0.1	-259	1.03	10.1	314	1.5	21.5	40.98	03-Jul-2024	275.07	274.45		No Comments	NS	11	19000	NS	NS	NS	NS	NS	NS	NS	NS	<EQL (0.1)	NS	NS	[1.2]	<EQL (4)	83	150000	25000	<EQL (50)	<EQL (1)	<EQL (1)	73	<EQL (1)	<EQL (1)	7.1
			04-Nov-2024	24	0.1	-125	8.5	10.7	274	0.7	24	42.2	03-Jul-2024	275.07	273.23		No Comments	37300	8.76	18800	[19.3]	[12.9]	REJ	<EQL (50)	[81]	205	[4.15]	[796]	<EQL (0.25)	704	4.73	[0.389]	<EQL (0.1)	92.1	138000	19800	<EQL (50)	<EQL (1)	<EQL (1)	40.6	<EQL (1)	<EQL (1)	4.13
			10-Feb-2025	15	0.1	-284	1.2	10.3	298	0.4	18.9	41.63	07-Jan-2025	273.99	273.8		No Comments	37800	8.85	16800	130	49.3	<EQL (100)	<EQL (50)	[69.5]	62	[2.27]	10900	<EQL (0.25)	660	4.7	0.429	<EQL (0.1)	91.8	175000	19400	<EQL (50)	<EQL (1)	1.27	60.6	<EQL (1)	<EQL (1)	5.91
PIW004D	Monitoring Well	UAZ_UTRAU	30-Apr-2024	25	0.1	-334.7	1.4	10.8	399	2.4	21.9	42.1	03-Jul-2024	274.02	274.81		No Comments	66400	[18.5]	22500	10.7	[2.5]	<EQL (100)	<EQL (50)	148	<EQL (30)	[4.3]	634	<EQL (0.25)	1290	6.08	0.494	<EQL (0.1)	138	253000	22900	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			13-Aug-2024	29	0.1	-327	1.4	11	475	2.1	23	42.61	03-Jul-2024	274.02	274.3		No Comments	77000	26	NS	7.9	2	REJ	100	[58]	[9.2]	[1.8]	[441]	<EQL (0.1)	1200	5.2	<EQL (5)	<EQL (4)	160	300000	30000	<EQL (50)	<EQL (1)	<EQL (1)	[0.6]	<EQL (1)	<EQL (1)	<EQL (1)
			23-Sep-2024	24	0.1	-277	2.09	10.6	552	2.5	22	42.56	03-Jul-2024	274.02	274.35		No Comments	NS	26	31000	NS	NS	NS	NS	NS	NS	NS	NS	<EQL (0.1)	NS	NS	<EQL (5)	<EQL (4)	150	320000	26000	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			04-Nov-2024	22	0.1	-325	0.5	10.8	484	0.8	23	42.1	03-Jul-2024	274.02	274.81		No Comments	69300	21.3	29500	[11.6]	[3.2]	REJ	<EQL (50)	[37.6]	[10.9]	<EQL (5)	[616]	<EQL (0.25)	1420	6.55	0.476	<EQL (0.1)	162	261000	30700	[20]	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			10-Feb-2025	16	0.1	-315	0.5	10.5	589	0.6	19	43	07-Jan-2025	274.18	273.91		No Comments	69700	22.6	25200	[20.4]	<EQL (25)	<EQL (100)	<EQL (50)	<EQL (100)	[11.2]	[1.11]	1980	<EQL (0.25)	1360	7.08	0.537	<EQL (0.1)	160	296000	30700	<EQL (50)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
PRW001C	Monitoring Well	LAZ_UTRAU	30-Apr-2024	15	0.2	-262	1.15	10.6	289	8.8	20.2	50.87	03-Jul-2024	262.28	262.43		No Comments	NS	11.2	14400	612	217	NS	NS	NS	NS	NS	3930	NS	NS	NS	NS	NS	NS	NS	15000	NS	<EQL (1)	<EQL (1)	9.73	<EQL (1)	<EQL (1)	15.8
			12-Aug-2024	28.4	0.2	-254	1.1	10.8	205	14.8	21.9	50.86	03-Jul-2024	262.28	262.44		No Comments	NS	12	NS	330	105	NS	NS	NS	NS	NS	2100	NS	NS	NS	NS	NS	NS	NS	15000	NS	<EQL (1)	<EQL (1)	9.4	<EQL (1)	<EQL (1)	12
			23-Sep-2024	21	0.2	-142	0.7	10	247	9.1	20.9	50.6	03-Jul-2024	262.28	262.7		No Comments	NS	13	15000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	16000	NS	<EQL (1)	<EQL (1)	7.9	<EQL (1)	<EQL (1)	13
			04-Nov-2024	21.4	0.2	-175	1.1	10.3	241	14.8	21.3	50.91	03-Jul-2024	262.28	262.39		No Comments	NS	10.8	12800	[349]	[108]	NS	NS	NS	NS	NS	[1910]	NS	NS	NS	NS	NS	44.7	NS	13400	NS	<EQL (1)	<EQL (1)	6.33	<EQL (1)	<EQL (1)	10.3
			10-Feb-2025	13.2	0.2	-202	0.6	10.6	236	8	20	50.78	07-Jan-2025	262.6	262.52		No Comments	NS	10.4	14400	483	120	NS	NS	NS	NS	NS	4370	NS	NS	NS	NS	NS	41.8	NS	13900	NS	<EQL (1)	<EQL (1)	7.11	<EQL (1)	<EQL (1)	12.9
PRW001DL	Monitoring Well	UAZ_UTRAU	30-Apr-2024	17	0.2	-134	0.32	6.6	494	1.7	20.4	39.22	03-Jul-2024	272.61	273.97		No Comments	NS	58.8	6030	55.1	<EQL (25)	NS	NS	NS	NS	NS	30600	NS	NS	NS	NS	NS	NS	NS	6050	NS	<EQL (1)	<EQL (1)	[0.67]	<EQL (1)	<EQL (1)	[0.77]
			12-Aug-2024	29.4	0.2	-111	0.7	6.7	350	3.8	22.4	40.18	03-Jul-2024	272.61	273.01		No Comments	NS	57	NS	19.1	<EQL (1.6)	NS	NS	NS	NS	NS	9260	NS	NS	NS	NS	NS	NS	NS	5200	NS	<EQL (1)	<EQL (1)	[0.38]	<EQL (1)	<EQL (1)	1.2
			23-Sep-2024	23	0.2	-12	2.4	6.3	275	1.5	21	39.5	03-Jul-2024	272.61	273.69		No Comments	NS	57	6100	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	6100	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			04-Nov-2024	22	0.1	-61	0.8	6.4	450	7.6	21.4	40.21	03-Jul-2024	272.61	272.98		No Comments	NS	52.7	6050	[26.7]	[3.2]	NS	NS	NS	NS	NS	[11800]	NS	NS	NS	NS	NS	121	NS	6200	NS	<EQL (1)	<EQL (1)	[0.34]	<EQL (1)	<EQL (1)	[0.72]
			10-Feb-2025	13.9	0.2	-72	1.1	6.5	309	2	20.2	40.35	07-Jan-2025	272.94	272.84		No Comments	NS	48.9	6540	29.9	<EQL (25)	NS	NS	NS	NS	NS	17800	NS	NS	NS	NS	NS	113	NS	5510	NS	<EQL (1)	<EQL (1)	[0.44]	<EQL (1)	<EQL (1)	[0.79]
PRW001DU	Monitoring Well	UAZ_UTRAU	30-Apr-2024	19	0.2	-24	0.48	5.9	49	3.1	20.6	39.22	03-Jul-2024	273.75	273.96		No Comments	NS	6.26	1110	17.9	[3.8]	NS	NS	NS	NS	NS	5320	NS	NS	NS	NS	NS	NS	NS	1030	NS	<EQL (1)	<EQL (1)	1.01	1.46	<EQL (1)	35.6
			12-Aug-2024	30.1	0.2	49	0.8	6.1	45	2.8	21.9	39.09	03-Jul-2024	273.75	274.09		No Comments	NS	4.9	NS	2.4	<EQL (1.6)	NS	NS	NS	NS	NS	701	NS	NS	NS	NS	NS	NS	NS	1000	NS	<EQL (1)	<EQL (1)	1	2.5	<EQL (1)	78
			23-Sep-2024	24	0.2	122	1.8	5.2	41	0.9	21.1	39.05	03-Jul-2024	273.75	274.13		No Comments	NS	4.8	1600	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	[760]	NS	<EQL (1)	<EQL (1)	1.2	3	<EQL (1)	140
			04-Nov-2024	23.6	0.1	99	1.7	5.6	39	2.4	21.4	39.01	03-Jul-2024	273.75	274.17		No Comments	NS	4.23	[600]	[6.8]	[1.7]	NS	NS	NS	NS	NS	[1540]	NS	NS	NS	NS	NS	8.8	NS	[713]	NS	<EQL (1)	<EQL (1)	1.4	2.45	<EQL (1)	109
			10-Feb-2025	14.3	0.2	103	3.1	5.5	37	4.6	20.2	39.34	07-Jan-2025	274	273.84		No Comments	NS	3.72	2440	<EQL (25)	<EQL (25)	NS	NS	NS	NS	NS	2820	NS	NS	NS	NS	NS	6.9	NS	[540]	NS	<EQL (1)	<EQL (1)	1.89	3.7	<EQL (1)	185
PRW002C	Monitoring Well	LAZ_UTRAU	30-Apr-2024	14	0.2	-68.1	2.5	6.1	130	2.6	20.2	50.8	03-Jul-2024	262	262.81		No Comments	NS	13.3	[804]	490	9.5	NS	NS	17700	NS	NS	7470	NS	NS	NS	NS	NS	NS	NS	[703]	NS	<EQL (1)	<EQL (1)	9.47	<EQL (1)	<EQL (1)	<EQL (1)
			12-Aug-2024	26.1	0.2	-88	1.1	6.7	123	3	22.5	51.22	03-Jul-2024	262	262.39		No Comments	NS	15	NS	253	2.8	NS	NS	19000	NS	NS	4420	NS	NS	NS	NS	NS	NS	NS	1100	NS	<EQL (1)	<EQL (1)	8.1	<EQL (1)	<EQL (1)	<EQL (1)
			23-Sep-2024	26	0.2	-22	1.7	6	131	3.7	21.3	51.25	03-Jul-2024	262	262.36		No Comments	NS	15	1800	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1100	NS	<EQL (1)	<EQL (1)	6.4	<EQL (1)	<EQL (1)	<EQL (1)
			04-Nov-2024	19.2	0.1	-13	0.9	6.3	125	8.1	21.4	51.29	03-Jul-2024	262	262.32		No Comments	NS	14.8	1570	[226]	[13.9]	NS	NS	19200	NS	NS	[5240]	NS	NS	NS	NS	NS	32.4	NS	1550	NS	<EQL (1)	<EQL (1)	2.62	<EQL (1)	<EQL (1)	<EQL (1)
			10-Feb-2025	15.1	0.2	-19	2.1	6.3	131	1.5	19.9	51.12	07-Jan-2025	262.56	262.49		No Comments	NS	13.3	3200	285	<EQL (25)	NS	NS	18100	NS	NS	8510	NS	NS	NS	NS	NS	33.9	NS	1140	NS	<EQL (1)	<EQL (1)	5.04	<EQL (1)	<EQL (1)	<EQL (1)
PRW002DL	Monitoring Well	UAZ_UTRAU	30-Apr-2024	17	0.2	7.9	1.2	5.7	201	2.8	20.5	40.4	03-Jul-2024	272.57	273.29		No Comments	NS	26.2	2440	81.6	[1]	NS	NS	17400	NS	NS	13700	NS	NS	NS	NS	NS	NS	NS	2630	NS	<EQL (1)	<EQL (1)	5.27	<EQL (1)	<EQL (1)	6.26
			12-Aug-2024	25.9	0.2	-2.7	1.3	6	190	5.3	21.8	40.21	03-Jul-2024	272.57	273.48		No Comments	NS	30	NS	41.2	[0.9]	NS	NS	15000	NS	NS	5480	NS	NS	NS	NS	NS	NS	NS	2900	NS	<EQL (1)	<EQL (1)	5.5	<EQL (1)	<EQL (1)	7.2
			23-Sep-2024	27	0.2	30	0.3	5.6	204	3.3	21.2	40.8	03-Jul-2024	272.57	272.89		No Comments	NS	32	3200	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	3300	NS	<EQL (1)	<EQL (1)	5.7	<EQL (1)	<EQL (1)	6
			04-Nov-2024	16.2	0.1	22	1.6	5.9	211	3.4	21.2	40.78	03-Jul-2024	272.57	272.91		No Comments	NS	27.3	2950	[48]	[2.1]	NS	NS	17300	NS	NS	[5550]	NS	NS	NS	NS	NS	63.4	NS	2910	NS	<EQL (1)	<EQL (1)	4.05	<EQL (1)	<EQL (1)	5.68
			10-Feb-2025	15	0.2	34	0.8	5.9	193	1.6	20.2	41.02	07-Jan-2025	272.81	272.67		No Comments	NS	27.6	4560	63.3	<EQL (25)	NS	NS	14800	NS	NS	9930	NS	NS	NS	NS	NS	60.3	NS	2780	NS	<EQL (1)	<EQL (1)	5.59	<EQL (1)	<EQL (1)	4.72
PRW002DU	Monitoring Well	UAZ_UTRAU	30-Apr-2024	19	2	-97	0.3	6.6	69	1	20.8	39.51	03-Jul-2024	273.28	274.12		No Comments	NS	10.6	[490]	39.6	<EQL (5)	NS	NS	4520	NS	NS	13200	NS	NS	NS	NS	NS	NS	NS	[407]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			12-Aug-2024	24.2	0.2	-92	0.5	6.6	64	1.4	21.2	40.02	03-Jul-2024	273.28	273.61		No Comments	NS	9.8	NS	13.2	<EQL (1.6)	NS	NS	4000	NS	NS	4500	NS	NS	NS	NS	NS	NS	NS	[800]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			23-Sep-2024	28	0.3	-47	0.3	6.3	68	1.5	21.3	39.8	03-Jul-2024	273.28	273.83		No Comments	NS	9.6	[900]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	[960]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			04-Nov-2024	15.2	0.2	-92	0.3	6.5	69	2	20.5	39.99	03-Jul-2024	273.28	273.64		No Comments	NS	9.43	<EQL (1000)	[19.1]	[1.5]	NS	NS	4300	NS	NS	[4740]	NS	NS	NS	NS	NS	21.3	NS	[847]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			10-Feb-2025	15	0.2	-44	0.4	6.6	68	1	20	40.28	07-Jan-2025	273.53	273.35		No Comments	NS	9.39	1080	27	<EQL (25)	NS	NS	5270	NS	NS	11100	NS	NS	NS	NS	NS	27.1	NS	[764]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
PRW003C	Monitoring Well	LAZ_UTRAU	30-Apr-2024	24	0.2	-89	0.8	6.5	92	14.1	20.7	50.3	03-Jul-2024	262.31	263.11		No Comments	NS	8.01	<EQL (1000)	85.5	6.4	NS	NS	NS	NS	NS	2190	NS	NS	NS	NS	NS	NS	NS	[346]	NS	<EQL (1)	<EQL (1)	37.8	<EQL (1)	[0.65]	31.2
			12-Aug-2024

EMR for the PAGW OU ZVI-PRB RA (U) 2024-2025
Savannah River Site
April 2026

Table A. PAGW OU RA
EMR Monitoring Well Data
2Q24 - 1Q25

Station	Well Use	Aquifer Zone	Field Data: SAMPLE COLLECTION DATE (day-month-year)	AIR TEMPERATURE (degC)	FLOW RATE (gal/min)	OXIDATION/REDUCTION POTENTIAL (mV)	OXYGEN (mg/L)	PH (umitless)	SPECIFIC CONDUCTANCE (uS/cm)	TURBIDITY (NTU)	WATER TEMPERATURE (degC)	DEPTH TO WATER (ft)	SYNCHRONOUS MEASUREMENT DATE (day-month-year)	SYNCHRONOUS WATER ELEVATION (ft)	SAMPLING EVENT WATER ELEVATION (ft)	Constituent / Unit / GWPS	FIELD CONDITIONS	CALCIUM (ug/L)	CHLORIDE (mg/L)	DISSOLVED ORGANIC CARBON (ug/L)	ETHANE (ug/L)	ETHYLENE (ug/L)	FERRIC IRON (ug/L)	FERROUS IRON (ug/L)	IRON (ug/L)	MAGNESIUM (ug/L)	MANGANESE (ug/L)	METHANE (ug/L)	NITRATE-NITRITE AS NITROGEN (mg/L)	POTASSIUM (ug/L)	SODIUM (mg/L)	SULFATE (mg/L)	SULFIDE (ug/L)	TOTAL ALKALINITY (AS CACO3) (mg/L)	TOTAL DISSOLVED SOLIDS (ug/L)	TOTAL ORGANIC CARBON (ug/L)	TOTAL PHOSPHATES (AS P) (ug/L)	VOC: 1,1-DICHLOROETHYLENE (ug/L)	CHLOROETHENE (VINYL CHLORIDE) (ug/L)	CIS-1,2-DICHLOROETHYLENE (ug/L)	TETRACHLOROETHYLENE (PCE) (ug/L)	TRANS-1,2-DICHLOROETHYLENE (ug/L)	TRICHLOROETHYLENE (TCE) (ug/L)
								12								GWPS									14000		430		10									7	2	70	5	100	5
PRW004DL	Monitoring Well	UAZ_UTRAU	24-Sep-2024	27	0.1	3	0.94	5.8	201	2.9	21	41.95	03-Jul-2024	272.28	272.68		No Comments	NS	21	6500	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2600	NS	[0.57]	<EQL (1)	86	[0.66]	1.3	190
			04-Nov-2024	22.3	0.2	83	0.4	5.8	188	1.9	20.7	42	03-Jul-2024	272.28	272.63		No Comments	NS	18.1	1990	[14.1]	[1.6]	NS	NS	NS	1780	NS	NS	[453]	NS	NS	NS	NS	NS	51.5	NS	2080	NS	[0.4]	<EQL (1)	[54.6]	[0.41]	[0.84]	157
			11-Feb-2025	7.2	0.2	58	0.7	6.1	192	0.9	18.6	42.22	07-Jan-2025	272.58	272.41		No Comments	NS	17.1	3610	28.4	<EQL (25)	NS	NS	NS	3870	NS	NS	1800	NS	NS	NS	NS	NS	59.9	NS	1800	NS	<EQL (4)	<EQL (4)	58.2	<EQL (4)	<EQL (4)	192
PRW004DU	Monitoring Well	UAZ_UTRAU	01-May-2024	23	0.1	-74	1.4	5.8	55	0.9	20.4	40.8	03-Jul-2024	274.19	274.32		X	NS	2.64	[493]	53.9	[4.3]	NS	NS	NS	7340	NS	NS	11400	NS	NS	NS	NS	NS	NS	NS	[429]	NS	<EQL (1)	<EQL (1)	22.8	<EQL (1)	<EQL (1)	17.7
			13-Aug-2024	27.4	0.2	-94	0.2	6	62	3.9	21.3	40.76	03-Jul-2024	274.19	274.36		No Comments	NS	3	NS	35.4	2.6	NS	NS	NS	10000	NS	NS	[6460]	NS	NS	NS	NS	NS	NS	NS	1000	NS	<EQL (1)	<EQL (1)	28	<EQL (1)	<EQL (1)	6.5
			24-Sep-2024	25	0.2	-22	0.44	5.5	64	1.5	20.8	40.86	03-Jul-2024	274.19	274.26		No Comments	NS	[2.9]	8200	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	3200	NS	<EQL (1)	<EQL (1)	28	<EQL (1)	<EQL (1)	13
			04-Nov-2024	23.3	0.2	-38	0.3	5.6	55	9	20.8	41.42	03-Jul-2024	274.19	273.7		No Comments	NS	2.6	1190	[19.4]	[2.8]	NS	NS	NS	8970	NS	NS	[2610]	NS	NS	NS	NS	NS	27.3	NS	1380	NS	<EQL (1)	<EQL (1)	29.3	<EQL (1)	<EQL (1)	12.8
			11-Feb-2025	7.4	0.2	-42	0.4	6.1	62	12.2	18.6	40.12	07-Jan-2025	274.39	275		No Comments	NS	2.53	7830	65.7	<EQL (25)	NS	NS	NS	8570	NS	NS	12700	NS	NS	NS	NS	NS	27.3	NS	7380	NS	<EQL (1)	<EQL (1)	26.5	<EQL (1)	<EQL (1)	10.5
PRW005DL	Monitoring Well	UAZ_UTRAU	30-Apr-2024	21	0.1	116.9	1.5	5.1	62	3.9	21.3	39.2	03-Jul-2024	272.76	273.51		No Comments	NS	10.4	[708]	[2.7]	<EQL (5)	NS	NS	NS	1870	NS	NS	179	NS	NS	NS	NS	NS	NS	NS	[759]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.67]
			13-Aug-2024	23.5	0.2	90	1.2	5	62	7.6	21.5	39.51	03-Jul-2024	272.76	273.2		No Comments	NS	12	NS	[1.7]	<EQL (1.6)	NS	NS	NS	2200	NS	NS	[95.8]	NS	NS	NS	NS	NS	NS	NS	1100	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.74]
			24-Sep-2024	25	0.1	232	2.9	5.2	68	12.1	21.4	39.61	03-Jul-2024	272.76	273.1		No Comments	NS	12	1800	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1500	NS	<EQL (1)	<EQL (1)	1.6	<EQL (1)	<EQL (1)	33
			04-Nov-2024	24	0.1	141	0.4	5.1	63	4.2	21.4	39.8	03-Jul-2024	272.76	272.91		No Comments	NS	9.98	[857]	[2.6]	[1.3]	NS	NS	NS	1870	NS	NS	[89.3]	NS	NS	NS	NS	NS	9.4	NS	1060	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.56]
			10-Feb-2025	16	0.1	-18	0.7	5.2	68	2	20.5	39.95	07-Jan-2025	273.03	272.76		No Comments	NS	9.91	[720]	<EQL (25)	<EQL (25)	NS	NS	NS	1510	NS	NS	221	NS	NS	NS	NS	NS	8.1	NS	[940]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.52]
PRW005DU	Monitoring Well	UAZ_UTRAU	30-Apr-2024	23	0.1	-19	0.8	5.9	42	1.4	21.4	37.84	03-Jul-2024	274.3	275.06		No Comments	NS	2.91	<EQL (1000)	9.6	[2]	NS	NS	NS	7910	NS	NS	204	NS	NS	NS	NS	NS	NS	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			13-Aug-2024	24.3	0.2	48	0.5	5.4	32	1.9	21.3	38.42	03-Jul-2024	274.3	274.48		No Comments	NS	3.1	NS	2	<EQL (1.6)	NS	NS	NS	4600	NS	NS	[39.5]	NS	NS	NS	NS	NS	NS	NS	[630]	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			24-Sep-2024	26	0.1	161	0.6	5.5	31	2.1	21.1	38.3	03-Jul-2024	274.3	274.6		No Comments	NS	3.2	[750]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	[880]	NS	<EQL (1)	<EQL (1)	[0.72]	<EQL (1)	<EQL (1)	17
			04-Nov-2024	24	0.1	-18	0.3	5.8	46	2.1	21.1	38.42	03-Jul-2024	274.3	274.48		No Comments	NS	2.93	<EQL (1000)	[2.5]	[1.4]	NS	NS	NS	15100	NS	NS	[26.8]	NS	NS	NS	NS	NS	30.9	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
			10-Feb-2025	15	0.1	-81	0.3	5.8	35	1	20.3	38.7	07-Jan-2025	274.48	274.2		No Comments	NS	2.35	[386]	<EQL (25)	<EQL (25)	NS	NS	NS	13200	NS	NS	79.6	NS	NS	NS	NS	NS	37.3	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)
PRW006C	Monitoring Well	LAZ_UTRAU	11-Feb-2025	7	0.1	192	1.65	4.3	129	1.8	18.1	69	07-Jan-2025	261.36	261.08		No Comments	NS	32.7	4720	[20.1]	<EQL (25)	NS	NS	NS	839	NS	NS	179	NS	NS	NS	NS	NS	[1.9]	NS	4730	NS	<EQL (1)	<EQL (1)	6.87	<EQL (1)	<EQL (1)	20.9
PRW006DL	Monitoring Well	UAZ_UTRAU	11-Feb-2025	7	0.1	237	6.1	4.4	40	1.1	18.9	60.67	07-Jan-2025	270.2	269.58		No Comments	NS	2.86	[606]	<EQL (25)	<EQL (25)	NS	NS	NS	<EQL (100)	NS	NS	<EQL (25)	NS	NS	NS	NS	NS	[1.7]	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	[0.7]	2.93	<EQL (1)	92
PRW006DU	Monitoring Well	UAZ_UTRAU	11-Feb-2025	8	0.1	225	6.54	4.5	52	1.4	19.5	56.85	07-Jan-2025	273.72	273.47		No Comments	NS	3.66	[832]	<EQL (25)	<EQL (25)	NS	NS	NS	<EQL (100)	NS	NS	<EQL (25)	NS	NS	NS	NS	NS	2.4	NS	[524]	NS	<EQL (1)	<EQL (1)	<EQL (1)	1	<EQL (1)	3.33
PRW007DL	Monitoring Well	UAZ_UTRAU	01-May-2024	25	0.1	29	5.5	5.2	58	1	20.3	44.3	03-Jul-2024	271.68	272.48		No Comments	NS	5.4	<EQL (1000)	<EQL (5)	<EQL (5)	NS	NS	NS	<EQL (100)	NS	NS	10.1	NS	NS	NS	NS	NS	NS	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	1.55	<EQL (1)	<EQL (1)	26.9
			13-Aug-2024	31	0.1	138	6.1	5.4	53	0.9	21.4	44.53	03-Jul-2024	271.68	272.25		No Comments	NS	6.9	NS	<EQL (1.8)	<EQL (1.6)	NS	NS	[27]	NS	NS	<EQL (7.7)	NS	NS	NS	NS	NS	NS	NS	[510]	NS	<EQL (1)	<EQL (1)	2.2	<EQL (1)	<EQL (1)	36
			24-Sep-2024	27	0.1	134	0.8	5	59	1.3	20.6	44.6	03-Jul-2024	271.68	272.18		No Comments	NS	6.3	1100	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	[610]	NS	<EQL (1)	<EQL (1)	2	<EQL (1)	<EQL (1)	32
			04-Nov-2024	23	0.1	244	5.4	5.1	57	0.8	20.5	44	03-Jul-2024	271.68	272.78		No Comments	NS	6.69	<EQL (1000)	[1.2]	[1.2]	NS	NS	NS	<EQL (100)	NS	NS	RFJ	NS	NS	NS	NS	NS	5.3	NS	<EQL (1000)	NS	<EQL (1)	<EQL (1)	[1.34]	<EQL (1)	<EQL (1)	[26.6]
			11-Feb-2025	6	0.1	226	5.2	4.7	60	0.7	19.1	44.85	07-Jan-2025	272.15	271.93		No Comments	NS	7.46	1240	<EQL (25)	<EQL (25)	NS	NS	NS	<EQL (100)	NS	NS	<EQL (25)	NS	NS	NS	NS	NS	5.5	NS	[544]	NS	<EQL (1)	<EQL (1)	1.69	<EQL (1)	<EQL (1)	30.7
PRW007DU	Monitoring Well	UAZ_UTRAU	01-May-2024	27	0.1	89	1.5	4.8	148	2.3	20.7	42	03-Jul-2024	273.58	274.43		No Comments	NS	[35.3]	3100	48.9	[1.8]	NS	NS	NS	409	NS	NS	6730	NS	NS	NS	NS	NS	NS	NS	2760	NS	<EQL (1)	<EQL (1)	12	1.14	<EQL (1)	22.3
			13-Aug-2024	31	0.1	1.5	0.9	5.6	126	1.8	22	44.53	03-Jul-2024	273.58	271.9		No Comments	NS	35	NS	16.6	[1.1]	NS	NS	NS	540	NS	NS	[1950]	NS	NS	NS	NS	NS	NS	NS	6300	NS	<EQL (1)	<EQL (1)	12	[0.93]	<EQL (1)	160
			24-Sep-2024	27	1	134	0.8	4.9	139	3.5	21	42.33	03-Jul-2024	273.58	274.1		No Comments	NS	33	2800	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2600	NS	<EQL (1)	<EQL (1)	16	1.5	<EQL (1)	310
			04-Nov-2024	22	0.1	215	0.7	4.8	131	1.4	20.6	42.51	03-Jul-2024	273.58	273.92		No Comments	NS	29.5	1990	[28.2]	[3.1]	NS	NS	NS	1270	NS	NS	[3100]	NS	NS	NS	NS	NS	8.6	NS	2340	NS	<EQL (1)	<EQL (1)	12.2	1.37	<EQL (1)	242
			11-Feb-2025	7	0.1	78	0.34	4.8	135	1.3	19.1	42.72	07-Jan-2025	273.91	273.71		No Comments	NS	25.7	2580	44.1	<EQL (25)	NS	NS	NS	5700	NS	NS	8380	NS	NS	NS	NS	NS	28	NS	2610	NS	<EQL (5)	<EQL (5)	42.3	<EQL (5)	<EQL (5)	270

Field Condition Code:

T	Samples were collected, but some samples were not sent due to high turbidity.
X	Well went dry during purging, samples collected after well recovered.

Explanation

[##]	EPA Functional Guideline Code of 'J' was applied to the result, indicating an estimated quantity.
<EQL(##)>	Constituent was below detection. The sample-specific Estimated Quantitation Limit is in parentheses.
	Result exceeds applicable limit.
REJ	Result Rejected.
	Result is less than the applicable limit and without EPA Functional Guidline qualifiers.
NS	Requested to be sampled but was not. See comments as to why not.
Blue Text	Not a required sample analysis.

