2017 Annual Status Report
Boomsnub/Airco Superfund Site
Hazel Dell, Washington

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LIST OF ACRONYMS AND ABBREVIATIONS

ALS	ALS Environmental
BDCM	bromodichloromethane
BOC	The BOC Group, Inc.
Boomsnub	Boomsnub Corporation
BPA	Bonneville Power Administration
CD	Consent Decree
COC	Contaminant of concern
DCE	Dichloroethene
EA	EA Engineering, Science, and Technology, Inc., PBC
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ft	feet
GMS	Groundwater Modeling System
gpm	gallons per minute
IWS	in-well stripping
lb	pound
Linde	Linde LLC
µg/L	micrograms per liter
MCL	Maximum Contaminant Level
MTCA	Model Toxics Control Act
NFS	no further sampling
O&M	operation and maintenance
OU	operable unit
PFAS	Per – (Poly) Fluoroalkyl Substances
QASP	Quality Assurance and Sampling Plan
ROD	Record of Decision

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

Site	Boomsnub/Airco Superfund Site
SVE	soil vapor extraction
TCE	trichloroethene
URS	URS Group, Inc.
VOC	volatile organic compound

EXECUTIVE SUMMARY

Introduction

This Annual Status Report summarizes information on activities that took place during 2017 at the Boomsnub/Airco Superfund Site (Site) in Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc., PBC (EA), under contract to Linde LLC (Linde), is operating and maintaining a Site-wide groundwater extraction and treatment system. Work at the Site is conducted under a Consent Decree (CD) between the U.S. Environmental Protection Agency (EPA) and Linde, formerly The BOC Group, Inc. (BOC), Docket No. CO7-5163FDB, which was entered by the court on 29 June 2007 (EPA 2007).

Site Background and Operating Objectives

In 1987, the Washington State Department of Ecology (Ecology) determined that a plume of chromium-contaminated groundwater was emanating from the Boomsnub Corporation (Boomsnub) manufacturing facility. In 1991, during cleanup activities at the Boomsnub facility, a second plume containing volatile organic compounds (VOCs) was detected and determined to be coming from the Linde industrial gas production facility, located east of the Boomsnub facility. The two contaminant plumes overlap and become commingled downgradient of the source areas.

The Site is divided into three operable units (OUs) to manage cleanup activities: OU-1 (Boomsnub Soil); OU-2 (Linde Soil); and OU-3 (Site-wide Groundwater). The primary VOC of concern is trichloroethene (TCE), which serves as an indicator of VOC presence at the Site. The operating objectives are to remove sources of VOCs and chromium that may be acting as the source to groundwater, remove VOCs and chromium from the groundwater, halt the off-property migration of VOCs and chromium in groundwater, and reduce contaminant migration into the deeper Troutdale aquifer which serves as the drinking water source for the area.

In 1994 and 2001 EPA conducted removal actions at OU-1 to remove the majority of the hexavalent chromium contaminated soils which were serving as a source of hexavalent chromium in groundwater.

The OU-2 selected remedial action was a combination of in-well stripping (IWS) and soil vapor extraction (SVE) to remove VOCs from both the soil and groundwater. The IWS and SVE systems became operational in February 2004. The SVE system was operated to treat the vadose zone soil in OU-2 until 2008, when it was turned off with EPA approval. The IWS system was operated to treat groundwater in OU-2, until it was turned off with EPA approval in August 2013. Following shutdown of the IWS system, groundwater samples were collected from monitoring wells within the TCE source area at an increased frequency to monitor for changes or possible rebound in VOC concentrations. Two years of post-shutdown sampling were completed in late 2015 and the results were evaluated and provided to EPA. It was agreed that the IWS system will remain off.

The OU-3 groundwater extraction and treatment system is designed to operate continuously with minimal operator supervision. The treatment system is composed of an ion-exchange system to remove chromium from extracted groundwater; and a granular activated carbon air stripper system to remove TCE and other volatile contaminants from groundwater. The treatment facility is located on the Boomsnub property. Treated groundwater is discharged to an infiltration gallery located on the Linde property. The groundwater treatment system has been in operation since 1990.

In 2008, an investigation identified another plume of VOC contamination in groundwater north of the Boomsnub/Airco Plume (OU-3 plume). This offsite plume is referred to as the Northern Plume. The Northern Plume continues to be monitored along with the OU-3 plume to evaluate potential impacts to the Site and treatment system. The source of this plume is unknown; however, EPA does not attribute this contamination to activities on the Boomsnub or Linde properties.

2017 OU-3 System Operations

During the 2017 reporting period, 67,142,339 gallons of groundwater were treated and discharged to the Linde infiltration gallery. The groundwater extraction and treatment system operated within the performance standards established for the Site. The system was in operation approximately 99 percent of the reporting period. The percent availability includes actual minutes of operation and scheduled down time. Routine monitoring of the treatment system influent and effluent was conducted throughout the year and included monthly sampling and analysis of TCE, chromium, and pH. In addition, semiannual site-wide groundwater monitoring was conducted in Spring 2017 and Fall 2017.

The mass of contaminants removed during the reporting period continued to decline compared to the previous reporting period. This is primarily due to the continuing downward trend in contaminant concentrations in Site groundwater, as reflected in the average influent concentrations of chromium and TCE at the Site over the years.

2017 Annual Screening of Groundwater Monitoring Data

Annual screening of groundwater monitoring data is conducted for each monitoring and extraction well currently sampled. The data are used to determine what changes, if any, should be made to current system operations and the well sampling schedule. The annual screening for this report was conducted in accordance with EPA's *Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions* (EPA 2013). A combination of quantitative and qualitative evaluations of the Site data was used to derive the recommendations for the annual screening.

Based on the results of the annual screening of groundwater monitoring data through 2017, the following conclusions and recommendations are made:

- Remediation monitoring for VOCs was complete at MW-8B and MW-9B by October 2017, therefore monitoring is placed on hold until attainment monitoring is started.

- MW-38 was moved from a Northern Plume monitoring well into the OU-3 Well grouping. The sampling frequency of this well decreased from semiannual to annual.

Status of Previous Recommendations for 2017

To meet the operating objectives for OU-2 and OU-3, planned activities for 2017 were recommended in the 2016 Annual Status report. The status of those planned activities is summarized below:

- **Well Sampling** – Wells were sampled in accordance with the updated sampling schedule and subsequent revisions approved by EPA.
- **Closure Plan** – Discussions with EPA continued and the Site Closure Plan finalization is planned for 2018.
- **Extraction Well Pumping Rates** – As recommended in the 2015 and 2016 Annual Status Reports for the Site, pumping rates and plume capture were evaluated to determine if pumping should be reduced or discontinued in the following active extraction wells where VOCs and chromium remediation monitoring is complete: MW-6B, MW-10C, PW-1B, MW-21D, and MW-22D. The existing Site groundwater flow and transport model (EA 2004a) was used to evaluate contaminant capture under current conditions and how capture would be affected if pumping were decreased or shut off in these extraction wells. The results of the modeling indicate that it is possible to shut off wells PW-1B, MW-6B, MW-10C, and MW-21D while maintaining the current level of OU-3 plume capture, and decreasing the capture of the Northern Plume. However, pumping from extraction well MW-22D is critical for maintaining capture of the downgradient portion of the plume. Additional details on the modeling and results are provided in Appendix D.

- **Easement Agreements and Restrictive Covenants –** EA requested access to parcels on a case-by-case basis where no access agreement is in place. EPA has been asked to aid in obtaining easement agreements and restrictive covenants with non-responsive property owners.
- **Infrastructure Removal –** Selected infrastructure in the Toe-of-Plume area was no longer needed for Site remediation or monitoring and was removed on the Bonneville Power Administration (BPA) property and Parcel No. 144718-000 to allow for development of Parcel No. 144718-000. Wells on Parcel No. 144718-000 (MW-37, MW-31, MW-32 and MW-35) were decommissioned in September 2017. In October 2017 vaults and piping were removed from Parcel No. 144718-000 and infrastructure was removed from the BPA property. Wells on the BPA property (AMW-42, MW-48, MW-41 and MW46) were all converted to flush-mount monitoring wells and both properties were re-graded and seeded. All work was performed after EPA approval was received.

- **Padden Parkway Business Park –** Work continued with the owner/developer of the Padden Parkway Business Park as they develop their property. Plans to modify the pipeline running through containment vault CV-8 to accommodate property development have been delayed and is anticipated for 2018.
- **In-situ Treatments** – EPA approval of the Closure Plan was delayed and finalization is anticipated for 2018. Discussions with EPA regarding the potential need for in-situ treatment in areas of residual contamination and an implementation strategy are anticipated for 2018 after approval of the closure plan.

Recommendations and Planned Activities for 2018

The following activities are planned during the 2018 reporting period:

- **Well Sampling** – Sample wells in accordance with the updated sampling schedule (Table 5). Based on pumping rate modeling, the sampling frequency has changed in wells MW-8B, MW-9B, MW-35, and MW-38 (Table 2).
- **Closure Plan** – Finalize the Site Closure Plan, with EPA approval.
- **Easement Agreements and Restrictive Covenants –** Continue to request EPA assistance to obtain the required agreements with non-responsive property owners. EA will continue efforts to obtain agreements as opportunities arise.
- **Padden Parkway Business Park –** Work with the owner/developer of the Padden Parkway Business Park as they develop their property. Modify the pipeline running through containment vault CV-8 to accommodate property development.
- **In-situ Treatments** – Following EPA approval of the Closure Plan, discuss with EPA the potential need for in-situ treatment in areas of residual contamination and plan an implementation strategy. Develop a work plan for implementation.
- **Modeling** – Results of extraction well pumping rate modeling and potential extraction well pumping rates will be discussed with EPA.
- **Flouroalkyl Substances** – EPA has recently identified former chrome-plating facilities to be potential sources of per-(poly) flouroalkyl substances (PFAS). In order to address this concern, develop a work plan for sampling for the presence of per-(poly) flouroalkyl substances (PFAS).

1. INTRODUCTION

This Annual Status Report summarizes information on activities that took place during 2017 at the Boomsnub/Airco Superfund Site (Site) in Hazel Dell, Washington. EA Engineering, Science, and Technology, Inc., PBC (EA), under contract to Linde LLC (Linde), is operating and maintaining a Site-wide groundwater extraction and treatment system. Work at the Site is conducted under a Consent Decree (CD) between the U.S. Environmental Protection Agency (EPA) and Linde, formerly The BOC Group, Inc. (BOC), Docket No. CO7-5163FDB, which was entered by the court on 29 June 2007 (EPA 2007).

1.1 Background

The Site is located just north of the city limits of Vancouver, Washington, as depicted on Figure 1. It includes two adjacent facilities, the former Boomsnub Corporation (Boomsnub) chrome plating facility and the Linde industrial gas production facility. The Linde plant manufactures compressed and liquefied gas products including nitrogen, oxygen, and argon. The plant also stores and distributes other specialty gases such as hydrogen and helium. The facility was built by Air Liquide America Corporation in 1963 and has been in operation since 1964.

In 1987, the Washington State Department of Ecology (Ecology) determined that a plume of chromium-contaminated groundwater was emanating from the Boomsnub facility. While cleanup activities were being conducted at the Boomsnub facility, volatile organic compounds (VOCs) were detected in groundwater samples and were suspected to be coming from the Linde property. Linde began investigating the nature and extent of VOCs in 1991. In June 1994, EPA took over the role of lead regulatory agency from Ecology and in April 1995 the Site was placed on the National Priorities List. The primary constituents of concern at the Site are hexavalent chromium and selected VOCs. Previous studies indicated that almost all chromium in groundwater was hexavalent chromium (ICF Kaiser 1999). For this reason, most historical and recent groundwater samples have been analyzed only for total chromium to represent hexavalent chromium. The primary VOC of concern is trichloroethene (TCE), which serves as an indicator of VOC presence at the Site. The chromium and TCE groundwater contaminant plumes overlapped and were commingled downgradient of the source areas. In the 1990s, the plumes were found to extend approximately 4,400 feet (ft) in a west-northwest direction from the sources.

The Site is divided into three operable units (OUs) to manage cleanup activities: OU-1, Boomsnub Soil; OU-2, BOC (Linde) Soil; and OU-3, Site-wide Groundwater. EPA conducted soil removal actions at OU-1 in 1994 and 2001 to remove the majority of the hexavalent chromium-contaminated soils serving as a source for groundwater contamination. Linde has conducted numerous site investigations, conducted a removal action, and operated a VOC source removal system on their property at OU-2.

The highest concentrations of Site contaminants have occurred in a shallow groundwater-bearing zone referred to as the alluvial aquifer. The alluvial aquifer is not used as a municipal water

supply, although a limited number of private wells pump from this aquifer. TCE and chromium have been detected, although at considerably lower concentrations, in the deeper groundwater-bearing zone, the Troutdale aquifer. The Troutdale aquifer serves as a municipal water supply for the city of Vancouver and Clark County. Municipal water supply wells are not located in areas impacted by the chromium or TCE groundwater contaminant plumes

A groundwater extraction and treatment system is used to capture and treat Site groundwater. The groundwater extraction and treatment system has been operational since 1990 and was constructed along the axis of the chromium plume. Since the initial system was installed, it has been modified, upgraded, and expanded several times to handle the VOCs and chromium, to increase pumping and treatment capacity, and to increase removal efficiency. The monitoring and extraction well network for the Site is presented on Figure 2. In recent years, selected portions of the extraction system have been shut down as the contaminant plumes have decreased in extent.

Chromium is removed from the extracted groundwater using an ion-exchange system. VOCs are removed from the extracted groundwater using air stripping with granular activated carbon treatment of the off-gases. The treatment facility is located on the Boomsnub property. Treated groundwater is discharged to an infiltration gallery located on the Linde property. The infiltration gallery was constructed during September and October 2005 and began receiving water in February 2006 (EA 2006). Prior to construction of the infiltration gallery, the treated groundwater was discharged to the City of Vancouver sanitary sewer system.

The Record of Decision (ROD) for the Site, dated February 2000, identified the following groundwater cleanup levels:

Groundwater Cleanup Levels

Contaminant of Concern	CAS Number	Basis	Practical[(a)] Quantitation Limit (µg/L)	Cleanup[(b)] Level (µg/L)
Hexavalent chromium	18540-29-9	MTCA B	5	80
Chromium (total)	7440-47-3	MCL	5	100
Bromodichloromethane	75-27-4	MTCA B	1	1
Carbon tetrachloride	56-23-5	MTCA B	1	1
Dibromochloromethane	124-48-1	MTCA B	1	1
1,2-Dichloroethane	107-06-2	MCL	1	5
1,1-Dichloroethene	75-35-4	MTCA B	1	1
Tetrachloroethene	127-18-4	MCL	1	5
1,1,1-Trichloroethane	71-55-6	MCL	1	200
Trichloroethene	79-01-6	MCL	1	5

NOTES: CAS = Chemical Abstract Service
µg/L = Micrograms per liter
MTCA = Washington State Model Toxics Control Act
MCL = Maximum Contaminant Level
(a) Ecology Implementation Memo No. 3 dated 24 November 1993 (Ecology 1993).
(b) Cleanup level established as the higher of the regulatory level or the practical quantitation limit; see Washington Administrative Code 173-340-700(6) and Ecology Implementation Memo No. 3 dated 24 November 1993.

The ROD identified the remedy for OU-3 as continued groundwater extraction and treatment until groundwater cleanup levels are achieved throughout the groundwater plume (EPA 2000). The remediation goals include the reduction of total chromium in groundwater to 80 micrograms per liter (μg/L) and the reduction of TCE to 5 μg/L.

An Action Memorandum was issued by EPA in September 2001, identifying the requirements for remediation activities for OU-2 (EPA 2001). On 18 September 2002, Linde and EPA entered an Administrative Order on Consent (EPA Docket Number CERCLA 10-2002-0052; EPA 2002), addressing the specific design, construction, and operational requirements for a Non-Time-Critical Removal Action for OU-2 to implement the requirements of the Action Memorandum.

On 1 April 2002, Linde assumed interim responsibility for the operation and maintenance (O&M) of the groundwater extraction and treatment system. Linde continues with O&M of the system.

In October 2002, URS Group, Inc. (URS), working under contract with EPA and in cooperation with representatives from the EPA Environmental Services Assistance Team, conducted additional soil characterization activities on the Boomsnub property around the groundwater extraction and treatment system building. The purpose of the work was to identify areas in the shallow soils (15 ft or less deep) with concentrations of chromium above the cleanup levels specified in the ROD. The results of the soil characterization activities were presented in the *Soil Characterization: Groundwater Treatment System Compound* report, finalized in April 2003 (URS 2003).

In September 2003, Linde began construction of the Non-Time Critical Removal Action at their facility to address the VOC source area (OU-2). The selected remedial action was a combination of in-well stripping (IWS) and soil vapor extraction (SVE) systems to remove VOCs from both the groundwater and soil. The systems became operational in February 2004. The SVE system was operated to treat the vadose zone soil in OU-2 until 2008, when it was turned off with EPA approval. The IWS system was operated to treat groundwater in OU-2, until it was turned off with EPA approval in August 2013.

The Toe-of-Plume Pilot Study, an in-situ treatment program, was performed in 2006 to treat an area of recalcitrant chromium and TCE contamination near the original toe of the groundwater contaminant plumes. Chromium and TCE concentrations in the pilot study monitoring wells have remained below the cleanup level since that time, indicating that the treatment was effective.

In 2008, an investigation identified another plume of VOC contamination in groundwater north of the Boomsnub/Airco Plume (OU-3 plume), in the area around well AMW-18 (EA 2008). This offsite plume is referred to as the Northern Plume. In May 2011, EPA and Linde performed a joint investigation of the Northern Plume area to get a better understanding of the source, extent, and concentrations of VOCs in the plume (EA 2011). A new monitoring well (AMW-64)

was installed in February 2012, at the request of the EPA, to monitor the Northern Plume northwest of well AMW-18 (EA 2012). The Northern Plume continues to be monitored, along with the OU-3 plume, to evaluate potential impacts to the Site and treatment system, and in accordance with an agreement between Linde and EPA. The source of this plume is unknown; however, EPA does not attribute this contamination to activities on the Boomsnub or Linde properties.

1.2 Purpose

The purpose of this report is to provide an overview of Site activities at OU-2 and OU-3 for the reporting period of 1 January through 31 December 2017.

1.3 Operating Objectives

The operating objectives for OU-2, identified in the 2001 Action Memorandum (EPA 2001), include the following:

- Remove VOCs from the vadose zone that may be acting as the source to groundwater.
- Remove VOCs from groundwater on the western portion of the Linde property.
- Halt off-property migration of VOCs in groundwater.

The operating objectives for OU-3 are defined in the ROD (EPA 2000). Activities at the Site are designed to meet the following overall objectives:

- Reduce contaminant migration within the alluvial aquifer (expansion of the plumes).
- Continue mass removal activities designed to restore impacted groundwater to Site-specific cleanup levels.
- Reduce contaminant migration into the Troutdale aquifer by reducing contamination in the alluvial aquifer.

1.4 Organization of this Document

This report is divided into eight sections and three appendices:

- Section 1 provides the background, purpose, and operating objectives.
- Sections 2 and 3 present summaries of the system operations and monitoring for OU-2 and OU-3, respectively.
- Section 4 provides a discussion of groundwater monitoring results and trends.
- Section 5 summarizes other Site activities conducted during the reporting period.
- Section 6 presents the results of the annual assessment of groundwater monitoring data and provides recommendations, as appropriate, for changes to the well sampling schedule.

- Section 7 summarizes the status of previously recommended activities for 2017, and presents recommendations and planned activities for 2018.
- Section 8 lists the references cited in this document.

Information on chromium and TCE concentrations in groundwater is presented in Appendices A and B, respectively. The information is presented both by well groupings and by individual wells. Appendices A and B are organized in sections, as follows:

- Tables reporting chromium and TCE groundwater concentrations for the last four semiannual sampling events are provided in Appendices A-1 and B-1, respectively. Only wells sampled during the 2017 reporting period are included in these tables.
- Graphs showing chromium and TCE concentration trends by well grouping are presented in Appendices A-2 and B-2, respectively. Only wells sampled during the 2017 reporting period are included. These graphs allow a comparison of trends within geographical or hydrogeological groupings. They also allow immediate comparison of concentrations between wells in a grouping and the ability to identify potential outliers.
- Graphs showing chromium and TCE concentrations over time for individual wells are presented in Appendices A-3 and B-3, respectively. Only wells sampled during the 2017 reporting period are included.