APPENDIX B

PAGW OU RA EMR Hydrographs

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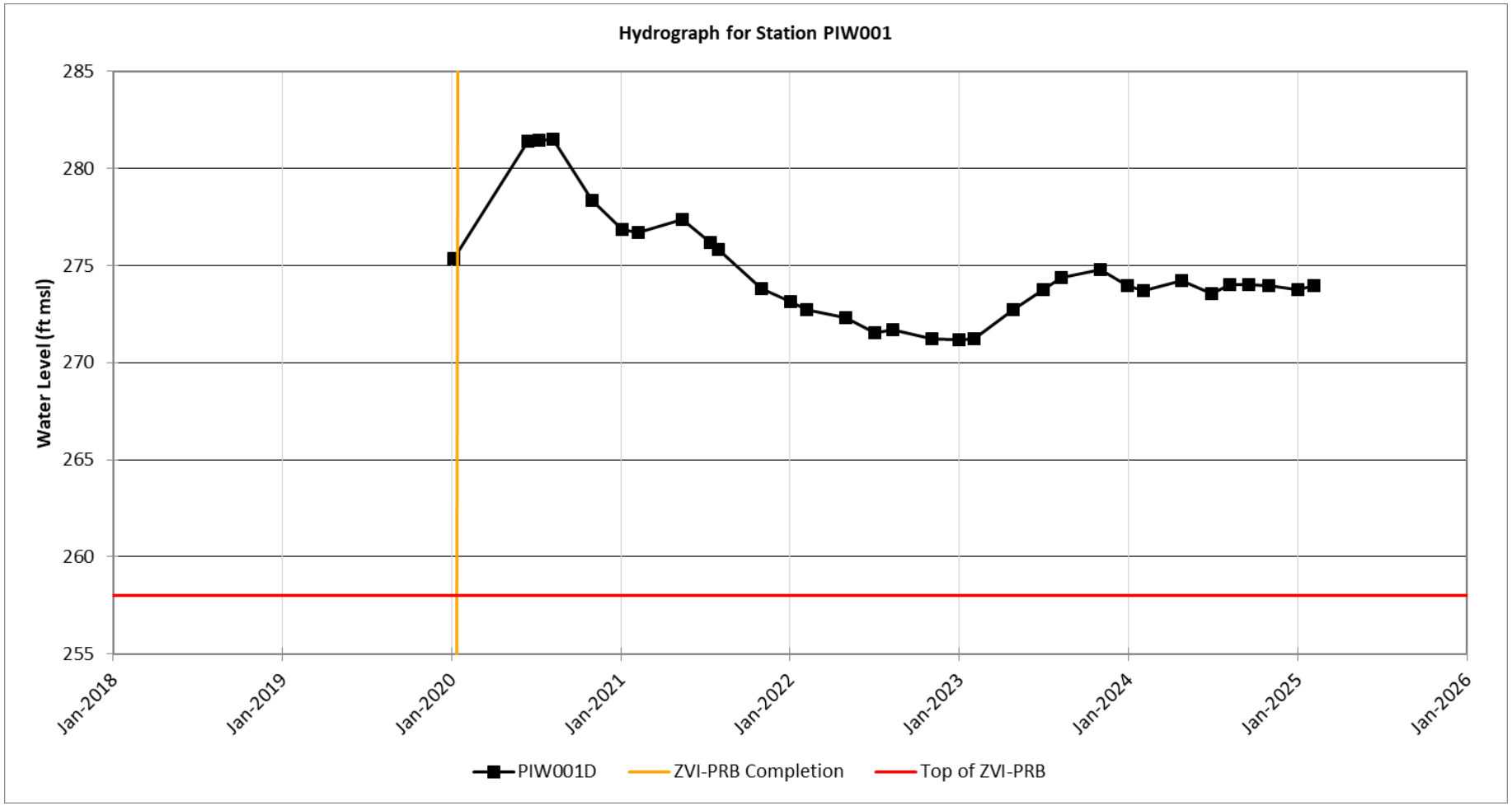


Figure B.1. Hydrograph for PIW001D

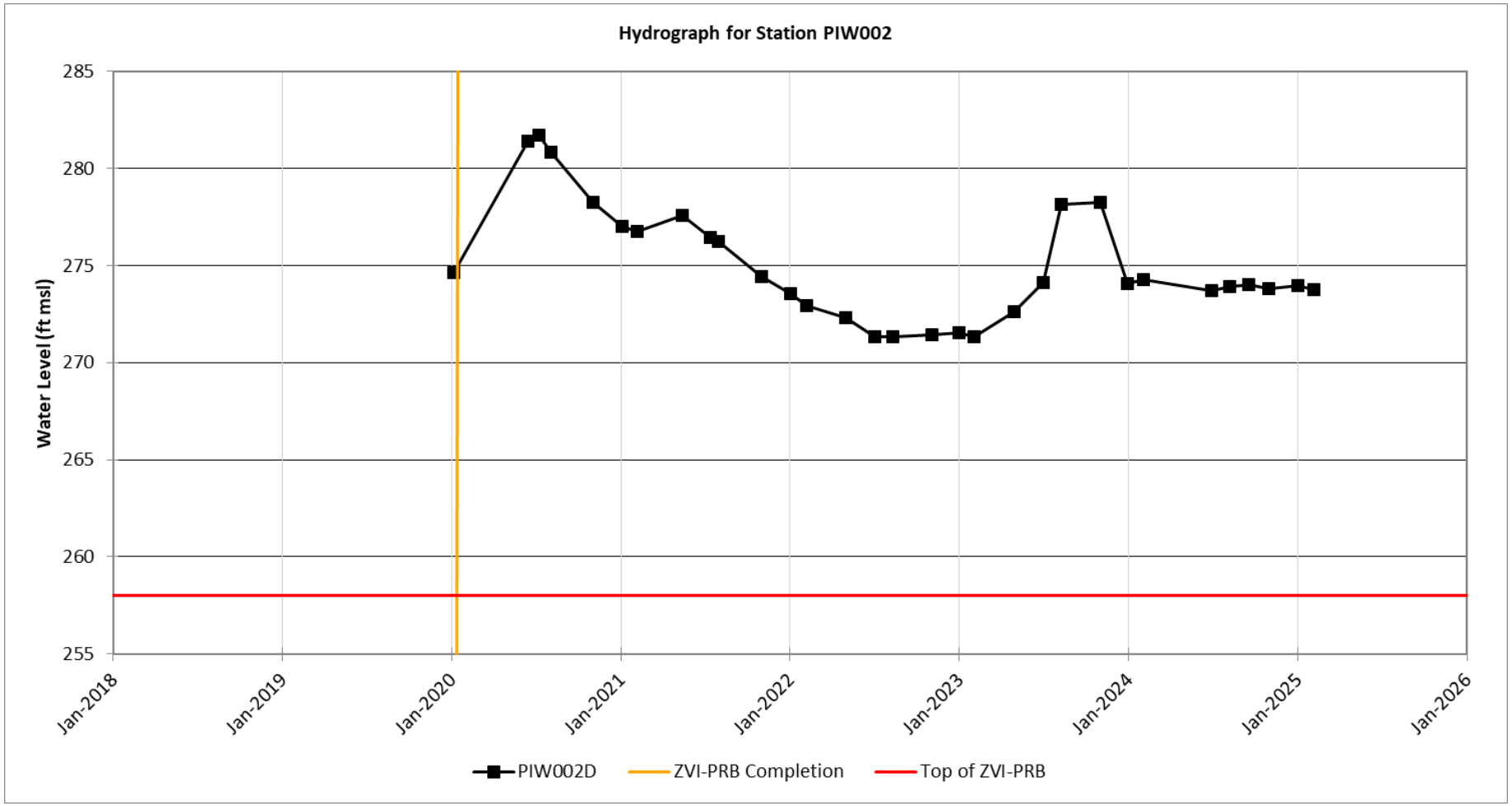


Figure B.2. Hydrograph for PIW002D

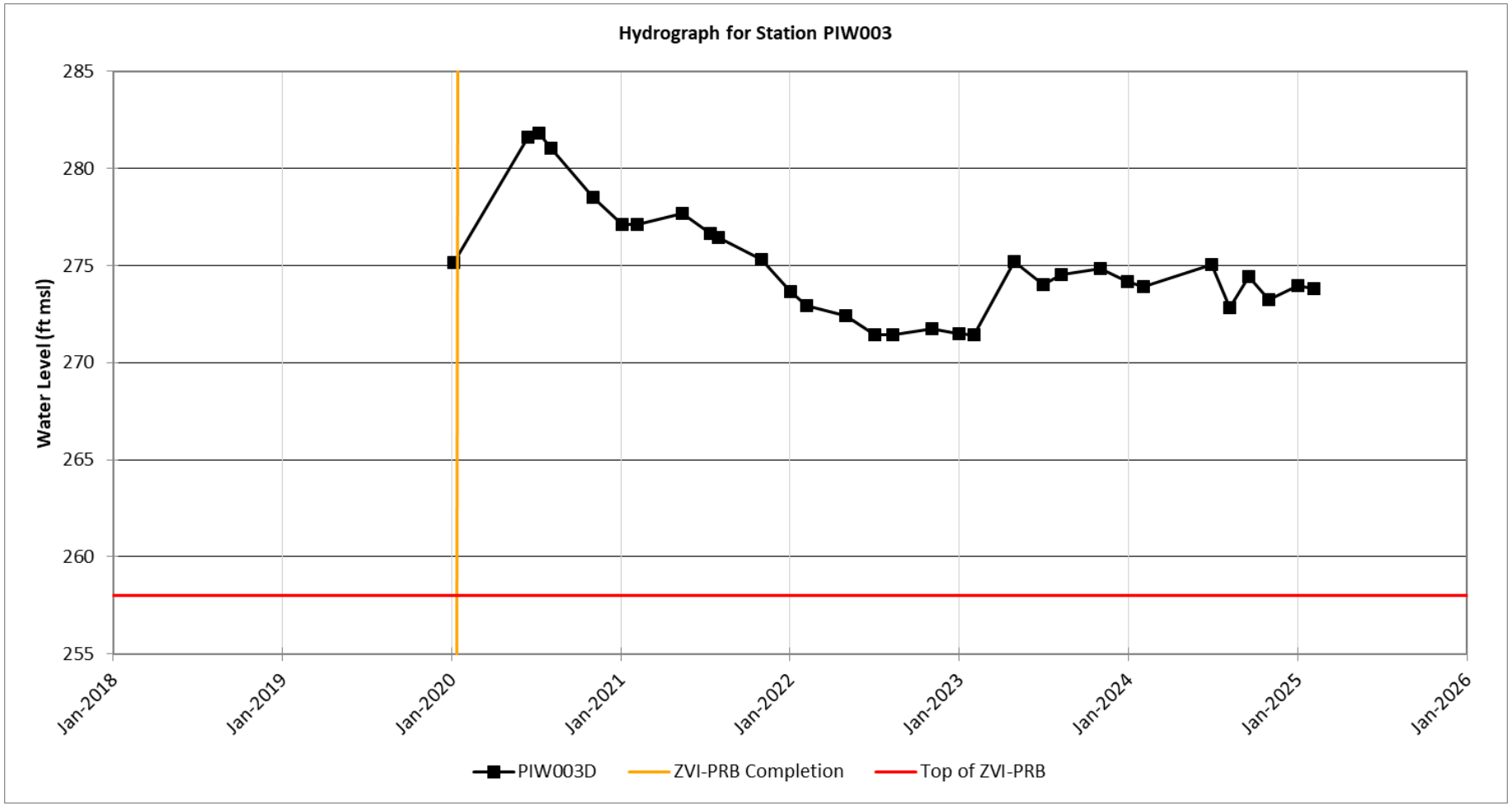


Figure B.3. Hydrograph for PIW003D

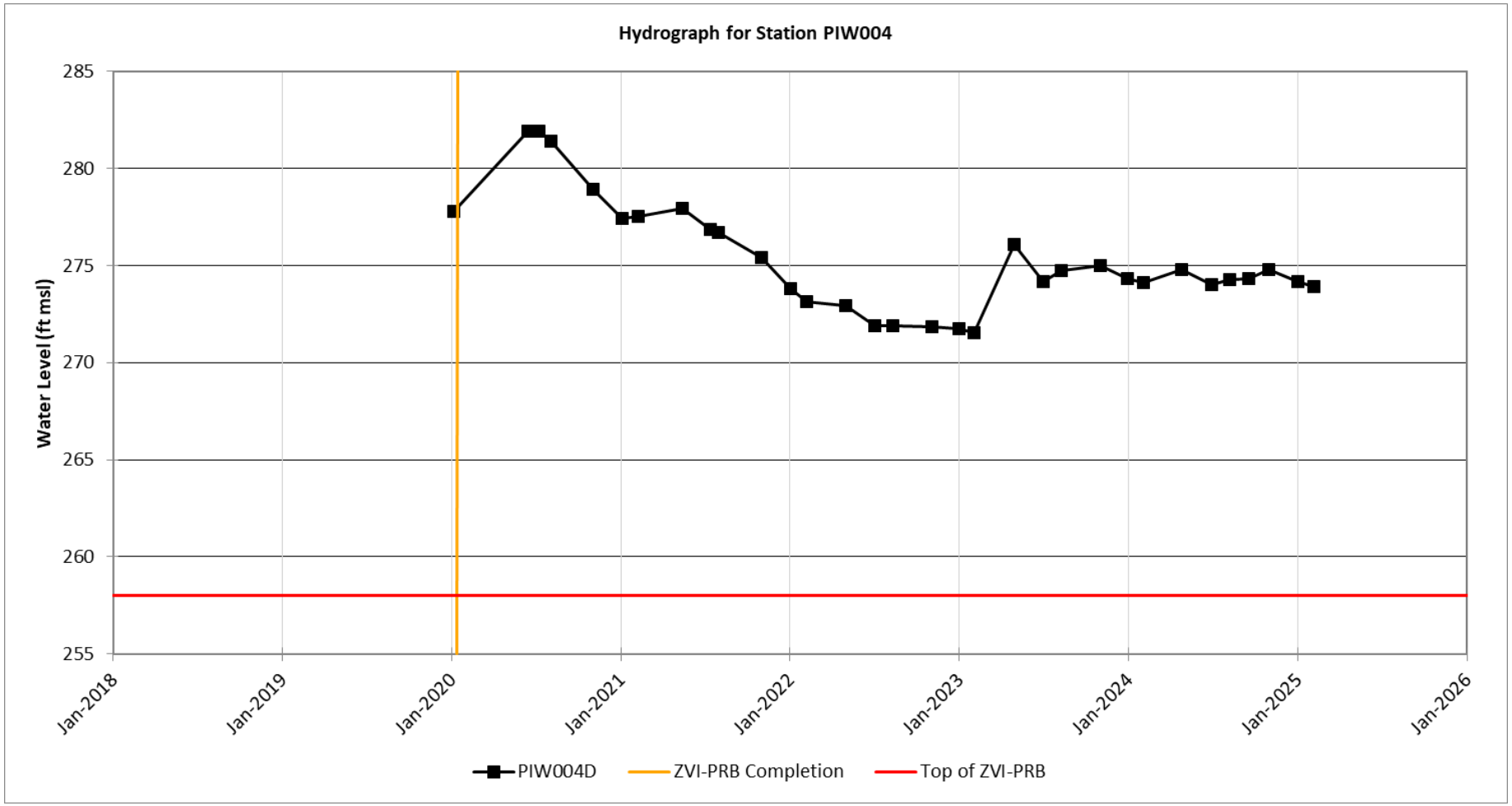


Figure B.4. Hydrograph for PIW004D

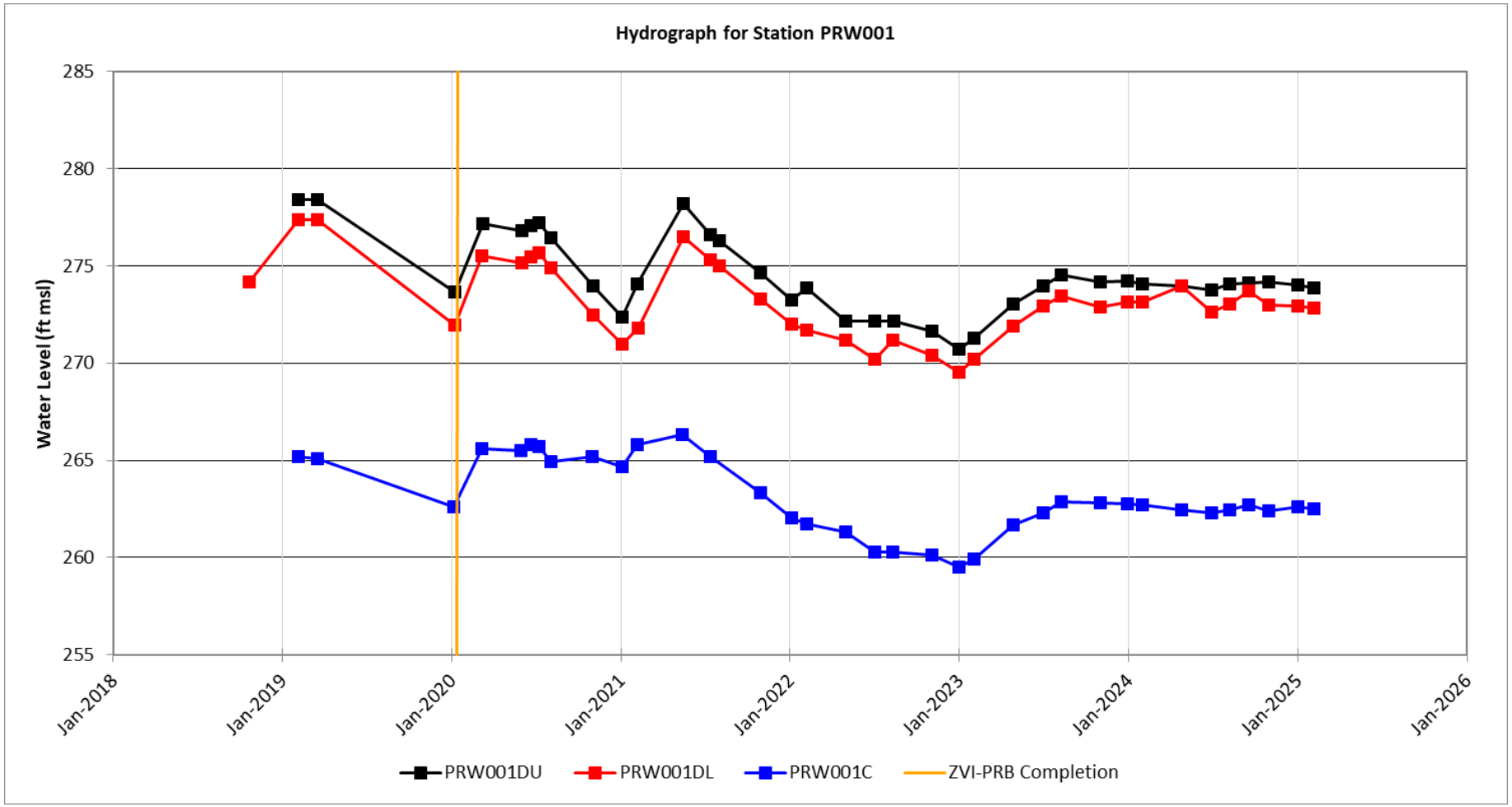


Figure B.5. Hydrograph for PRW001 Cluster

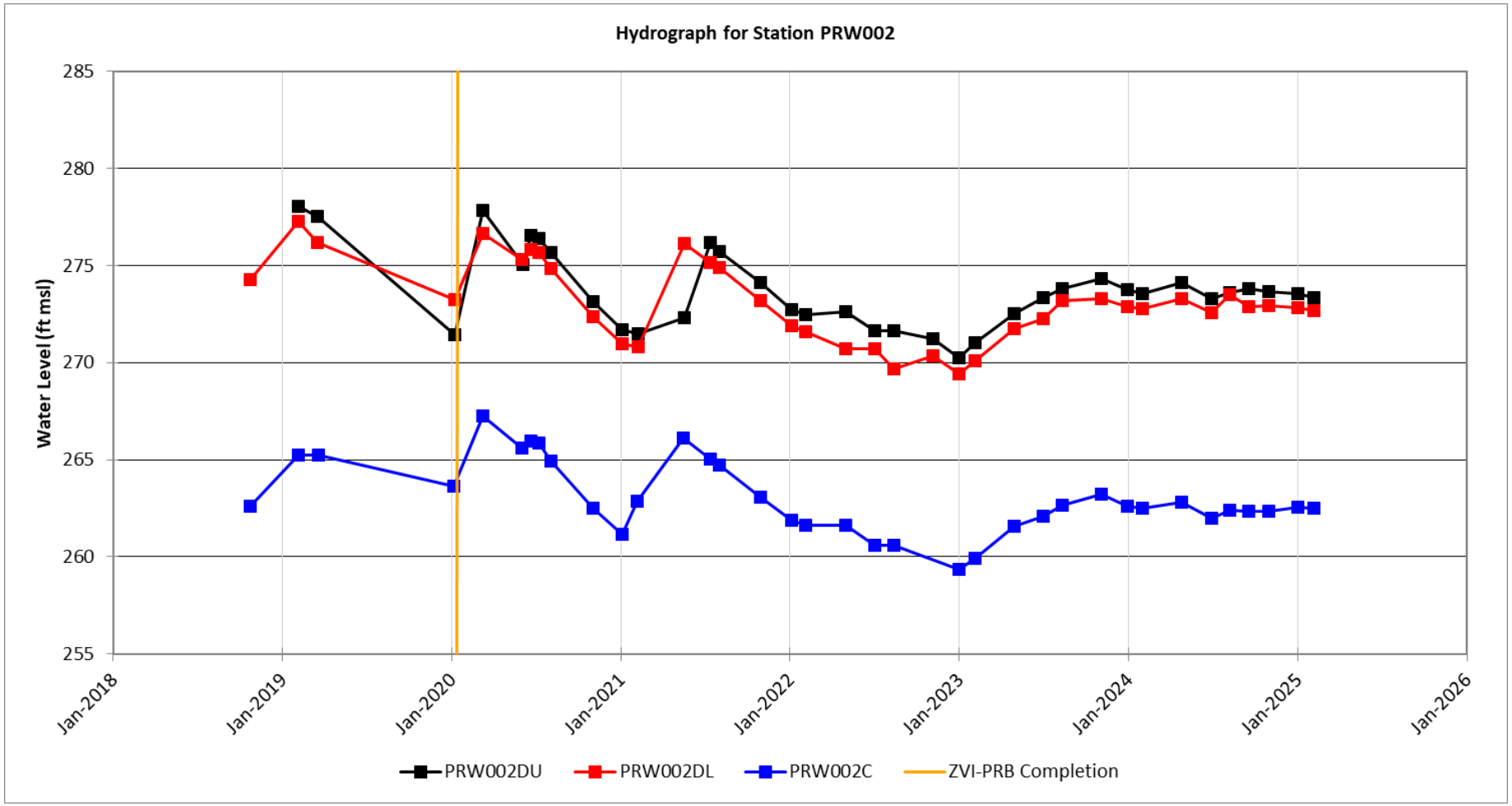


Figure B.6. Hydrograph for PRW002 Cluster

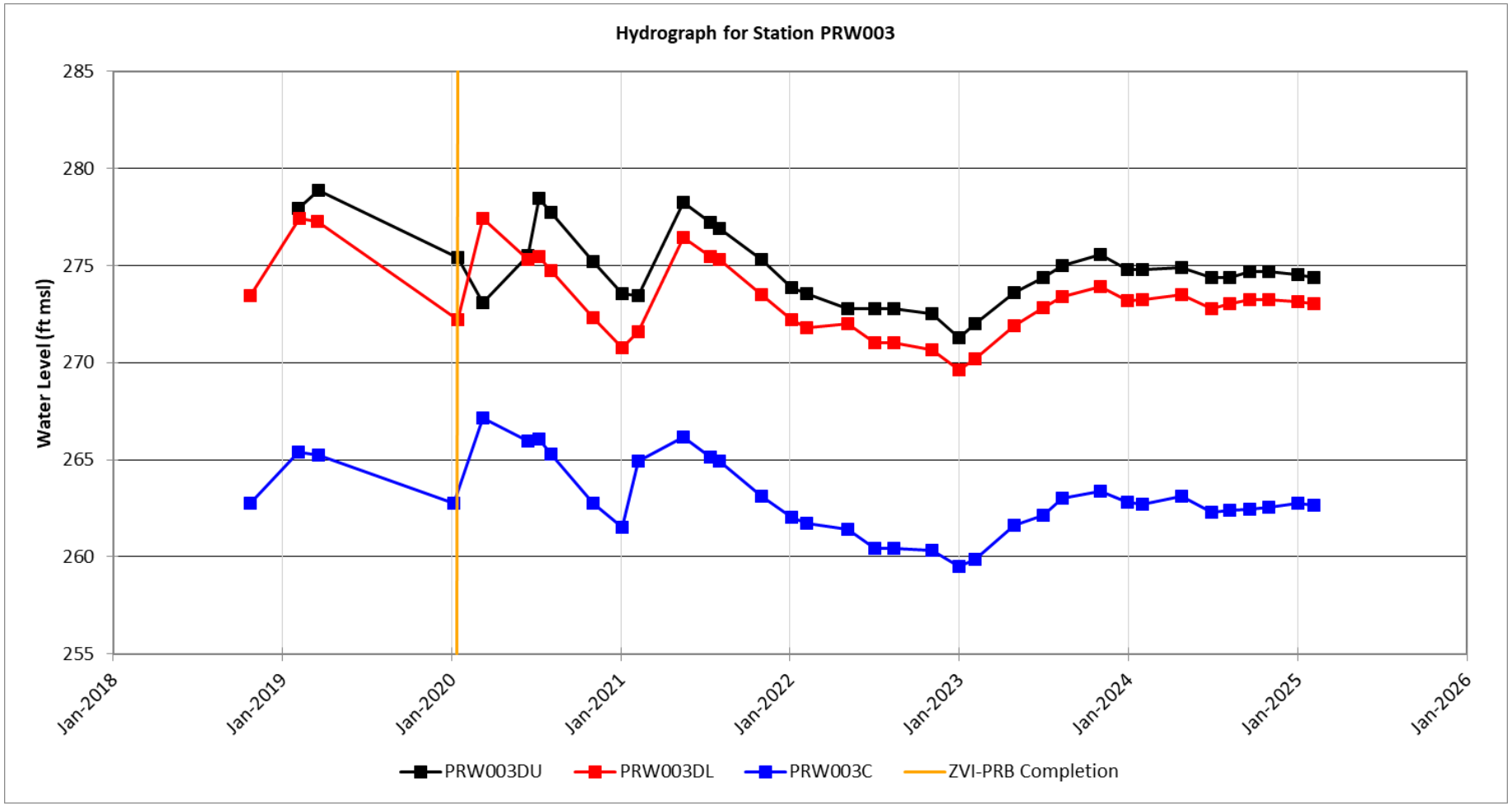


Figure B.7. Hydrograph for PRW003 Cluster

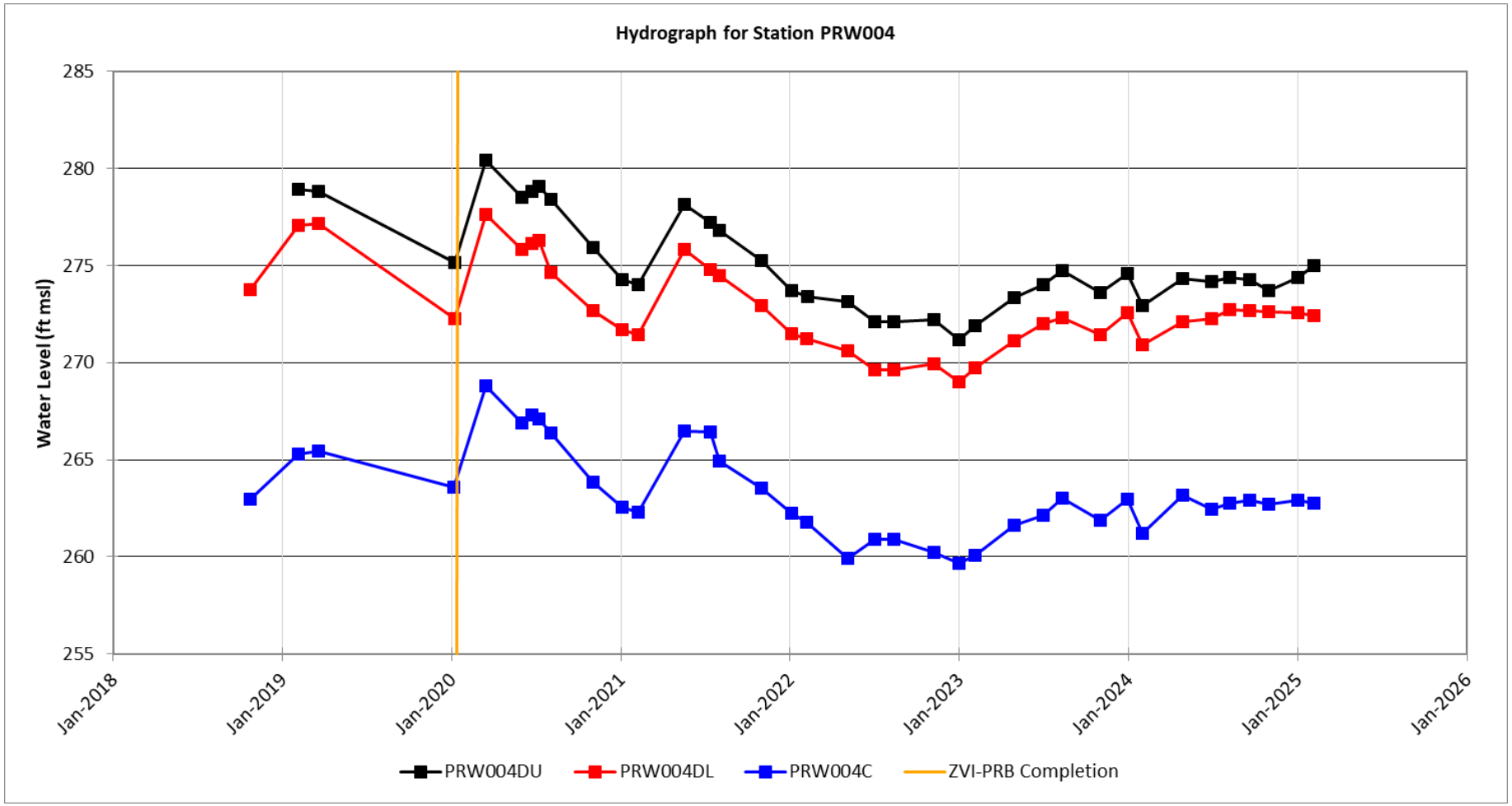


Figure B.8. Hydrograph for PRW004 Cluster

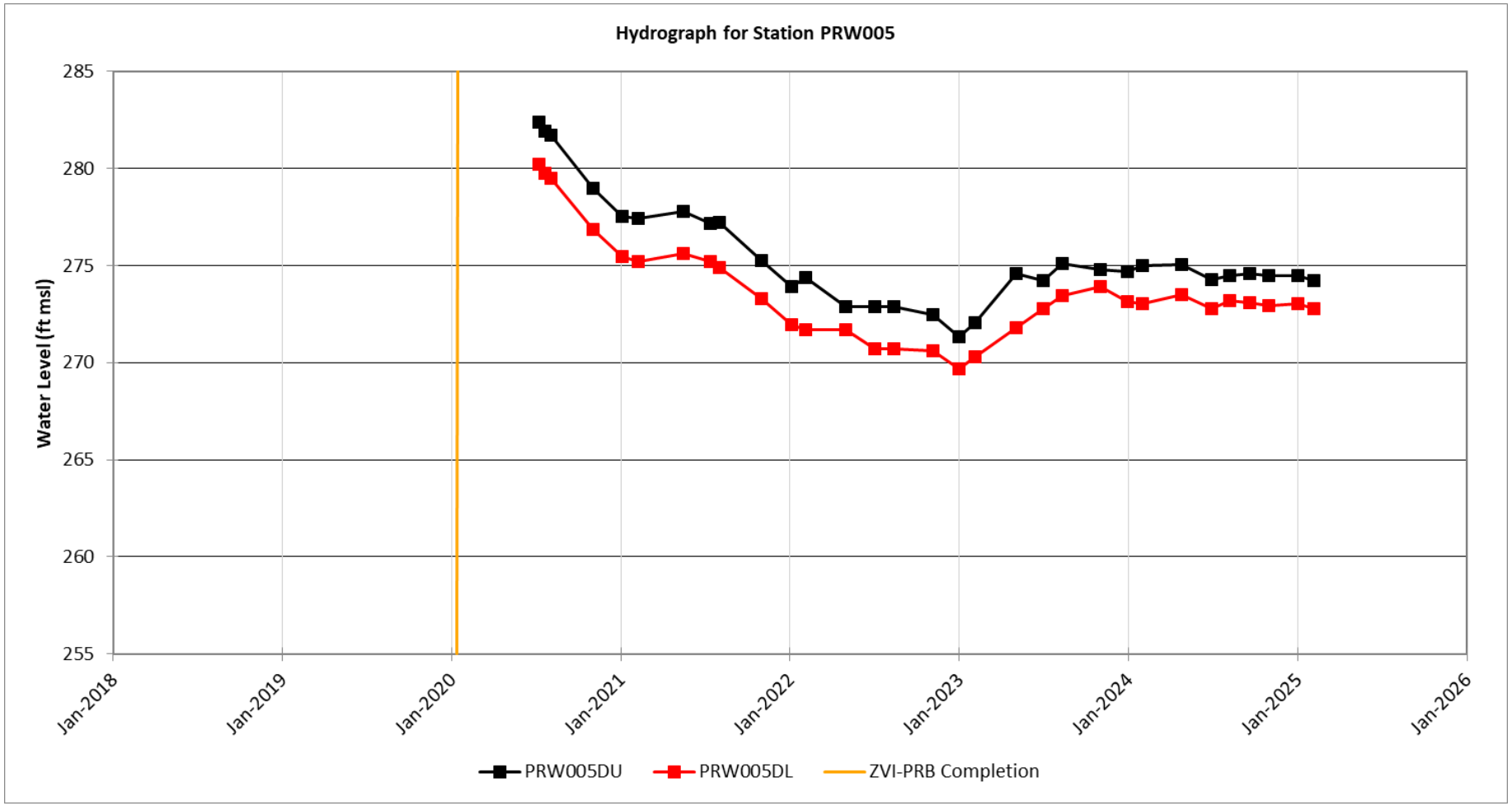


Figure B.9. Hydrograph for PRW005 Cluster

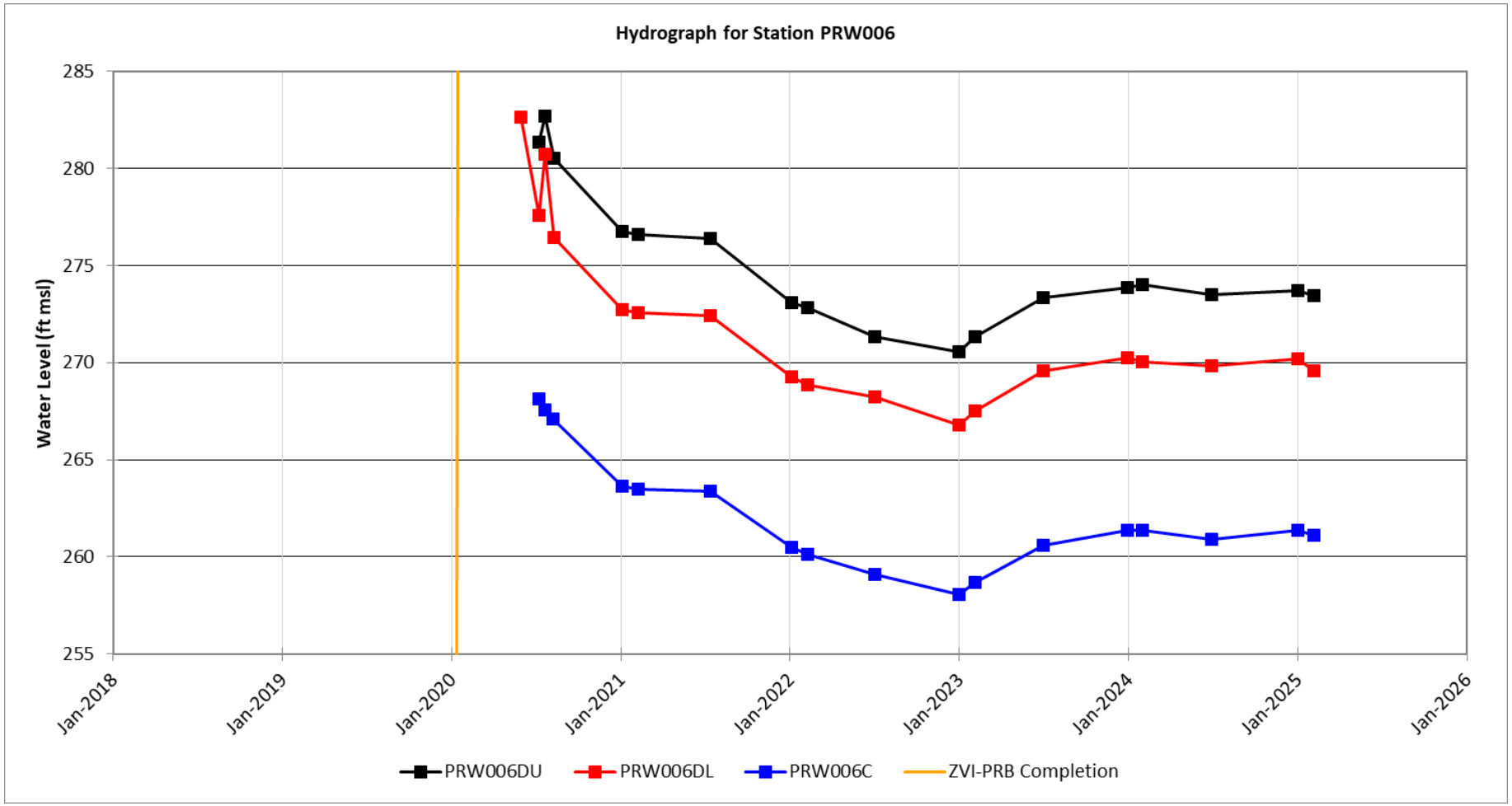


Figure B.10. Hydrograph for PRW006 Cluster

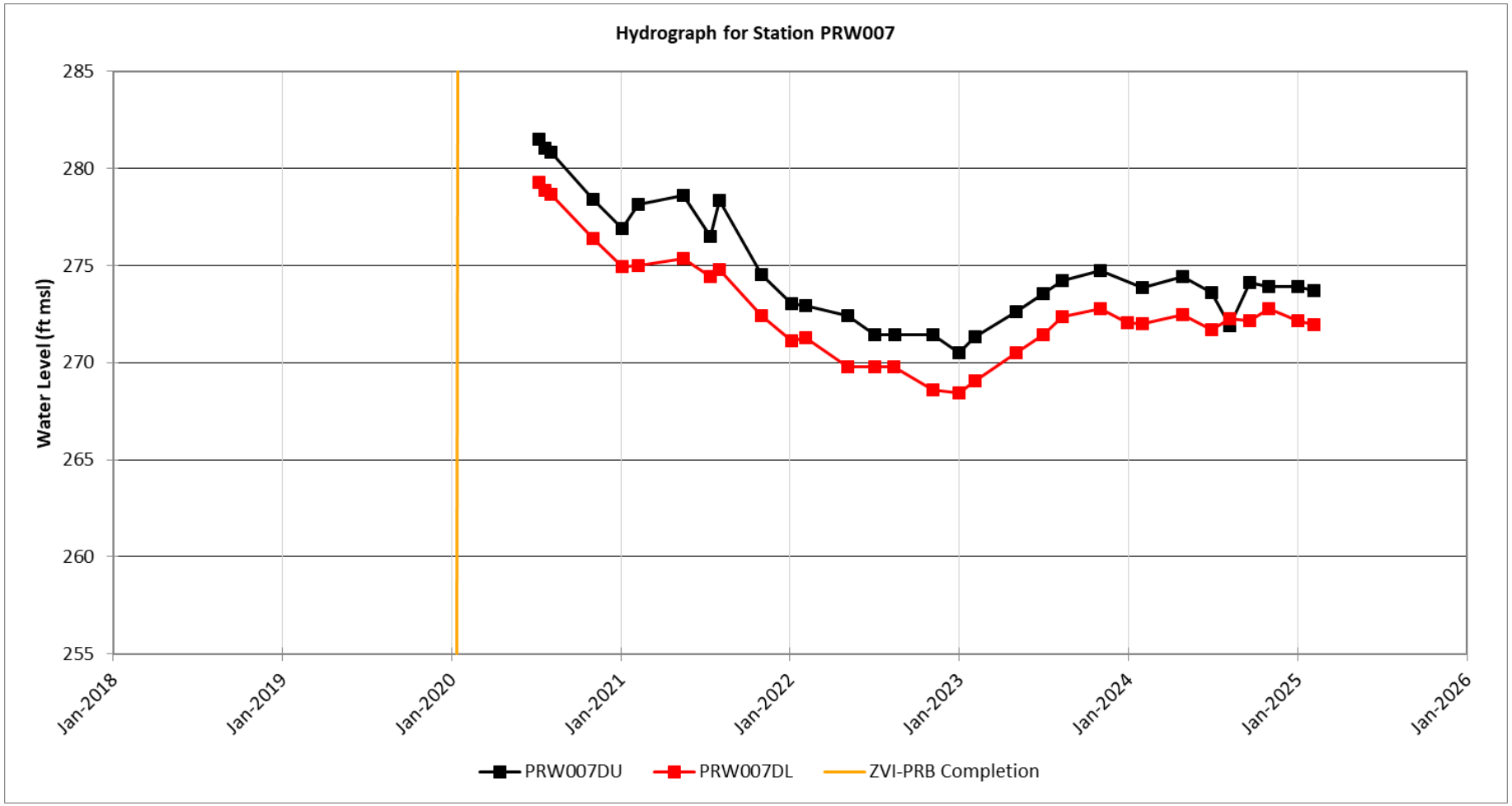


Figure B.11. Hydrograph for PRW007 Cluster

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APPENDIX C

PAGW OU RA EMR Time-Series Plots

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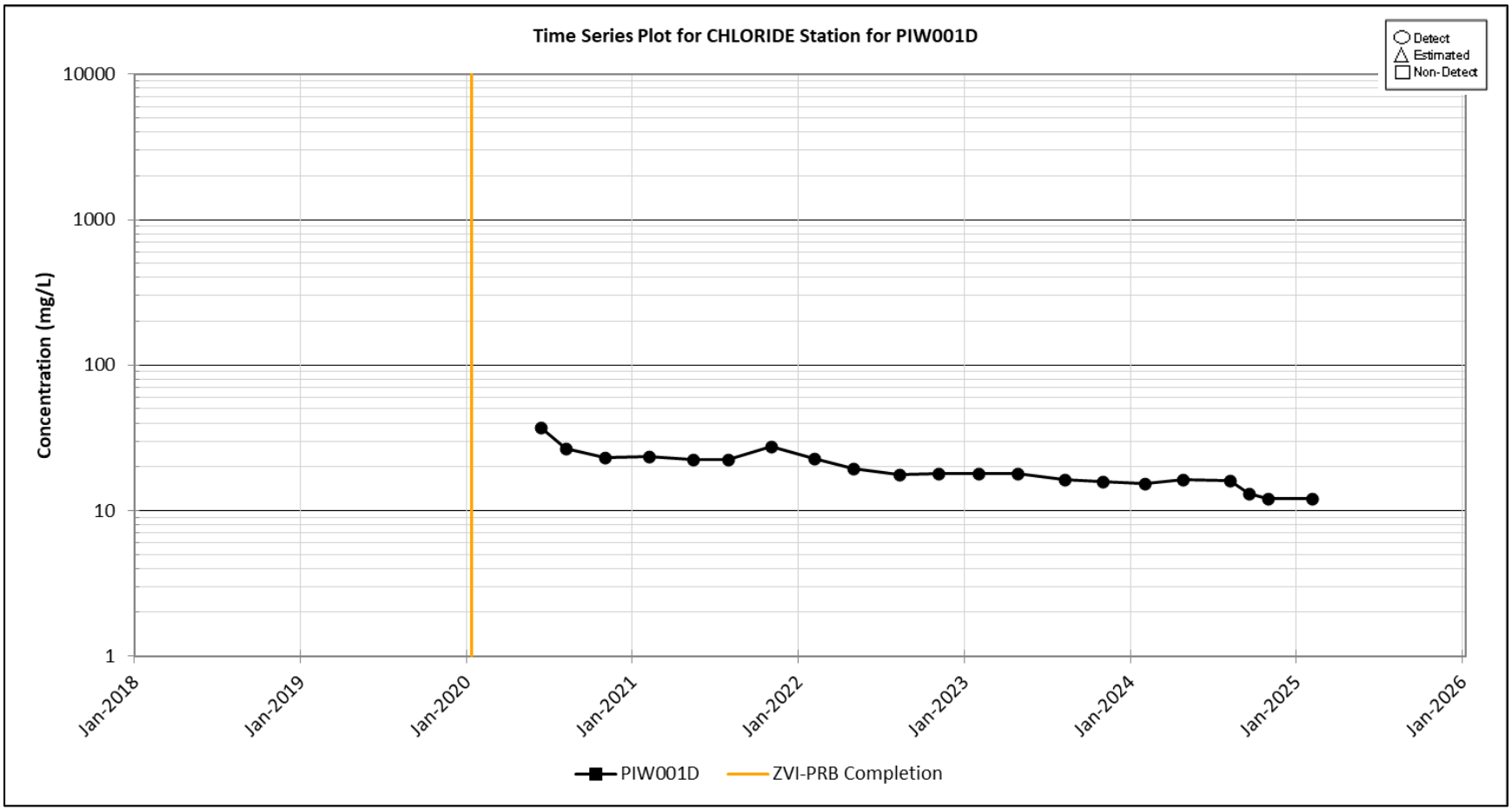