Appendix C includes supporting information for the closure monitoring assessment, including a list of wells excluded from closure monitoring, and tables showing the results of the remediation monitoring analysis and attainment monitoring analysis for each contaminant of concern (COC).

Appendix D includes the plume capture evaluation and associated figures. Pumping rates and plume capture were evaluated to determine if pumping should be reduced or discontinued in active extraction wells where VOCs and chromium remediation monitoring is complete.

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2. OU-2 MONITORING

This section provides a summary of the OU-2 monitoring conducted between 1 January and 31 December 2017. Groundwater sampling and analyses were conducted in accordance with the recommendations in the 2016 Annual Status Report (EA 2017b). Locations of the OU-2 treatment and monitoring wells are shown on Figure 3.

Since the IWS system was turned off in August 2013, groundwater samples from OU-2 have been collected to monitor for changes/rebound in VOC concentrations. Groundwater monitoring was conducted in Spring and Fall 2017, following EPA approval of the associated Quality Assurance Sampling Plan (QASP) addenda (EA 2017a, 2017c). Groundwater samples were collected from 11 OU-2 monitoring wells during the 2017 reporting period.

Section 4.2.2.2 provides a discussion and presents the TCE data from OU-2 wells sampled during the 2017 reporting period. Residual VOC contamination in OU-2 groundwater will continue to be monitored to evaluate the potential need for future remedial actions in this area.

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3. OU-3 SYSTEM OPERATIONS AND MONITORING

This section provides a summary of OU-3 system operations, system performance, and plume monitoring conducted from 1 January to 31 December 2017. Groundwater sampling and analyses were conducted in accordance with the procedures in the EPA-approved Site QASP (EA 2004b), and subsequent EPA-approved QASP addenda (EA 2017a, 2017c).

3.1 System Operations

Routine system operation details are presented in the Progress and Groundwater Monitoring Reports (EA 2017d, 2018a). During the reporting period the groundwater extraction and treatment system operated within the performance standards established for the Site.

3.1.1 Groundwater Extraction System

The extraction well pumping rates were recorded once a month during the reporting period. The recorded pumping rates are shown in Table 1. There were no major changes to extraction well pumping rates during 2017. The flow meters in wells MW-14E and 18D are not working properly and the totalizer flow in these wells has not been recorded since September 2017; however, the pumps are still working. The pumping rate shown on Table 1 for wells MW-14E and MW-18D were determined by comparing the total influent flow coming to the system to the past flow and knowledge of the set discharge rate for the well. The flow meters in wells MW-14E and MW-18D will be repaired or replaced.

3.1.2 Groundwater Treatment System

Routine monitoring of the treatment system influent and effluent was conducted throughout the year including monthly sampling and analysis of VOCs, chromium, and pH. Treatment system components are briefly described in the following sections.

3.1.2.1 Ion-Exchange and Air Stripper Systems

As reported in the Progress and Groundwater Monitoring Reports (EA 2017d and 2018a), monthly influent and effluent sample concentrations were used to determine approximate chromium and TCE removal rates on a monthly basis. In 2017, the ion-exchange system had an annual average chromium removal rate of approximately 98 percent and the air stripper system an annual average VOC removal rate of approximately 98 percent.

TCE and chromium concentrations in effluent discharged to the infiltration gallery during 2017 were consistently below the maximum allowable effluent concentrations of 1.9 µg/L for TCE and 19.2 µg/L for chromium. Effluent monitoring results are provided in the Progress and Groundwater Monitoring Reports (EA 2017d and 2018a).

3.1.2.2 Linde Infiltration Gallery

Treated groundwater from the Site treatment system is discharged back into the alluvial aquifer through an infiltration gallery. The infiltration gallery is located in the southeast corner of the Linde property and is designed to accept treated water at 160 gallons per minute (gpm). During 2017, the average system flow rate was typical to previous years at approximately 127.5 gpm (Table 1). No modifications or significant repairs were made to the infiltration gallery during the reporting period.

As noted above, TCE and chromium concentrations in effluent discharged to the infiltration gallery during 2017 were consistently below the maximum allowable effluent concentrations of 1.9 µg/L for TCE and 19.2 µg/L for chromium. Effluent monitoring results are provided in the Progress and Groundwater Monitoring Reports (EA 2017d and 2018a).

3.2 System Performance

OU-3 system performance for 2017 is summarized in the following table. Additional details are provided in the Progress and Groundwater Monitoring reports.

OU-3 System Performance Summary, 2017

Month	Hours/Month	Hours of Operation/Month	Availability (percent)	Flow (gallons)
January	744	741.97	99.73	5,789,427
February	672	657.12	97.79	5,107,116
March	744	638.33	85.91	4,937,374
April	720	720	100	5,607,991
May	744	744	100	5,732,786
June	720	720	100	5,661,744
July	744	744	100	5,865,822
August	744	744	100	5,808,750
September	720	720	100	5,567,735
October	744	744	100	5,732,321
November	720	720	100	5,531,450
December	744	744	100	5,799,823
2017 Totals	**8,760**	**8,647.32**	**98.62**	**67,142,339**

Note:
The system shut down March 3, 9, 14, 15, 24 and 25 due to heavy precipitation causing flooding in containment vault CV-9.
The percent availability includes actual minutes of operation and scheduled down time.

3.2.1 Water Treated

During the reporting period, 67,142,339 gallons of groundwater were treated and discharged to the Linde infiltration gallery.

3.2.2 System Availability

The treatment system was operational for 8,647 hours, or approximately 99 percent of the reporting period, exceeding the 90 percent requirement of the CD. Details are provided in the Progress and Groundwater Monitoring Reports (EA 2017d and 2018a).

3.2.3 Mass Removal

The following table presents cumulative chromium and TCE removed in 2017, along with monthly influent data and flow.

OU-3 Chromium and TCE Removal Summary, 2017

Date	Monthly Flow (gallons)	Influent Chromium (µg/L)	Influent TCE (µg/L)	Monthly Chromium Removal (lbs)	Monthly TCE Removal (lbs)	Cumulative Chromium Removed (lbs)	Cumulative TCE Removed (lbs)
January	5,789,427	48.8	13	2.4	0.6	22,419.0	2,222.8
February	5,107,116	47.7	15	2.0	0.6	22,421.1	2,223.4
March	4,937,374	47.8	14	2.0	0.6	22,423.0	2,224.0
April	5,607,991	47.8	13	2.2	0.6	22,425.3	2,224.6
May	5,732,786	44.4	13	2.1	0.6	22,427.4	2,225.2
June	5,661,744	45.0	13	2.1	0.6	22,429.5	2,225.8
July	5,865,822	41.2	15	2.0	0.7	22,431.5	2,226.6
August	5,808,750	39.5	13	1.9	0.6	22,433.5	2,227.2
September	5,567,735	38.1	12	1.8	0.6	22,435.2	2,227.7
October	5,732,321	38.2	11	1.8	0.5	22,437.1	2,228.3
November	5,531,450	40.7	13	1.9	0.6	22,438.9	2,228.9
December	5,799,823	43.1	13	2.1	0.6	22,441.0	2,229.5

Note:
lbs = pounds
µg/L = micrograms per liter

On the basis of measured influent and effluent concentrations and the total monthly treatment system flow, 24.3 pounds (lbs) of chromium and 7.2 lbs of TCE were removed by the groundwater extraction and treatment system during 2017. This brings the cumulative total mass of chromium and TCE removed to approximately 22,441 and 2,229.5 lbs, respectively, since initiating operations in 1990. There is a continuing downward trend in contaminant concentrations in Site groundwater, as reflected in the average influent concentrations of chromium and TCE at the Site over the years.

Figure 4 shows the cumulative removal amounts for total chromium and TCE since June 1999. Figure 5 depicts the total chromium and TCE concentrations in the treatment system influent and

effluent since 1999. Figure 6 provides a comparison of the average annual influent chromium and TCE concentrations over the last 16 years.

3.3 Plume Monitoring

3.3.1 Semiannual Site-wide Groundwater Monitoring

Semiannual Site-wide groundwater monitoring was conducted in Spring and Fall 2017, following EPA approval of the associated QASP addenda (EA 2017a, 2017c). The sampling events were conducted as planned and no significant issues or problems were encountered.

Groundwater samples were submitted to ALS of Kelso, Washington for analysis. Samples collected during the Fall event were analyzed by ALS of Everett, Washington due to an overload of work at the Kelso laboratory. The samples were analyzed for chromium using EPA Method 200.7 and/or VOCs using EPA Method 8260C. Groundwater monitoring results and concentration trends are discussed in Section 4.

3.3.2 Water Level Gauging Program

Depth-to-groundwater measurements were collected from monitoring and extraction wells at the Site during the Spring and Fall sampling events. Groundwater level data are collected to determine the groundwater flow direction and gradient. During both sampling events in 2017, the measurements were made while the groundwater treatment system was actively pumping to assess groundwater flow under drawdown conditions.

Generalized groundwater elevation contour maps for the alluvial and Troutdale aquifers for the Spring and Fall 2017 water level gauging events are provided in the Progress and Groundwater Sampling Reports (EA 2017d, 2018a). The groundwater elevation contours maps for the Fall event are also presented as Figures 7 and 8, herein. The flow direction and horizontal gradient in both aquifers were similar to those observed previously. The alluvial aquifer groundwater elevations measured in Fall 2017 were generally about 3 to 4 ft lower than those measured in Spring 2017, reflecting the seasonal variation in rainfall. In the deeper, semi-confined Troutdale aquifer, the groundwater elevations measured in Fall 2017 were also about 1 to 2 ft lower than those measured in Spring 2017. Water levels in the alluvial and Troutdale aquifers were approximately 2 feet higher during the Fall 2017 sampling event compared to the Fall 2016 sampling event.

The vertical hydraulic gradient varies at the Site due to the groundwater pumping. Water levels in alluvial aquifer well clusters tend to be similar at the different depths, except near active extraction wells where groundwater withdrawals impact the flow patterns. However, there is a significant downward hydraulic gradient from the alluvial aquifer to the semi-confined Troutdale aquifer.

The horizontal gradients for the alluvial and Troutdale aquifers were determined using data from the Fall 2017 water level gauging event. In the alluvial aquifer, the hydraulic gradient across the

Linde property was approximately 0.008; this area is impacted by the infiltration gallery. Downgradient, within the plume area, (using an average from just west of the Linde property to the original toe-of-plume area) the gradient was approximately 0.004. The flow direction within the alluvial aquifer is generally to the west-northwest.

In the Troutdale aquifer, the average hydraulic gradient across the Site area was approximately 0.006. The flow direction in this aquifer is generally to the west-southwest.

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4. GROUNDWATER MONITORING RESULTS AND TRENDS

This section presents the concentration trends observed in groundwater since 1995, when EPA assumed regulatory responsibility for the Site, with a focus on data collected during 2017. More detailed presentations of the 2017 groundwater monitoring data are provided in the semiannual Progress and Groundwater Monitoring reports (EA 2017d and 2018a).

Groundwater sampling and analyses were conducted to monitor the groundwater quality in extraction and monitoring wells in accordance with the procedures in the Site QASP (EA 2004b). Task-specific QASP addenda are prepared for each sampling event to be compliant with the schedule established in the Long-Term Monitoring Plan (EA 2007) and subsequent updates. The sampling schedule is reviewed and updated annually; recommendations are presented in the Annual Status Reports. The recommended sampling schedule for 2017 was presented in the 2016 Annual Status Report (EA 2017b). The 2017 well sampling frequencies are presented in Table 2.

The Spring 2017 sampling event included wells on a semiannual sampling schedule. The Fall 2017 sampling event included all wells in the sampling program, per EPA request, in preparation for the pending five-year review.

4.1 Well Groupings

To facilitate analysis of contaminant concentrations across the Site, the wells are grouped by aquifer and geographical location as follows:

- Alluvial aquifer wells
  - Upgradient wells
  - TCE Source wells (includes OU-2 monitoring wells)
  - Proximal wells
  - Intermediate wells
  - Church of God wells
  - Toe-of-Plume wells
- Troutdale aquifer wells.

The aquifer and geographic well groupings are presented on Figure 9. All wells except those identified as Troutdale aquifer wells are screened within or slightly below the alluvial aquifer.

4.2 Contaminant Concentrations and Trends

4.2.1 Overview

Groundwater monitoring results indicate that the current pumping scheme is maintaining control of the plume and that overall concentrations for both chromium and TCE continue on decreasing

trends. The extent of impacted groundwater in the alluvial aquifer, as determined from groundwater sampling data obtained in 1995 and Fall 2017, is presented on Figure 10 for chromium and on Figure 11 for TCE (OU-3 plume). These figures illustrate that groundwater remedial actions have been effective in mass removal and in reducing the footprints of both the chromium and TCE plumes. The only sample from a downgradient well with a reported chromium concentration exceeding the Site cleanup level in 2017 was a sample collected from Intermediate well MW-19D in Spring 2017. During Fall 2016 and Fall 2017, no chromium concentrations exceeded the Site cleanup level in downgradient wells. This indicates that chromium contamination in groundwater now remains primarily in the chromium source area (see Figure 10).

Chromium and TCE concentrations detected in groundwater during sampling in 2017 are presented in Appendices A-1 and B-1, respectively. The highest concentration of chromium during the 2017 reporting period was detected in the sample collected from well MW-4A (490 µg/L) during the Fall 2017 sampling event, located within the Proximal well group (in the chromium source area). The highest concentrations of TCE were detected during Spring 2017 in the sample collected from Northern Plume well MW-23D (180 µg/L), and during Fall 2017 in Intermediate well MW-18E (180 µg/L). Wells with 2017 groundwater sampling results exceeding the Site cleanup levels of 80 µg/L for chromium and 5 µg/L TCE are highlighted on Figures 12 and 13, respectively.

For this report, tables, figures, and graphs were used to assist in evaluating groundwater trends across the Site. Chromium and TCE concentration trends are presented in Appendices A and B, respectively. The information is presented both by well groupings and by individual wells.

Specific information on trends observed within each well grouping is discussed in the following sections. Analytical results for 2017 are provided along with prior results from the last four sampling events (with the dates of these prior events varying by well) for comparison purposes. In data summary tables presented in this report, analytical results shown in red bold are above the Site-specific cleanup level of 80 µg/L for chromium or 5 µg/L for TCE. For duplicate samples, the higher of the two results is reported.

4.2.2 Alluvial Aquifer Wells - TCE and Chromium

During the 2017 reporting period, groundwater samples were collected from all well groups; Upgradient, TCE Source, Proximal, Intermediate, Northern Plume, Church of God, and Toe-of-Plume.

4.2.2.1 Upgradient Wells

The Upgradient wells are located near the upgradient (eastern) Site boundary. These wells are sampled every two years, in the fall.

Chromium

Four monitoring wells were sampled for chromium during the Fall 2017 event. The chromium concentration was below the cleanup level of 80 µg/L in all four wells sampled. The following table presents the results from the last four sampling events for comparison.

Upgradient Well Chromium Concentrations, in µg/L

Well	Fall 2012	Fall 2014	Fall 2016	Fall 2017
AMW-6A	6.9	9.6	5.8	3.6 J
AMW-7A	2.9 J	0.7 J	1.1 J	1.9 J
AMW-10A	18.7	8.3	3.7 J	4.8
AMW-11A	2 J	1.7 J	1.2 J	1.2 J

Note:
J Estimated concentration.

TCE

Five monitoring wells were sampled for TCE during the Fall 2017 event. The TCE concentration remained below the cleanup level of 5 µg/L in all five wells sampled. The following table presents the results from the last four sampling events for comparison.

Upgradient Well TCE Concentrations, in µg/L

Well	Fall 2012*	Fall 2014	Fall 2016	Fall 2017
AMW-6A	0.42 J	0.24 J	0.23 J	0.26 J
AMW-7A	0.24 J	0.21 J	0.21 J	0.1 J
AMW-8A	0.4 J (Fall 2013)	0.46 J	0.37 J	0.22 J
AMW-10A	0.32 J	0.14 J	0.5 U	0.12 J
MW-11A	0.41 J	0.27 J	0.25 J	0.17 J

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.

4.2.2.2 TCE Source Area Wells

The TCE Source Area wells are located on the western half of the Linde property (Figure 9), near the historic TCE-impacted soil. A source removal system was previously operated in this area. These wells are typically sampled for VOCs only, as part of the OU-2 monitoring program, as these wells are upgradient of the chromium source area.

Chromium

During the 2017 reporting period, well AMW-54A was the only well sampled for chromium, and was sampled during the Fall sampling event. The chromium result in this well (2.5 J µg/L)

remained below the cleanup level of 80 µg/L. The well was first sampled in Fall 2016 as a chromium background well.

TCE

During the 2017 reporting period, TCE concentrations were below the 5 µg/L cleanup level in groundwater samples collected from six of the eleven wells sampled. The following table presents the results from the last four sampling events for comparison.

TCE Source Area Well TCE Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
AMW-1A	0.50 U	0.44 J	**5.2**	**39**
AMW-2A	**80**	**120**	**170**	**86**
AMW-3A	0.44 J (Fall 2013)	0.34 J (Fall 2014)	0.53 (Fall 2015)	0.71
AMW-4A	0.5 U (Fall 2004)	0.16 J (Fall 2008)	0.23 J (Fall 2009)	0.11 J
AMW-12A	**18**	**19**	**23**	**22**
AMW-19A	1.1 (Fall 2013)	1.2 (Fall 2014)	1.4 (Fall 2015)	1.3
AMW-26	0.24 J (Fall 2010)	0.52 (Fall 2012)	0.7 (Fall 2014)	4.3
AMW-53A	0.26 J	1.1	0.66	**5.4**
AMW-54A	1.8 (Fall 2013)	2.9 (Fall 2014)	3 (Fall 2015)	2.1
AMW-56A	2.4 (Fall 2013)	1.7 (Fall 2014)	1.7 (Fall 2015)	3.7
MW-1A	2.2	**51**	**24**	**110**

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

Since the IWS system was turned off in August 2013, groundwater samples from the TCE Source Area have been collected to monitor for changes/rebound in VOC concentrations.

Five wells were sampled for TCE during the Spring 2017 sampling event, and eleven wells were sampled for TCE in Fall 2017. The TCE concentration exceeded the cleanup level in wells AMW-1A, AMW-2A, AMW-12A, AMW-53A, and MW-1A. Notably, the TCE concentration in well MW-1A increased from 24 µg/L in Spring 2017 to 110 µg/L in Fall 2017, the highest it has been since Fall 2005 (210 µg/L). The TCE concentration in well AMW-53A was below the cleanup level for the last three sampling events and increased to above the cleanup level (5.4 µg/L) in Fall 2017. TCE concentrations in well AMW-1A have increased during the last four sampling events; however, TCE concentrations exceeding the cleanup level were previously reported in samples collected from this well in Spring and Fall 2015. Historically, TCE concentrations in wells in this area tend to fluctuate (Appendix B).

4.2.2.3 Proximal Wells

The Proximal wells are located west of the maintenance building (former machine shop) on the Boomsnub property and east of NE St. Johns Road (Figure 9). These wells are proximal to the chromium source. All four extraction wells in this group (MW-6B, MW-10B, MW-10C, and PW-1B) were actively pumping when they were sampled during both the spring and fall sampling events.

Chromium

During the 2017 reporting period, chromium concentrations were below the 80 µg/L cleanup level in groundwater samples collected from eight of the 11 wells sampled, as presented in the following table.

Proximal Well Chromium Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
MW-2A	**130** (Fall 2014)	39.8 (Fall 2015)	**91.9 J** (Fall 2016)	40.4
MW-3A	72.1 (Fall 2013)	63.6 (Fall 2014)	**98.3** (Fall 2016)	**149**
MW-4A	**505** (Spring 2013)	**376** (Fall 2013)	**495** (Fall 2014)	**490**
MW-4B	**809** (Fall 2014)	**702** (Fall 2015)	**795** (Fall 2016)	**438**
MW-4BSHED	**85.9** (Fall 2009)	65.5 (Spring 2013)	68.3 (Fall 2013)	65
MW-4C	**107** (Spring 2004)	**126** (Fall 2004)	61 (Fall 2009)	55.5
MW-6A	**167** (Fall 2009)	52.6 (Spring 2013)	**133** (Fall 2013)	20.1
MW-6B	27.1	11.4	30.7	9.6
MW-10B	36.5	28.4	31.7	26.3
MW-10C	75.6	53.1	78.5	53.6
PW-1B	56.4	38.7	41.8	30.7

Notes:
* Unless otherwise noted.
J Estimated concentration.
Results shown in **blue bold** exceed the established cleanup level of 80 µg/L.
Wells shown in **bold** are extraction wells.