Figure C.1. Time Series Plot for Chloride at Monitoring Well PIW001D

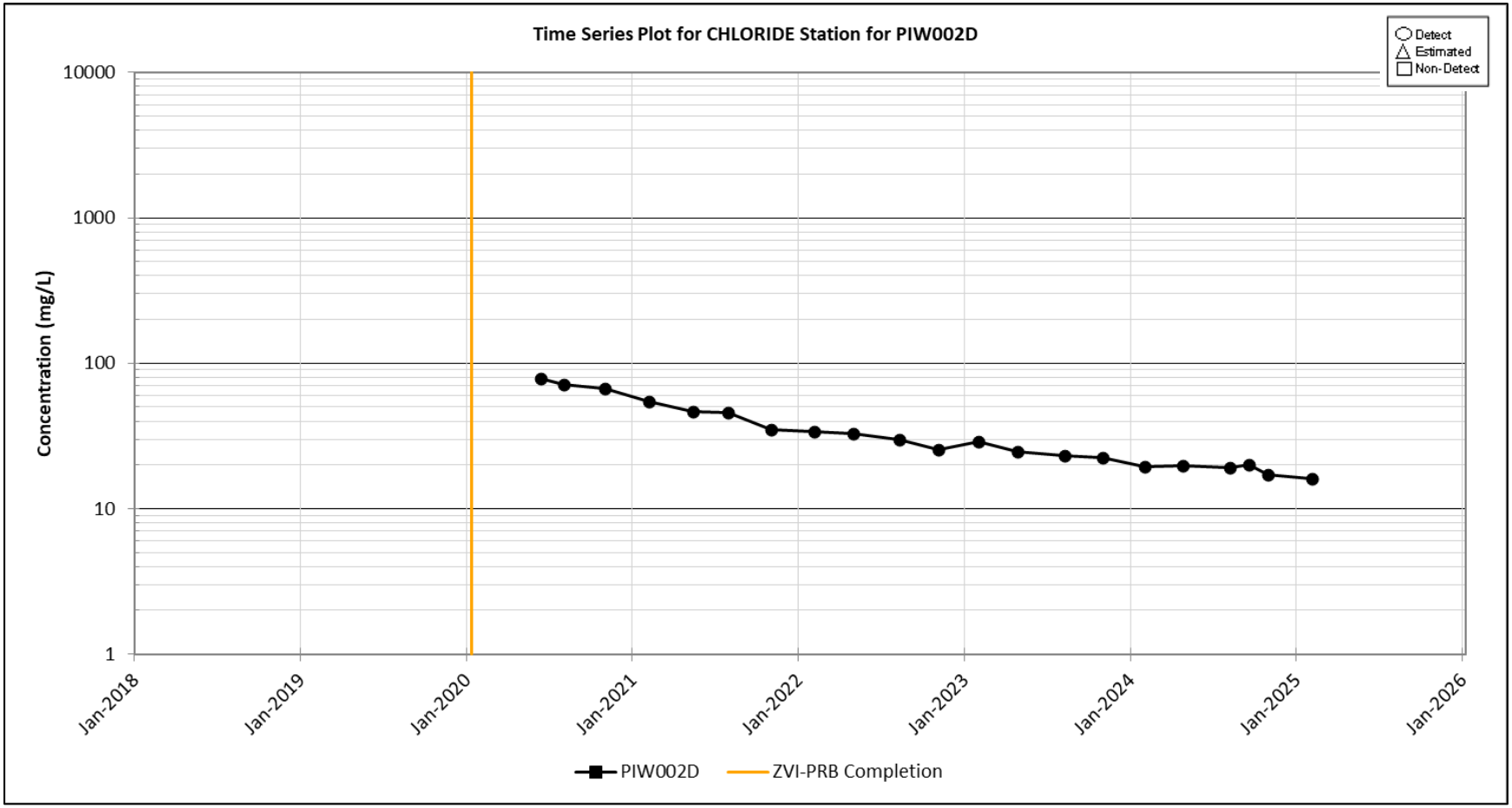


Figure C.2. Time Series Plot for Chloride at Monitoring Well PIW002D

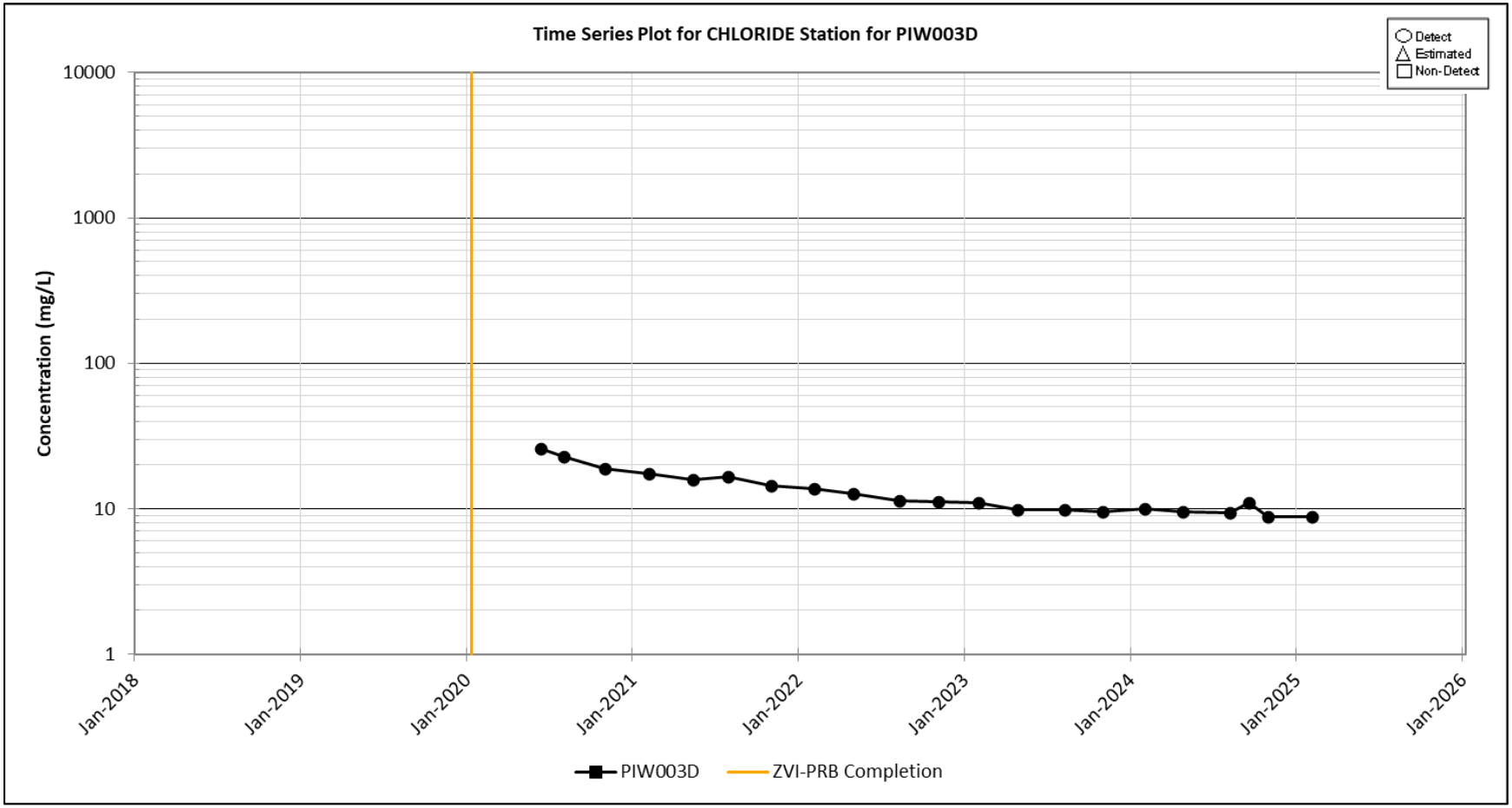


Figure C.3. Time Series Plot for Chloride at Monitoring Well PIW003D

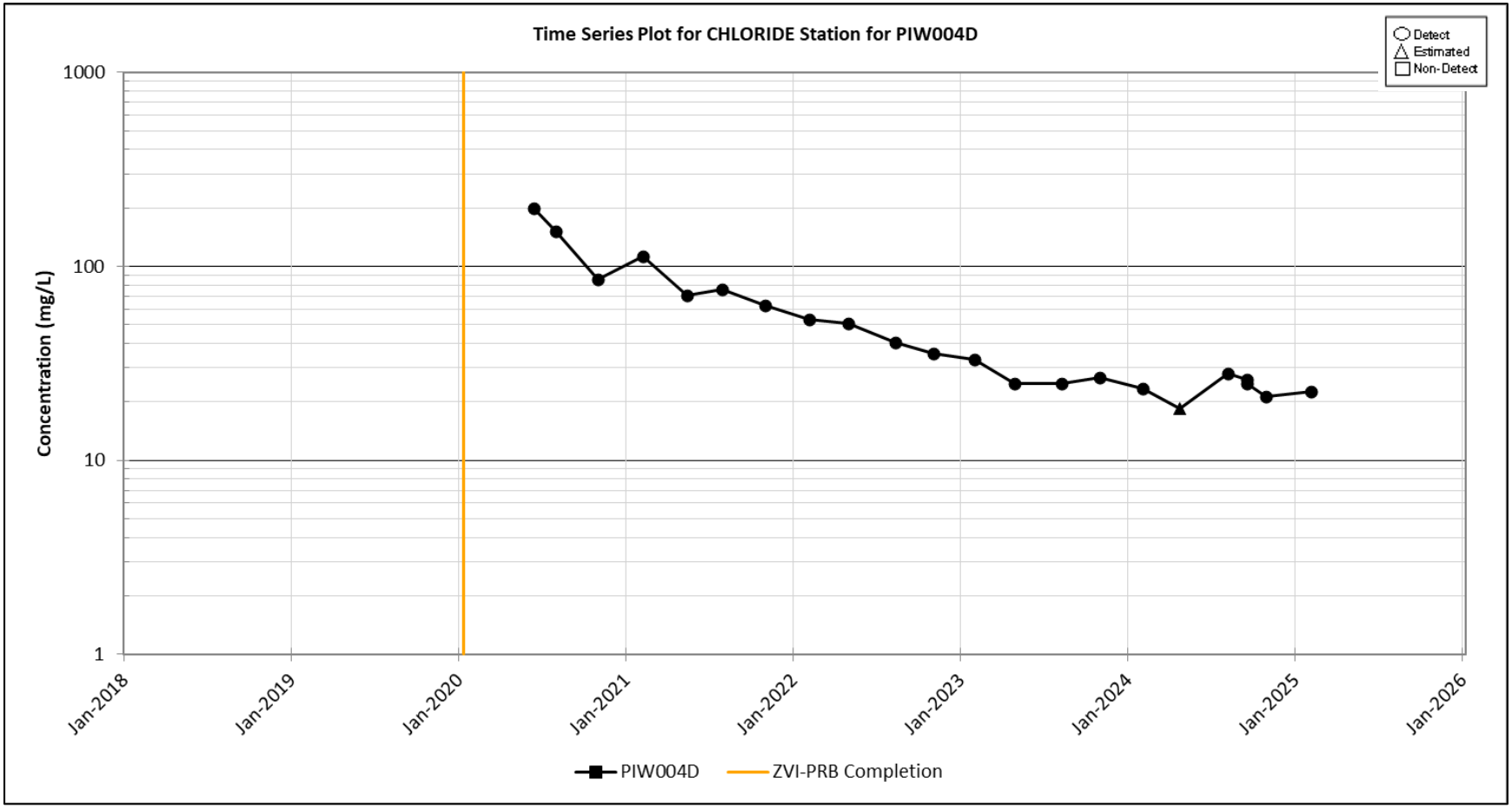


Figure C.4. Time Series Plot for Chloride at Monitoring Well PIW004D

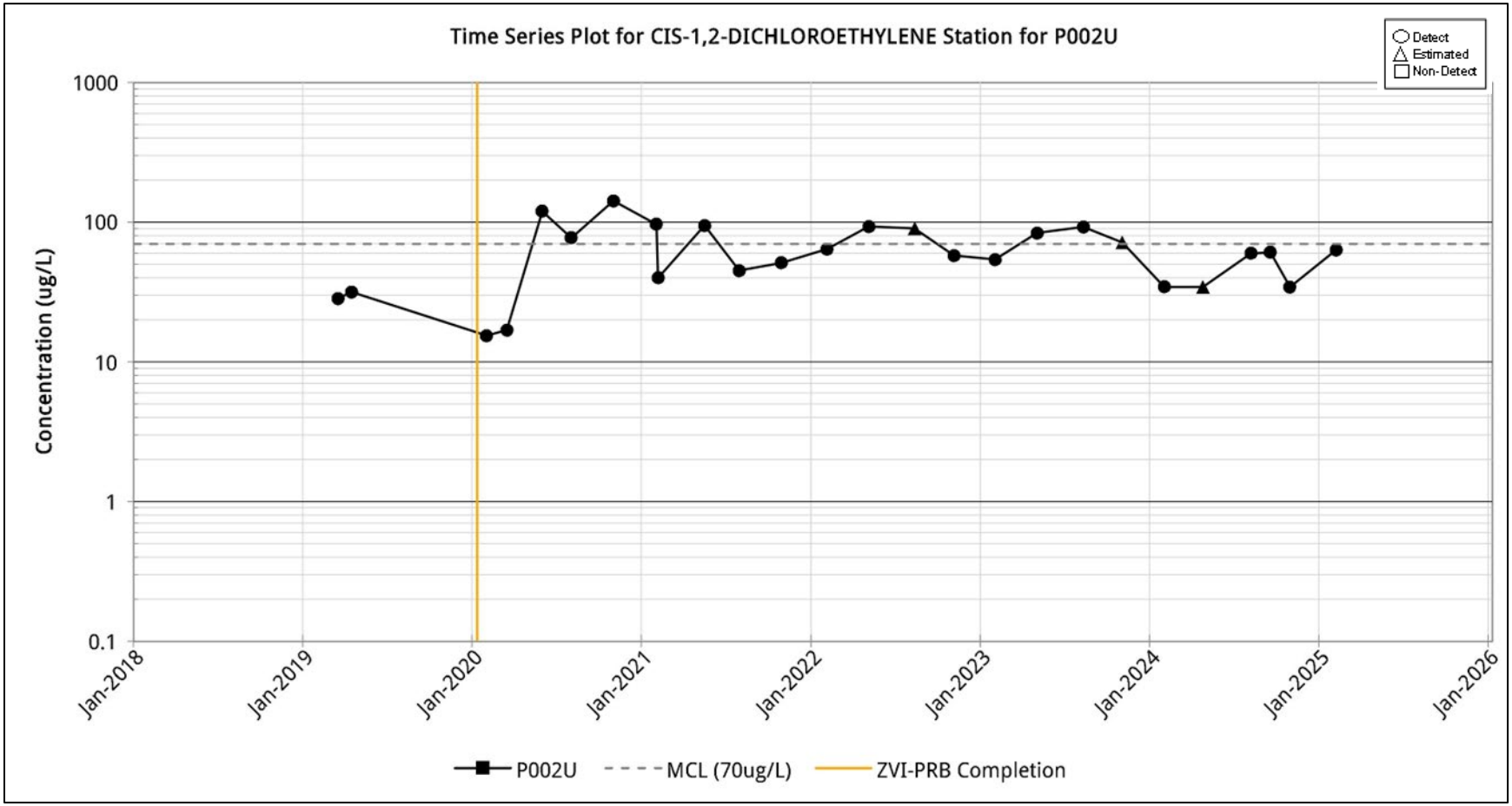


Figure C.5. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well P002U

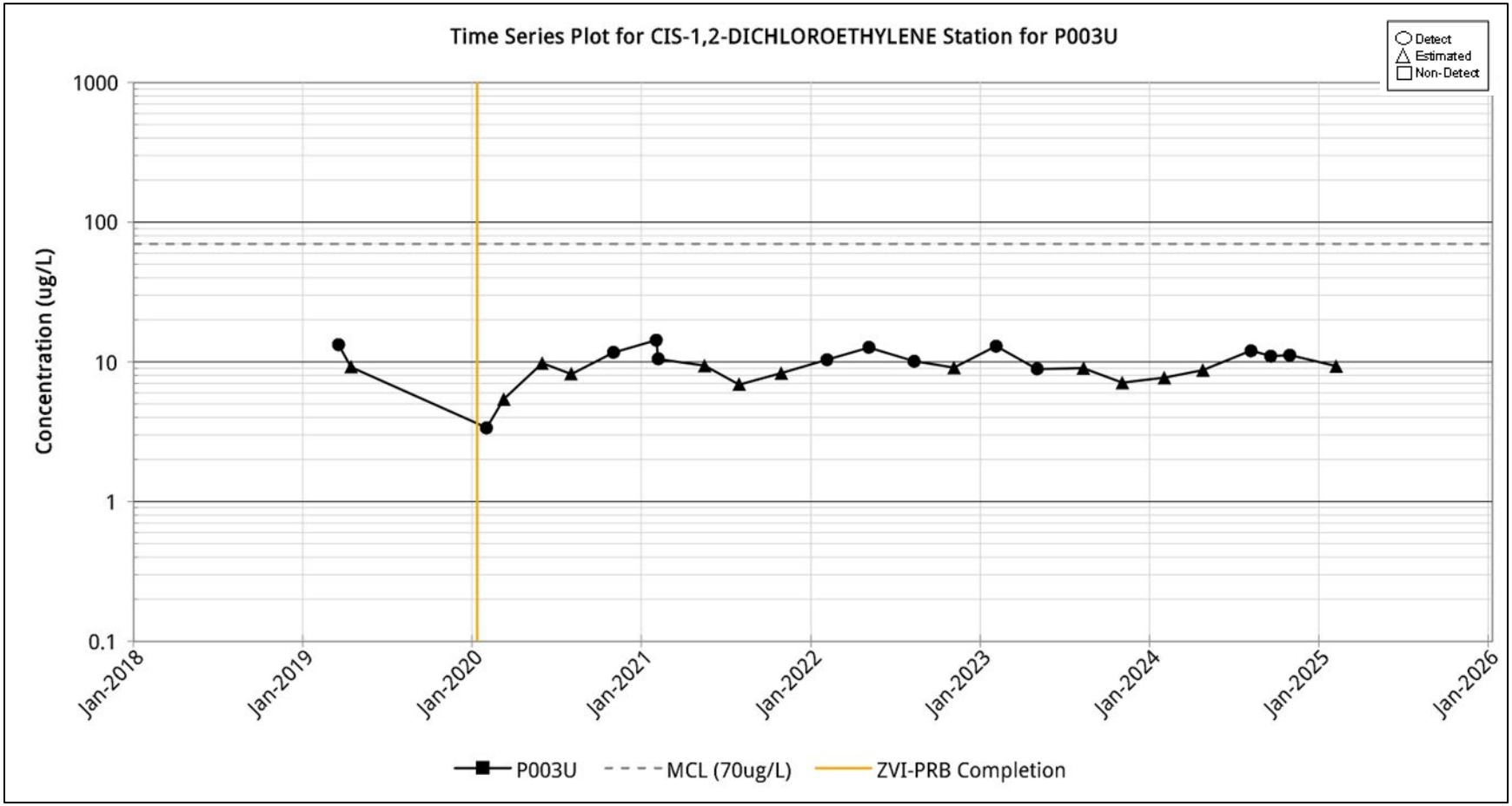


Figure C.6. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well P003U

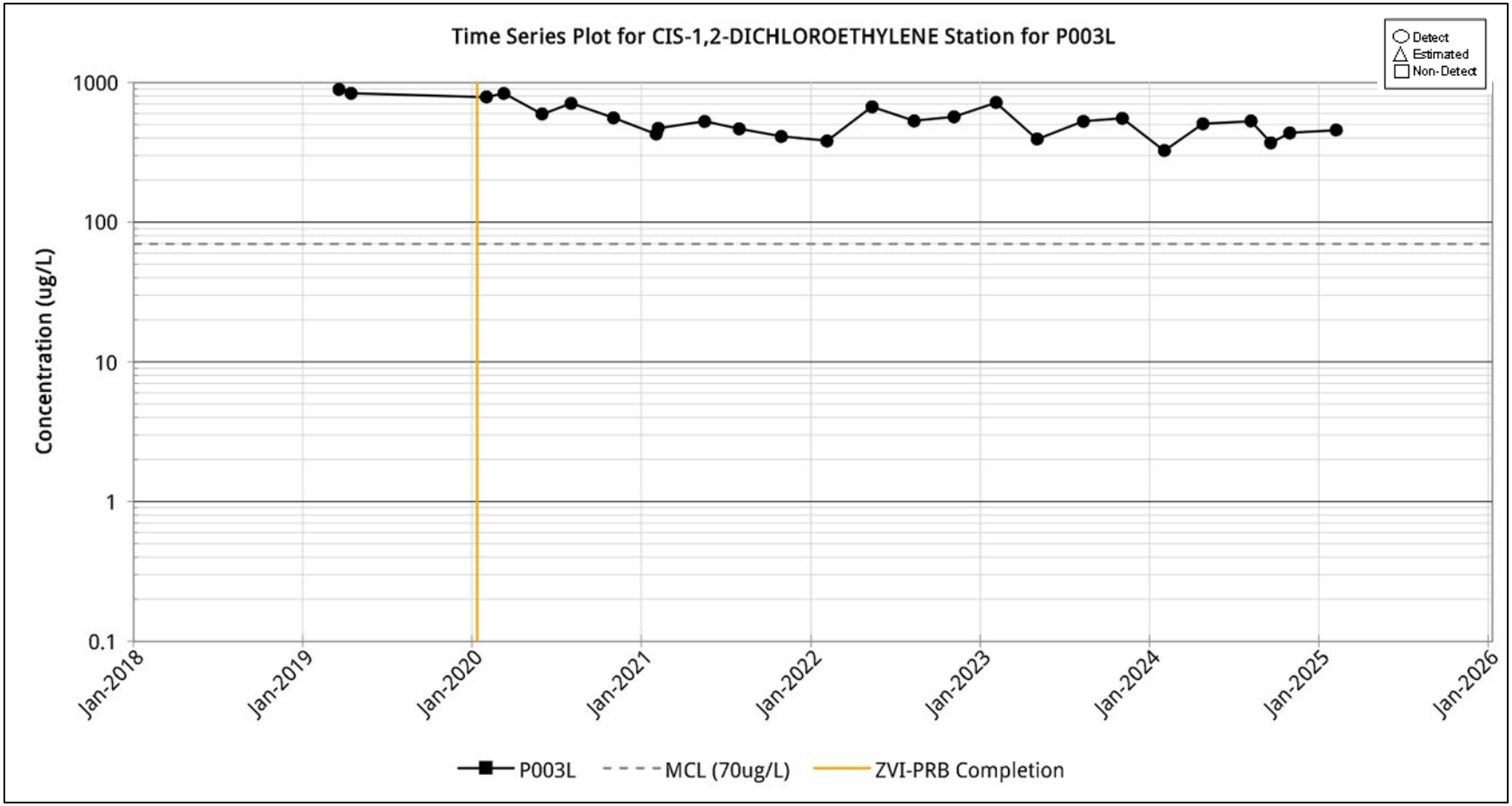


Figure C.7. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well P003L

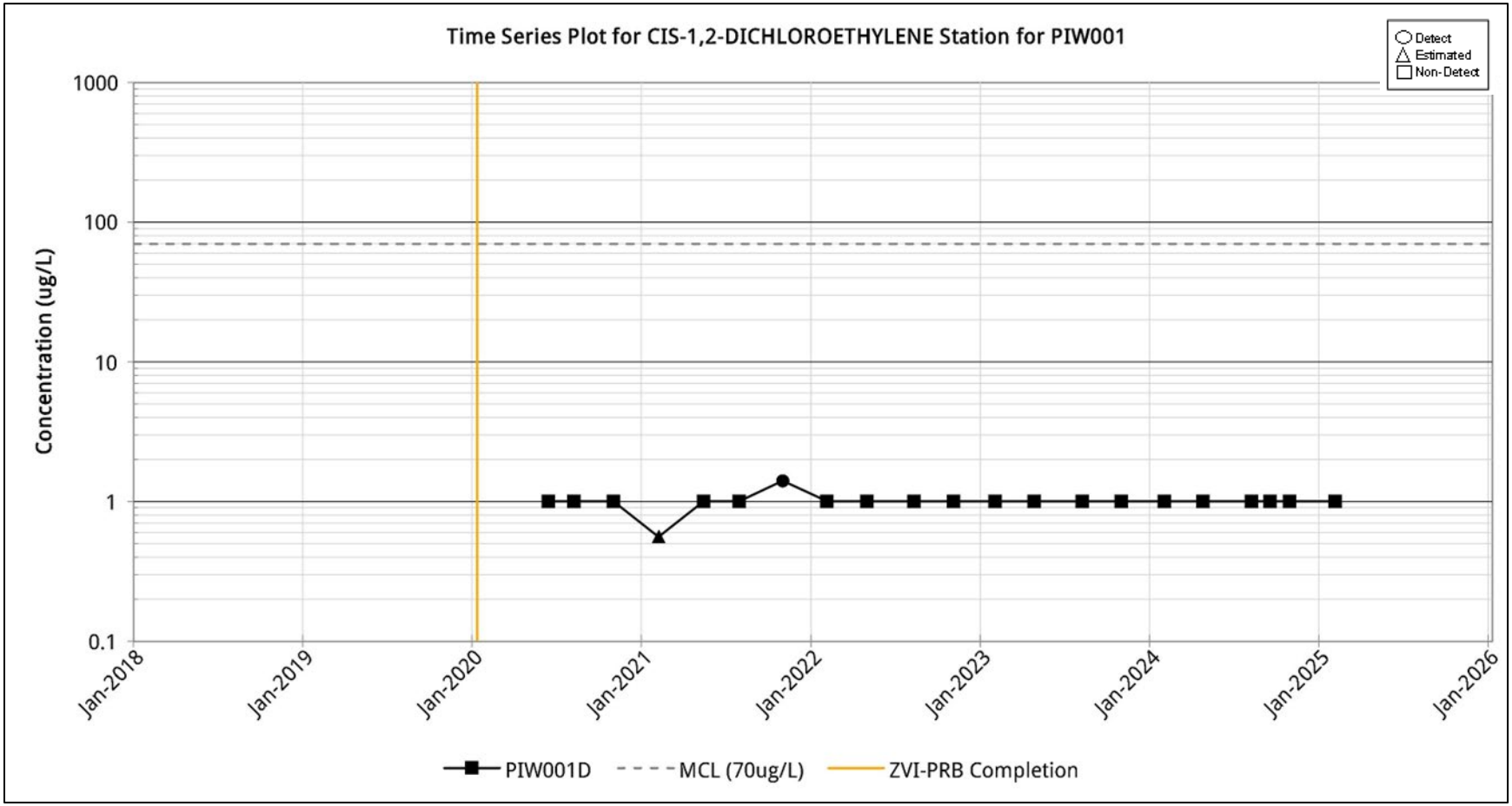


Figure C.8. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well PIW001D

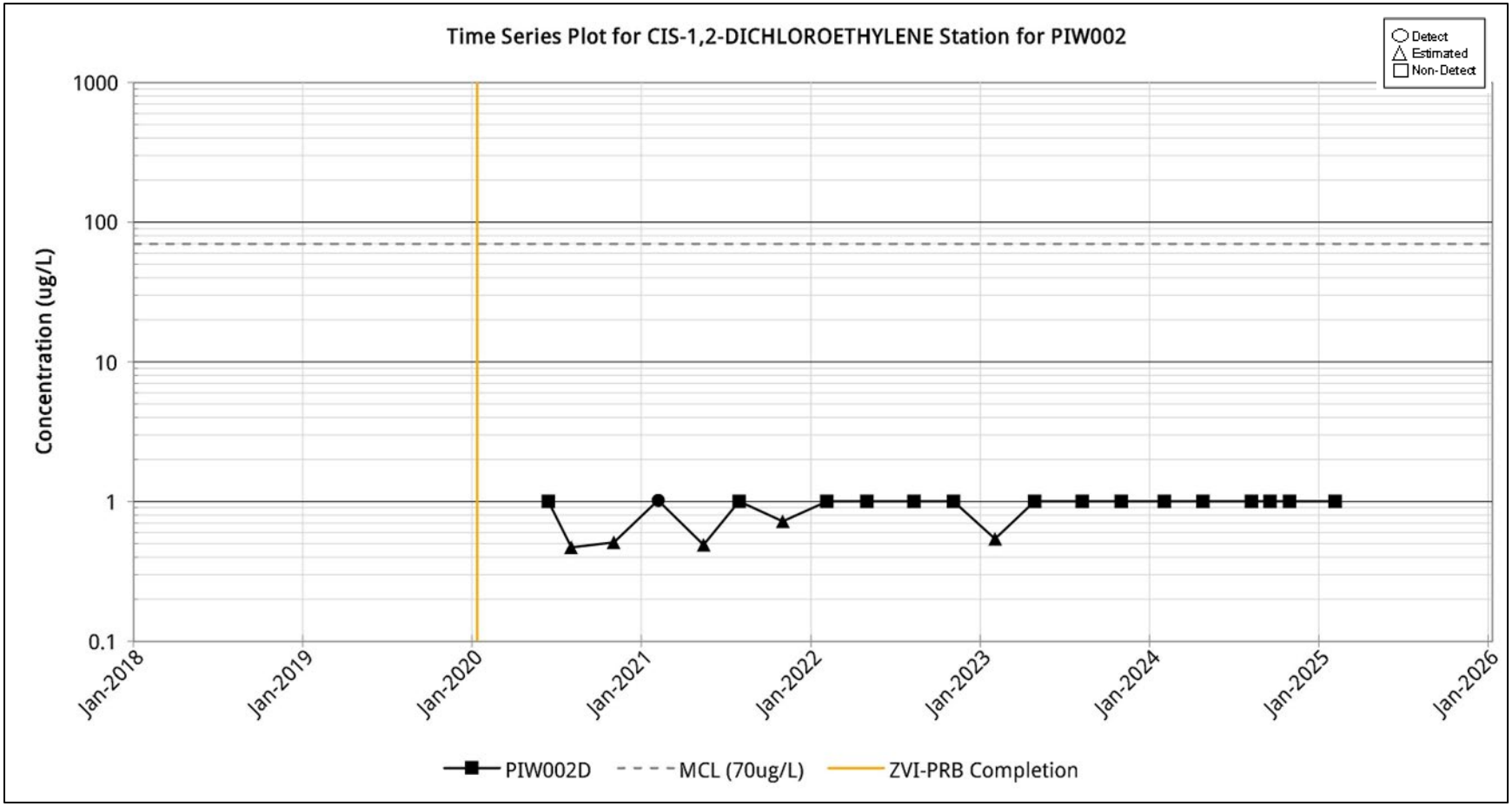


Figure C.9. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well PIW002D

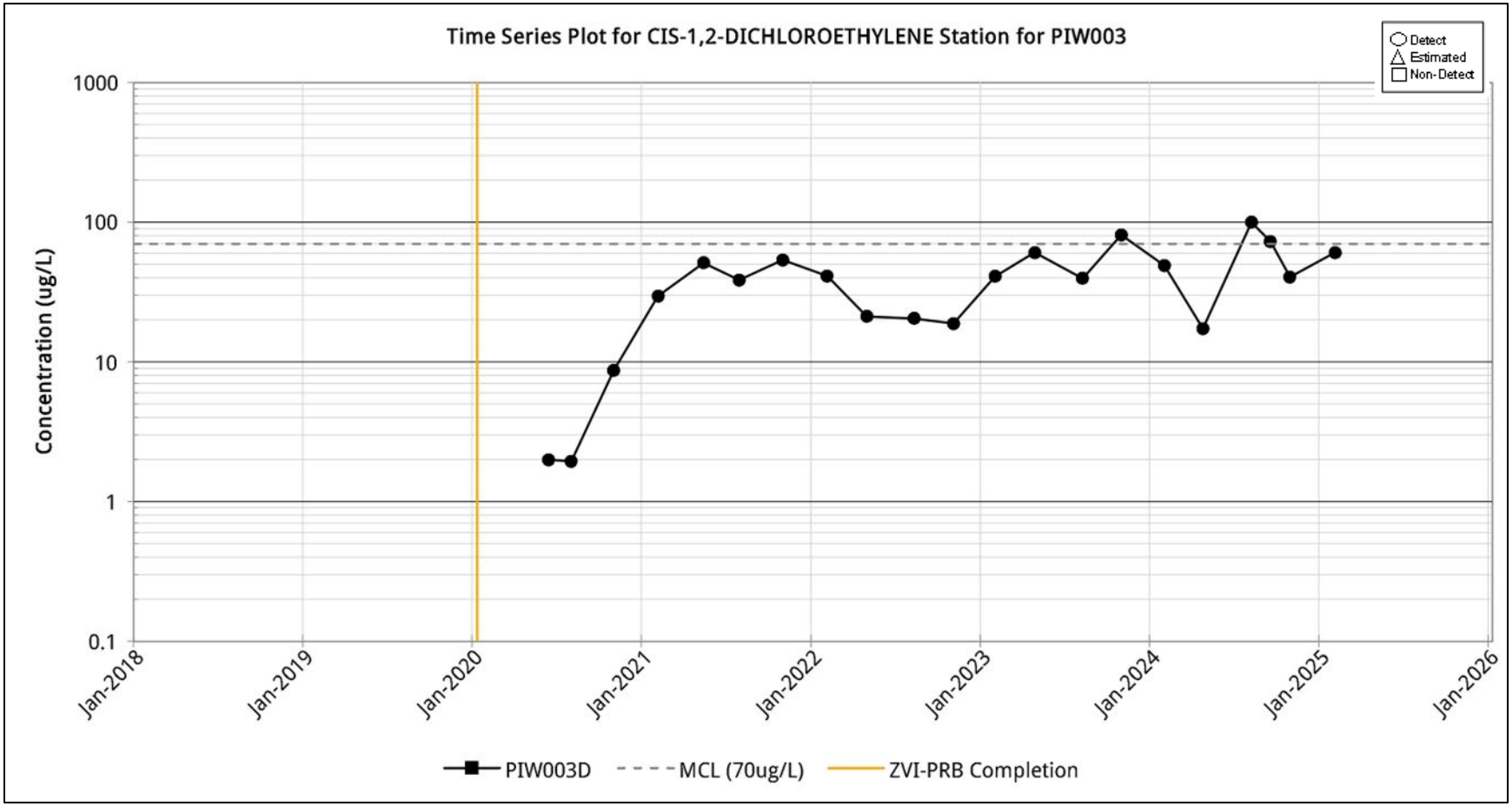


Figure C.10. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well PIW003D

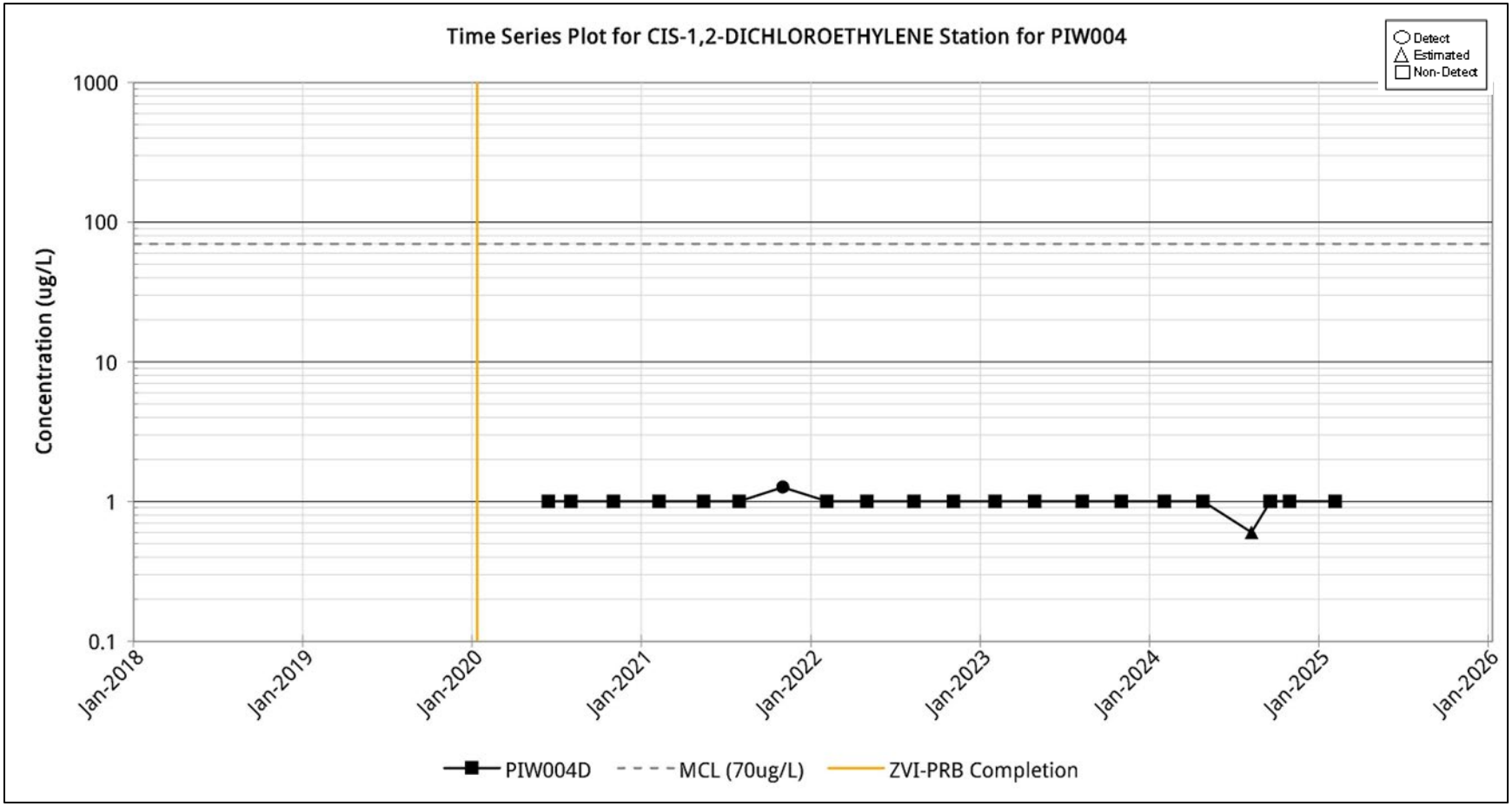


Figure C.11. Time Series Plot for Cis-1,2-Dichloroethylene at Monitoring Well PIW004D

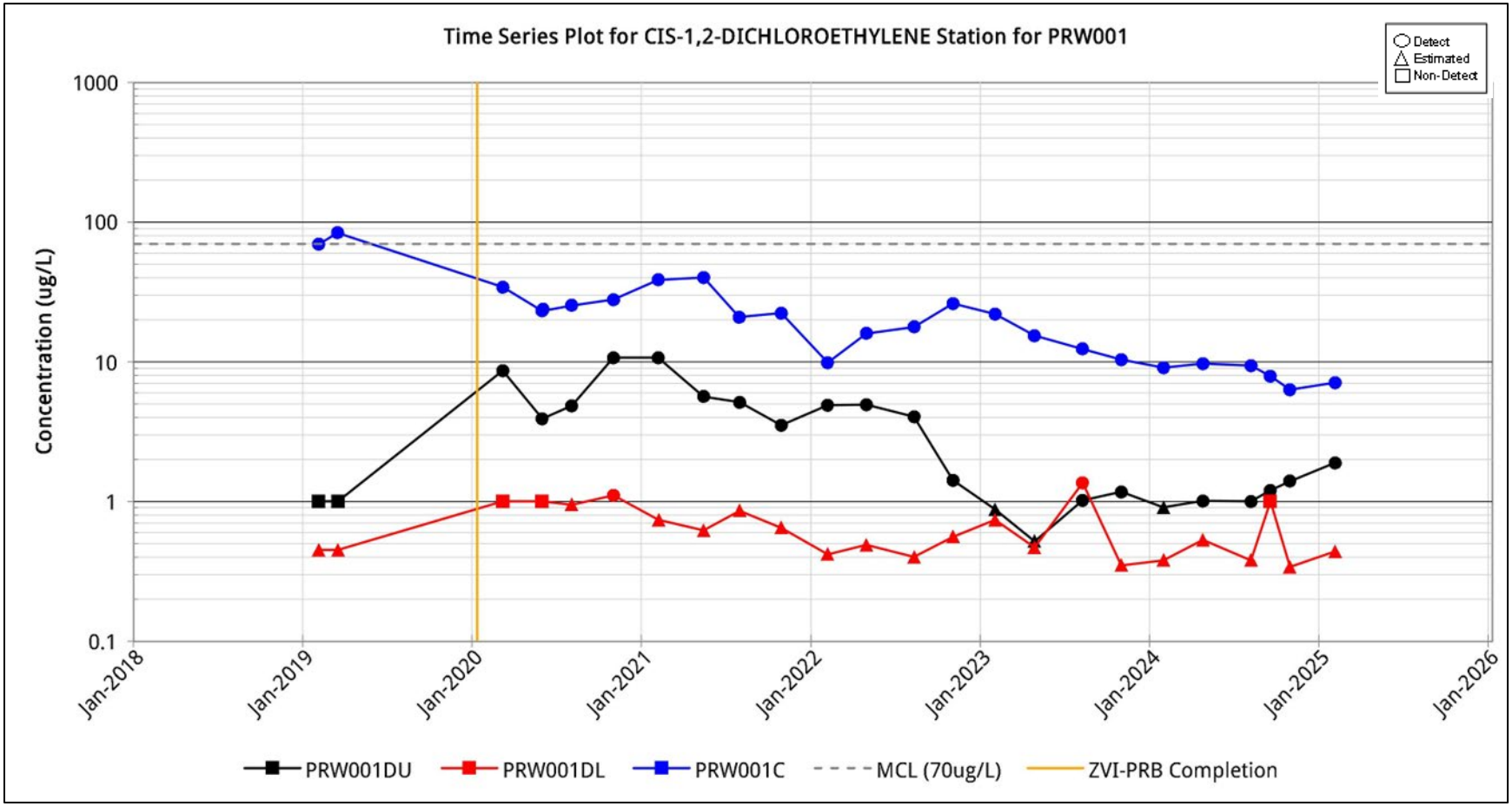


Figure C.12. Time Series Plot for Cis-1,2-Dichloroethylene at PRW001 Series Monitoring Wells

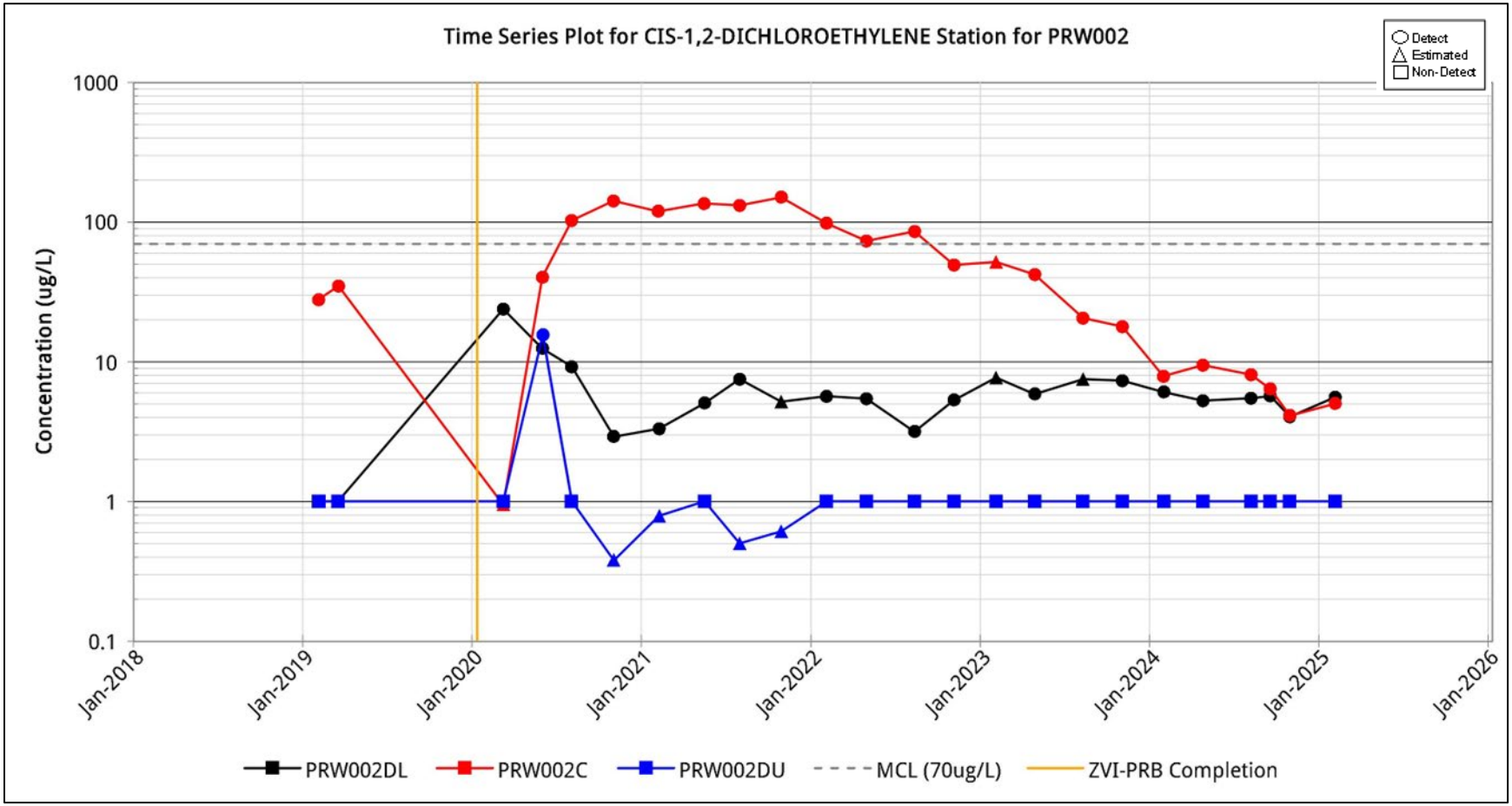


Figure C.13. Time Series Plot for Cis-1,2-Dichloroethylene at PRW002 Series Monitoring Wells

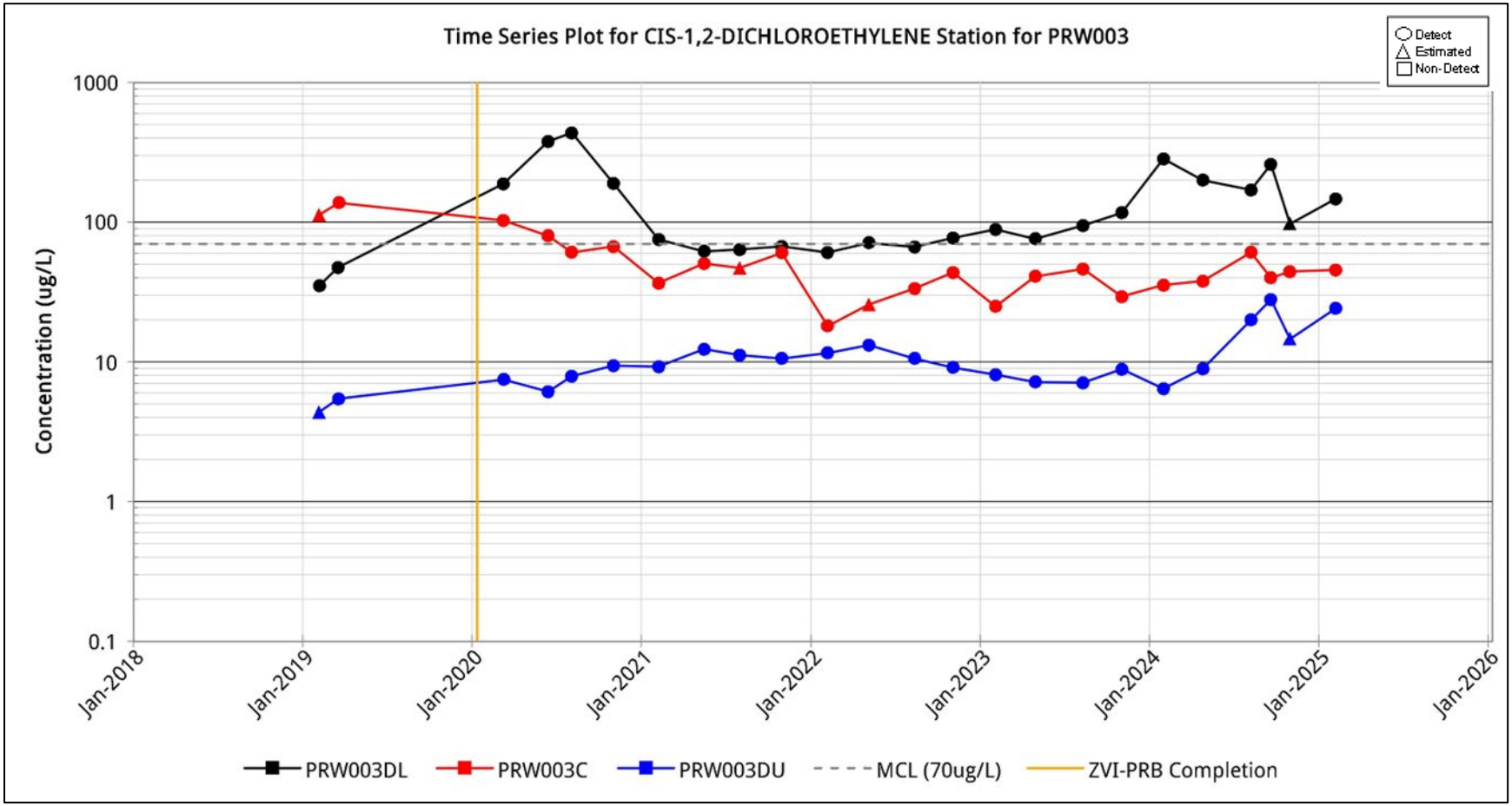


Figure C.14. Time Series Plot for Cis-1,2-Dichloroethylene at PRW003 Series Monitoring Wells

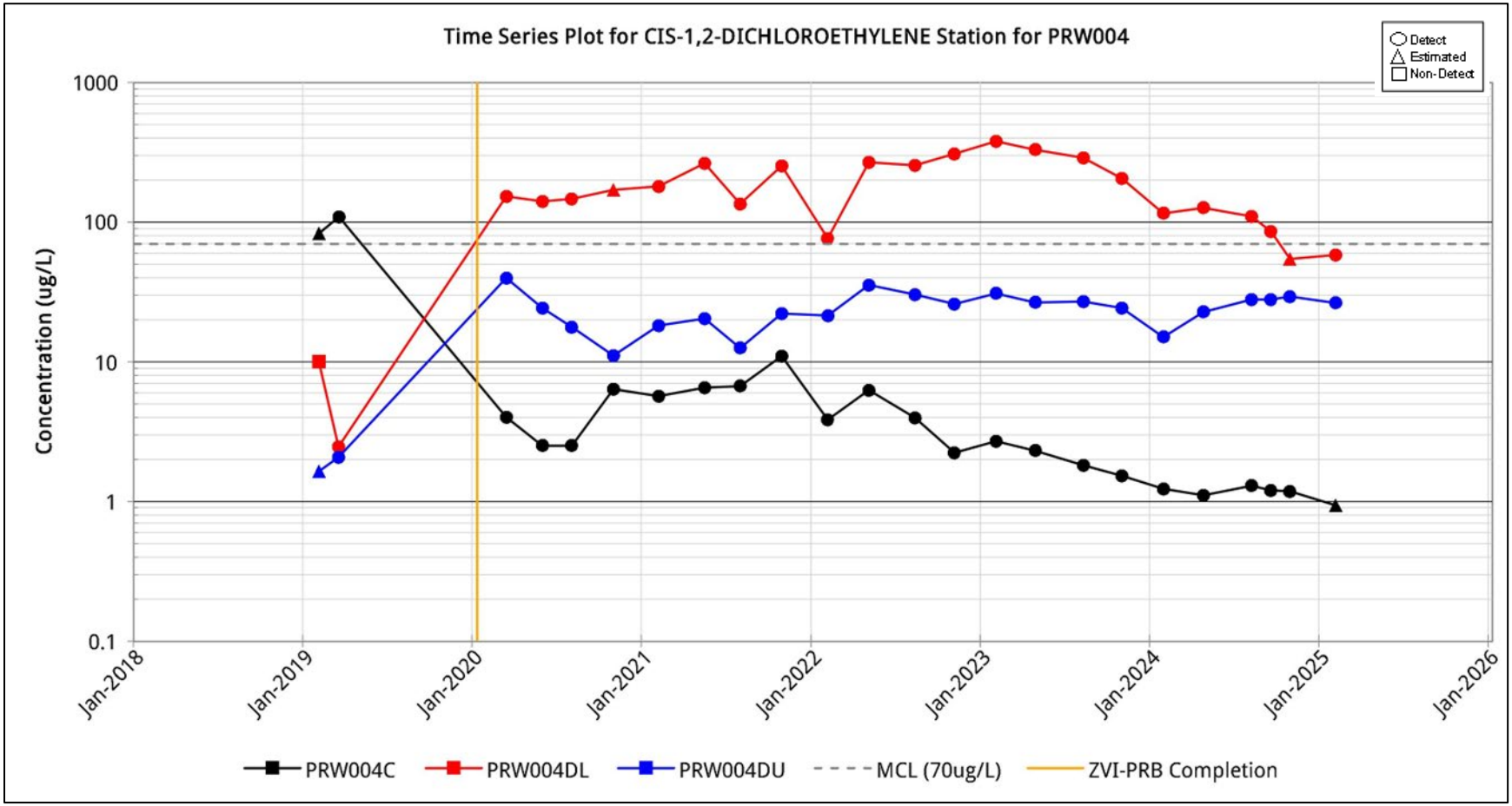


Figure C.15. Time Series Plot for Cis-1,2-Dichloroethylene at PRW004 Series Monitoring Wells

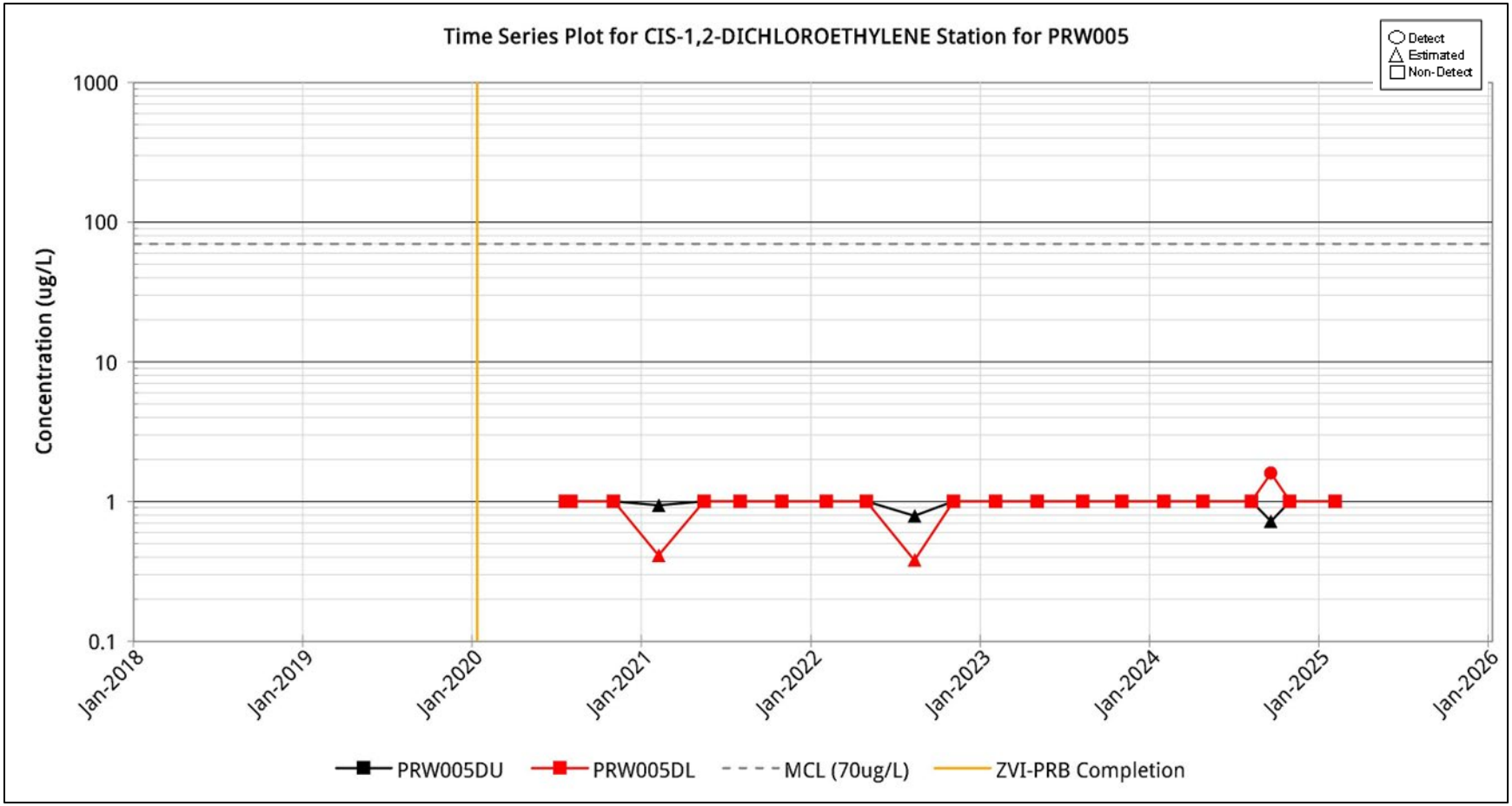


Figure C.16. Time Series Plot for Cis-1,2-Dichloroethylene at PRW005 Series Monitoring Wells

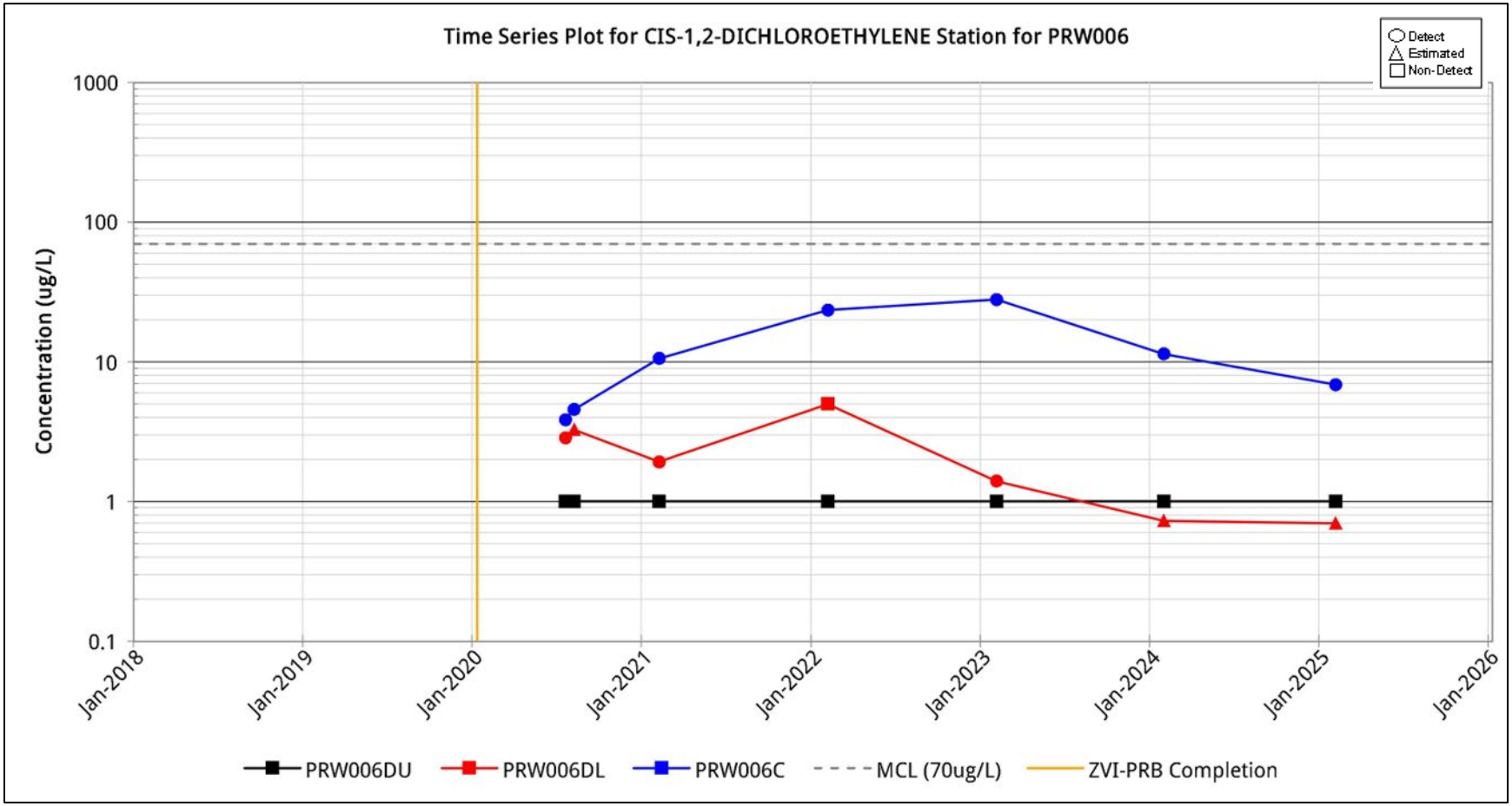


Figure C.17. Time Series Plot for Cis-1,2-Dichloroethylene at PRW006 Series Monitoring Wells

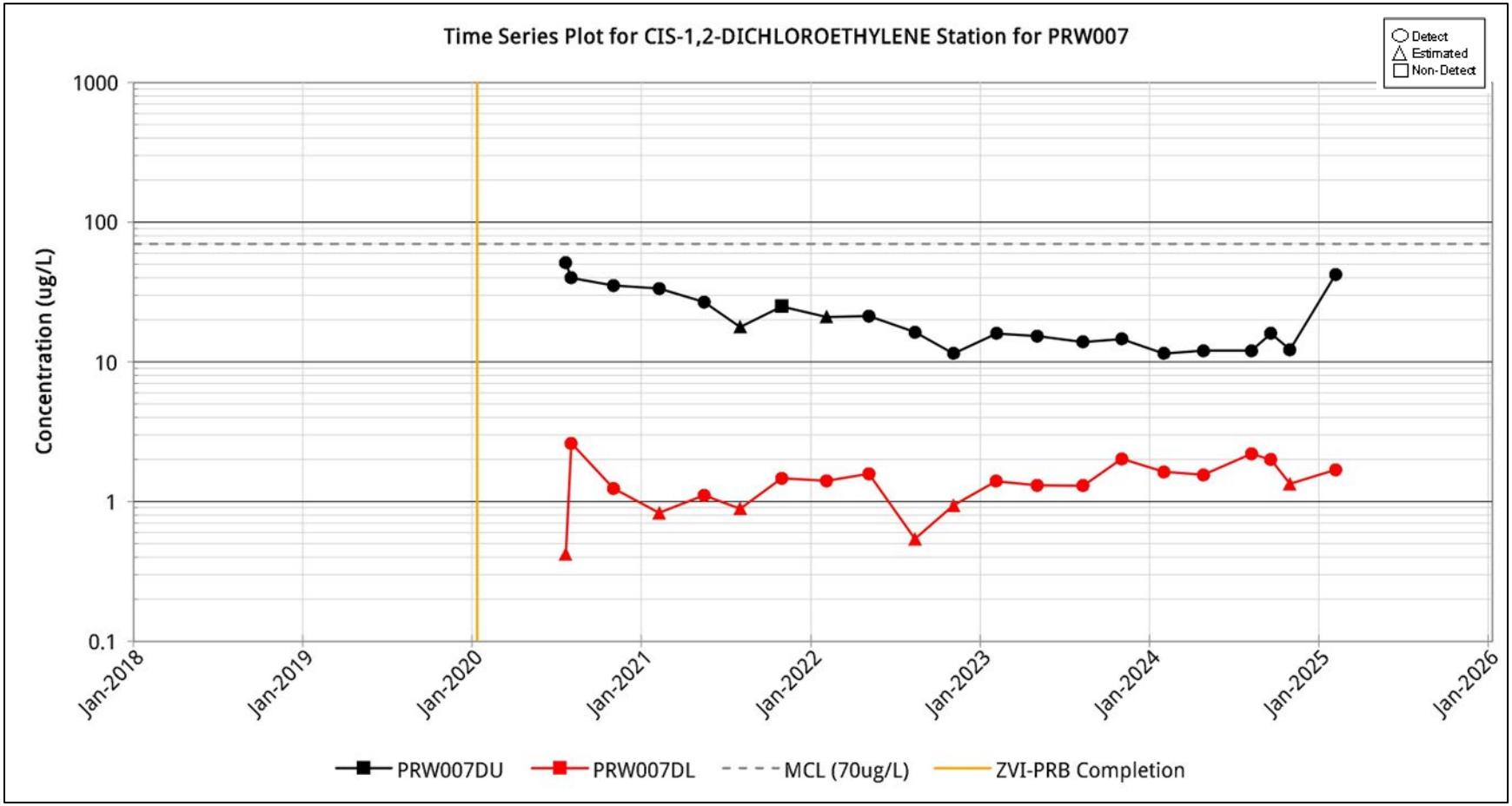


Figure C.18. Time Series Plot for Cis-1,2-Dichloroethylene at PRW007 Series Monitoring Wells