During the 2017 reporting period wells MW-3A, MW-4A, and MW-4B had concentrations above the 80 µg/L cleanup level. Groundwater samples from wells MW-4A and MW-4B continue to exhibit some of the highest concentrations of chromium in groundwater at the Site and consistently remain above the cleanup level. However, concentration fluctuations are typical in these wells. Historically, groundwater from wells in the Proximal area have had large fluctuations in chromium concentrations and results from the sampling event were within the normal range of fluctuations (Appendix A).

TCE

During the 2017 reporting period, TCE concentrations were below the 5 µg/L cleanup level in groundwater samples collected from 15 of the 18 wells sampled, as presented in the following table.

Proximal Well TCE Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
MW-2B	**5.9** (Fall 2003)	**6.5** (Fall 2004)	2.4 (Fall 2009)	2
MW-3C	**6.8** (Fall 2002)	**5.6** (Fall 2003)	3.8 (Fall 2004)	1.8
MW-4A	4.7 (Spring 2004)	3.5 (Fall 2004)	**5.5** (Fall 2009)	2.1
MW-4BSHED	**7.2** (Fall 2003)	**5.2** (Fall 2004)	4.1 (Fall 2009)	2.1
MW-4C	**10** (Spring 2004)	**11** (Fall 2004)	3.8 (Fall 2009)	2
MW-6A	1.5 (Fall 1995)	0.3 U (Fall 1997)	0.5 U (Fall 2009)	0.5 U
MW-6B	3.3 (Spring 2016)	3.6 (Fall 2016)	3.3 (Spring 2017)	2.5
MW-6C	**16** (Fall 2003)	**9.7** (Fall 2004)	0.54 (Fall 2009)	0.19 UJ
MW-6D	**17** (Fall 1999)	**6.7** (Fall 2004)	4.3 (Fall 2009)	1.5 UJ
MW-7B	**110** (Fall 2004)	**7.3** (Fall 2009)	3.6 (Fall 2014)	**6.1**
MW-8B	3.3 (Fall 2010)	2.4 (Fall 2012)	1.8 (Fall 2014)	1.8
MW-9B	3.7 (Fall 2012)	2.8 (Fall 2014)	2.4 (Fall 2016)	2
MW-9C	**37** (Fall 1998)	**10** (Fall 2004)	3.8 (Fall 2009)	**5.8**
MW-10B	**10**	**10**	**9.6**	**7**
MW-10C	1.6	1.8	1.6	1.2
MW-12C	1.4 (Fall 2012)	0.89 (Fall 2014)	0.69 (Fall 2016)	0.71
MW-13C	**5.8** (Fall 2012)	2.4 (Fall 2014)	3.5 (Fall 2016)	2.2
PW-1B	1.8	2.9	4.1	3.1 J

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.
Active extraction wells are shown are in **bold**.
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

The TCE concentration exceeded the cleanup level in wells MW-7B, MW-9C, and MW-10B. The TCE concentration in well MW-10B remains above the cleanup level but has been on a decreasing trend. TCE concentrations in wells MW-7B and MW-9C dropped below the cleanup

level in Fall 2014 and Fall 2009 respectively, but exceeded the cleanup level in Fall 2017. Historically, TCE concentrations in groundwater samples from this area have been on a decreasing trend (Appendix B).

4.2.2.4 Intermediate Wells

The Intermediate wells are located west of NE St. Johns Road, north and south of NE 78th Street (Figure 9). All five extraction wells in this area (MW-14C, MW-14E, MW-18D, MW-19D, and MW-20D) were actively pumping during both the Spring and Fall 2017 sampling events.

Chromium

During the spring sampling event, chromium concentrations exceeded the cleanup level in two of the six wells sampled. During the fall sampling event, chromium concentrations were below the 80 µg/L cleanup level in all six wells sampled, as presented in the following table.

Intermediate Well Chromium Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
MW-14C	62.6	51.5	52.3	44.2
MW-14E	49.3	42.1	31.4	27.1
MW-18D	**86.5**	74	79.7	72
MW-19D	**91.6**	79.5	**85.3**	72.3
MW-20D	58.1	50	56.2	43.5
MW-40	**330** (Fall 2003)	**271** (Fall 2004)	**126** (Fall 2008)	35.1**

Note:
* Unless otherwise noted.
** Due to turbidity in the well a filtered sample was also collected (34 µg/L).
Active extraction wells are shown are in **bold**.
Results shown in **blue bold** exceed the established cleanup level of 80 µg/L.

Notably, the chromium concentrations in well MW-40 dropped below the cleanup level for the first time. The chromium concentrations in well MW-19D have fluctuated around the cleanup level over the past two years, with concentrations exceeding in Spring but not in Fall. Chromium concentrations in groundwater samples from wells in this area continue on an overall decreasing trend (Appendix A).

TCE

TCE concentrations were below the 5 µg/L groundwater cleanup level in four of the eighteen wells sampled in this area (Appendix B). Five of these wells (AMW-16, AMW-17, AMW-18, AMW-64, and MW-23D) were sampled to monitor the offsite Northern Plume. TCE concentrations reported in groundwater from the Northern Plume wells in 2017 were similar to or lower than concentrations reported in Fall 2016. TCE concentrations in all five of the Northern Plume monitoring wells remain above the cleanup level as shown in the following table.

Northern Plume Well TCE Concentrations, in µg/L

Well	Spring 2016	Fall 2016	Spring 2017	Fall 2017
AMW-16	**71**	**67**	**53**	**41**
AMW-17	**64**	**96**	**70**	**79**
AMW-18	**40**	**40**	**43**	**28**
AMW-64	**28**	**24**	**22**	**15**
MW-23D	**140**	**140**	**180**	**140**

Note:
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

Additional discussion of the Northern Plume, including previous monitoring results, is provided in Appendix G of the Progress and Groundwater Sampling Report July – December 2017 (EA 2018a).

TCE concentrations were below the 5 µg/L groundwater cleanup level in four of the thirteen OU-3 wells (not impacted by the Northern Plume) sampled in this area, as shown on the following table.

OU-3 Intermediate Well TCE Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
AMW-59	**92** (Fall 2012)	**58** (Fall 2014)	**56** (Fall 2016)	**53**
AMW-60	0.72 (Fall 2005)	0.94 (Fall 2005)	0.5 U (Fall 2009)	0.22 J
CPU-14	**5.5** (Spring 2015)	**5.5** (Fall 2015)	4.9 (Fall 2016)	3.9
MW-14C	**10**	**9.2**	**8**	**6.1**
MW-14E	**61**	**63**	**49**	**37**
MW-15E	2.3 (Fall 2014)	2.4 (Fall 2015)	2.1 (Fall 2016)	2.5
MW-18D	**29**	**27**	**24**	**21**
MW-18E	**96** (Fall 2014)	**69** (Fall 2015)	**76** (Fall 2016)	**180**
MW-19D	**22**	**23**	**22**	**20**
MW-20D	**26**	**23**	**25**	**20**
MW-38	**29**	**23**	**19**	**9.5**
MW-40	4.8 (Fall 2003)	2.7 (Fall 2004)	1.2 (Fall 2008)	0.44 J
PZ-39	**28**	**29**	**25**	**19**

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.
Active extraction wells are shown are in **bold**.
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

The TCE concentration exceeded the cleanup level in wells AMW-59, MW-14C, MW-14E, MW-18D, MW-18E, MW-19D, MW-20D, MW-38, and PZ-39. For wells with TCE concentrations above the cleanup level, the TCE concentrations reported in Fall 2017 were lower than the last time the wells were sampled, except for MW-18E. Concentrations in MW-18E increased from 69 µg/L in Fall 2015 to 180 µg/L in Fall 2017. Historically, TCE concentrations in groundwater samples from wells in this area (not impacted by the Northern Plume) have been on a decreasing trend (Appendix B).

4.2.2.5 Church of God Wells

The Church of God wells are located north of NE 78th Street between the west side of the Clark County sports field complex and the western Church of God property line (Figure 9). Two extraction wells in this area (MW-21D and MW-22D) were actively pumping during both the Spring and Fall 2017 sampling events. Church of God wells sampled for chromium and TCE during 2017 are shown in the following tables.

Chromium

During the reporting period chromium was not detected above the 80 µg/L cleanup level in groundwater from any of the four wells sampled, as shown in the following table.

Church of God Well Chromium Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017*
AMW-61	**1410** (Fall 2006)	17.3 (Fall 2008)	35.2 (Fall 2010)	39.7
CPU-12	6.5 (Fall 2008)	8 (Fall 2009)	5 U (Fall 2010)	3.3 J
MW-21D	9.6	8.7	9.2	8.3
MW-22D	19.1	15.1	17.3	15.1

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.
Active extraction wells are shown are in **bold**.
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

TCE

During the reporting period, TCE concentrations in groundwater were below the 5 µg/L cleanup level in groundwater from four of the five wells sampled, as presented in the following table.

Church of God Well TCE Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
AMW-23	0.5 U (Fall 2002)	0.5 U (Fall 2003)	0.5 U (Fall 2016)	0.1 J
AMW-61	**5.5** (Fall 2015)	**5.9**	**7.1**	**5.1**
CPU-12	4 (Spring 2015)	2.2 (Fall 2015)	2.5 (Fall 2016)	2.6
MW-21D	2.5	2.4	2.2	2.4
MW-22D	2.7	2.3	2.3	1.7

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.
Active extraction wells are shown are in **bold**.
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

TCE concentrations were above the 5 µg/L cleanup level in the groundwater samples collected from well AMW-61. The TCE concentrations in silt well AMW-61 fluctuate. Historically, TCE concentrations in samples collected from wells in this area have been on an overall decreasing trend (Appendix B).

4.2.2.6 Toe-of-Plume Wells

The Toe-of Plume wells are located west of the Church of God building (Figure 9). TCE Groundwater samples were collected during the reporting period from wells AMW-63, MW-35, and MW-41, and concentrations remained below the cleanup levels.

Chromium

During the reporting period chromium was not detected above the 80 µg/L cleanup level in groundwater from the two wells sampled, as shown in the following table.

Toe-of-Plume Chromium Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
AMW-63	12.4 (Fall 2009)	6.8 (Fall 2010)	11.4 UJ (Fall 2014)	14.3
MW-41	5 U (Fall 2010)	5 U (Fall 2011)	4 U (Fall 2014)	0.9 U

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit.

TCE

During the reporting period, TCE concentrations in groundwater were below the 5 µg/L cleanup level in groundwater from all three wells sampled, as presented in the following table.

Toe-of-Plume TCE Concentrations, in µg/L

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
AMW-63	0.17 J (Fall 2009)	0.5 U (Fall 2010)	0.17 U (Fall 2014)	0.17 J
MW-35	3	3.4	3.6	NS
MW-41	0.5 U (Fall 2010)	0.5 U (Fall 2011)	0.5 U (Fall 2014)	0.5 U

Note:
* Unless otherwise noted.
J Estimated concentration.
U Analyte not detected above the specified reporting limit
NS Well was decommissioned in Fall 2017 and not sampled during the fall event.

4.2.3 Troutdale Aquifer Wells – TCE and Chromium

The Troutdale aquifer serves as a municipal water supply for the City of Vancouver and Clark County. Groundwater samples were collected from three Troutdale aquifer wells, including the Bennett private well, during the 2017 reporting period.

Chromium

The Bennett well was the only Troutdale aquifer well sampled for chromium analysis during the 2017 reporting period. The well was sampled during the Spring event and the chromium concentration was below the 80 µg/L cleanup level (4.2 U µg/L). This is consistent with previous results (Appendix A).

TCE

During the 2017 reporting period, TCE concentrations were above the 5 µg/L cleanup level in two of the three wells sampled, as presented in the following table. TCE concentrations in groundwater from wells AMW-24 and MW-33 consistently dropped during the last four sampling events, but remain above the cleanup level. The TCE concentration in groundwater from the Bennett private well historically fluctuates above and below the cleanup level but has remained below during the last four sampling events (Appendix B).

Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017
AMW-24	**10** (Fall 2014)	**9.9** (Fall 2015)	**8.3** (Fall 2016)	**7.8**
BENNETT	1.8	1.7	1.4	1.7
MW-33	**11** (Fall 2014)	**8.5** (Fall 2015)	**6.3** (Fall 2016)	**5.1**

Notes:
* Unless otherwise noted.
Results shown in **blue bold** exceed the established cleanup level of 5 µg/L.

4.2.4 Other Detected VOCs

In addition to TCE, several other VOCs were detected at the Site. Routinely detected other VOCs include: tetrachloroethene; trichlorofluoromethane; 1,1,1-trichloroethane; 1,1-DCE; bromodichloromethane (BDCM); and cis-1,2-DCE (EA 2017d and 2018a). Vinyl chloride and trans-1,2-DCE were also detected in a few wells.

Detected concentrations of 1,1-DCE exceeded the 1.0 µg/L Site-specific cleanup level, as established in the ROD (EPA 2000), in four of twenty-six groundwater samples analyzed for VOCs during the Spring 2017 event, and seven of the sixty-five groundwater samples analyzed for VOCs during the Fall 2017 event (EA 2017d and 2018). All wells with 1,1-DCE concentrations above the cleanup level were alluvial aquifer wells. Six of these wells are in the Intermediate well group, where the highest TCE concentrations remain, and one well (MW-23D) was in the Northern Plume Group. Results for all VOCs analyzed are provided in the Progress and Groundwater Monitoring Reports (EA 2017d and 2018a).

5. OTHER ACTIVITIES

During the 2017 reporting period, the following other activities were performed.

5.1 Easement Agreements and Restrictive Covenants

EA, on behalf of Linde, has pursued easement agreements and restrictive covenants for non-Linde owned properties, as required by Sections 25 and 26 of the CD (EPA 2007). Properties which include Site infrastructure but for which Linde has been unable to negotiate easement agreements include the following:

Easement Agreements Needed

Property Owner	Parcel Number	Reason Agreement Needed
Clark County	144505-000 and various un-numbered	Wells, vaults, pipelines
Gaither Family II LLC	144492-000	Well CPU-12
Holtgrieve Estate	144718-000	Wells, vaults, pipelines
Xylem LLC	099630-000	Well MW-33

Further progress toward gaining easement agreements and restrictive covenants from non-responsive property owners is pending EPA assistance.

5.2 Padden Parkway Development

The Padden Parkway development began in 2016. Two monitoring wells were decommissioned and several well elevations were modified to match the new property grade. EA began design of pipeline modifications and it is anticipated that the required modifications will be completed during 2018. EA plans to work with the owner/developer of the Padden Parkway Business Park as they develop their property, and modify the pipeline running through containment vault CV-8 to accommodate property development.

5.3 Closure Plan

In 2016 EA addressed EPA comments and revised the Closure Plan. EA produced Revision 3 of the Closure Plan and submitted it to EPA, along with responses to EPA comments, on 27 February 2018. EA plans to finalize the Closure Plan with EPA approval in 2018.

5.4 Sustainability Practices

Linde and EA have a commitment to sustainable practices. In the office and in the field, attempts are made to reduce, reuse, and recycle whenever possible. In addition, the following monitoring and O&M activities are in place:

- Using passive diffusion bags or dedicated pumps for groundwater sampling wherever possible to eliminate the use of disposable tubing and decontamination solutions.
- Using the infiltration gallery to discharge treated groundwater from the OU-3 treatment system back into the alluvial aquifer instead of to the sanitary sewer, eliminating the processing of millions of gallons per year of clean water through the city sewage treatment plant.
- Upgrading the groundwater treatment system to minimize energy usage by using variable frequency drives and smaller pumps, optimizing water flow to minimize head loss, removing redundant tanks (and pumps), and replacing air stripper packing.

6. ANNUAL ASSESSMENT OF GROUNDWATER SAMPLING

This section summarizes the annual assessment of the groundwater sampling results and sampling frequency for the Site. The purpose of this assessment is to determine if any changes should be made to the current system operations and/or well monitoring schedule. To this end, the assessment includes two primary tasks: (1) evaluation of the status of wells included in the Closure Monitoring Program, specifically with regards to progress toward completion of remediation and attainment monitoring; and (2) evaluation of recommended changes to the well sampling frequencies.

6. 1 Evaluation of Closure Monitoring Wells

The procedures used to evaluate groundwater monitoring data for wells included in the Closure Monitoring Program are based on the Site closure requirements described in the Closure Plan, Revision 3 for the Site (EA 2018b), which incorporates EPA suggestions and recent EPA guidance, as discussed below.

As described in the Closure Plan, site closure will occur when the concentrations of all Site COCs in groundwater monitoring and extraction wells included in the Closure Monitoring Program have reached the Site-specific cleanup levels, as defined in the ROD. The following EPA guidance documents were used to develop the procedures in the Closure Plan to determine when the groundwater cleanup levels have been achieved:

- *Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well* (EPA 2014)
- *Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions* (EPA 2013).

Site closure will occur in two phases: (1) remediation monitoring will be performed to determine when remediation is complete (see Section 6.1.1); and (2) attainment monitoring will be performed to confirm COC concentrations are expected to remain below the cleanup levels in the future (see Section 6.1.2). The Site will be closed once all Closure Monitoring Program wells have reached attainment for all COCs.

Table 3 lists the wells included in the Closure Monitoring Program for the Site, as presented in the Closure Plan (EA 2018b). Wells excluded from closure monitoring are listed on Table C-1 in Appendix C. Excluded wells include wells that have never had COC concentrations greater than the cleanup levels and wells impacted by the Northern Plume.

The sections below present the results of annual screening to evaluate whether VOCs and/or chromium concentrations in groundwater from Closure Monitoring Program wells at the Site have met the requirements for remediation monitoring complete and/or attainment monitoring complete.

6.1.1 Remediation Monitoring Phase

The remediation monitoring phase refers to the phase of the remedy where remedial activities are being implemented to reach groundwater cleanup levels. Once the cleanup levels have been met decisions can be made regarding shutting off pumps in nearby extraction wells, in preparation for attainment monitoring.

The most recent four data points from each Closure Monitoring Program well were evaluated to assess whether remediation monitoring is complete for each COC in each well, in accordance with the Closure Plan (EA 2018b) and EPA guidance (EPA 2014). Remediation monitoring is considered complete for wells where all COCs have been either non-detect or reported at levels below the cleanup levels for the most recent four consecutive sampling events. These wells may be considered for decreased sampling frequency.

If certain COCs meet their cleanup levels during four consecutive sampling events in a given well but other COCs are reported at concentrations above cleanup levels during one or more of the four sampling events, then remediation monitoring is considered complete for the COCs that have been below cleanup levels for four events. A decision may be made to remove the COCs that are below the cleanup levels from the monitoring program for wells fitting this scenario.

Factors used in evaluating the status of the closure monitoring wells are presented in Table 2. In the table, wells are presented by well groupings (as presented in Section 4.1) to demonstrate what is happening in specific areas of the plume. Columns titled "Remediation Monitoring Phase Complete?" in Table 2 show the results of the analysis based on the most recent four data points for TCE, all VOCs, and chromium. Columns titled "Never Exceeded Cleanup Level?" indicate wells where no exceedance has been reported for VOCs or for chromium. Generally, COCs that have never exceeded cleanup levels in a well are excluded from the Closure Monitoring Program.

Summary data are provided in Table 2 for TCE and chromium, the primary COCs at the Site. However, as indicated in the table, for a few wells, remediation monitoring is incomplete due to other VOCs reported at concentrations exceeding cleanup levels. Specifically, wells AMW-3A and AMW-4A in OU-2 have completed remediation monitoring for TCE, but had exceedances of the cleanup levels for chlorodibromomethane and/or BDCM. AMW-60 had an exceedance of 1,1-DCE. Data for the other Site COCs are included on Appendix C-2.