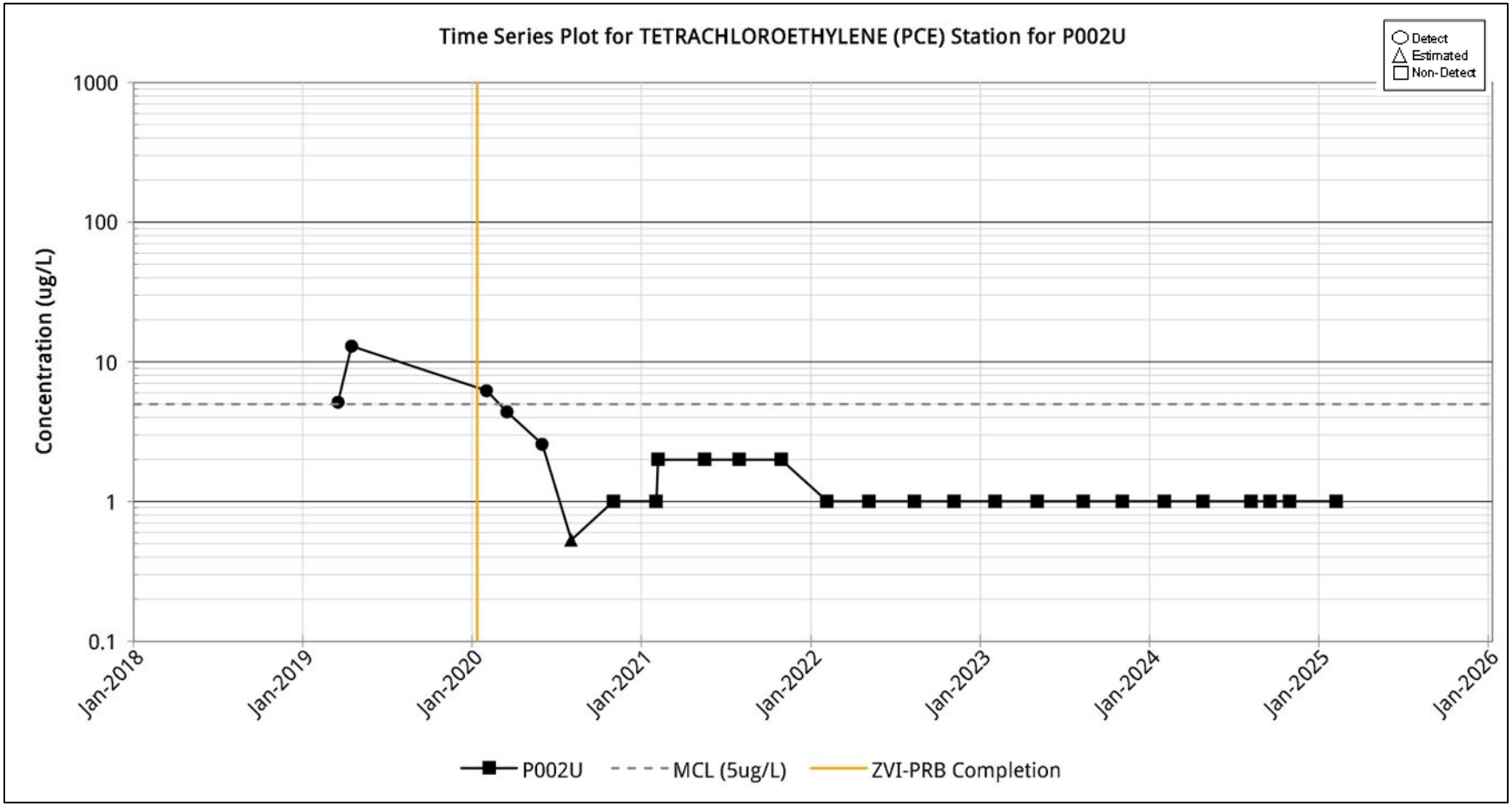


Figure C.19. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well P002U

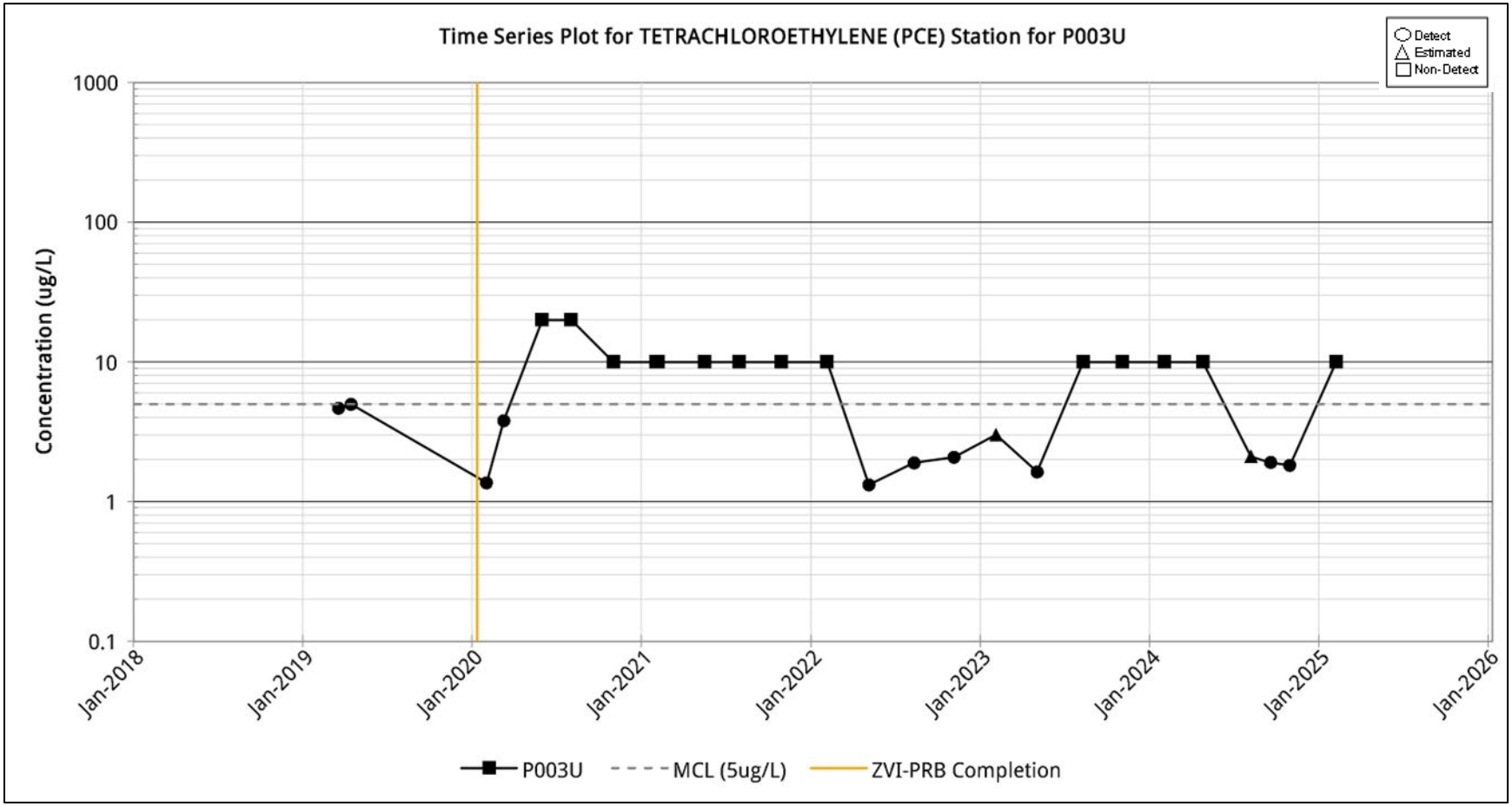


Figure C.20. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well P003U

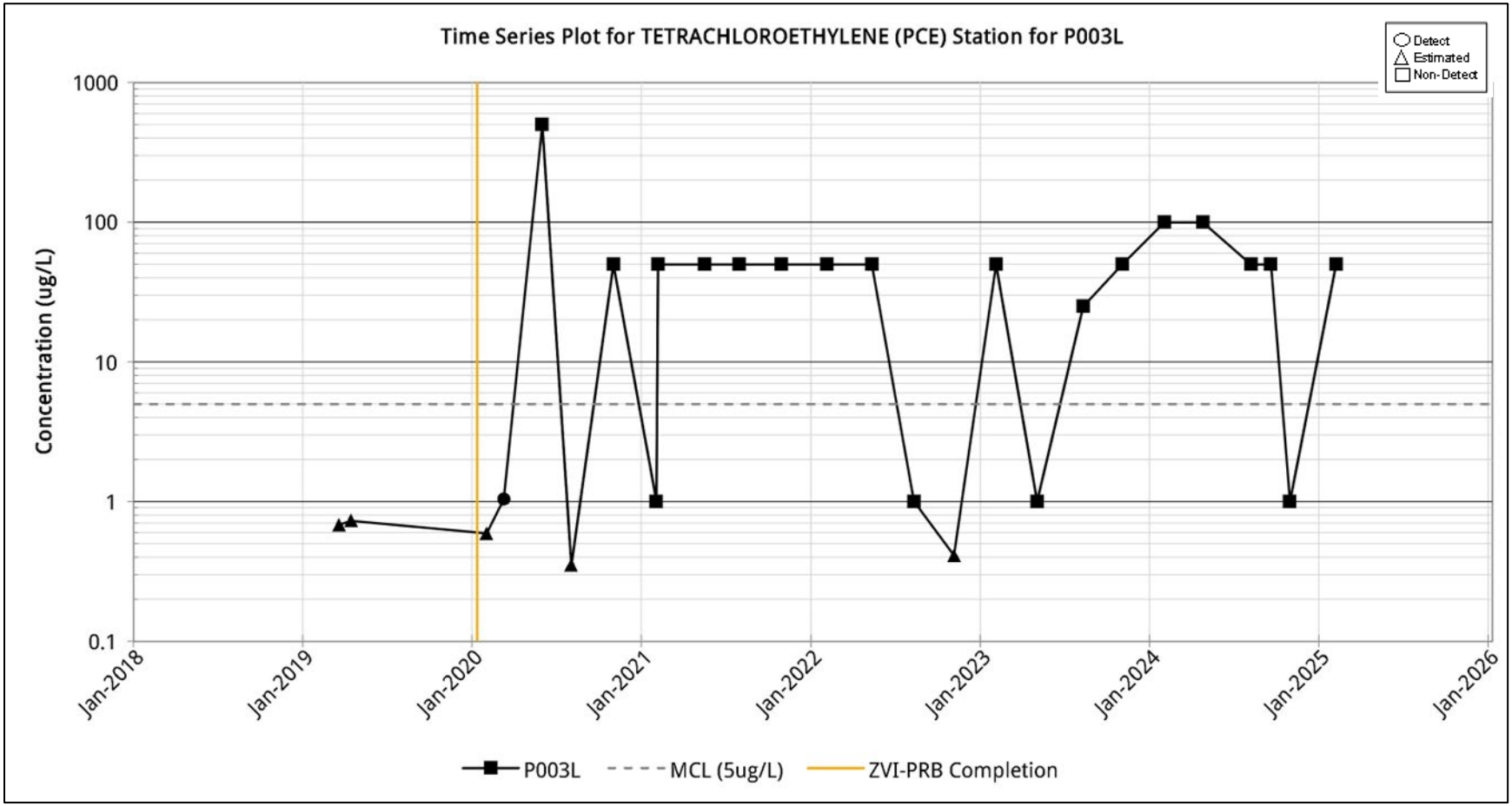


Figure C.21. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well P003L

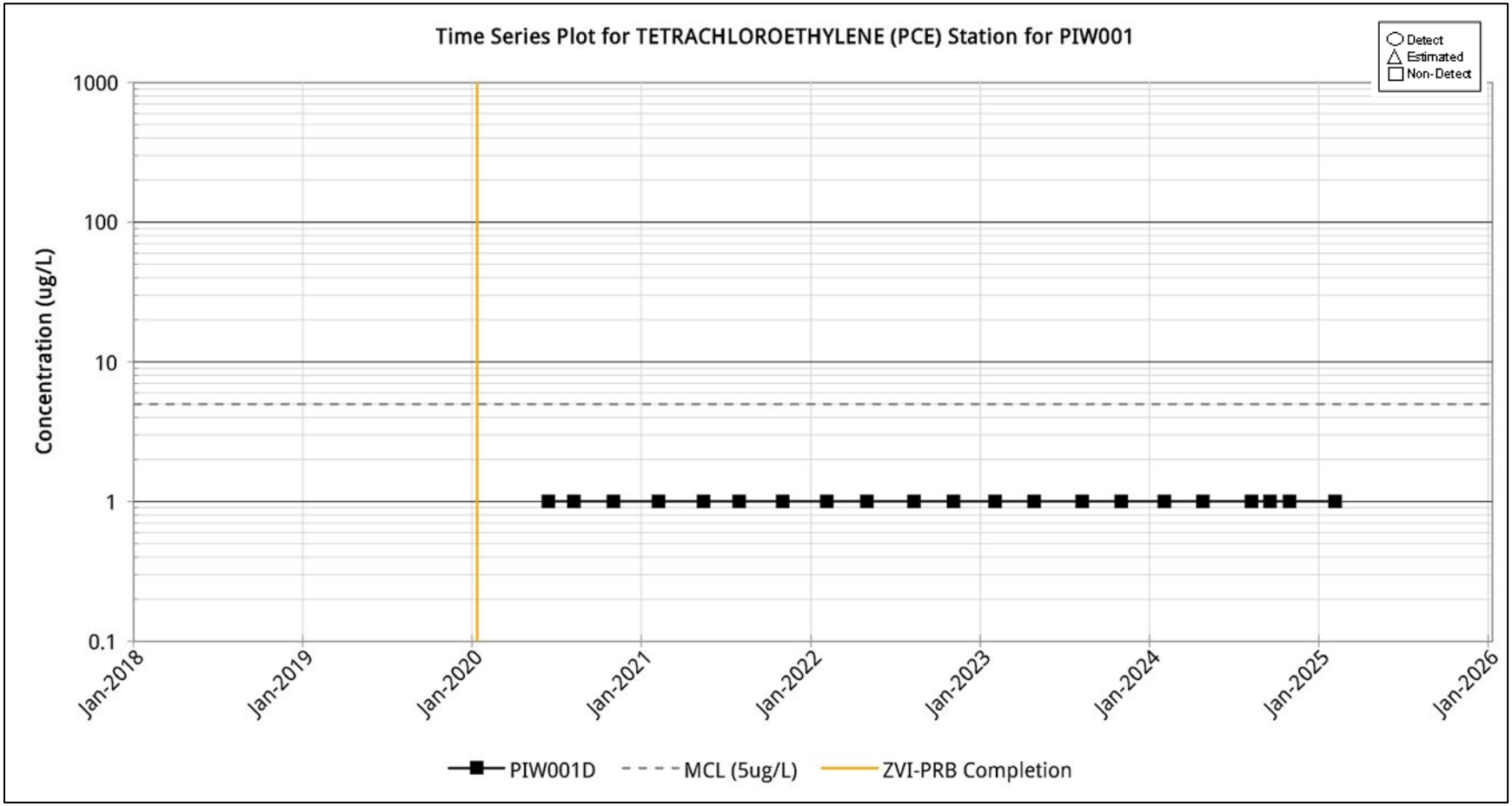


Figure C.22. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well PIW001D

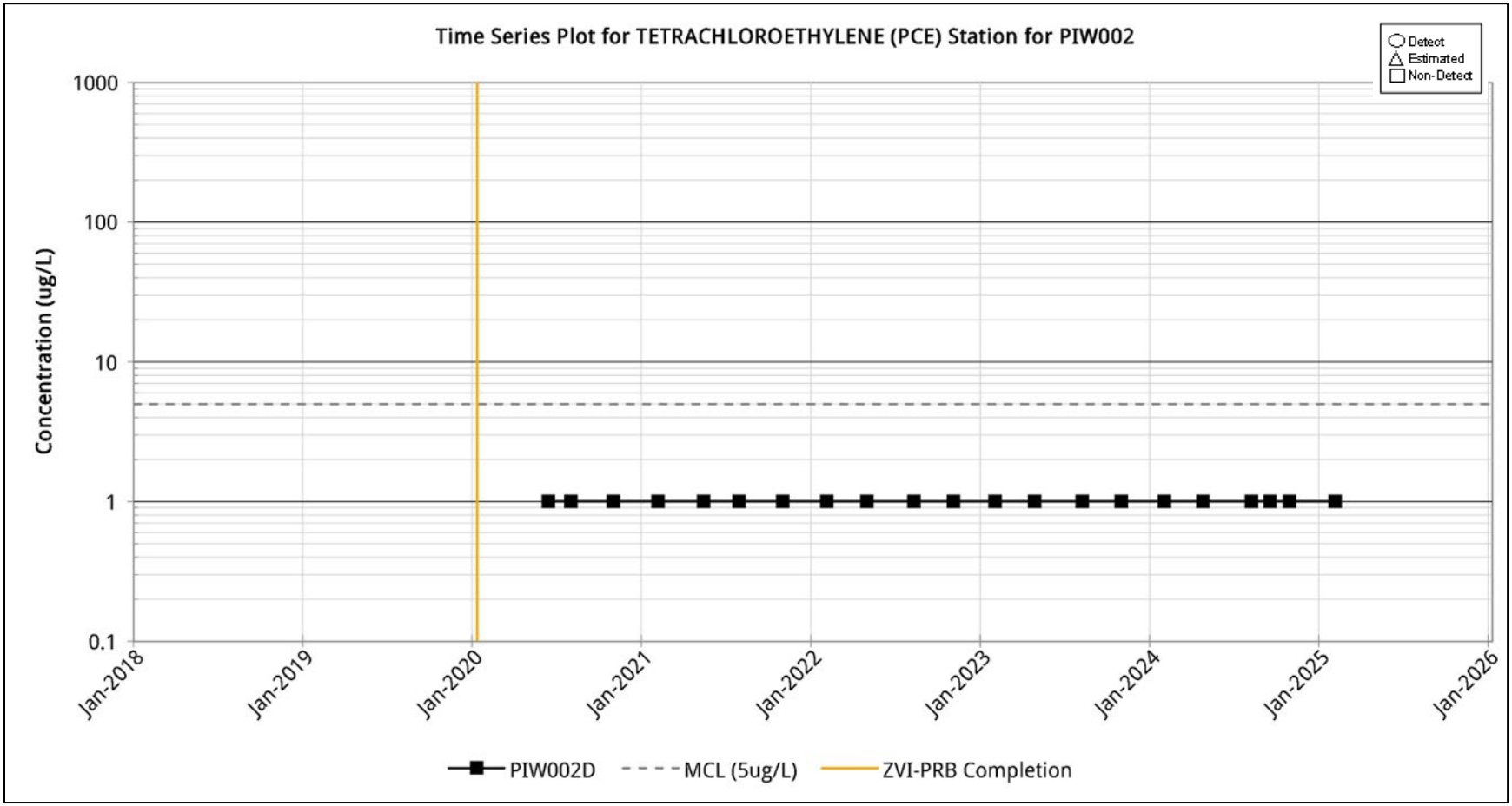


Figure C.23. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well PIW002D

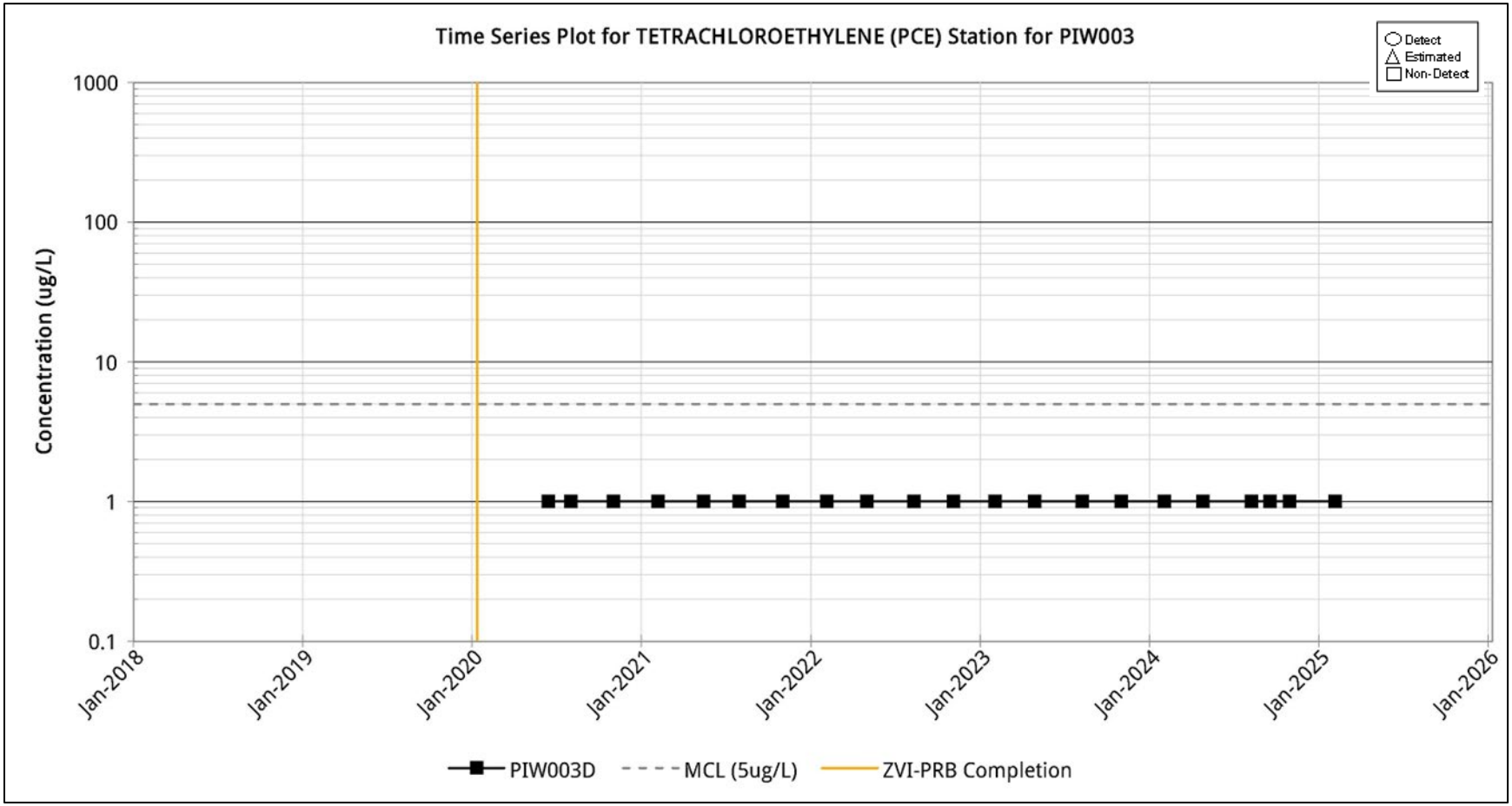


Figure C.24. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well PIW003D

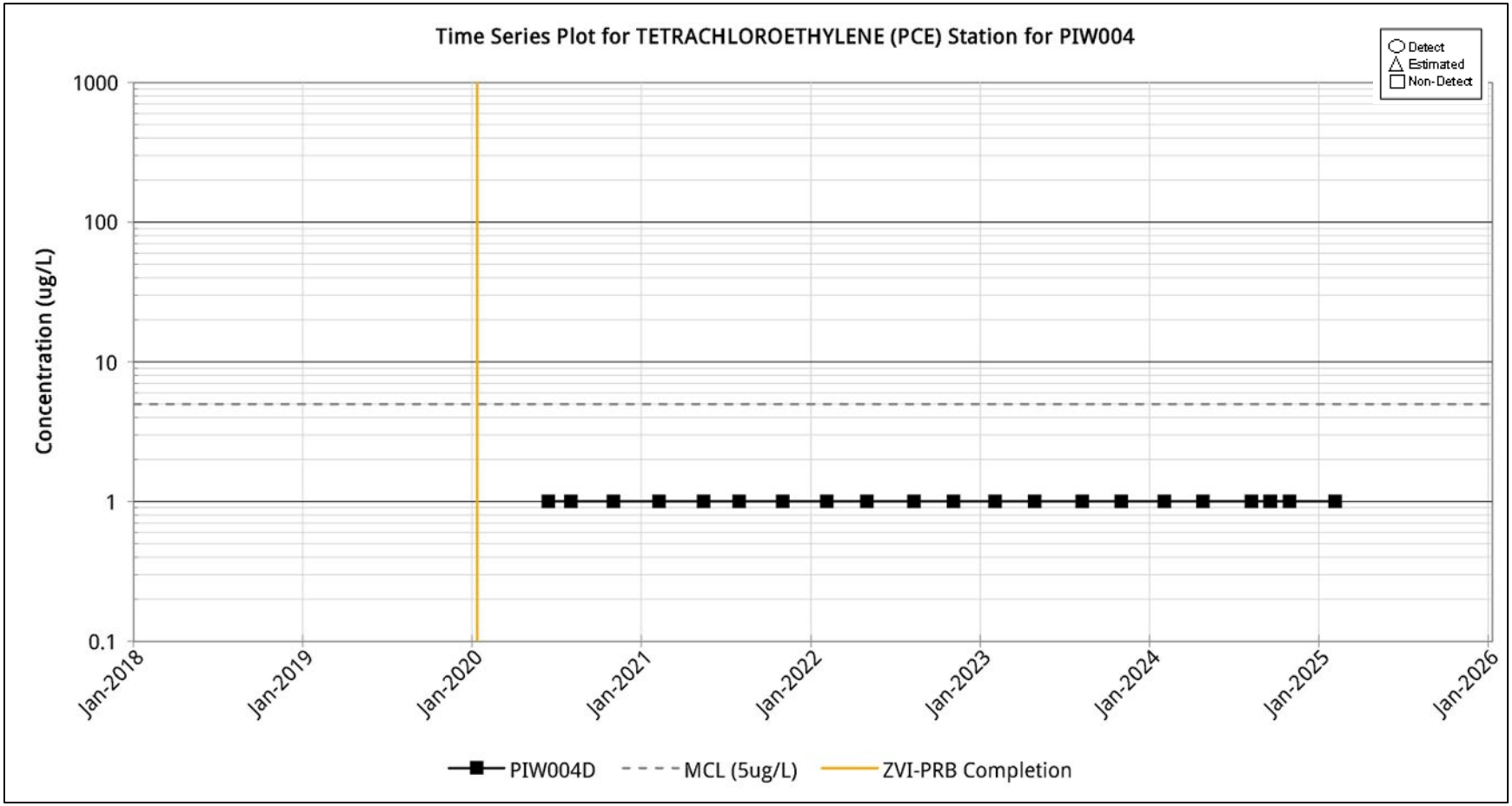


Figure C.25. Time Series Plot for Tetrachloroethylene (PCE) at Monitoring Well PIW004D

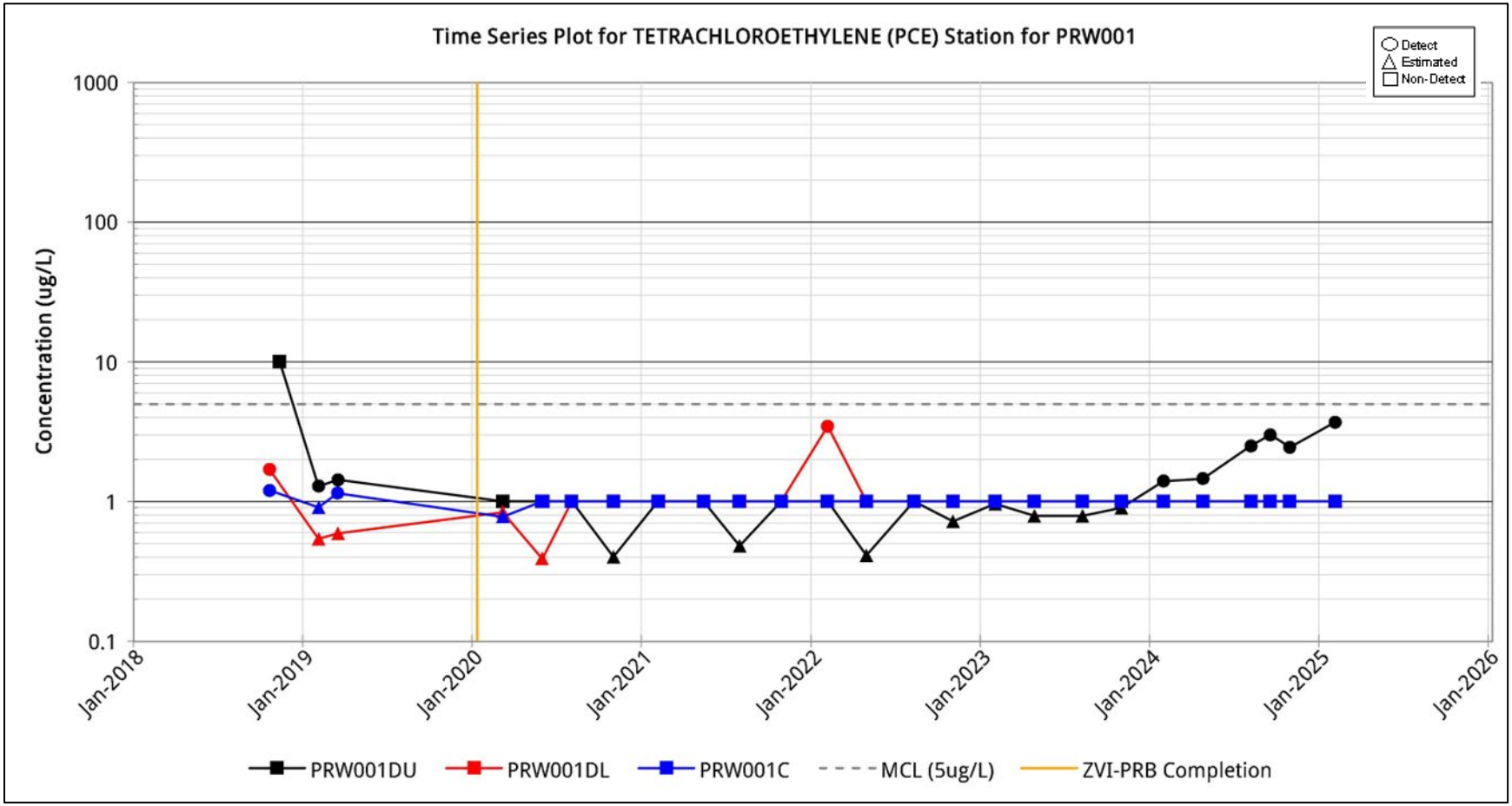


Figure C.26. Time Series Plot for Tetrachloroethylene (PCE) at PRW001 Series Monitoring Wells

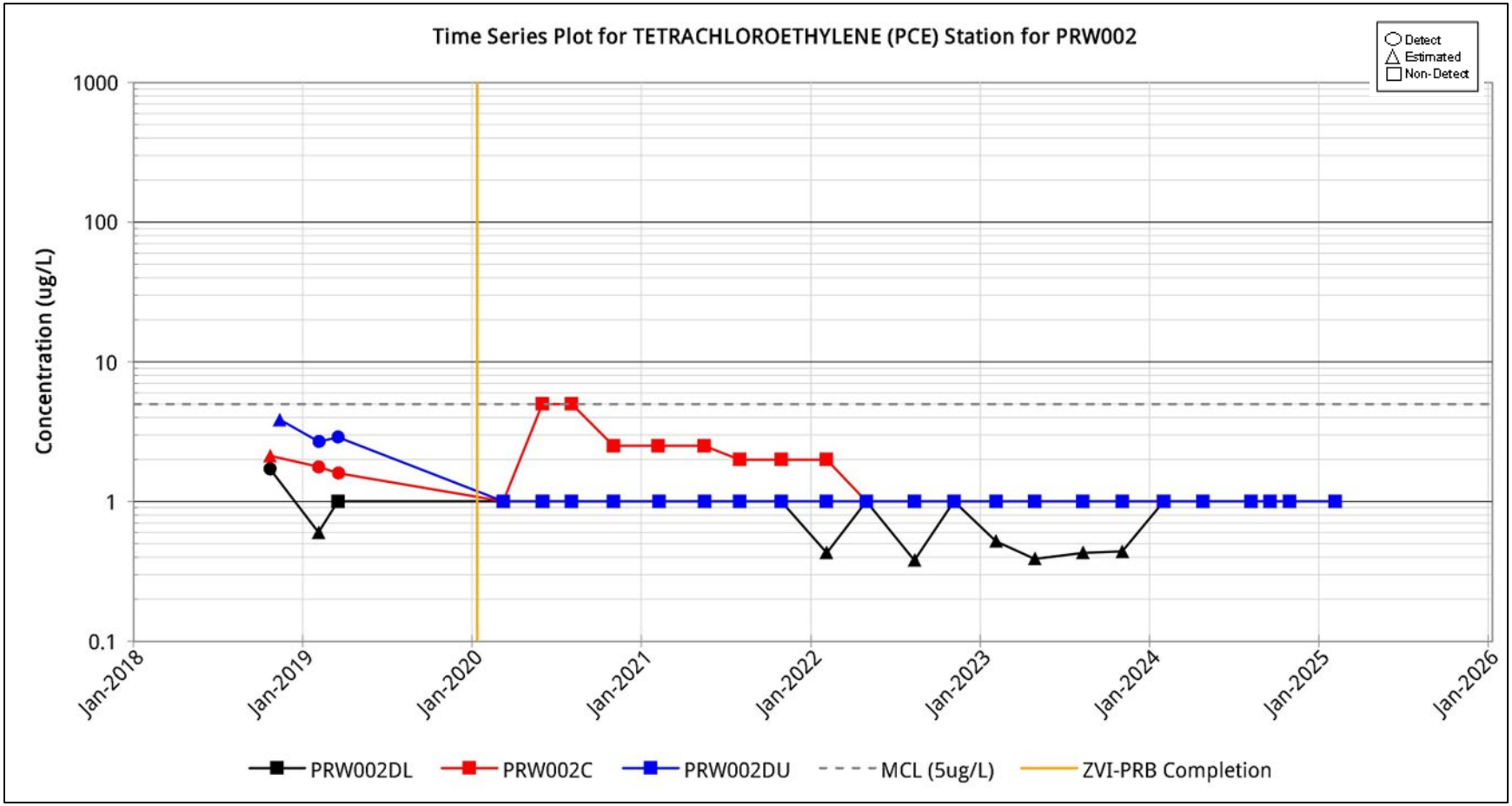


Figure C.27. Time Series Plot for Tetrachloroethylene (PCE) at PRW002 Series Monitoring Wells

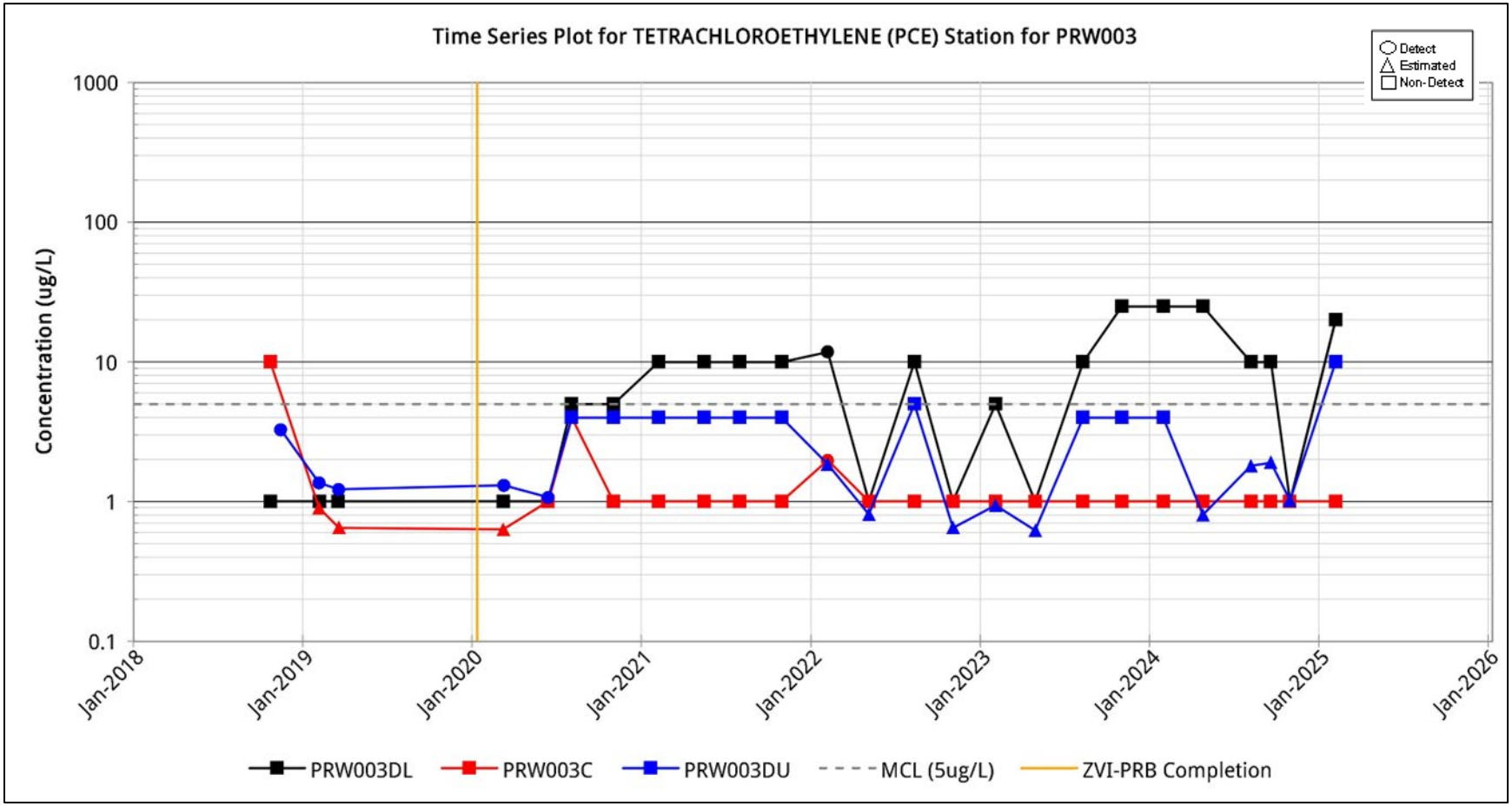


Figure C.28. Time Series Plot for Tetrachloroethylene (PCE) at PRW003 Series Monitoring Wells

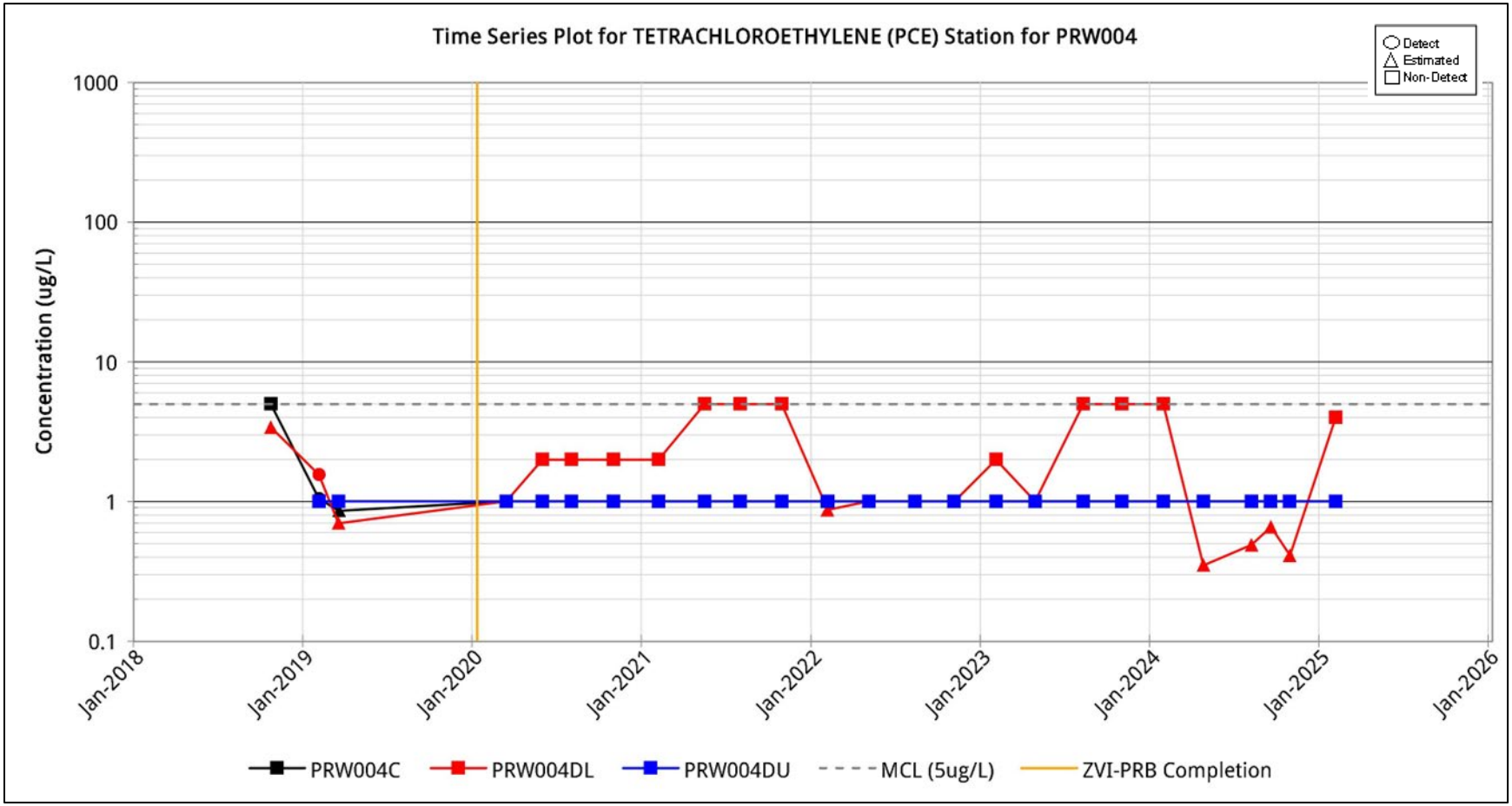


Figure C.29. Time Series Plot for Tetrachloroethylene (PCE) at PRW004 Series Monitoring Wells

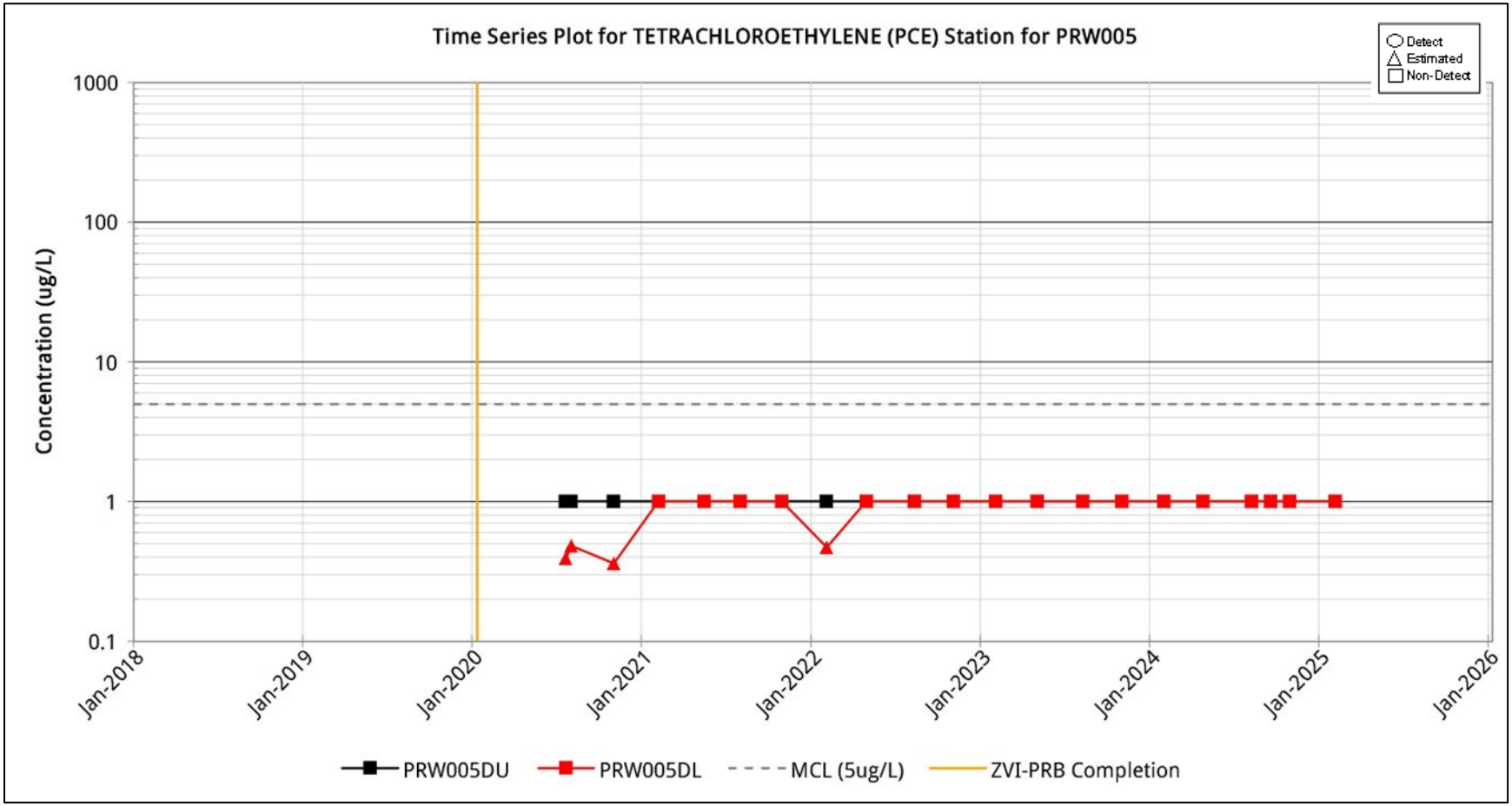


Figure C.30. Time Series Plot for Tetrachloroethylene (PCE) at PRW005 Series Monitoring Wells

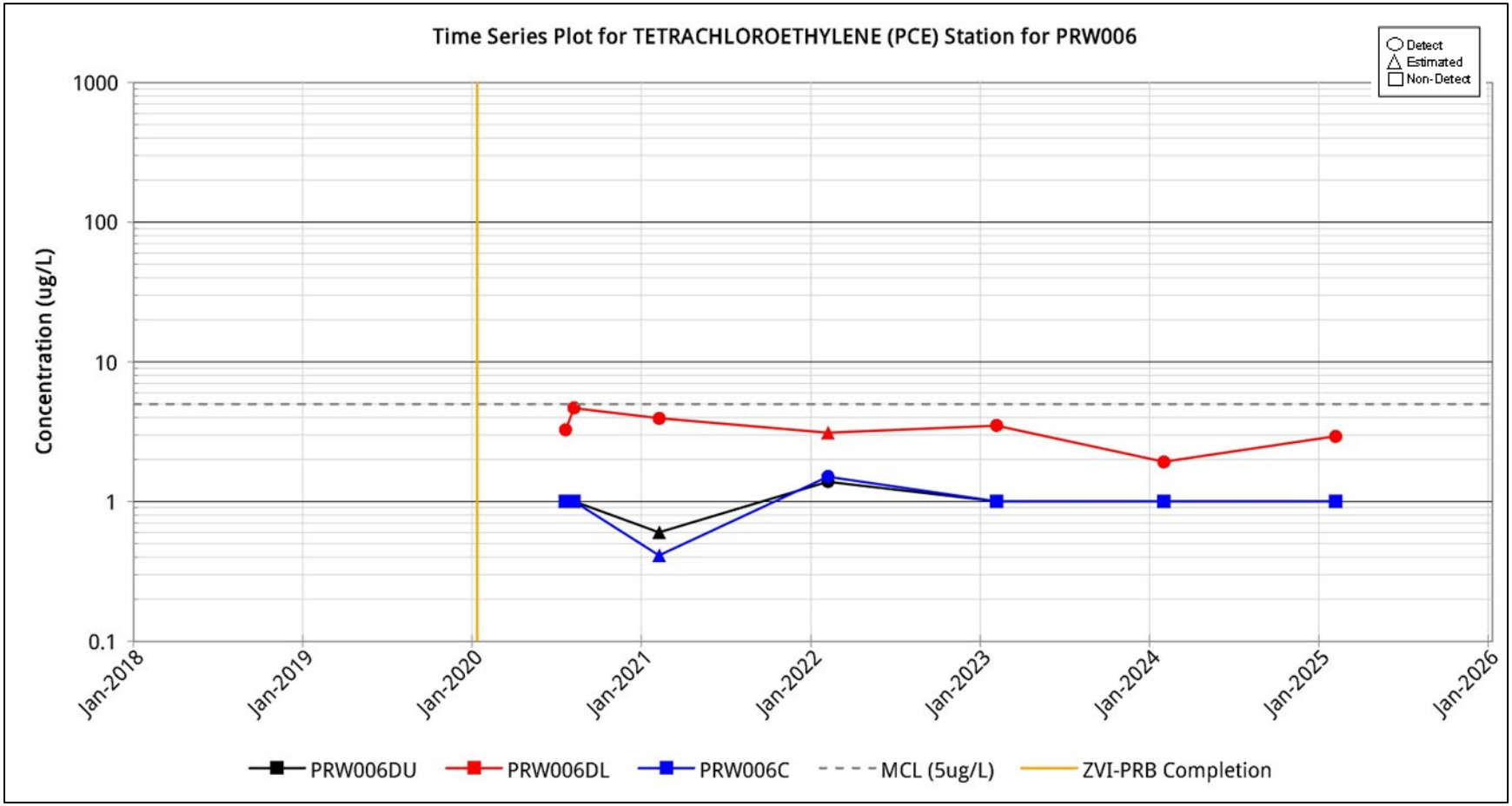


Figure C.31. Time Series Plot for Tetrachloroethylene (PCE) at PRW006 Series Monitoring Wells

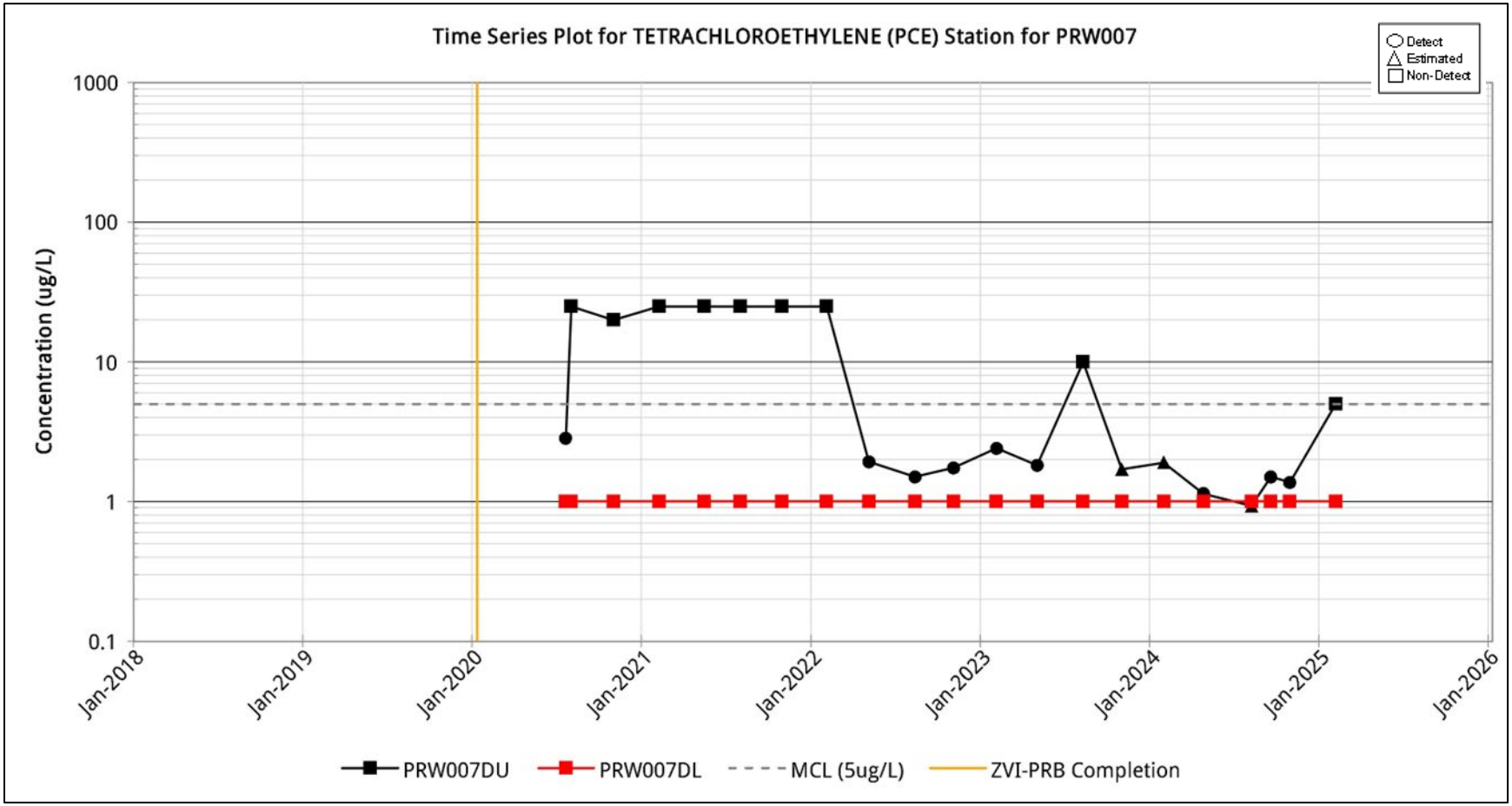


Figure C.32. Time Series Plot for Tetrachloroethylene (PCE) at PRW007 Series Monitoring Wells

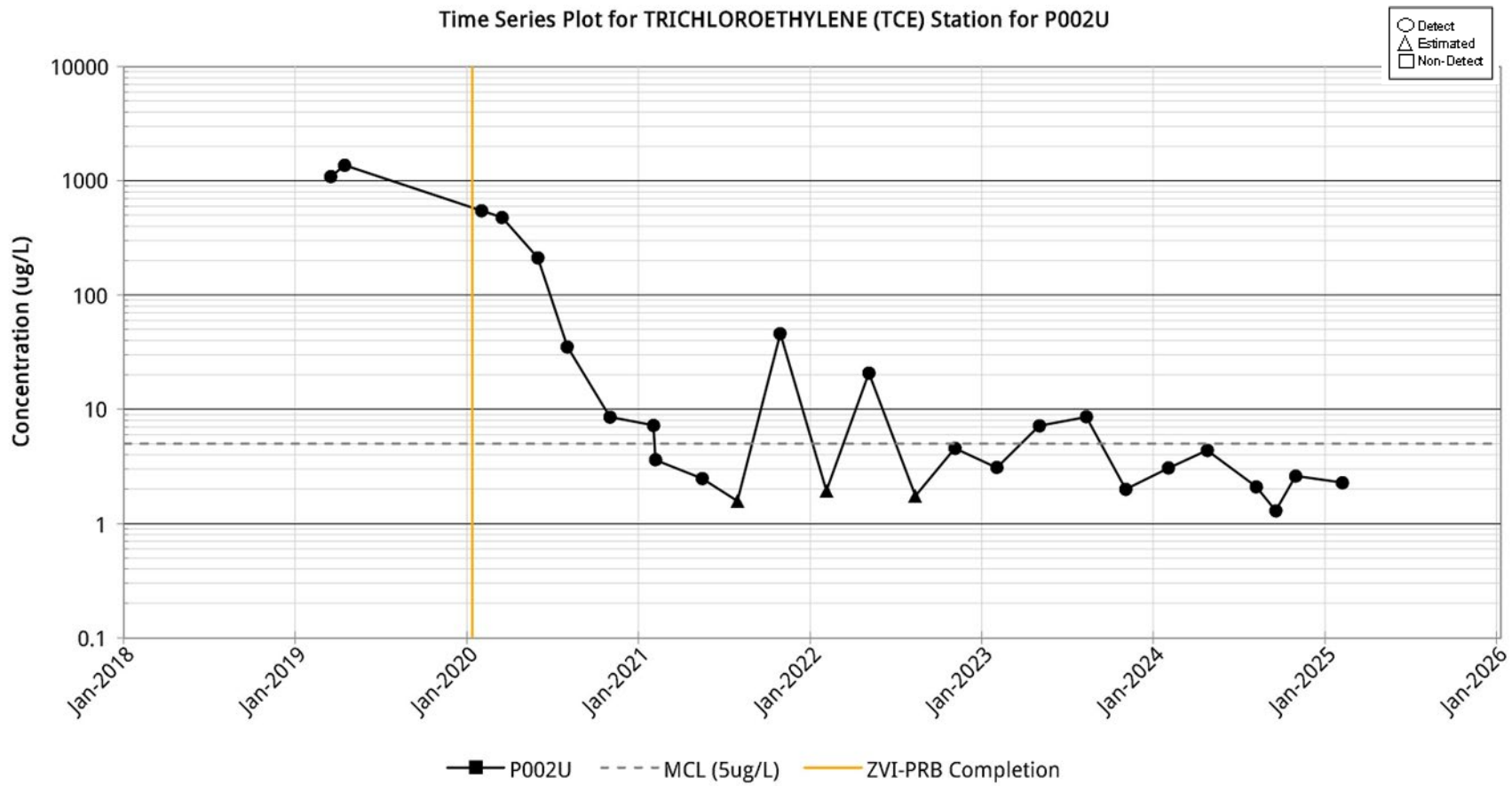


Figure C.33. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well P002U

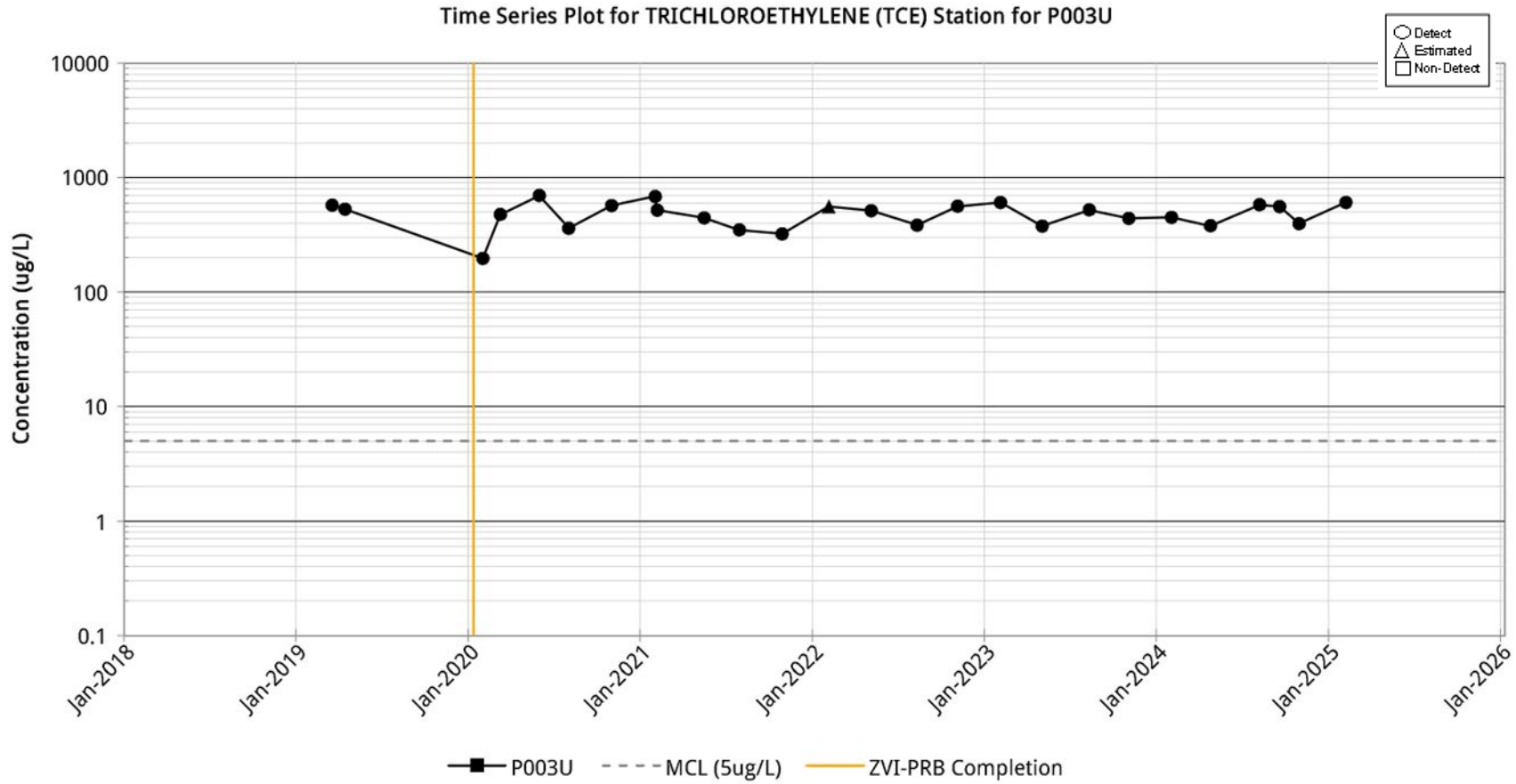


Figure C.34. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well P003U

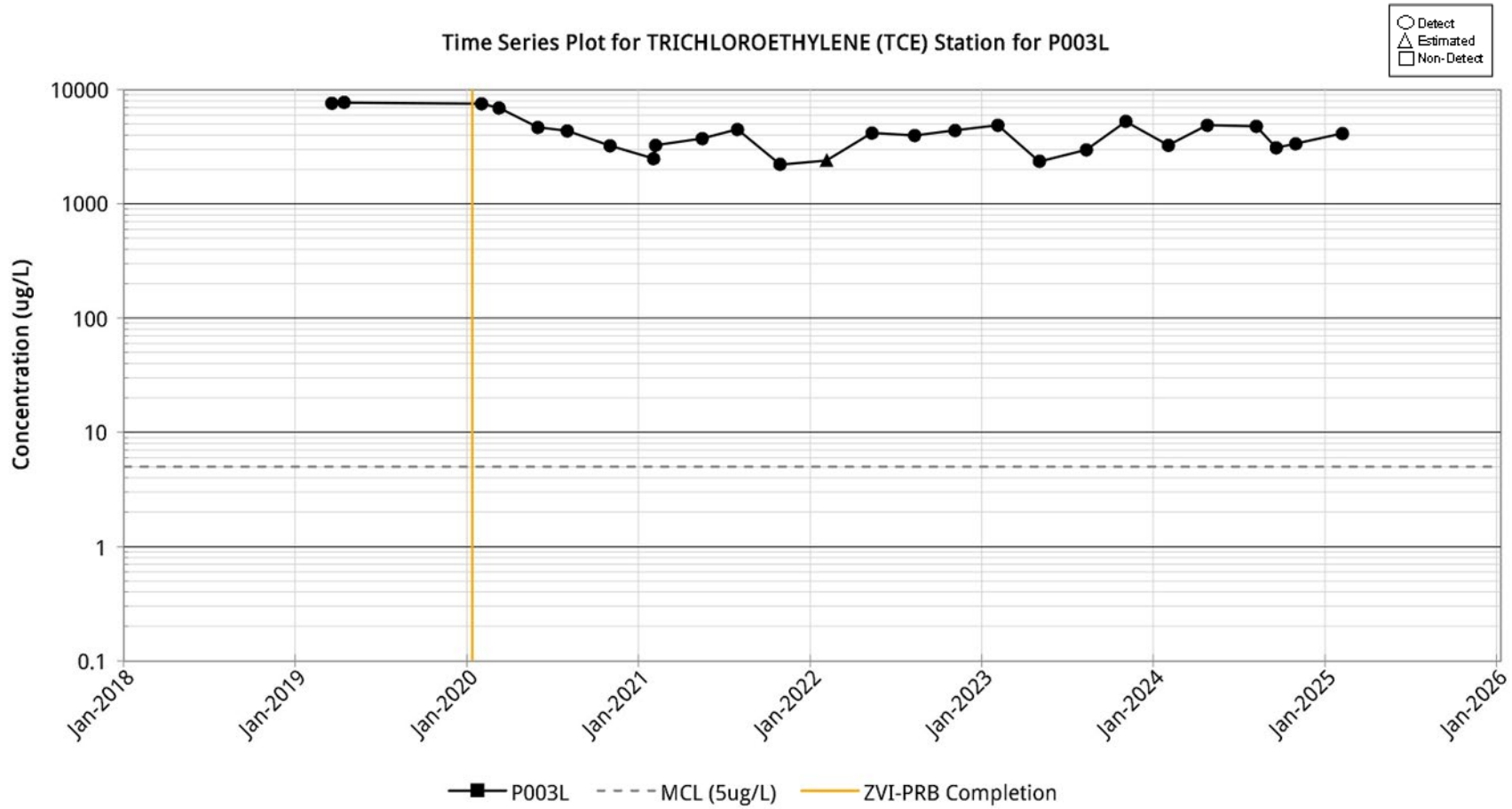


Figure C.35. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well P003L

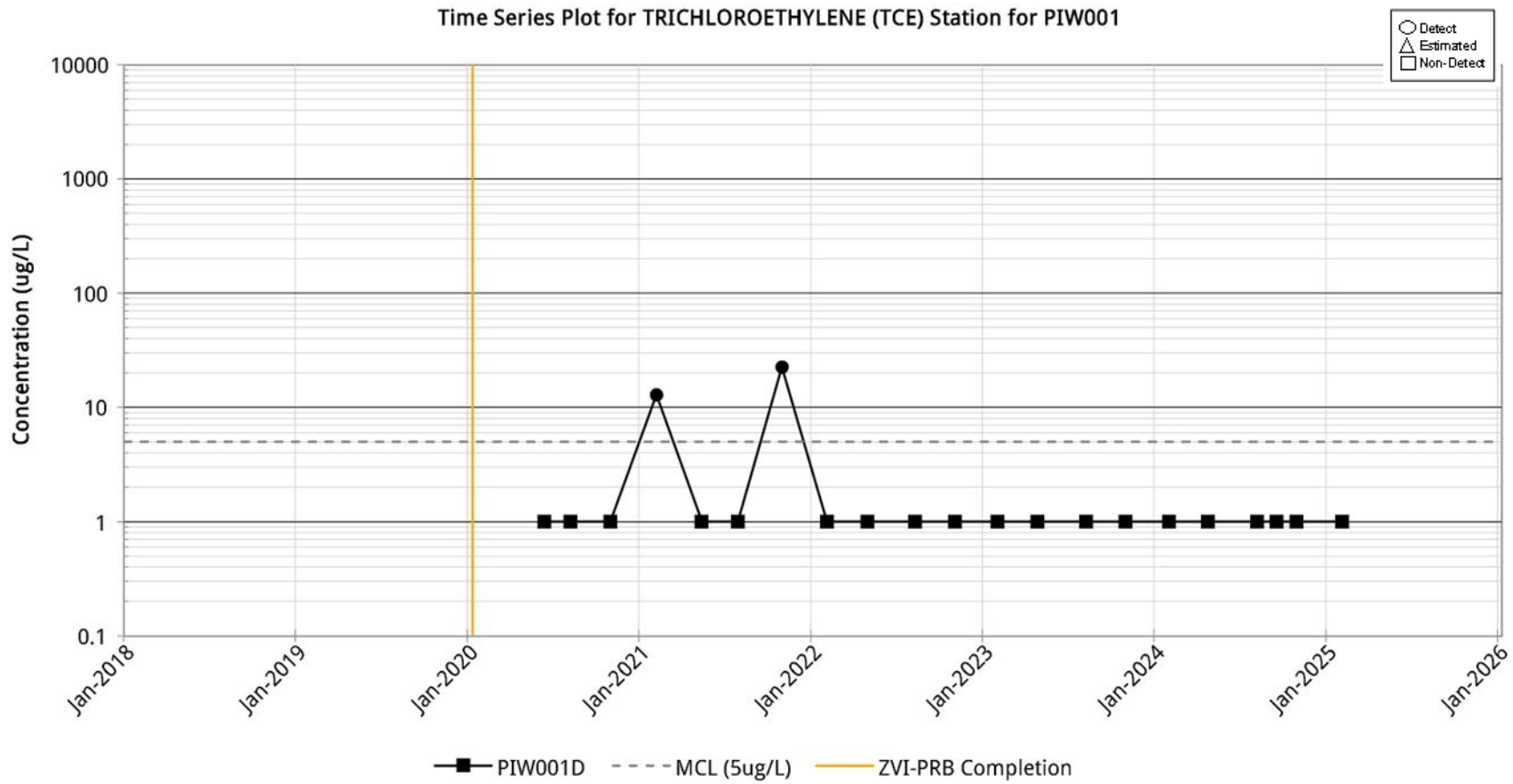


Figure C.36. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well PIW001D

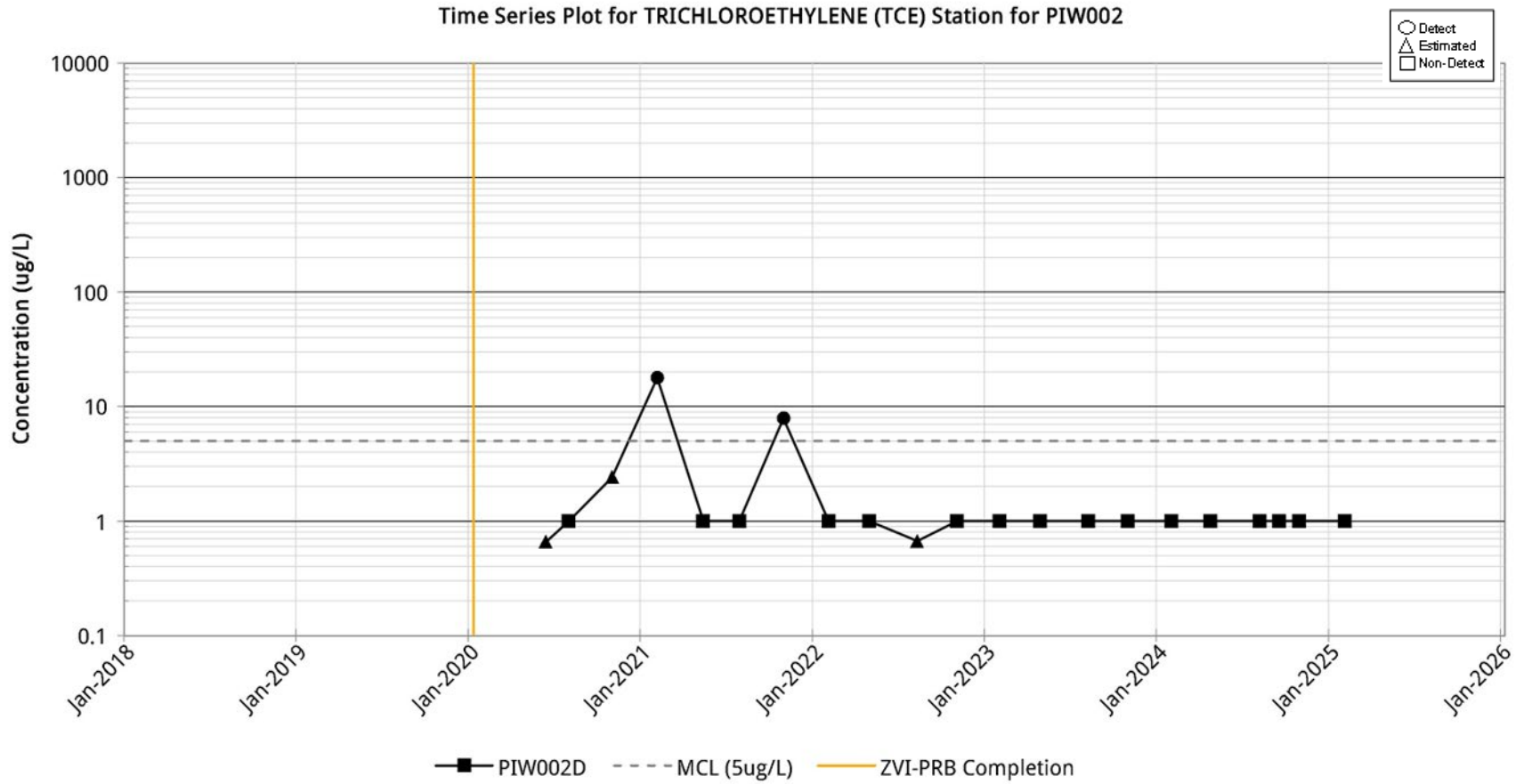


Figure C.37. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well PIW002D

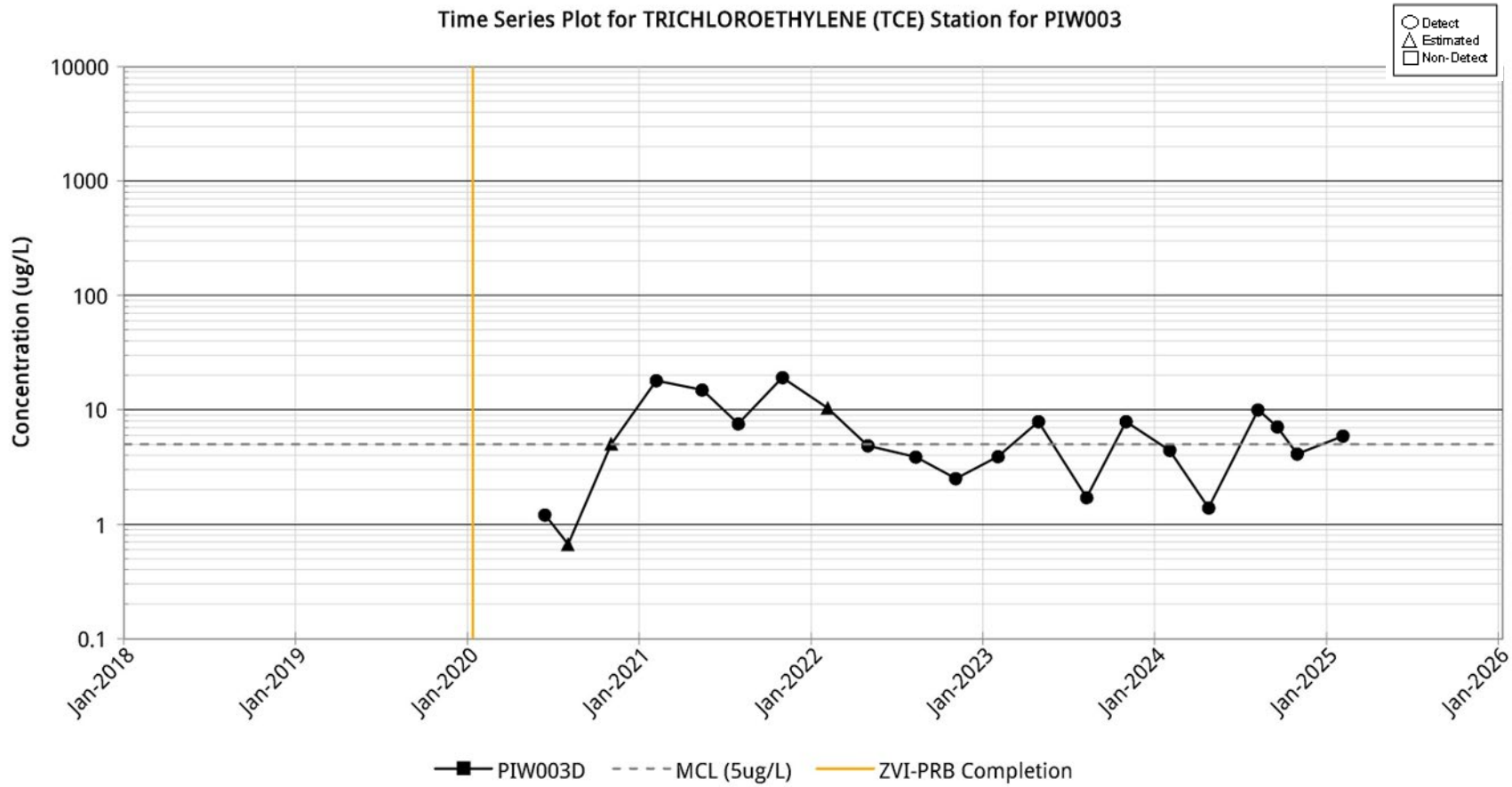


Figure C.38. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well PIW003D

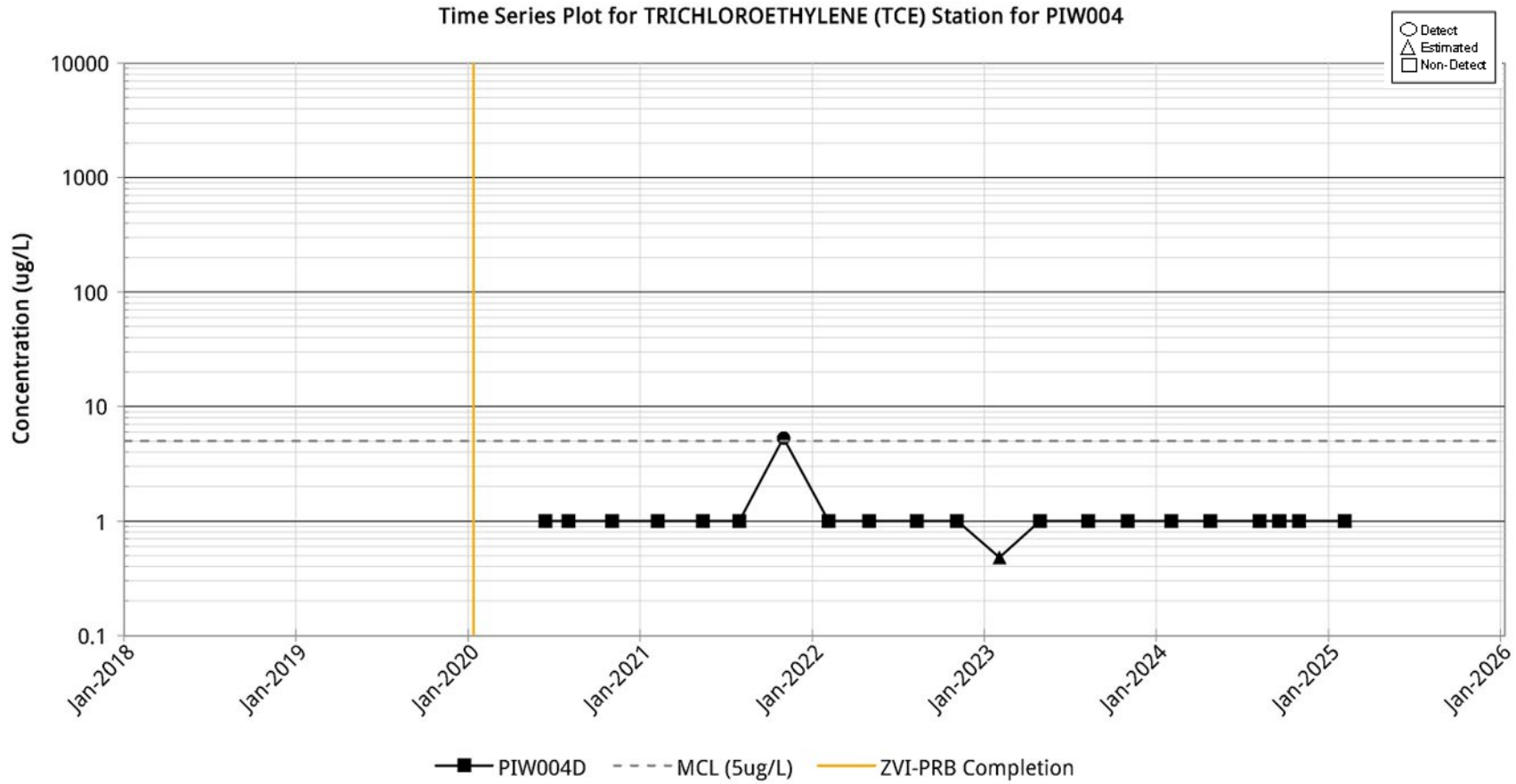


Figure C.39. Time Series Plot for Trichloroethylene (TCE) at Monitoring Well PIW004D