Closure Monitoring Program wells that are currently undergoing remediation monitoring and wells for which remediation monitoring is complete are shown on Table 3 and Figures 14 and 15 for VOCs and chromium, respectively. Note that wells classified as "Remediation Phase Complete" (yellow-shaded) on the figures are not yet ready for attainment monitoring, due to continued groundwater extraction nearby, and therefore are not yet included as part of the attainment monitoring program.

Per the Closure Plan, more than four data points may be required to document the completion of remediation monitoring in some cases, if statistical analysis is required to evaluate a mixture of

COC concentrations above and below the cleanup levels from recent sampling events. However, statistical analysis was not performed as part of this annual assessment. Rather, wells with any exceedances of the cleanup level over the last four sampling events were considered, for the purposes of this assessment, to require additional remediation monitoring.

6.1.2 Attainment Monitoring Phase

The attainment monitoring phase is intended to confirm that COC concentrations will remain at or below the cleanup levels in the future. In accordance with EPA guidance, the attainment monitoring phase for each well will not begin until after the remediation monitoring phase is complete for the well and the groundwater in the vicinity is in steady state conditions.

Table 4 summarizes which of the closure monitoring wells/COCs currently meet the requirements for the initiation of attainment monitoring: (1) remediation monitoring is complete and (2) steady state conditions are present near the well (i.e., no pumping from extraction wells in the area has occurred for at least one month).

Cleanup attainment will be measured using eight data points, in accordance with EPA guidance (EPA 2014). As with the remediation monitoring, the attainment monitoring phase evaluation is conducted separately for each COC at each well. If the eight consecutive attainment monitoring results are either non-detect or below the cleanup level for one or more COCs in a given well, then attainment monitoring will be considered complete for that well/COC(s).

For wells that are ready for attainment monitoring, Table 4 provides a summary of their status, based on an evaluation of VOC and chromium concentrations reported from the last eight sampling events. This evaluation indicates that eleven wells meet the requirements for attainment monitoring complete for both VOCs and chromium (or are excluded from closure monitoring for one of the COCs). Note that MW-31 and MW-35 have been removed from the closure monitoring program since they were abandoned with EPA approval in 2017. For AMW-27 attainment monitoring is almost complete for TCE and chromium.

Closure Monitoring Program wells that are currently undergoing attainment monitoring and wells for which attainment monitoring is complete are shown on Table 4 and Figures 14 and 15 for VOCs and chromium, respectively.

Similar to remediation monitoring, statistical analysis may be used to assess completion of attainment monitoring; however, no statistical analyses were conducted for this report.

6.2 Evaluation of Sampling Frequency

As part of the annual assessment, the current sampling frequency for each well is evaluated and, if appropriate, revised. When proposing a revised sampling frequency for a well, the following factors were considered: the current sampling frequency; the use of the well at the Site; and, for closure monitoring wells, whether remediation monitoring and/or attainment monitoring is complete for VOCs and/or chromium. These factors are summarized in Table 2. Additionally, a

review of graphs of historical TCE and chromium concentrations in each well sampled during 2017 (presented in Appendices A and B) was performed during the evaluation of recommended sampling frequencies for 2018.

Wells to be sampled in 2018 are included on Figure 16. Recommended sampling frequencies for 2018 are included in Table 2 and summarized in Table 5. Factors that may yield recommended changes in sampling frequency for Closure Monitoring Program wells include the following:

- In most cases, sampling from monitoring wells that meet the requirements for remediation but not attainment monitoring complete for VOCs and/or chromium will be temporarily discontinued, until attenuation monitoring begins for each well. The designation for these wells is "On Hold" to signify that sampling of these wells for attenuation monitoring will occur in future years. These wells will remain available for future sampling, if needed, and then for attainment monitoring.
- Some active extraction wells also meet the requirements for remediation monitoring complete for VOCs and/or chromium. In cases where COC concentrations in these extraction wells are stable below the cleanup levels and semiannual monitoring is not required for other purposes, the sampling frequency is recommended to be decreased from semiannual to annual for the COCs reported at concentrations below cleanup levels.
- Wells for which attainment monitoring is complete and for which sampling is not required for other purposes are designated for NFS, as no further sampling of these wells is recommended.

Generally, changes in sampling frequency are not recommended for Northern Plume wells or infiltration gallery wells. Four infiltration gallery wells are sampled biennially. Five Northern Plume wells are monitored semiannually for VOCs, and one additional well (AMW-23) is recommended for annual sampling of VOCs to monitor the approach of the Northern Plume (Tables 2 and 5). Few changes to monitoring frequencies were recommended this year, because the evaluation completed in 2017 was very comprehensive.

6.3 Annual Well Screening Conclusions and Recommendations

Based on the results of the annual screening of groundwater monitoring data through 2017, the following conclusions and recommendations are made:

- Remediation monitoring for VOCs was complete at MW-8B and MW-9B by October 2017, therefore monitoring is placed on hold until attainment monitoring is started.
- MW-38 was moved from a Northern Plume monitoring well into the OU-3 Well grouping. The sampling frequency of this well be decreased from semiannual to annual.

Changes to sampling frequencies are recommended based on the results of the annual assessment. Well sampling frequency recommendations for 2018 are provided in Table 2 and summarized in Table 5.

7. RECOMMENDATIONS AND PLANNED ACTIVITIES

The following sections summarize the status of activities recommended for 2017, as well as recommendations and planned activities for 2018.

7.1 Status of Previous Recommendations for 2017

To meet the operating objectives for OU-2 and OU-3, planned activities for 2017 were recommended in the 2016 Annual Status report. The status of those planned activities is summarized below:

- **Well Sampling** – Wells were sampled in accordance with the updated sampling schedule and subsequent revisions approved by EPA.
- **Closure Plan** – Discussions with EPA continue and the Site Closure Plan finalization is planned for 2018.
- **Extraction Well Pumping Rates** – As recommended in the 2015 and 2016 Annual Status Reports for the Site, pumping rates and plume capture were evaluated to determine if pumping should be reduced or discontinued in the following active extraction wells where VOCs and chromium remediation monitoring is complete: MW-6B, MW-10C, PW-1B, MW-21D, and MW-22D. The existing Site groundwater flow and transport model (EA 2004a) was used to evaluate contaminant capture under current conditions and how capture would be affected if pumping were decreased or shut off in these extraction wells. The results of the modeling indicate that it is possible to shut off wells PW-1B, MW-6B, MW-10C, and MW-21D while maintaining the current level of OU-3 plume capture, and decreasing the capture of the Northern Plume. However, pumping from extraction well MW-22D is critical for maintaining capture of the downgradient portion of the plume. Additional details on the modeling and results are provided in Appendix D.

- **Easement Agreements and Restrictive Covenants –** EA requested access to parcels on a case-by-case basis where no access agreement is in place. EPA has been asked to aid in obtaining easement agreements and restrictive covenants with non-responsive property owners.
- **Infrastructure Removal –** Selected infrastructure in the Toe-of-Plume area was no longer needed for Site remediation or monitoring and was removed on the Bonneville Power Administration (BPA) property and Parcel No. 144718-000 to allow for development of Parcel No. 144718-000. Wells on Parcel No. 144718-000 (MW-37, MW-31, MW-32 and MW-35) were decommissioned in September 2017. In October 2017 vaults and piping were removed from Parcel No. 144718-000 and infrastructure was removed from the BPA property. Wells on the BPA property (AMW-42, MW-48, MW-41 and MW46) were all converted to flush-mount monitoring wells and both properties were re-graded and seeded.

- **Padden Parkway Business Park –** Work continues with the owner/developer of the Padden Parkway Business Park as they develop their property. Plans to modify the pipeline running through containment vault CV-8 to accommodate property development have been delayed and are anticipated for 2018.
- **In-situ Treatments** – EPA approval of the Closure Plan was delayed and finalization is anticipated for 2018. Discussions with EPA regarding the potential need for in-situ treatment in areas of residual contamination and an implementation strategy are anticipated for 2018 after approval of the closure plan.

7.2 Recommendations and Planned Activities for 2018

The following activities are planned during the 2018 reporting period:

- **Well Sampling** – Sample wells in accordance with the updated sampling schedule (Table 5). Based on pumping rate modeling, the sampling frequency has changed in wells MW-8B, MW-9B, MW-35, and MW-38 (Table 2).
- **Closure Plan** – Finalize the Site Closure Plan, with EPA approval.
- **Easement Agreements and Restrictive Covenants –** Continue to request EPA assistance to obtain the required agreements with non-responsive property owners. EA will continue efforts to obtain agreements as opportunities arise.
- **Padden Parkway Business Park –** Work with the owner/developer of the Padden Parkway Business Park as they develop their property. Modify the pipeline running through containment vault CV-8 to accommodate property development.
- **In-situ Treatments** – Following EPA approval of the Closure Plan, discuss with EPA the potential need for in-situ treatment in areas of residual contamination and plan an implementation strategy. Develop a work plan for implementation.
- **Modeling** – Results of extraction well pumping rate modeling and potential extraction well pumping rates will be discussed with EPA.
- **Flouroalkyl Substances** – EPA has recently identified former chrome-plating facilities to be potential sources of per-(poly) flouroalkyl substances (PFAS). In order to address this concern, develop a work plan for sampling for the presence of per-(poly) flouroalkyl substances (PFAS).

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FIGURES

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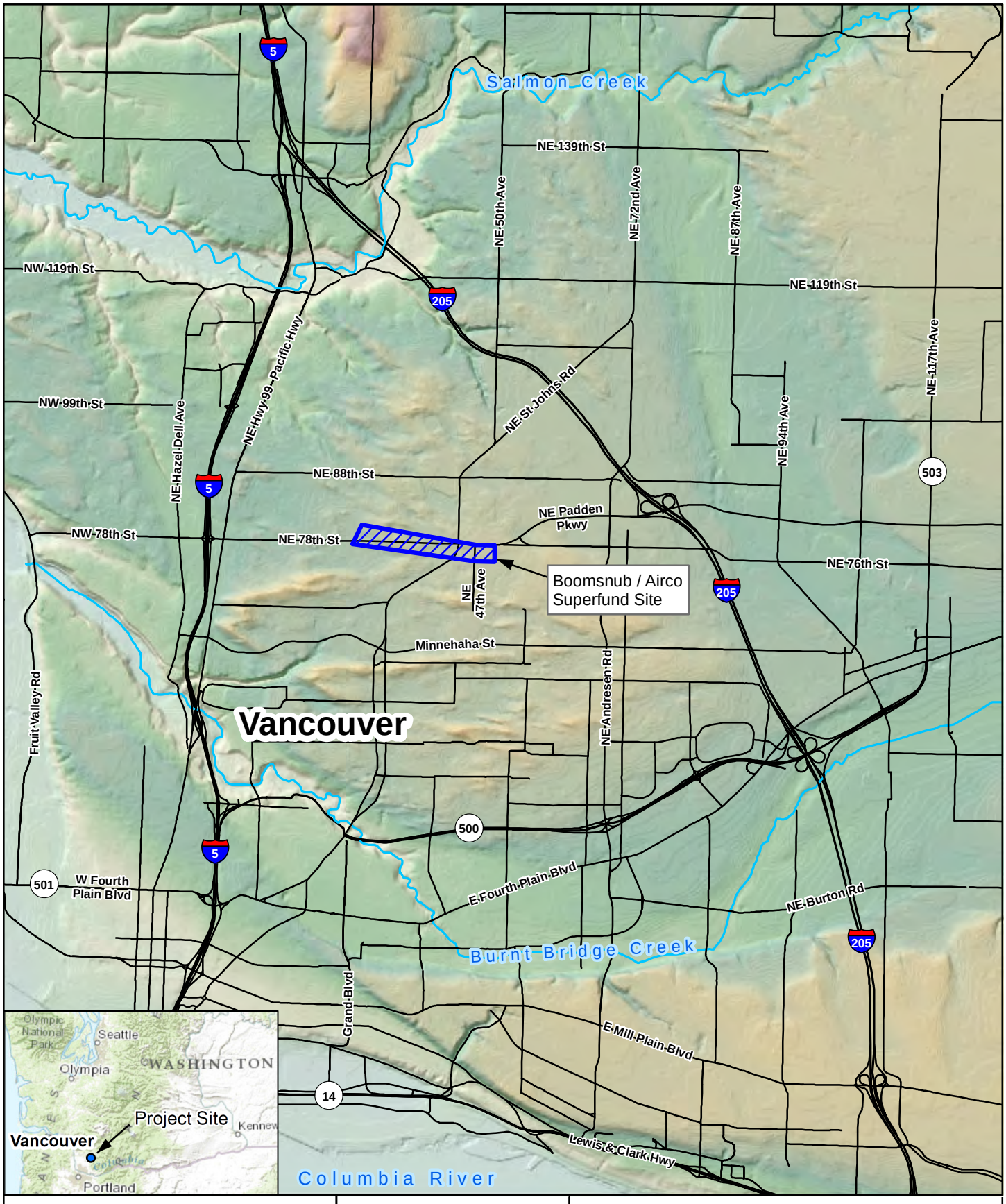

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FIGURE 1
SITE LOCATION MAP

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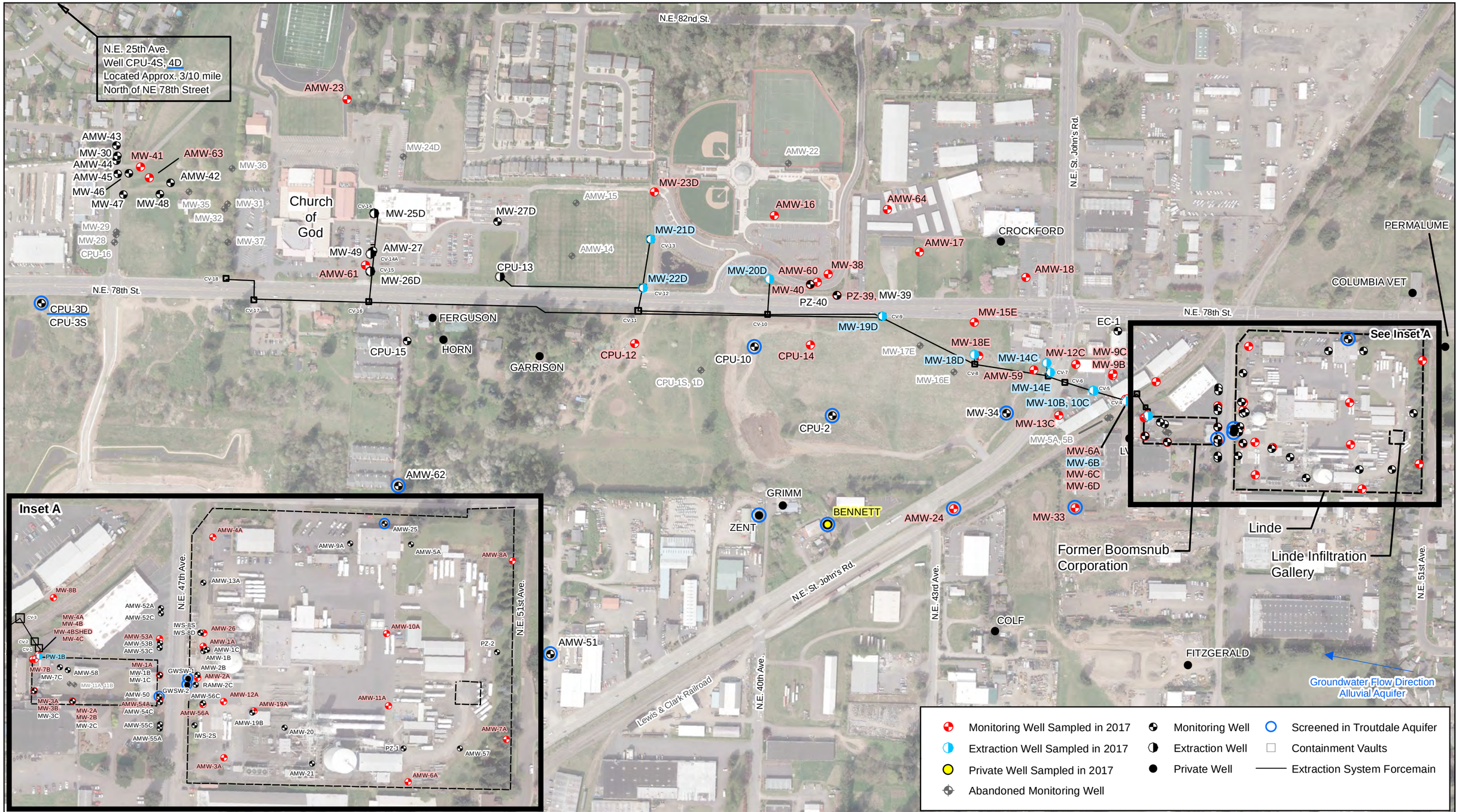