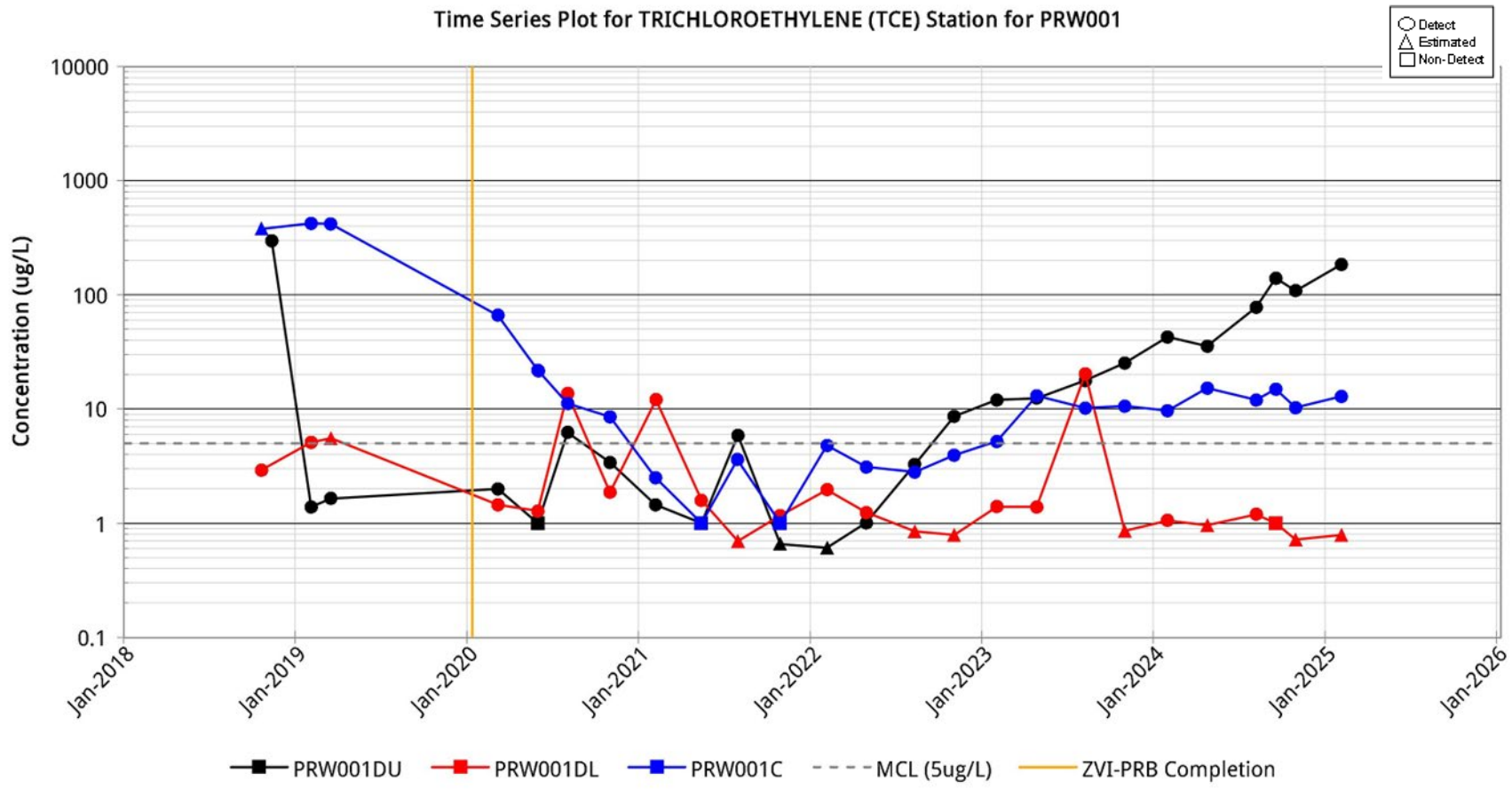


Figure C.40. Time Series Plot for Trichloroethylene (TCE) at PRW001 Series Monitoring Wells

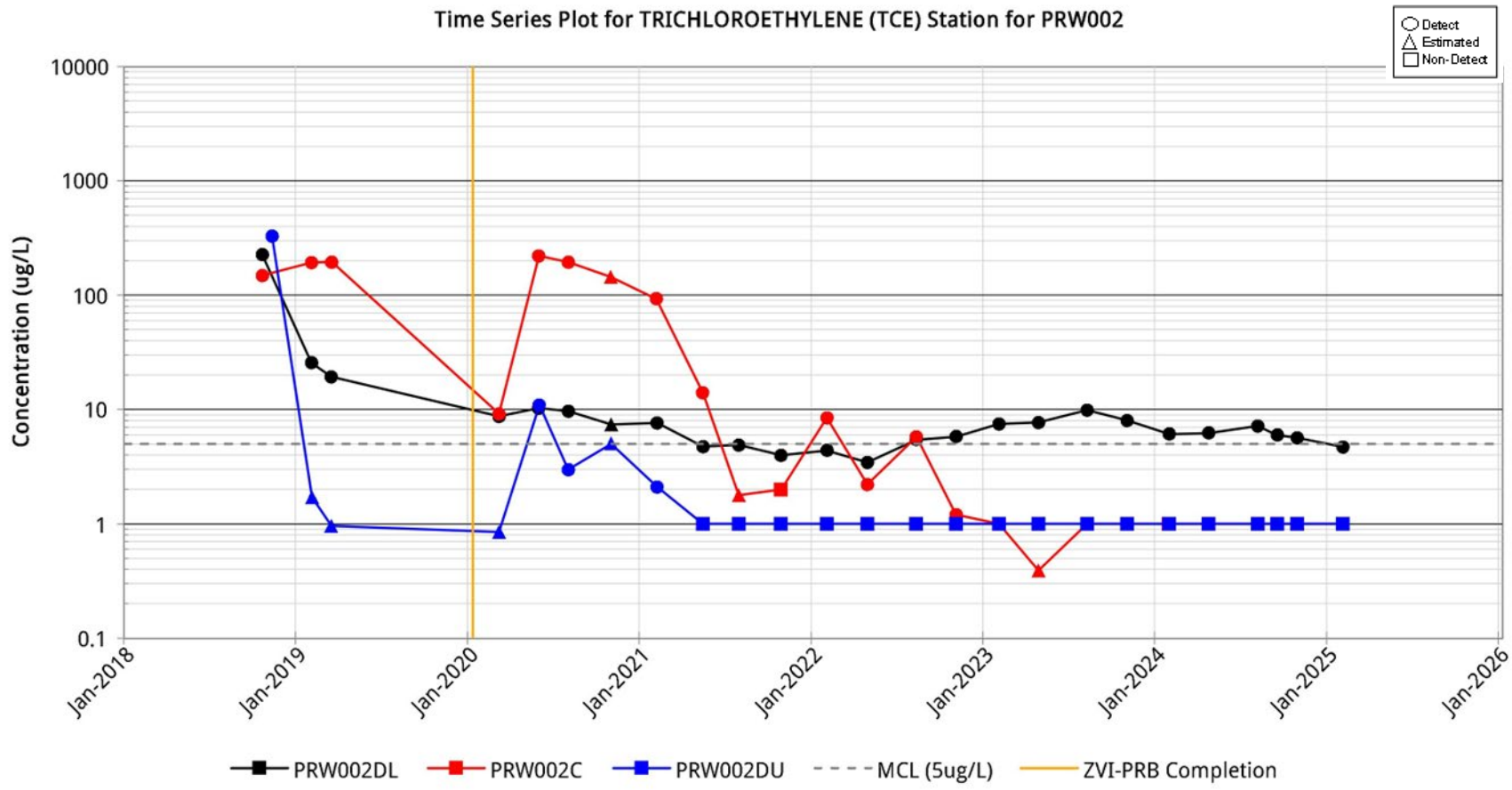


Figure C.41. Time Series Plot for Trichloroethylene (TCE) at PRW002 Series Monitoring Wells

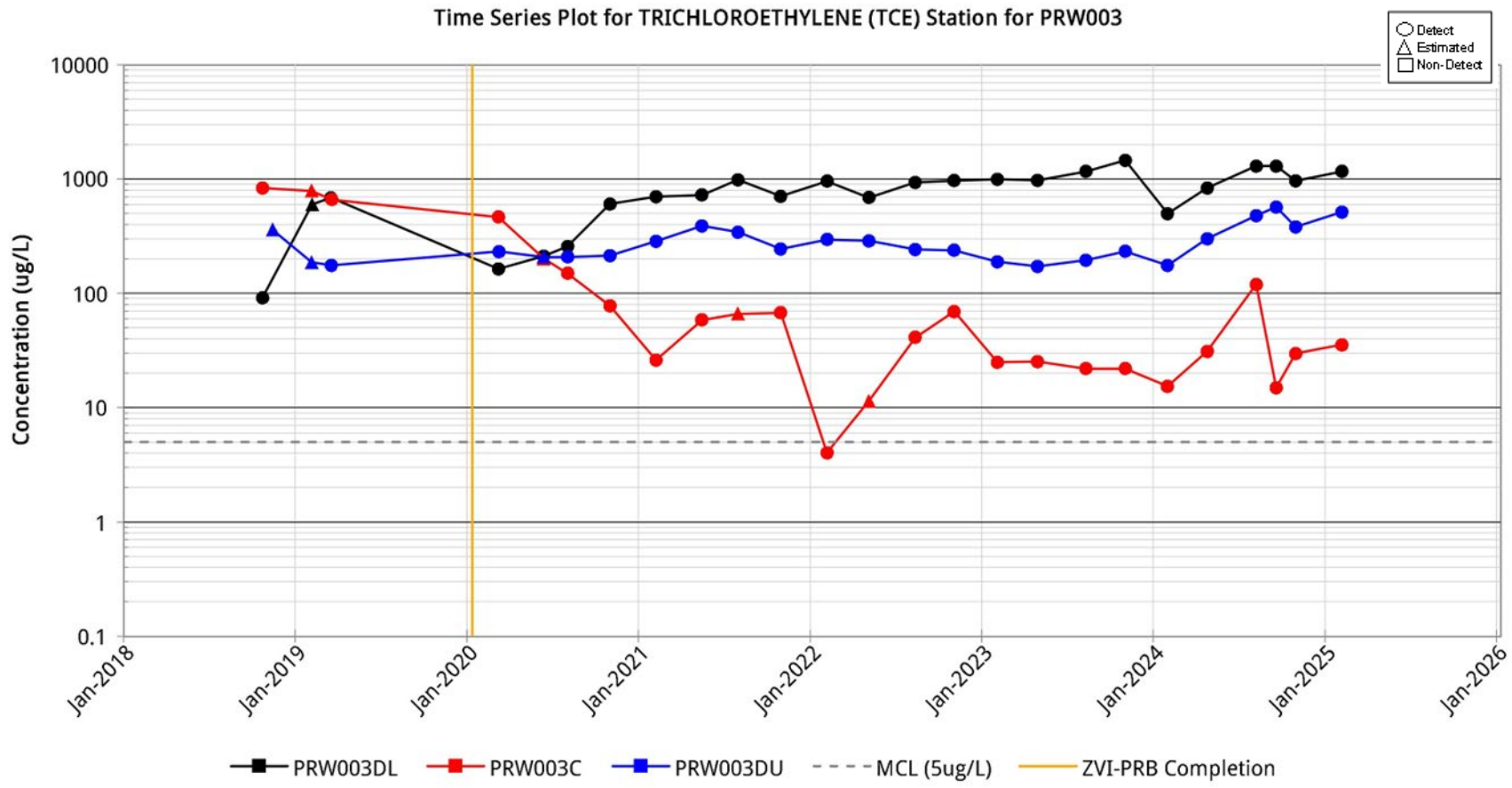


Figure C.42. Time Series Plot for Trichloroethylene (TCE) at PRW003 Series Monitoring Wells

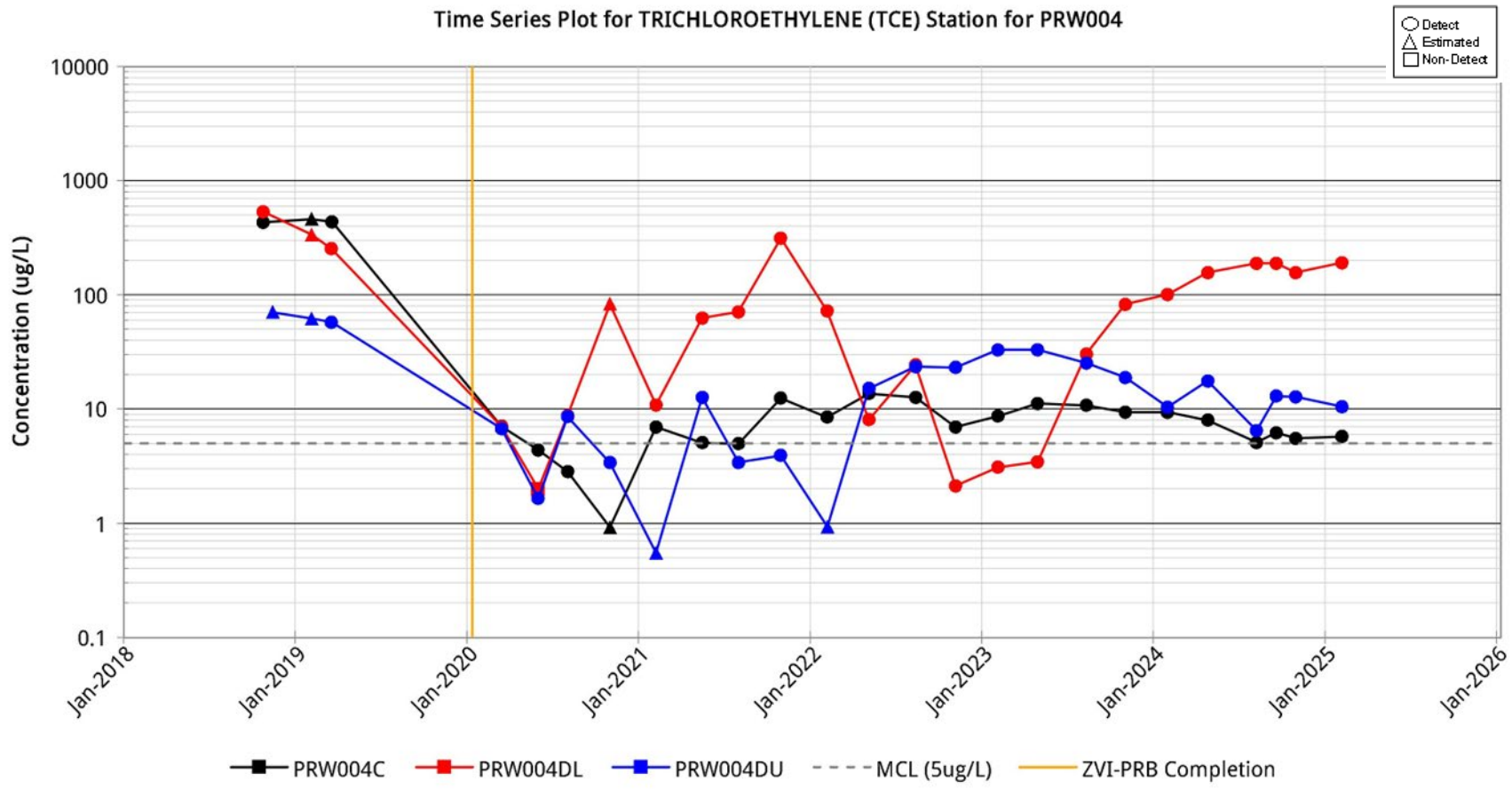


Figure C.43. Time Series Plot for Trichloroethylene (TCE) at PRW004 Series Monitoring Wells

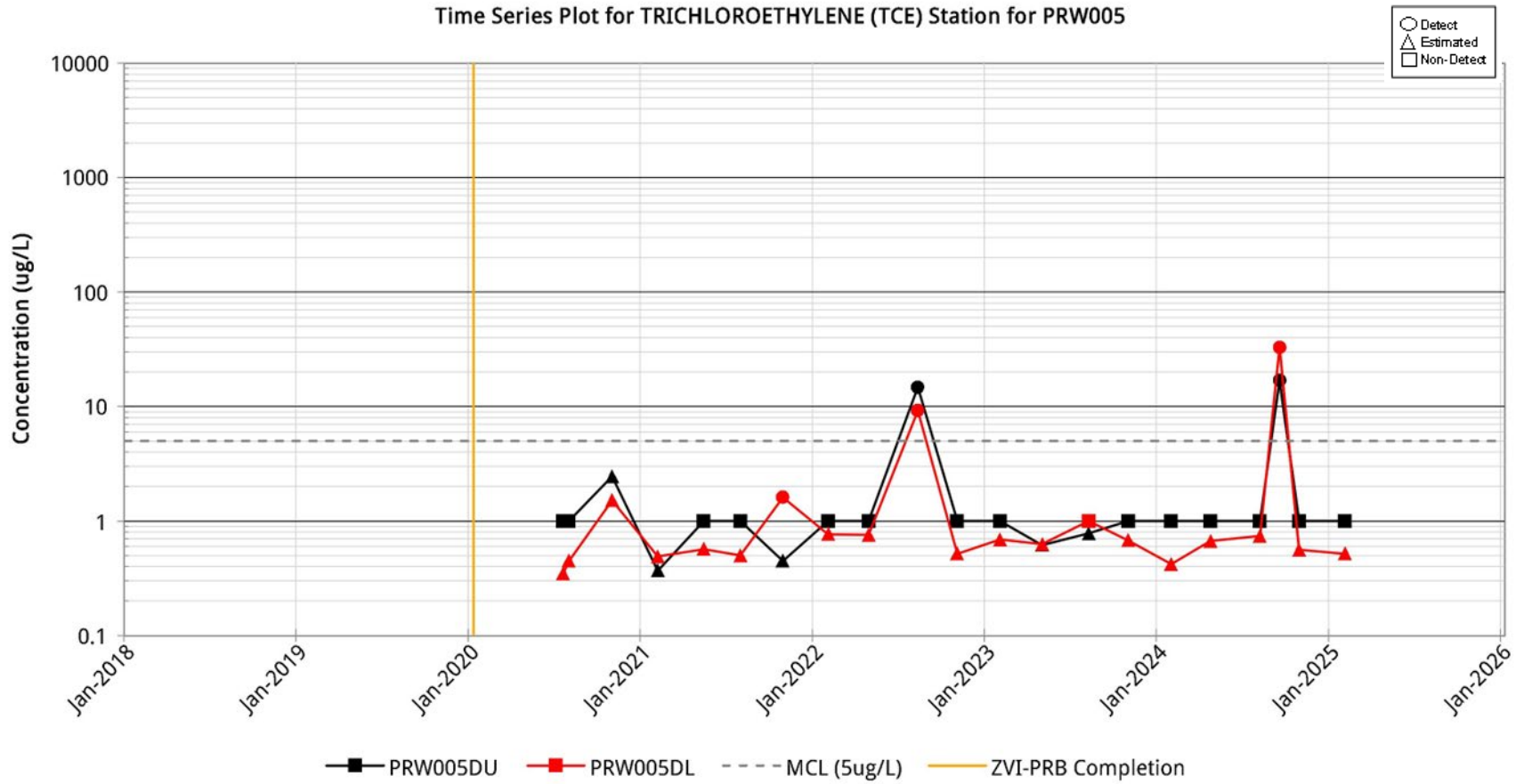


Figure C.44. Time Series Plot for Trichloroethylene (TCE) at PRW005 Series Monitoring Wells

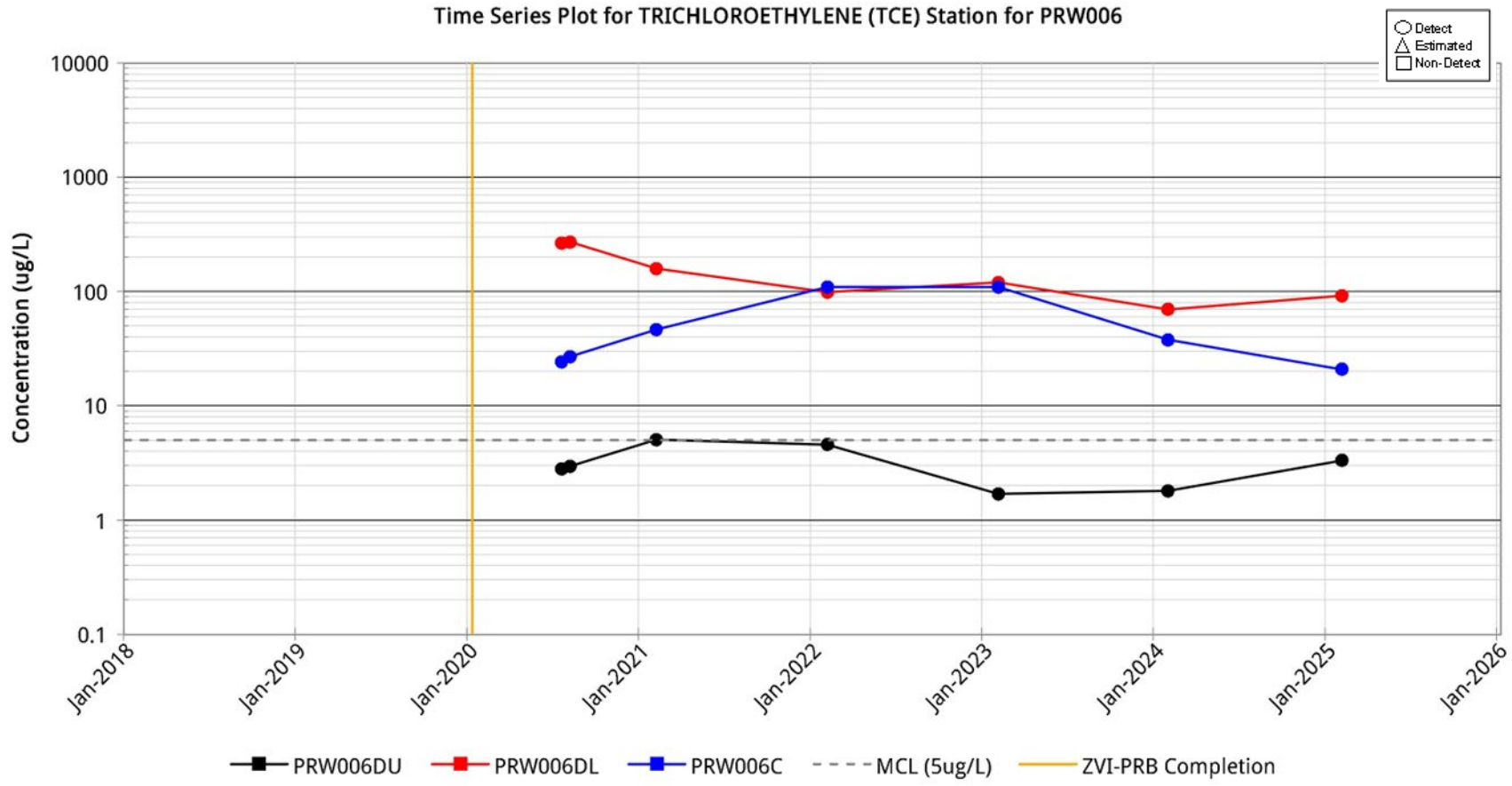


Figure C.45. Time Series Plot for Trichloroethylene (TCE) at PRW006 Series Monitoring Wells

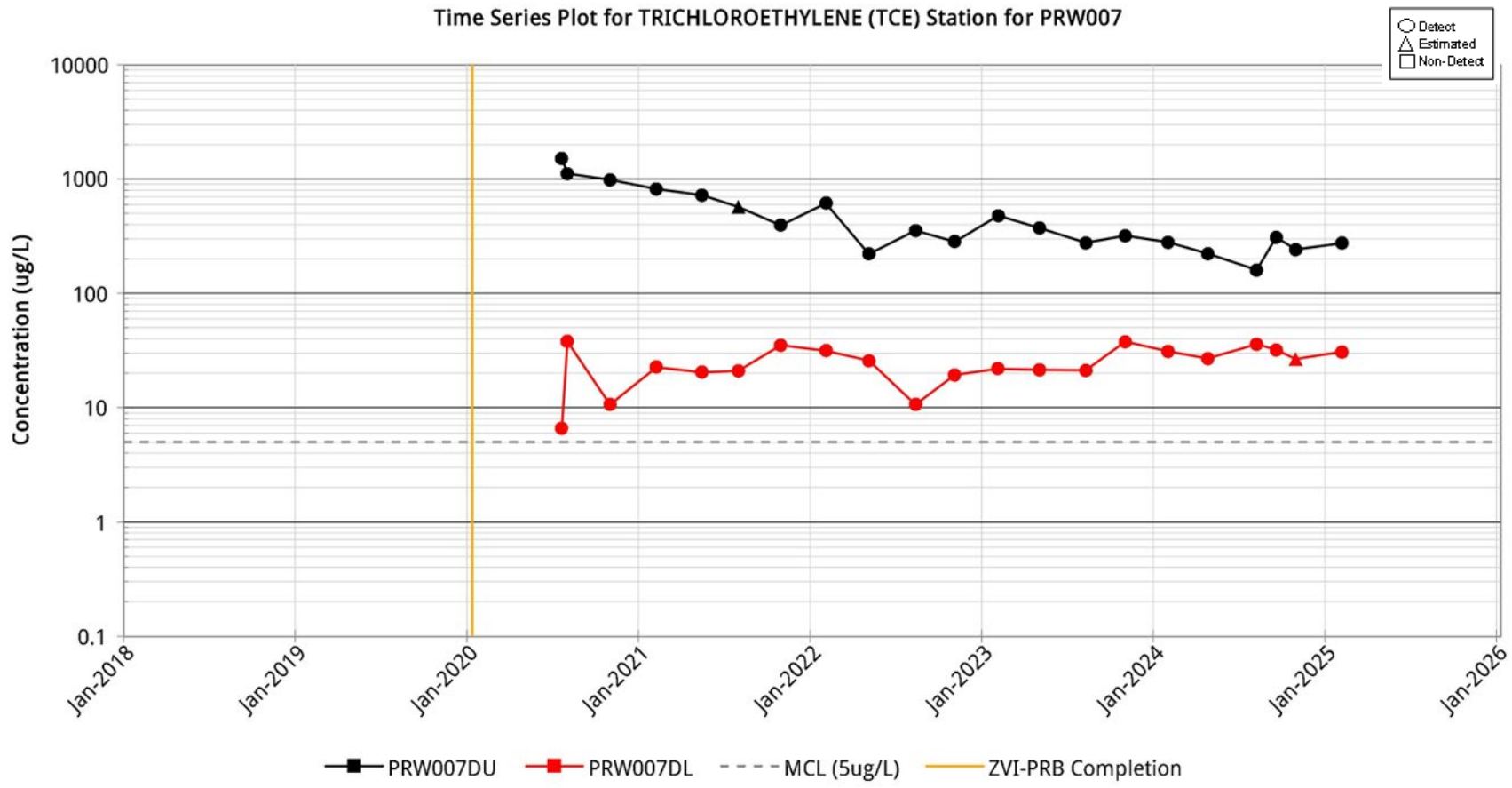


Figure C.46. Time Series Plot for Trichloroethylene (TCE) at PRW007 Series Monitoring Wells