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FIGURE 2
MONITORING AND EXTRACTION WELL NETWORK

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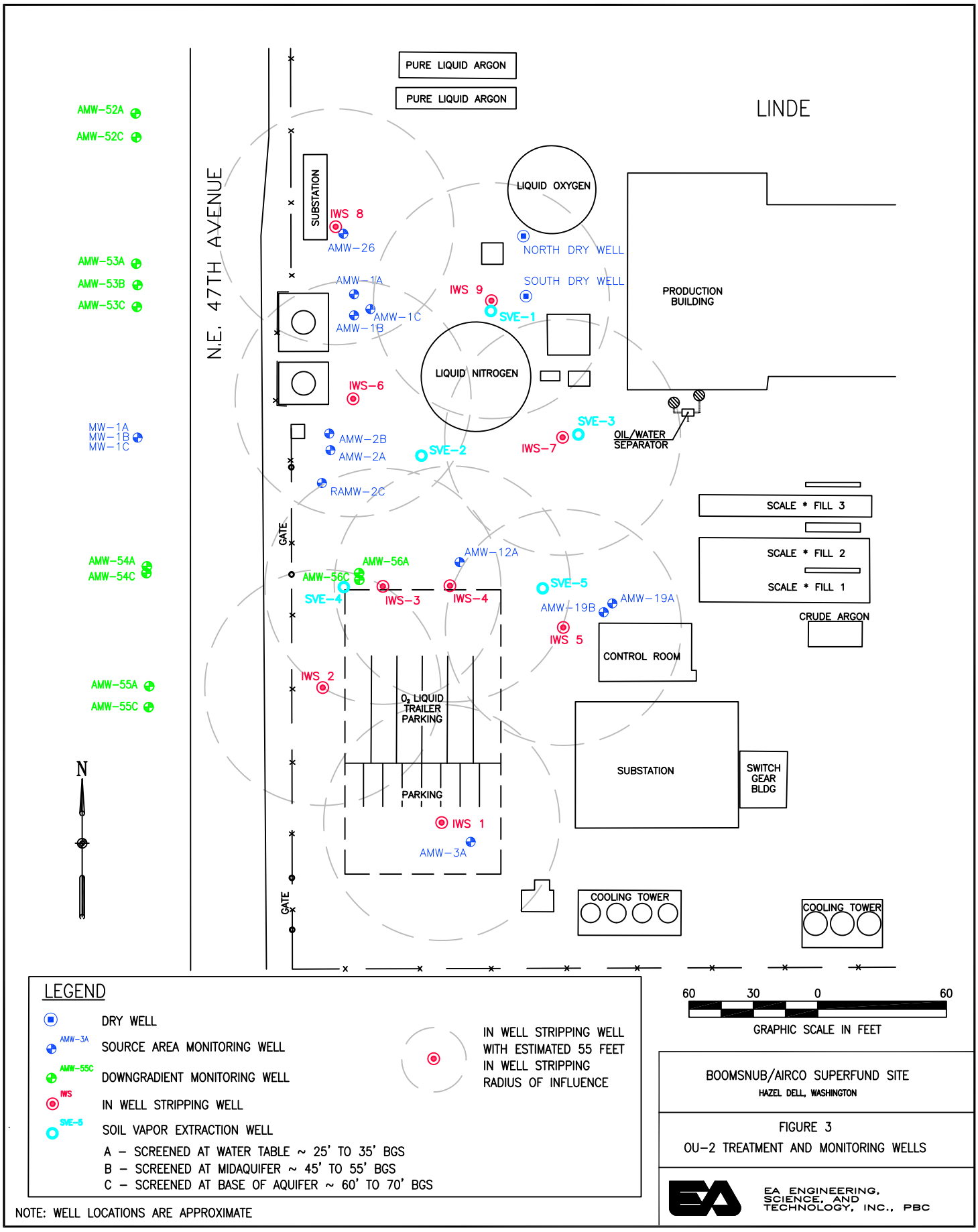
PURE LIQUID ARGON
PURE LIQUID ARGON
LINDE
AMW-52A
AMW-52C
N.E. 47TH AVENUE
SUBSTATION
IWS 8
AMW-26
LIQUID OXYGEN
NORTH DRY WELL
AMW-53A
AMW-53B
AMW-53C
AMW-1A
AMW-1C
AMW-1B
IWS 9
SVE-1
SOUTH DRY WELL
PRODUCTION BUILDING
LIQUID NITROGEN
IWS-6
MW-1A
MW-1B
MW-1C
AMW-2B
AMW-2A
SVE-2
SVE-3
IWS-7
OIL/WATER SEPARATOR
RAMW-2C
SCALE * FILL 3
SCALE * FILL 2
SCALE * FILL 1
CRUDE ARGON
GATE
AMW-54A
AMW-54C
AMW-56A
AMW-12A
AMW-56C
SVE-4
IWS-3
IWS-4
SVE-5
AMW-19B
AMW-19A
IWS 5
CONTROL ROOM
IWS 2
AMW-55A
AMW-55C
0, LIQUID TRAILER PARKING
PARKING
SUBSTATION
SWITCH GEAR BLDG
IWS 1
AMW-3A
N
GATE
COOLING TOWER
COOLING TOWER
LEGEND
DRY WELL
AMW-3A
SOURCE AREA MONITORING WELL
AMW-55C
DOWNGRADIENT MONITORING WELL
IWS
IN WELL STRIPPING WELL
SVE-5
SOIL VAPOR EXTRACTION WELL
A – SCREENED AT WATER TABLE ~ 25' TO 35' BGS
B – SCREENED AT MIDAQUIFER ~ 45' TO 55' BGS
C – SCREENED AT BASE OF AQUIFER ~ 60' TO 70' BGS
IN WELL STRIPPING WELL WITH ESTIMATED 55 FEET IN WELL STRIPPING RADIUS OF INFLUENCE
NOTE: WELL LOCATIONS ARE APPROXIMATE
60 30 0 60
GRAPHIC SCALE IN FEET
BOOMSNUB/AIRCO SUPERFUND SITE
HAZEL DELL, WASHINGTON
FIGURE 3
OU-2 TREATMENT AND MONITORING WELLS
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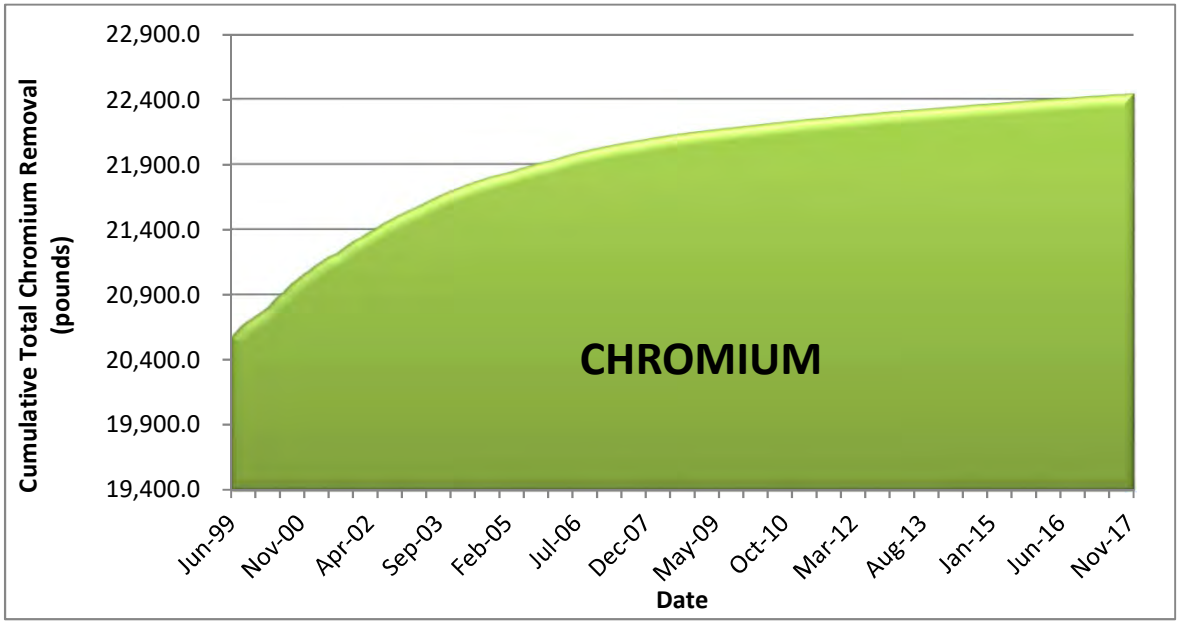
FIGURE 4. OU-3 CUMULATIVE REMOVAL OVER TIME



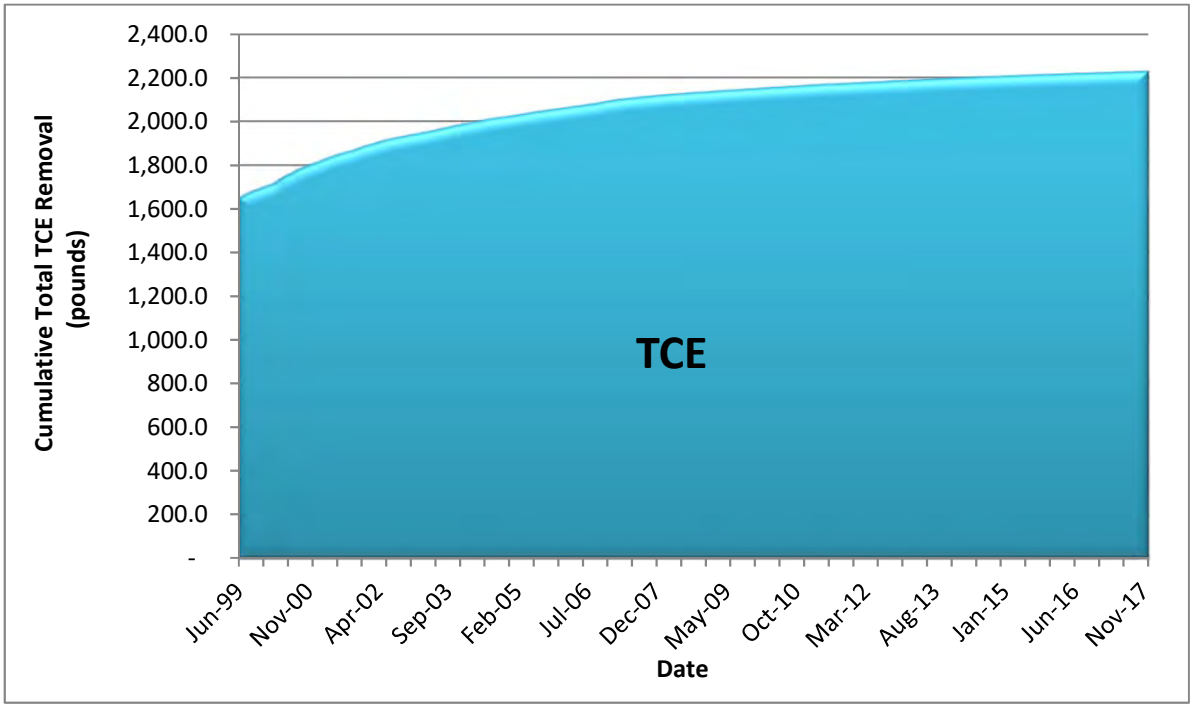


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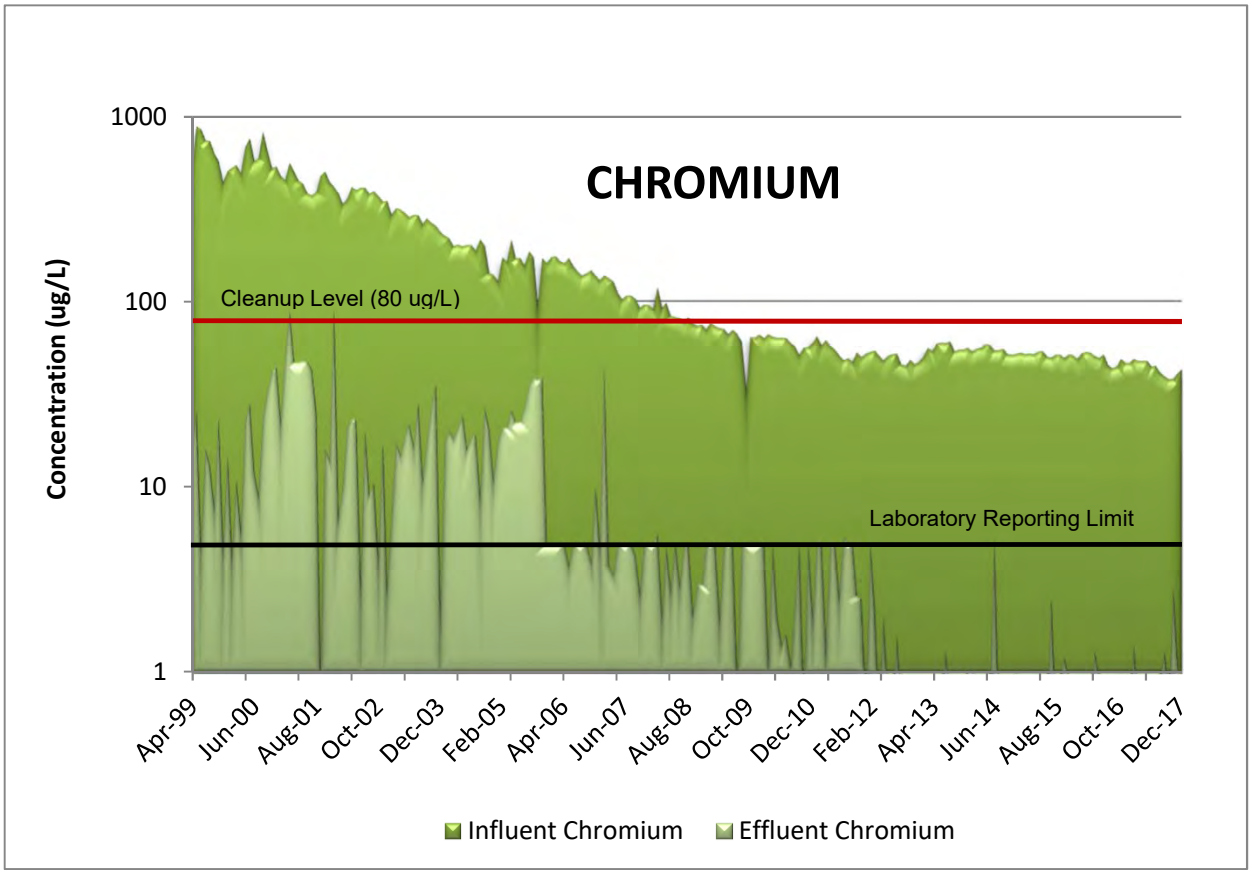
FIGURE 5. OU-3 INFLUENT AND EFFLUENT CONCENTRATIONS VERSUS TIME - LOGARITHMIC SCALE



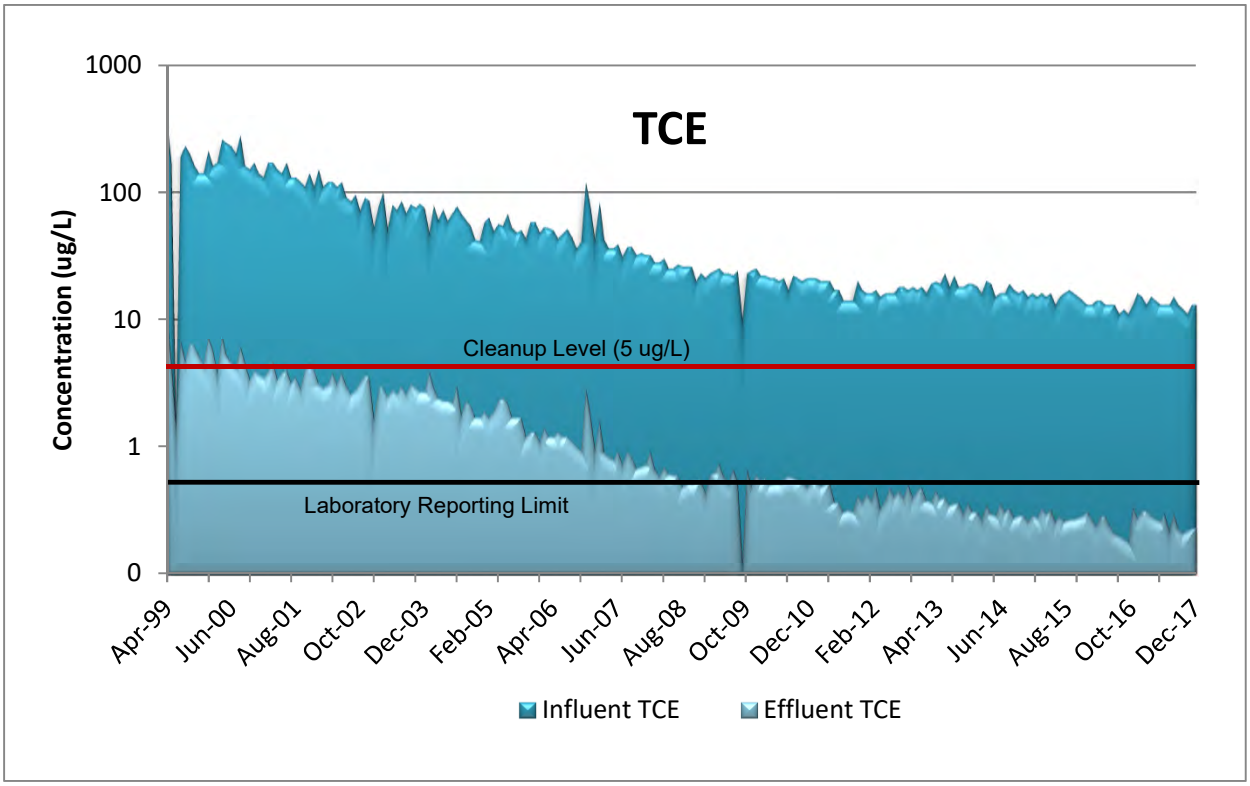


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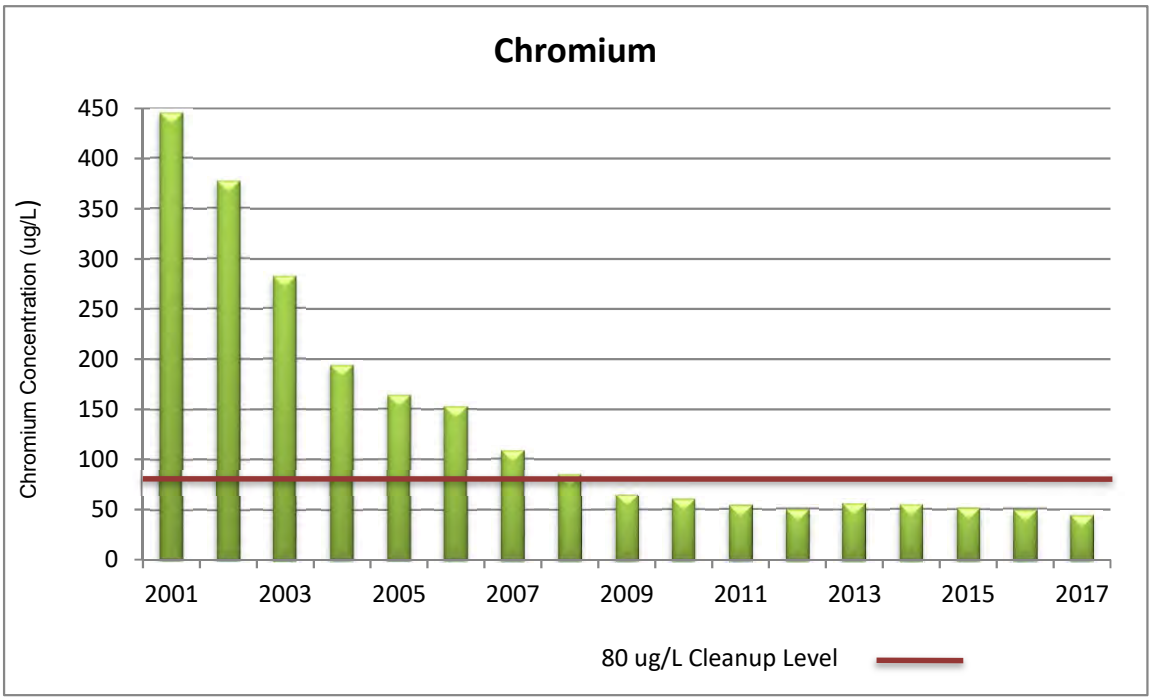
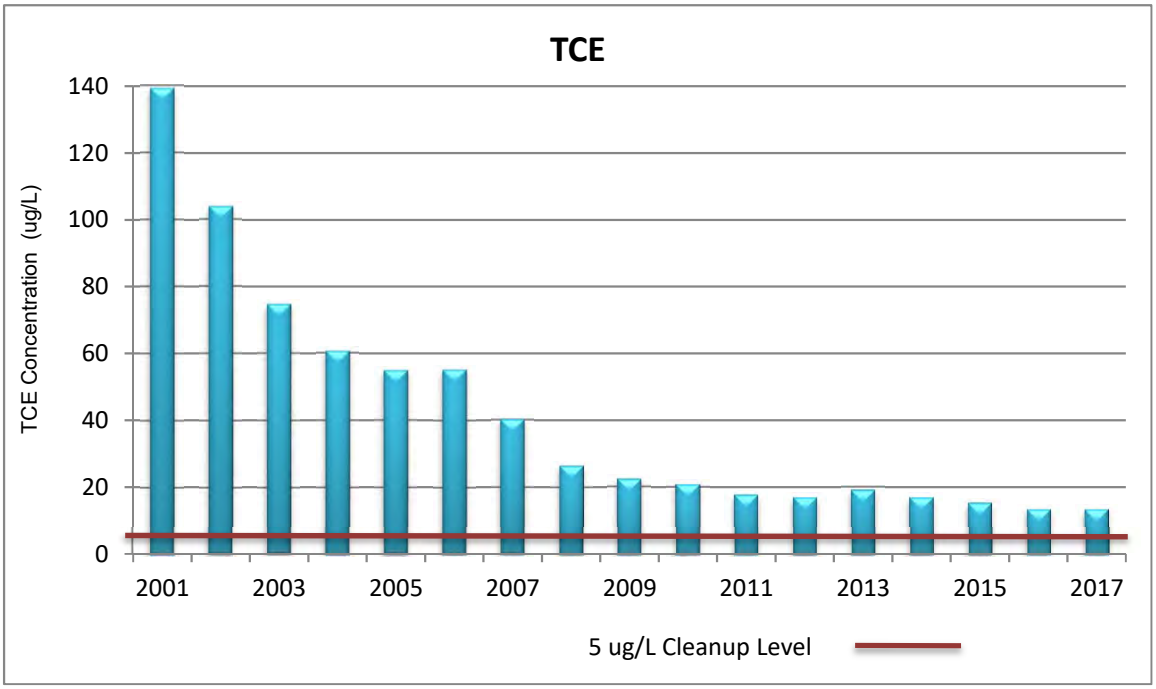
FIGURE 6. OU-3 INFLUENT CONCENTRATIONS OVER TIME





Note: Concentrations per year are an average of monthly data.

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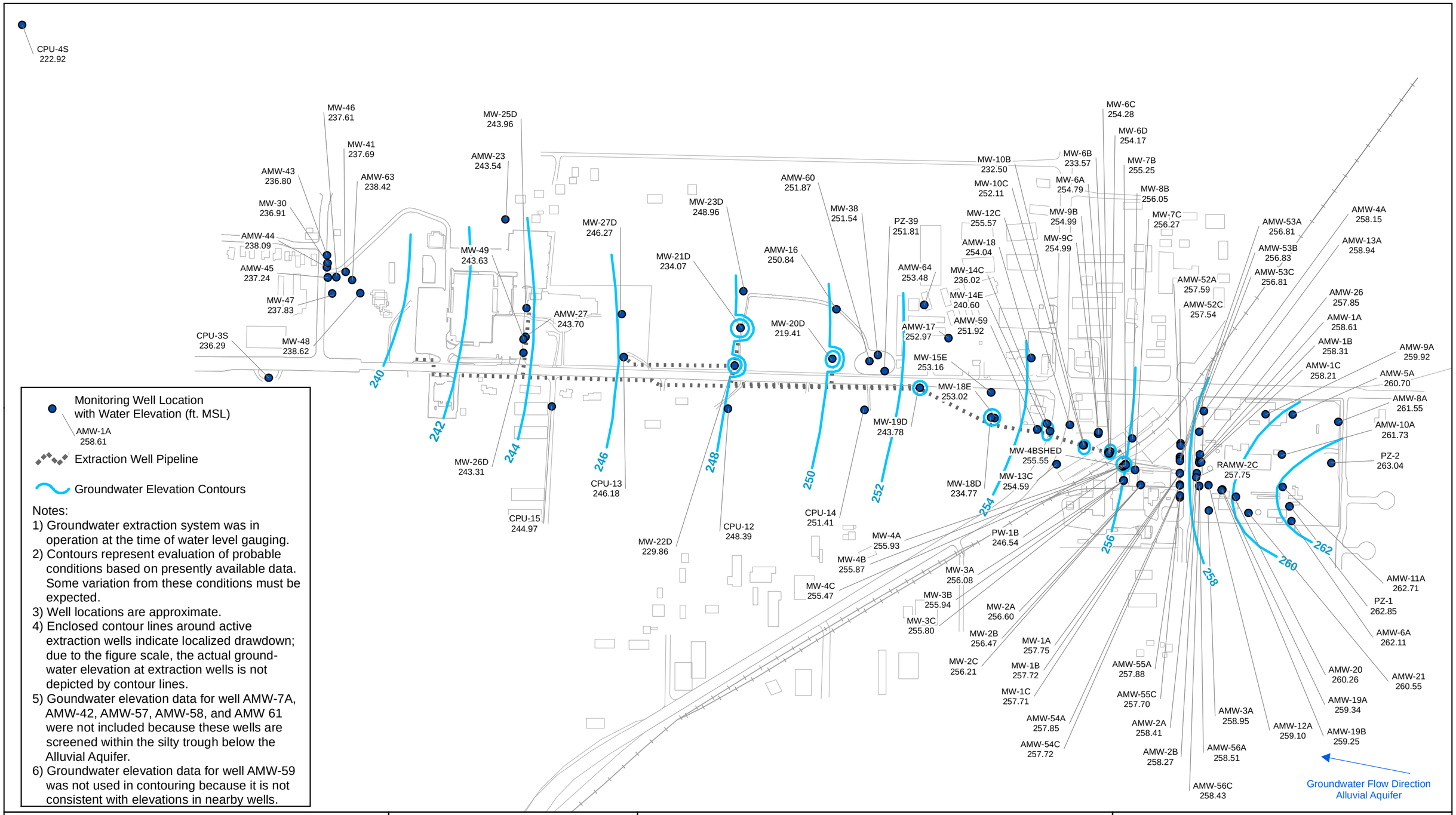

Monitoring Well Location with Water Elevation (ft. MSL)

AMW-1A
258.61

Extraction Well Pipeline

Groundwater Elevation Contours

Notes:

1) Groundwater extraction system was in operation at the time of water level gauging.
2) Contours represent evaluation of probable conditions based on presently available data. Some variation from these conditions must be expected.
3) Well locations are approximate.
4) Enclosed contour lines around active extraction wells indicate localized drawdown; due to the figure scale, the actual ground-water elevation at extraction wells is not depicted by contour lines.
5) Goundwater elevation data for well AMW-7A, AMW-42, AMW-57, AMW-58, and AMW 61 were not included because these wells are screened within the silty trough below the Alluvial Aquifer.
6) Groundwater elevation data for well AMW-59 was not used in contouring because it is not consistent with elevations in nearby wells.

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FIGURE 7
ALLUVIAL AQUIFER GROUNDWATER CONTOURS
FALL 2017

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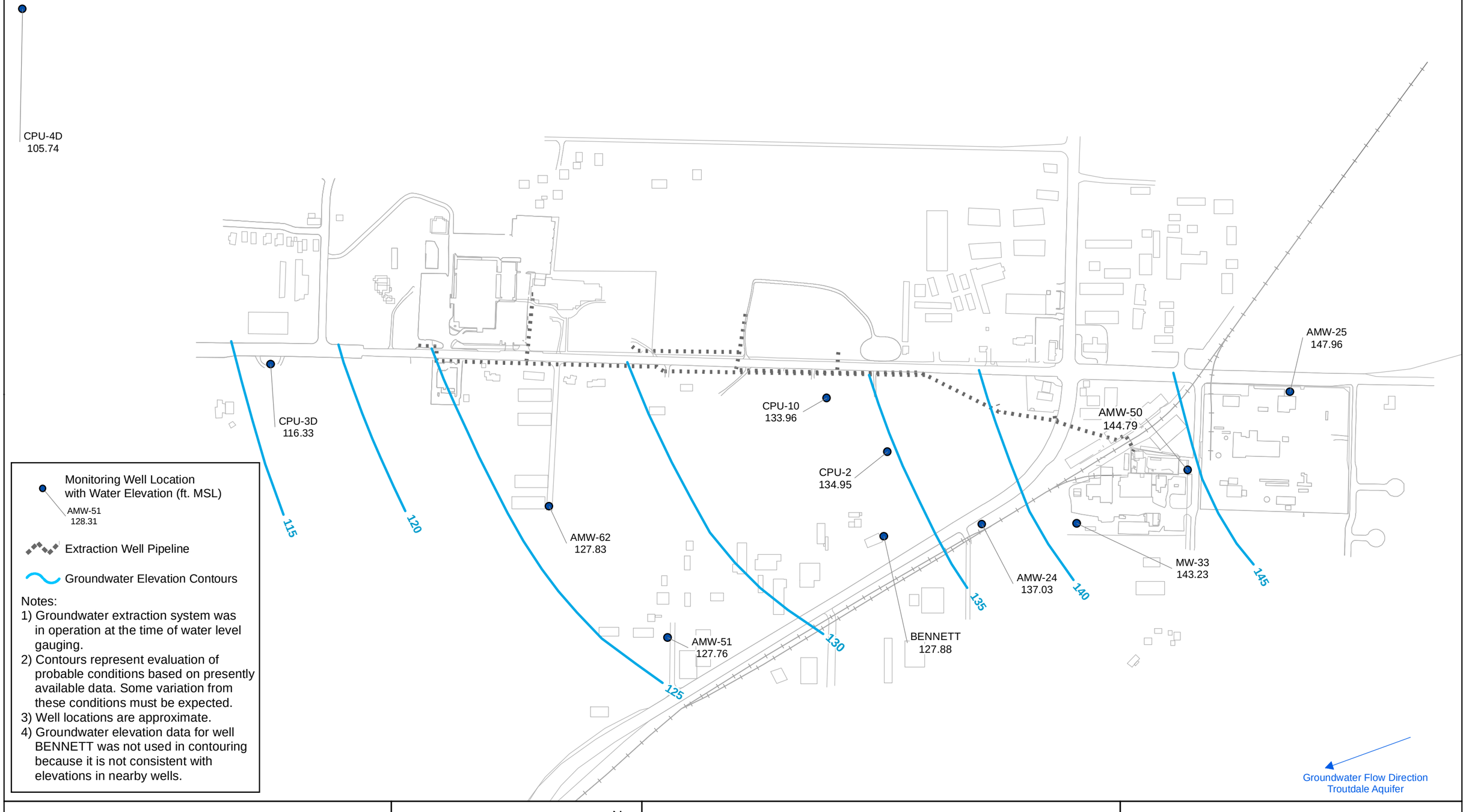

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FIGURE 8
TROUTDALE AQUIFER GROUNDWATER CONTOURS
FALL 2017

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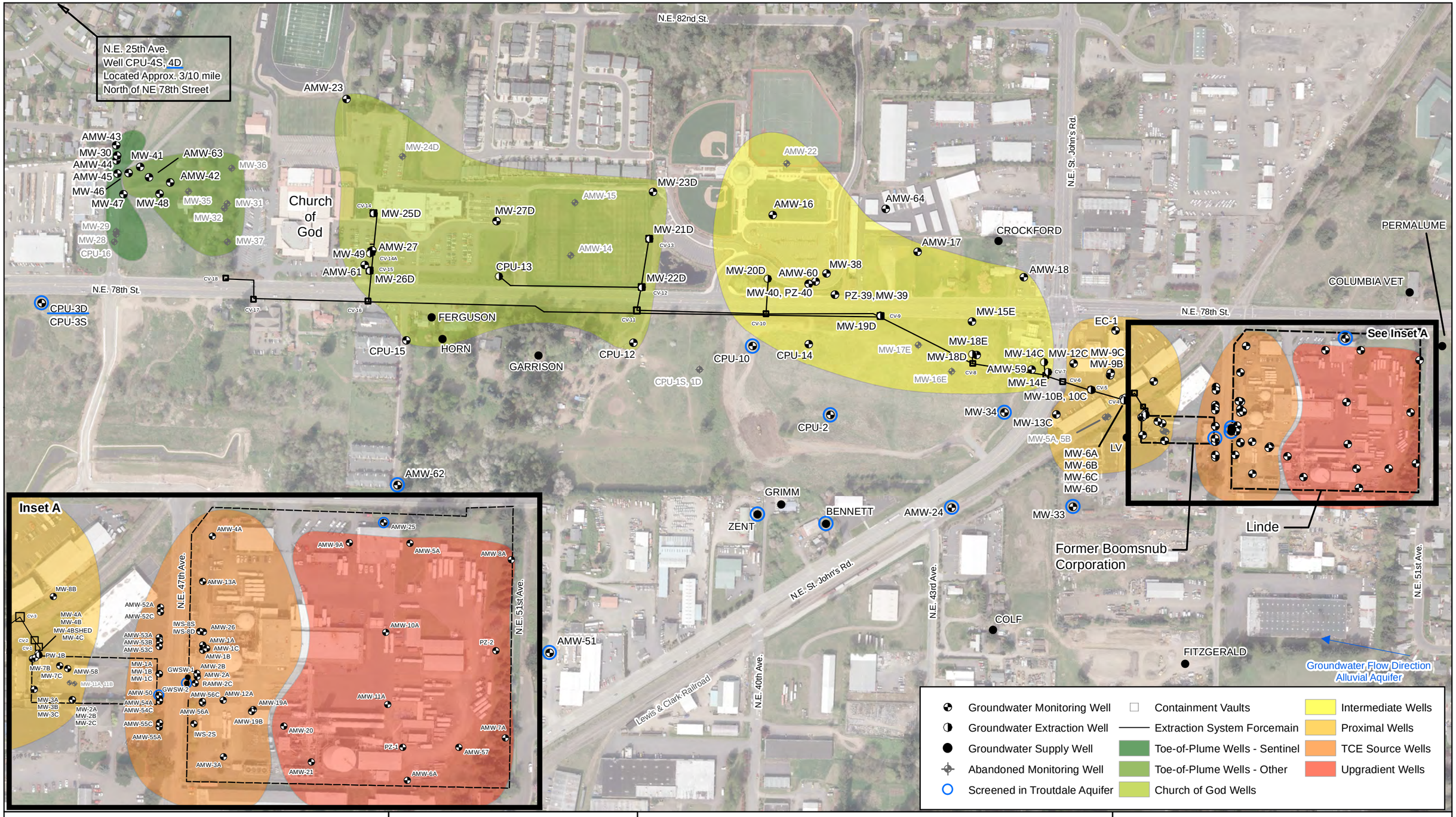

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FIGURE 9
EXTRACTION AND MONITORING WELL GROUPINGS

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1995

2017

Groundwater Flow Direction
Alluvial Aquifer

Extraction Well Pipeline

Chromium Concentration Contours

- 80 - 250 µg/L
- 250 - 500 µg/L
- 500 - 1,500 µg/L
- 1,500 - 5,000 µg/L
- 5,000 - 10,000 µg/L
- 10,000 - 20,000 µg/L
- >20,000 µg/L

Note:
Contours represent evaluation of probable conditions based on presently available data. Some variations from these conditions must be expected.

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FIGURE 10
CHROMIUM PLUME COMPARISON
1995 VS. 2017

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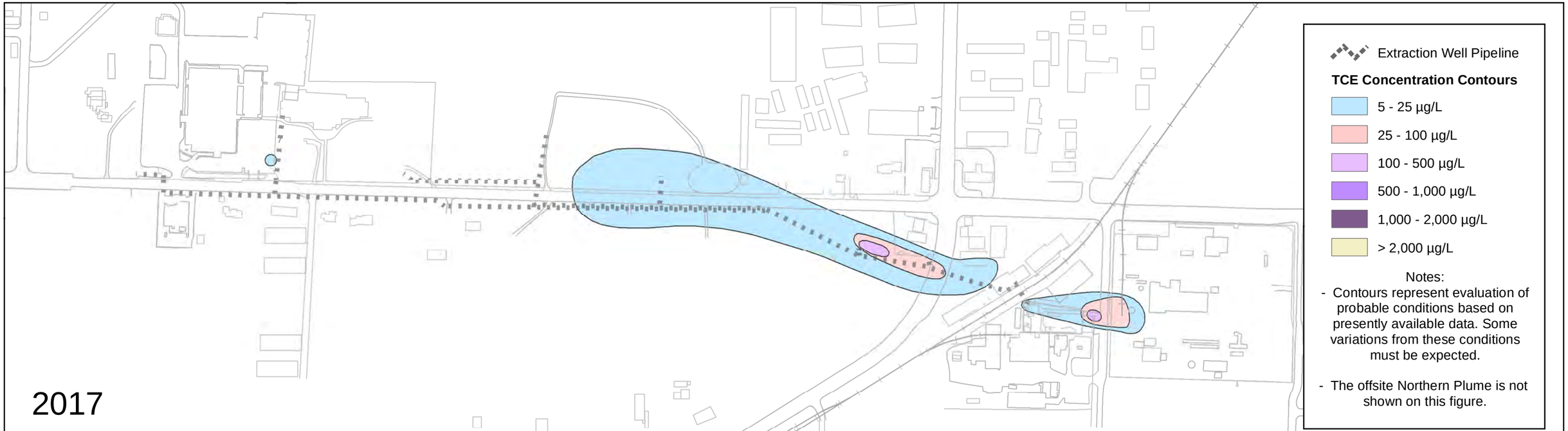

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File Name: Fig_11_TCE_Plume

FIGURE 11
TRICHLOROETHENE PLUME COMPARISON
1995 VS. 2017

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N.E. 25th Ave.
Well CPU-4S, 4D
Located Approx. 3/10 mile
North of NE 78th Street

N.E. 82nd St.

N.E. St. John's Rd.

AMW-23
AMW-43
MW-30
MW-41
AMW-63
AMW-44
AMW-45
AMW-42
MW-46
MW-47
MW-48
MW-36
MW-35
MW-31
MW-32
MW-24D
MW-29
MW-28
CPU-16
MW-37
Church of God
CV-14
MW-25D
MW-27D
AMW-15
MW-23D
AMW-22
AMW-16
AMW-64
AMW-17
CROCKFORD
PERMALUME
MW-49
AMW-27
CV-14A
AMW-61
CV-15
MW-26D
CPU-13
MW-21D
CV-13
AMW-14
MW-22D
CV-12
MW-20D
AMW-60
MW-38
MW-40
PZ-39, MW-39
PZ-40
AMW-18
COLUMBIA VET
N.E. 78th St.
CV-18
CV-17
CV-16
CV-11
CV-10
CV-9
CPU-3D
CPU-3S
FERGUSON
MW-19D
MW-15E
EC-1
See Inset A
CPU-15
HORN
GARRISON
CPU-12
CPU-10
CPU-14
MW-17E
MW-18E
MW-18D
CV-8
MW-14C
MW-12C
MW-9C
MW-9B
AMW-59
CV-7
CV-6
CV-5
CV-4
MW-14E
MW-10B
MW-10C
MW-16E
CPU-1S, 1D
MW-34
MW-13C
MW-5A, 5B
CPU-2
MW-6A
MW-6B
MW-6C
MW-6D
MW-33
AMW-62
GRIMM
BENNETT
AMW-24
ZENT
Linde
Former Boomsnub Corporation
N.E. 43rd Ave.
N.E. 51st Ave.
AMW-51
COLF
FITZGERALD
Groundwater Flow Direction
Alluvial Aquifer
Lewis & Clark Railroad
N.E. 40th Ave.

Inset A
N.E. 47th Ave.
N.E. 51st Ave.
AMW-4A
AMW-25
AMW-9A
AMW-5A
AMW-8A
AMW-13A
MW-8B
AMW-52A
AMW-52C
MW-4A
MW-4B
MW-4BSHED
MW-4C
CV-3
CV-2
CV-1
PW-1B
IWS-8S
IWS-8D
AMW-26
AMW-10A
PZ-2
AMW-53A
AMW-53B
AMW-53C
AMW-1A
AMW-1C
AMW-1B
MW-7B
MW-7C
AMW-58
MW-11A, 11B
MW-1A
MW-1B
MW-1C
GWSW-1
AMW-2B
AMW-2A
RAMW-2C
GWSW-2
MW-3A
MW-3B
MW-3C
AMW-50
AMW-54A
AMW-56C
AMW-12A
AMW-19A
AMW-11A
MW-2A
MW-2B
MW-2C
AMW-54C
AMW-56A
AMW-19B
AMW-55C
AMW-55A
IWS-2S
AMW-20
AMW-7A
PZ-1
AMW-57
AMW-3A
AMW-21
AMW-6A

Groundwater well with chromium concentration above the cleanup level of 80 µg/L during sampling in 2017
Groundwater well with chromium concentration below the cleanup level of 80 µg/L during sampling in 2017
Groundwater Monitoring Well
Groundwater Extraction Well
Groundwater Supply Well
Abandoned Monitoring Well
Screened in Troutdale Aquifer
Containment Vaults
Extraction System Forcemain

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FIGURE 12
WELLS WITH CHROMIUM CONCENTRATIONS ABOVE THE CLEANUP LEVEL IN 2017

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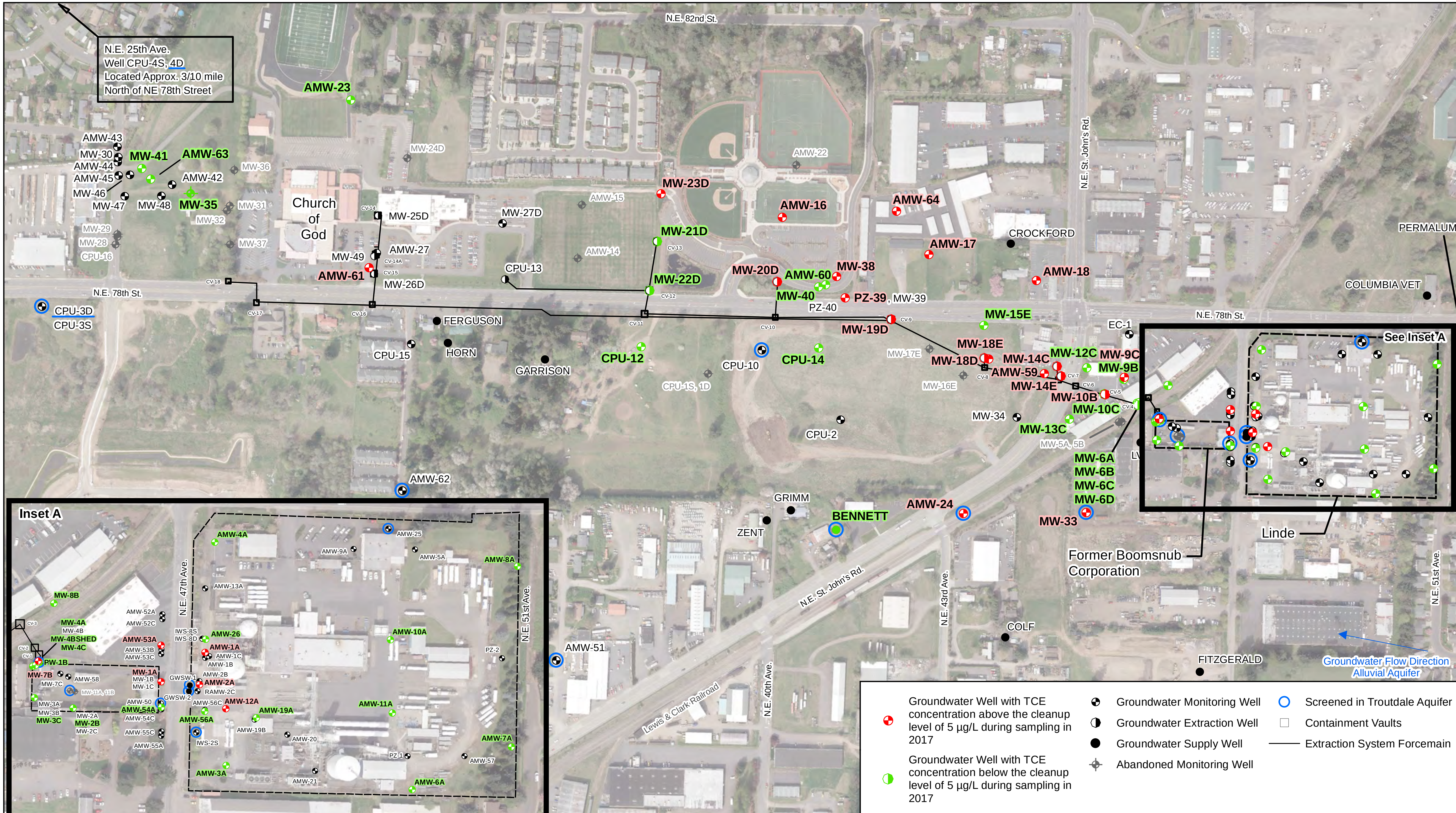
N.E. 25th Ave.
Well CPU-4S, 4D
Located Approx. 3/10 mile
North of NE 78th Street
N.E. 82nd St.
N.E. 78th St.
N.E. St. John's Rd.
N.E. 43rd Ave.
N.E. 40th Ave.
N.E. 51st Ave.
N.E. 47th Ave.
Lewis & Clark Railroad
Church of God
AMW-23
AMW-43
MW-30
AMW-44
AMW-45
MW-46
AMW-47
MW-41
AMW-63
AMW-42
MW-48
MW-35
MW-29
MW-28
CPU-16
MW-25D
MW-27D
AMW-27
MW-49
AMW-61
MW-26D
CPU-13
MW-21D
MW-22D
MW-23D
AMW-16
AMW-64
AMW-17
CROCKFORD
AMW-18
MW-20D
AMW-60
MW-38
MW-40
PZ-39
MW-39
PZ-40
MW-19D
MW-15E
CPU-3D
CPU-3S
FERGUSON
HORN
CPU-15
GARRISON
CPU-12
CPU-10
CPU-14
CPU-2
MW-18E
MW-18D
MW-14C
AMW-59
MW-14E
MW-12C
MW-9C
MW-9B
MW-10B
MW-10C
MW-13C
MW-34
MW-6A
MW-6B
MW-6C
MW-6D
MW-33
AMW-24
AMW-62
GRIMM
ZENT
BENNETT
AMW-51
COLF
FITZGERALD
EC-1
PERMALUME
COLUMBIA VET
See Inset A
Linde
Former Boomsnub Corporation
Groundwater Flow Direction
Alluvial Aquifer
Inset A
AMW-4A
AMW-25
AMW-9A
AMW-5A
AMW-8A
AMW-13A
MW-8B
MW-4A
MW-4B
MW-4BSHED
MW-4C
PW-1B
MW-7B
MW-7C
MW-3A
MW-3B
MW-3C
MW-2A
MW-2B
MW-2C
AMW-52A
AMW-52C
AMW-53A
AMW-53B
AMW-53C
AMW-26
AMW-1A
AMW-1C
AMW-1B
AMW-10A
PZ-2
MW-1A
MW-1B
MW-1C
AMW-2A
AMW-2B
AMW-54A
AMW-54C
AMW-55C
AMW-55A
AMW-56A
AMW-56C
AMW-12A
AMW-19A
AMW-19B
AMW-11A
AMW-20
AMW-7A
PZ-1
AMW-57
AMW-3A
AMW-21
AMW-6A
Groundwater Well with TCE concentration above the cleanup level of 5 µg/L during sampling in 2017
Groundwater Well with TCE concentration below the cleanup level of 5 µg/L during sampling in 2017
Groundwater Monitoring Well
Groundwater Extraction Well
Groundwater Supply Well
Abandoned Monitoring Well
Screened in Troutdale Aquifer
Containment Vaults
Extraction System Forcemain
Feet
0
175
350
700
N

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File Name: Fig_13_TCE_Concentration_2017

FIGURE 13
WELLS WITH TCE CONCENTRATIONS ABOVE THE CLEANUP LEVEL IN 2017

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N.E. 25th Ave.
Well CPU-4S, 4D
Located Approx. 3/10 mile
North of NE 78th Street

N.E. 82nd St.
N.E. 78th St.
N.E. St. John's Rd.
N.E. 43rd Ave.
N.E. 40th Ave.
N.E. 47th Ave.
N.E. 51st Ave.
Lewis & Clark Railroad
N.E. St. John's Rd.

Church of God

AMW-23
AMW-43
MW-30
AMW-44
AMW-45
MW-46
MW-47
MW-41
AMW-63
AMW-42
MW-48
MW-36
MW-35
MW-31
MW-32
MW-24D
MW-29
MW-28
CPU-16
MW-37
MW-25D
AMW-27
MW-49
AMW-61
MW-26D
CPU-13
MW-27D
AMW-15
AMW-14
MW-23D
AMW-22
AMW-16
AMW-64
MW-21D
MW-22D
MW-20D
AMW-60
MW-38
MW-40
PZ-40
PZ-39, MW-39
MW-19D
AMW-17
CROCKFORD
AMW-18
PERMALUME
COLUMBIA VET
MW-15E
EC-1
CPU-3D
CPU-3S
FERGUSON
HORN
GARRISON
CPU-15
CPU-12
CPU-10
CPU-14
CPU-1S, 1D
MW-17E
MW-18E
MW-18D
MW-16E
MW-14C
MW-12C
MW-9C
MW-9B
AMW-59
MW-14E
MW-10B
MW-10C
MW-34
MW-13C
CPU-2
MW-5A, 5B
MW-6A
MW-6B
MW-6C
MW-6D
LV
MW-33
AMW-24
GRIMM
BENNETT
ZENT
AMW-62
AMW-51
COLF
FITZGERALD
Former Boomsnub Corporation
Linde
See Inset A
Groundwater Flow Direction
Alluvial Aquifer

Inset A
MW-8B
MW-4A
MW-4B
MW-4BSHED
MW-4C
PW-1B
MW-7B
MW-7C
MW-3A
MW-3B
MW-3C
MW-2A
MW-2B
MW-2C
AMW-58
MW-11A, 11B
AMW-52A
AMW-52C
AMW-53A
AMW-53B
AMW-53C
MW-1A
MW-1B
MW-1C
AMW-50
AMW-54A
AMW-54C
AMW-55C
AMW-55A
GWSW-1
GWSW-2
IWS-8S
IWS-8D
IWS-2S
AMW-4A
AMW-13A
AMW-26
AMW-1A
AMW-1C
AMW-1B
AMW-2B
AMW-2A
RAMW-2C
AMW-56C
AMW-12A
AMW-56A
AMW-19A
AMW-19B
AMW-20
AMW-3A
AMW-21
AMW-25
AMW-9A
AMW-5A
AMW-8A
AMW-10A
PZ-2
AMW-11A
PZ-1
AMW-57
AMW-7A
AMW-6A

Remediation Phase
Remediation Phase Complete
Attainment Phase
Attainment Phase Complete
Excluded from Closure Monitoring Program
Monitoring Well
Extraction Well
Private Well
Abandoned Well
Screened in Troutdale Aquifer
Containment Vaults
Extraction System Forcemain

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FIGURE 14
STATUS OF CLOSURE MONITORING PROGRAM
VOLATILE ORGANIC COMPOUNDS
2017 ANNUAL REPORT

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N.E. 25th Ave.
Well CPU-4S, 4D
Located Approx. 3/10 mile
North of NE 78th Street

N.E. 82nd St.

AMW-23

AMW-43
MW-30
MW-41
AMW-63
AMW-44
AMW-45
AMW-42
MW-46
MW-47
MW-48
MW-36
MW-35
MW-31
MW-32
MW-29
MW-28
CPU-16
MW-37

MW-24D

Church of God

CV-14
MW-25D
MW-27D
AMW-15
MW-23D
AMW-22
AMW-16
AMW-64
N.E. St. John's Rd.
CROCKFORD
AMW-17
AMW-18
PERMALUME
COLUMBIA VET

MW-49
AMW-27
CV-14A
AMW-61
CV-15
MW-26D
AMW-14
CPU-13
MW-21D
CV-13
MW-22D
CV-12
MW-20D
AMW-60
MW-40
MW-38
PZ-39, MW-39
PZ-40
CV-11
CV-10
CV-9
MW-19D
MW-15E

CV-18
N.E. 78th St.
CV-17
CV-16
CPU-3D
CPU-3S
FERGUSON
CPU-15
HORN
GARRISON
CPU-12
CPU-10
CPU-14
CPU-1S, 1D
MW-17E
MW-18E
MW-18D
CV-8
MW-16E
AMW-59
CV-7
CV-6
CV-5
CV-4
MW-14C
MW-12C
MW-9C
MW-9B
MW-14E
MW-10B
MW-10C
MW-34
MW-13C
CPU-2
MW-5A, 5B
MW-6A
MW-6B
MW-6C
MW-6D
LV
MW-33
EC-1
N.E. 78th St.
See Inset 'A'
Linde

AMW-62

GRIMM
ZENT
BENNETT
AMW-24
Former Boomsnub Corporation
N.E. St. John's Rd.
N.E. 43rd Ave.
N.E. 51st Ave.
COLF
FITZGERALD
AMW-51
Lewis & Clark Railroad
N.E. 40th Ave.
Groundwater Flow Direction
Alluvial Aquifer

Inset A

MW-8B
MW-4A
MW-4B
MW-4BSHED
MW-4C
PW-1B
MW-7B
MW-7C
MW-3A
MW-3B
MW-3C
MW-2A
MW-2B
MW-2C
MW-11A, 11B
AMW-58
MW-1A
MW-1B
MW-1C
AMW-50
AMW-54A
AMW-54C
AMW-55C
AMW-55A
AMW-52A
AMW-52C
AMW-53A
AMW-53B
AMW-53C
GWSW-1
GWSW-2
AMW-4A
AMW-9A
AMW-25
AMW-5A
AMW-8A
AMW-13A
N.E. 47th Ave.
N.E. 51st Ave.
AMW-26
AMW-1A
AMW-1C
AMW-1B
AMW-2B
AMW-2A
RAMW-2C
AMW-56C
AMW-12A
AMW-56A
AMW-19A
AMW-19B
AMW-20
AMW-10A
PZ-2
AMW-11A
AMW-7A
PZ-1
AMW-57
AMW-3A
AMW-21
AMW-6A

Remediation Phase
Remediation Phase Complete
Attainment Phase
Attainment Phase Complete
Excluded from Closure Monitoring Program
Monitoring Well
Extraction Well
Private Well
Abandoned Well
Screened in Troutdale Aquifer
Containment Vaults
Extraction System Forcemain

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FIGURE 15
STATUS OF CLOSURE MONITORING PROGRAM
CHROMIUM
2017 ANNUAL REPORT

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N.E. 25th Ave.
Well CPU-4S, 4D
Located Approx. 3/10 mile
North of NE 78th Street

N.E. 82nd St.

AMW-23
AMW-43
MW-30
MW-41
AMW-63
AMW-44
AMW-45
AMW-42
MW-46
MW-47
MW-48
MW-24D
MW-36
MW-35
MW-31
MW-32
MW-29
MW-28
CPU-16
MW-37
Church of God
MW-25D
MW-27D
MW-23D
AMW-15
AMW-22
AMW-16
AMW-64
N.E. St. John's Rd.
CROCKFORD
AMW-17
AMW-18
PERMALUME
COLUMBIA VET
MW-49
AMW-27
AMW-61
MW-26D
CPU-13
MW-21D
AMW-14
MW-20D
AMW-60
MW-38
MW-40
PZ-40
PZ-39, MW-39
MW-22D
N.E. 78th St.
CPU-3D
CPU-3S
FERGUSON
MW-19D
MW-15E
EC-1
See Inset A
CPU-15
HORN
GARRISON
CPU-12
CPU-10
CPU-14
MW-17E
MW-18E
MW-18D
MW-14C
MW-12C
MW-9C
MW-9B
AMW-59
MW-14E
MW-16E
CPU-1S, 1D
MW-10B, 10C
MW-34
MW-13C
CPU-2
MW-5A, 5B
MW-6A
MW-6B
MW-6C
MW-6D
MW-33
AMW-62
GRIMM
ZENT
BENNETT
AMW-24
Linde
Former Boomsnub Corporation
Linde Infiltration Gallery
N.E. 51st Ave.
N.E. 43rd Ave.
COLF
AMW-51
FITZGERALD
Lewis & Clark Railroad
N.E. 40th Ave.
Groundwater Flow Direction
Alluvial Aquifer

Inset A
N.E. 47th Ave.
AMW-4A
AMW-25
AMW-9A
AMW-5A
AMW-8A
AMW-13A
MW-8B
AMW-52A
AMW-52C
MW-4A
MW-4B
MW-4BSHED
MW-4C
IWS-8S
IWS-8D
AMW-26
AMW-10A
AMW-53A
AMW-53B
AMW-53C
AMW-1A
AMW-1C
AMW-1B
PZ-2
PW-1B
MW-7B
MW-7C
AMW-58
MW-1A
MW-1B
MW-1C
AMW-2B
GWSW-1
AMW-2A
RAMW-2C
MW-11A, 11B
GWSW-2
AMW-50
AMW-54A
AMW-54C
AMW-56C
AMW-12A
AMW-56A
AMW-19A
AMW-11A
MW-3A
MW-3B
MW-3C
MW-2A
MW-2B
MW-2C
AMW-55C
AMW-55A
AMW-19B
AMW-20
IWS-2S
AMW-7A
PZ-1
AMW-57
AMW-3A
AMW-21
AMW-6A

Monitoring Well Sampled in 2018
Extraction Well Sampled in 2018
Private Well Sampled in 2018
Abandoned Monitoring Well
Monitoring Well
Extraction Well
Private Well
Screened in Troutdale Aquifer
Containment Vaults
Extraction System Forcemain

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FIGURE 16
WELLS TO BE SAMPLED IN 2018

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TABLES

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TABLE 1. 2017 EXTRACTION WELL PUMPING RATES

Flow Rates (gpm)												
Well ID	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
MW-6B	6.2	6.2	6.2	6.9	6.9	6.2	6.2	6.2	6.2	6.2	6.2	6.2
MW-10B	10.0	10.0	10.0	10.0	10.3	10.1	10.1	10.1	10.1	9.6	9.6	9.6
MW-10C	11.0	11.0	11.0	11.0	11.3	11.0	11.0	11.0	11.0	11.2	11.2	11.2
MW-14C	13.0	13.0	13.0	12.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
MW-14E	10.0	10.0	10.0	off	off	10.0	10.0	10	10	10.0	10.0	10.0
MW-18D	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
MW-19D	9.0	9.0	8.0	8.0	8.4	9.0	9.0	8.0	8.0	8.0	8.0	8.0
MW-20D	15.5	15.5	15.6	15.7	15.3	15.3	15.3	15.1	15.1	15.1	15.1	15.0
MW-21D	9.9	9.9	10.1	10.0	10.5	10.0	10.0	10.0	10.0	10.1	10.1	10.0
MW-22D	16.5	16.5	16.8	16.8	16.8	16.5	16.5	16.5	16.5	16.5	16.5	16.5
PW-1B	11.5	11.5	11.8	11.8	11.7	11.5	11.8	11.4	11.4	11.5	11.5	11.5
Total	**129.6**	**129.6**	**129.5**	**119.2**	**121.2**	**129.6**	**129.9**	**128.3**	**128.3**	**128.2**	**128.2**	**128.0**

Notes: MW-14E had electrical issues and the pump was running intermittently. MW-14E electrical issues were resolved on 6/6/17.
gpm = gallons per minute

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TABLE 2. WELLS AND RECOMMENDED SAMPLING FREQUENCIES

Well Name	Well Type	Total Number VOC Datapoints	TCE Annual Evaluation (Last 4 Samples)								Never Exceeded Cleanup Level for VOCs?	Total Number Cr Datapoints	Chromium Annual Evaluation (Last 4 Samples)								Never Exceeded Cleanup Level for Cr?	2017 Sampling Frequency [1]		2018 Sampling Frequency Recommendations and When Sampled Next[2]		Well Use / Rationale for Recommendation
			Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Consecutive Samples < Cleanup Goal	Remediation Monitoring Phase Complete for TCE? [3]	Remediation Phase Complete for all VOCs? [3]			Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Consecutive Samples < Cleanup Goal	Remediation Monitoring Phase Complete for Chromium? [3]			VOCs	Cr	VOCs	Cr	
Closure Monitoring Program Wells																										
Upgradient Wells																										
AMW-8A	M	37	10/2013	10/2017	0.22	0.46	0.22	4	YES	YES		2	04/1995	10/1995	U	U	U	2	NA		Biennial 2017	NA	Biennial 2019	NA	TCE background well
TCE Source Wells																										
AMW-1A	M	57	04/2016	10/2017	U	39.00	39.00	None	NO	NO											Semiannual	NA	Semiannual	NA	OU-2 well; well cluster, remediation monitoring for VOCs
AMW-1B	M	31	01/2009	10/2010	0.45	0.51	0.45	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; remediation monitoring complete
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; remediation monitoring complete
AMW-2A	M	60	04/2016	10/2017	80.00	170.00	86.00	None	NO	NO											Semiannual	NA	Semiannual	NA	OU-2 well; well cluster - most impacted, remediation monitoring for VOCs
AMW-2B	M	36	10/2012	10/2015	0.34	0.41	0.41	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; well cluster - remediation monitoring complete
AMW-3A	M	46	10/2013	10/2017	0.34	0.71	0.71	4	YES	NO											Annual	NA	Annual	NA	OU-2 well; remediation monitoring complete Cr but not for VOCs
AMW-4A	M	13	10/2004	10/2017	U	0.23	0.11	4	YES	NO											Annual	NA	Annual	NA	OU-2 well; remediation monitoring complete Cr but not for VOCs
AMW-12A	M	58	04/2016	10/2017	18.00	23.00	22.00	None	NO	NO											Semiannual	NA	Semiannual	NA	OU-2 well; remediation monitoring for VOCs
AMW-13A	M	45	10/2012	10/2015	0.17	0.26	0.26	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; remediation monitoring complete
AMW-19A	M	43	10/2013	10/2017	1.10	1.40	1.30	4	YES	YES											Every 5 years 2017	NA	Every 5 years 2022	NA	OU-2 boundary well
AMW-26	M	29	10/2010	10/2017	0.24	4.30	4.30	4	YES	YES											Every 5 years 2017	NA	Every 5 years 2022	NA	OU-2 boundary well
AMW-52A	M	28	10/2012	10/2015	U	0.32	0.32	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; remediation monitoring complete
AMW-53A	M	43	04/2016	10/2017	0.26	5.40	5.40	None	NO	NO											Semiannual	NA	Semiannual	NA	OU-2 well - remediation monitoring for VOCs
AMW-54A	M	30	10/2013	10/2017	1.80	3.00	2.10	4	YES	YES											Every 5 years 2017	Every 5 years 2017	Every 5 years 2022	Every 5 years 2022	OU-2 boundary well; remediation and attainment monitoring complete
AMW-55A	M	23	10/2012	10/2015	1.00	1.30	1.00	4	YES	YES											NFS	NA	NFS	NA	OU-2 well; remediation and attainment monitoring complete
AMW-56A	M	29	10/2013	10/2017	1.70	3.70	3.70	4	YES	YES											Every 5 years 2017	NA	Every 5 years 2022	NA	OU-2 boundary well; remediation and attainment monitoring complete
MW-1A	M	58	04/2016	10/2017	2.20	110.00	110.00	None	NO	NO											Semiannual	NA	Semiannual	NA	OU-2 well - well cluster; remediation monitoring for VOCs
MW-1B	M	26	10/2006	10/2009	U	0.29	0.28	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; remediation monitoring complete; well cluster
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES	YES											On Hold	NA	On Hold	NA	OU-2 well; remediation monitoring complete; well cluster
Proximal Wells																										
AMW-58	M	9	10/2006	10/2012	U	1.90	0.10	4	YES	YES		8	04/2006	10/2010	2.60	34.70	3.60	4	NA	X	On Hold	NA	On Hold	NA	Remediation monitoring complete for TCE; Cr never exceeded cleanup level
MW-2A	M	27	10/2011	10/2016	1.70	1.90	1.70	4	YES	YES		33	10/2014	10/2017	39.80	130.00	40.40	1	NO		On Hold	Annual	On Hold	Annual	Well cluster - remediation monitoring for Cr; remediation monitoring complete for VOCs.
MW-2B	M	15	10/2003	10/2017	2.00	6.50	2.00	2	NO	NO		14	10/2002	10/2009	U	9.60	9.60	4	YES		Annual	On Hold	Annual	On Hold	Well cluster - remediation monitoring for VOCs; remediation monitoring complete for Cr
MW-2C	M	8	10/2002	10/2009	0.36	3.30	0.36	4	YES	YES		8	10/2002	10/2009	U	11.60	U	4	NA	X	On Hold	NA	On Hold	NA	Well cluster - remediation monitoring complete for TCE; Cr never exceeded cleanup level
MW-3A	M	19	05/2004	10/2008	0.23	0.91	0.23	4	YES	YES	X	29	10/2013	10/2017	63.60	149.00	149.00	None	NO		NA	Biennial 2017	NA	Biennial 2019	Well cluster - remediation monitoring for Cr; TCE never exceeded cleanup level
MW-3B	M	15	10/2010	10/2016	1.40	2.00	1.40	4	YES	YES		11	10/2002	10/2009	U	10.40	U	4	YES		On Hold	On Hold	On Hold	On Hold	Well cluster - remediation monitoring complete
MW-3C	M	8	10/2002	10/2017	1.80	6.80	1.80	2	NO	NO		7	05/1995	10/2004	4.40	7.65	6.10	4	YES		Annual	On Hold	Annual	On Hold	Well cluster - not optimal depth; remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-4A	M	20	05/2004	10/2017	2.10	5.50	2.10	1	NO	NO		26	04/2013	10/2017	376.00	505.00	490.00	None	NO		Annual	Annual	Annual	Annual	Well cluster - not optimal depth; remediation monitoring for VOCs and Cr
MW-4B	M	16	10/2011	10/2016	3.10	4.60	3.10	4	YES	YES		20	10/2014	10/2017	438.00	809.00	438.00	None	NO		On Hold	Annual	On Hold	Annual	Well cluster - remediation monitoring complete for VOCs and Cr
MW-4BShed	M	15	10/2003	10/2017	2.10	7.20	2.10	2	NO	NO		19	10/2009	10/2017	65.00	85.90	65.00	3	NO		Biennial 2017	Annual	Biennial 2019	Annual	Well cluster - remediation monitoring for VOCs and Cr
MW-4C	M	9	05/2004	10/2017	2.00	11.00	2.00	2	NO	NO		9	05/2004	10/2017	55.50	126.00	55.50	2	NO		Annual	Annual	Annual	Annual	Well cluster - not optimal depth; remediation monitoring for VOCs and Cr
MW-6A	M	5	05/1995	10/2017	U	1.50	U	4	YES	YES		7	05/1995	10/2017	20.10	167.00	20.10	1	NO		Annual	Annual	Annual	Annual	Well cluster - not optimal depth; remediation monitoring complete for VOCs, remediation monitoring for Cr
MW-6B	E	56	04/2016	10/2017	2.50	3.60	2.50	4	YES	YES		56	04/2016	10/2017	9.60	30.70	9.60	4	YES		Annual	Annual	Annual	Annual	Extraction well - active; remediation monitoring complete (also well cluster, previously most impacted)

TABLE 2. WELLS AND RECOMMENDED SAMPLING FREQUENCIES

Well Name	Well Type	Total Number VOC Datapoints	TCE Annual Evaluation (Last 4 Samples)								Never Exceeded Cleanup Level for VOCs?	Total Number Cr Datapoints	Chromium Annual Evaluation (Last 4 Samples)							Never Exceeded Cleanup Level for Cr?	2017 Sampling Frequency [1]		2018 Sampling Frequency Recommendations and When Sampled Next[2]		Well Use / Rationale for Recommendation
			Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Consecutive Samples < Cleanup Goal	Remediation Monitoring Phase Complete for TCE? [3]	Remediation Phase Complete for all VOCs? [3]			Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Consecutive Samples < Cleanup Goal	Remediation Monitoring Phase Complete for Chromium? [3]		VOCs	Cr	VOCs	Cr	
MW-6C	M	11	10/2003	10/2017	U	16.00	U	2	NO	NO		10	10/2002	10/2009	U	22.90	U	4	YES		Annual	On Hold	Annual	On Hold	Well cluster - not optimal depth; remediation monitoring complete for Cr
MW-6D	M	9	10/1999	10/2017	U	17.00	U	2	NO	NO		8	05/1999	10/2009	6.10	29.80	29.80	4	YES		Annual	On Hold	Annual	On Hold	Well cluster - not optimal depth; remediation monitoring complete for Cr
MW-7B	M	8	10/2004	10/2017	3.60	110.00	6.10	None	NO	NO		6	04/1995	10/2009	U	72.60	U	4	YES		Annual	On Hold	Annual	On Hold	Well cluster - adjacent to MW-4 cluster; remediation monitoring complete for Cr
MW-7C	M	6	05/1995	10/2009	0.18	3.00	0.18	4	YES	YES		6	05/1995	10/2009	6.50	13.50	12.30	4	YES		On Hold	On Hold	On Hold	On Hold	Well cluster - remediation monitoring complete
MW-8B	M	15	10/2010	10/2017	1.80	3.30	1.80	4	YES	YES		11	05/1999	10/2008	U	13.00	7.30	4	YES		Annual	On Hold	**On Hold**	On Hold	Remediation monitoring complete for Cr and TCE
MW-9B	M	18	10/2012	10/2017	2.00	3.70	2.00	4	YES	YES		13	10/1999	10/2008	U	25.30	3.60	4	YES		Annual	On Hold	**On Hold**	On Hold	Well cluster - previously most TCE impacted; Remediation monitoring complete for Cr and TCE
MW-9C	M	10	05/1998	10/2017	3.80	37.00	5.80	None	NO	NO		9	10/1997	10/2009	4.10	65.40	65.40	4	NA	X	Annual	NA	Annual	NA	Well cluster - not optimum depth; remediation monitoring for VOCs; Cr never exceeded cleanup level
MW-10B	E	56	04/2016	10/2017	7.00	10.00	7.00	None	NO	NO		56	04/2016	10/2017	26.30	36.50	26.30	4	YES		Semiannual	Annual	Semiannual	Annual	Extraction well - active (also well cluster); remediation monitoring complete for Cr
MW-10C	E	58	04/2016	10/2017	1.20	1.80	1.20	4	YES	YES		58	04/2016	10/2017	53.10	78.50	53.60	4	YES		Annual	Annual	Annual	Annual	Extraction well - active (also well cluster); remediation monitoring complete
MW-12C	M	28	10/2012	10/2017	0.69	1.40	0.71	4	YES	YES		24	10/2007	10/2010	U	4.50	U	4	YES		Biennial 2017	On Hold	Biennial 2019	On Hold	TCE Plume boundary; remediation monitoring complete for VOCs, Cr
MW-13C	M	30	10/2012	10/2017	2.20	5.80	2.20	3	NO	NO		26	10/2007	10/2010	27.50	35.40	27.50	4	YES		Biennial 2017	On Hold	Biennial 2019	On Hold	TCE Plume boundary; remediation monitoring for VOCs; remediation monitoring complete for Cr
PW-1B	E	84	04/2016	10/2017	1.80	4.10	3.10	4	YES	YES		83	04/2016	10/2017	30.70	56.40	30.70	4	YES		Annual	Annual	Annual	Annual	Extraction well - active; remediation monitoring complete
Intermediate Wells																									
AMW-59	M/D	14	10/2012	10/2017	53.00	92.00	53.00	None	NO	NO		10	10/2006	10/2009	U	4.80	U	4	NA	X	Biennial 2017	NA	Biennial 2019	NA	Plume area - silt well; remediation monitoring for VOCs; Cr never exceeded cleanup level
AMW-60	M	5	11/2004	10/2017	U	0.94	0.22	4	YES	NO		4	11/2004	10/2009	U	23800.00	2.10	3	NA	X	Annual	NA	Annual	NA	Silt well, remediation monitoring for VOCs, Cr never exceeded cleanup level
CPU-14	M	36	04/2015	10/2017	3.90	5.50	3.90	2	NO	NO		33	10/2012	04/2015	U	53.60	U	4	YES		Annual	On Hold	Annual	On Hold	Plume boundary; remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-14C	E	68	04/2016	10/2017	6.10	10.00	6.10	None	NO	NO		68	04/2016	10/2017	44.20	62.60	44.20	4	YES		Semiannual	Annual	Semiannual	Annual	Extraction well - active (also well cluster); remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-14E	E	66	04/2016	10/2017	37.00	63.00	37.00	None	NO	NO		66	04/2016	10/2017	27.10	49.30	27.10	4	YES		Semiannual	Annual	Semiannual	Annual	Extraction well - active (also well cluster); remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-15E	M	29	10/2014	10/2017	2.10	2.50	2.50	4	YES	YES		13	10/2002	10/2008	3.30	17.30	3.30	4	YES		Biennial 2017	On Hold	Biennial 2019	On Hold	Remediation monitoring complete; monitoring potential **Northern Plume** impacts, but none noted to date
MW-18D	E	77	04/2016	10/2017	21.00	29.00	21.00	None	NO	NO		77	04/2016	10/2017	72.00	86.50	72.00	3	NO		Semiannual	Semiannual	Semiannual	Semiannual	Extraction well - active (also well cluster)
MW-18E	M/D	35	10/2014	10/2017	69.00	180.00	180.00	None	NO	NO		29	10/2009	10/2011	U	20.20	4.70	4	YES		Annual	On Hold	Annual	On Hold	Plume area - remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-19D	E	76	04/2016	10/2017	20.00	23.00	20.00	None	NO	NO		76	04/2016	10/2017	72.30	91.60	72.30	1	NO		Semiannual	Semiannual	Semiannual	Semiannual	Extraction well - active, remediation monitoring for VOCs, Cr
MW-20D	E	80	04/2016	10/2017	20.00	26.00	20.00	None	NO	NO		80	04/2016	10/2017	43.50	58.10	43.50	4	YES		Semiannual	Annual	Semiannual	Annual	Extraction well - active; remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-38	M	13	04/2016	10/2017	9.50	29.00	9.50	None	NO	NO		0	-	-	-	-	-	-	NA		Semiannual	NA	**Annual**	NA	Plume area - silt well; remediation monitoring for VOCs
MW-40	M	7	10/1999	10/2017	0.44	4.80	0.44	4	YES	YES		7	10/1999	10/2017	35.10	330.00	35.10	1	NO		Annual	Annual	Annual	Annual	Remediation monitoring for Cr, remediation monitoring complete for VOCs
PZ-39	M	17	04/2016	10/2017	19.00	29.00	19.00	None	NO	NO		3	10/1999	10/2010	U	11.00	4.80	3	NA	X	Annual	NA	Annual	NA	Monitoring for **Northern Plume** impacts; VOC concentrations decreasing; Cr never exceeded cleanup level
Church of God Wells																									
AMW-27	E/M	52	04/2015	10/2016	3.00	4.20	3.00	4	YES	YES		43	01/2013	10/2014	U	15.80	U	4	YES		On Hold	NFS	On Hold	NFS	Extraction well - inactive; remediation monitoring complete for VOCs & Cr
AMW-61	M	14	10/2015	10/2017	5.10	7.10	5.10	None	NO	NO		7	11/2004	10/2017	17.30	1410.00	39.70	3	NO		Annual	Every 5 years 2017	Annual	Every 5 years 2022	Plume area - silt well; remediation monitoring
CPU-12	M	35	04/2015	10/2017	2.20	4.00	2.60	4	YES	YES		28	10/2008	10/2017	U	8.00	3.30	4	YES		Biennial 2017	Annual	Biennial 2019	Annual	VOC Plume boundary; remediation monitoring complete for Cr and TOCs
CPU-13	E	59	04/2013	10/2014	0.92	1.20	0.94	4	YES	YES		59	04/2013	10/2014	25.30	54.80	45.70	4	YES		NFS	NFS	NFS	NFS	Former sentinel well; remediation and attainment monitoring complete
MW-21D	E	83	04/2016	10/2017	2.20	2.50	2.40	4	YES	YES		83	04/2016	10/2017	8.30	9.60	8.30	4	YES		Semiannual	Annual	Semiannual	Annual	Extraction well - active; remediation monitoring complete; monitor TCE for **Northern Plume** impacts
MW-22D	E	78	04/2016	10/2017	1.70	2.70	1.70	4	YES	YES		78	04/2016	10/2017	15.10	19.10	15.10	4	YES		Annual	Annual	Annual	Annual	Extraction well - active; remediation monitoring complete
MW-25D	E	77	10/2012	10/2014	1.30	3.00	1.70	4	YES	YES		76	10/2012	10/2014	2.70	6.30	6.30	4	YES		NFS	NFS	NFS	NFS	Former extraction well; remediation and attainment monitoring complete

TABLE 2. WELLS AND RECOMMENDED SAMPLING FREQUENCIES

Well Name	Well Type	Total Number VOC Datapoints	TCE Annual Evaluation (Last 4 Samples)								Never Exceeded Cleanup Level for VOCs?	Total Number Cr Datapoints	Chromium Annual Evaluation (Last 4 Samples)							Never Exceeded Cleanup Level for Cr?	2017 Sampling Frequency [1]		2018 Sampling Frequency Recommendations and When Sampled Next[2]		Well Use / Rationale for Recommendation
			Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Consecutive Samples < Cleanup Goal	Remediation Monitoring Phase Complete for TCE? [3]	Remediation Phase Complete for all VOCs? [3]			Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Consecutive Samples < Cleanup Goal	Remediation Monitoring Phase Complete for Chromium? [3]		VOCs	Cr	VOCs	Cr	
MW-26D	E	76	10/2012	10/2014	0.35	2.10	0.35	4	YES	YES		76	10/2012	10/2014	7.00	38.60	11.40	4	YES		NFS	NFS	NFS	NFS	Former extraction well; remediation and attainment monitoring complete
MW-27D	E	50	10/2011	10/2014	0.63	1.50	1.50	4	YES	YES		50	10/2011	10/2014	U	12.20	U	4	YES		NFS	NFS	NFS	NFS	Former sentinel well; remediation and attainment monitoring complete
MW-49	E	35	10/2012	10/2014	1.10	1.70	1.60	4	YES	YES		34	10/2012	10/2014	9.30	12.20	12.20	4	YES		NFS	NFS	NFS	NFS	Former extraction well; remediation and attainment monitoring complete
Toe Wells																									
AMW-42	E	52	10/2009	10/2014	0.65	1.30	0.65	4	YES	YES		53	10/2009	10/2014	U	21.30	U	4	YES		NFS	NFS	NFS	NFS	Remediation and attainment monitoring complete
MW-31	E	40	10/2008	10/2012	0.20	0.36	0.26	4	YES	YES		44	10/2008	10/2012	8.10	12.90	11.40	4	YES		NFS	NFS	NFS	NFS	Decommissioned 2017
MW-35	E/M	70	10/2015	04/2017	3.00	3.70	3.60	4	YES	YES		65	10/2012	04/2015	U	29.30	U	4	YES		Semiannual	NFS	**NA**	**NA**	Decommissioned 2017
MW-41	E/M	58	10/2010	10/2017	U	U	U	4	YES	YES		57	10/2010	10/2017	U	U	U	4	YES		Every 5 years 2017	Every 5 years 2017	Every 5 years 2022	Every 5 years 2022	Attainment monitoring complete for TCE and Cr. EPA request for sampling every 5 years to support Toe of-Plume Pilot Study.
MW-48	E	38	10/2006	10/2009	U	U	U	4	YES	YES		39	10/2006	10/2009	4.00	35.00	35.00	4	NA	X	NFS	NA	NFS	NA	Remediation and attainment monitoring complete; Cr never exceeded cleanup level
Troutdale Wells																									
AMW-24	M/D	29	10/2014	10/2017	7.80	10.00	7.80	None	NO	NO		26	10/2011	10/2014	3.50	13.60	13.60	4	NA	X	Annual	NA	Annual	NA	Troutdale well - TCE impacted; Cr never exceeded cleanup level
MW-33	M/D	29	10/2014	10/2017	5.10	11.00	5.10	None	NO	NO		30	10/2011	10/2014	1.90	3.20	2.20	4	NA	X	Annual	NA	Annual	NA	Troutdale well - TCE impacted; Cr never exceeded cleanup level
BENNETT	Other	24	04/2016	10/2017	1.40	1.80	1.70	4	YES	YES		21	10/2014	04/2017	U	U	U	4	NA	X	Annual	NA	Annual	NA	Troutdale well - remediation monitoring complete for TCE; Cr never exceeded cleanup level
Wells Excluded from Closure Monitoring Program																									
Northern Plume Wells																									
AMW-16	M	31	04/2016	10/2017	41.00	71.00	41.00	0	NA	NA									NA	X	Semiannual	NA	Semiannual	NA	Northern Plume monitoring well
AMW-17	M/D	41	04/2016	10/2017	70.00	96.00	79.00	0	NA	NA									NA	X	Semiannual	NA	Semiannual	NA	Northern Plume monitoring well
AMW-18	M	42	04/2016	10/2017	28.00	43.00	28.00	0	NA	NA									NA	X	Semiannual	NA	Semiannual	NA	Northern Plume monitoring well
AMW-23	M	10	10/2001	10/2017	U	U	U	4	NA	NA	X								NA	X	Annual	NA	Annual	NA	Northern Plume monitoring well
AMW-64	M	15	04/2016	10/2017	15.00	28.00	15.00	0	NA	NA									NA		Semiannual	NA	Semiannual	NA	Northern Plume monitoring well
MW-23D	M	34	04/2016	10/2017	140.00	180.00	140.00	0	NA	NA									NA		Semiannual	NA	Semiannual	NA	Northern Plume monitoring well
Toe Wells																									
AMW-63	M	11	10/2009	10/2017	U	U	U	4	NA	NA	X	0	10/2009	10/2017	6.80	14.30	14.30	4	NA	X	Every 5 years 2017	Every 5 years 2017	Every 5 years 2022	Every 5 years 2017	TCE and Cr below cleanup levels. EPA request for sampling every 5 years to support Toe-of-Plume Pilot Study.
Infiltration Gallery Wells																									
AMW-6A	M/D	21	10/2012	10/2017	0.23	0.42	0.26	4	YES	YES	X	21	10/2012	10/2017	3.60	9.60	3.60	4	YES	X	Biennial	Biennial	Biennial 2019	Biennial 2019	Infiltration gallery monitoring well
AMW-7A	M/D	30	10/2012	10/2017	0.10	0.24	0.10	4	YES	YES	X	22	10/2012	10/2017	0.70	2.90	1.90	4	YES	X	Biennial	Biennial	Biennial 2019	Biennial 2019	Infiltration gallery monitoring well
AMW-10A	M/D	20	10/2012	10/2017	U	0.32	0.12	4	YES	YES	X	19	10/2012	10/2017	3.70	18.70	4.80	4	YES	X	Biennial	Biennial	Biennial 2019	Biennial 2019	Infiltration gallery monitoring well
AMW-11A	M/D	21	10/2012	10/2017	0.17	0.41	0.17	4	YES	YES	X	20	10/2012	10/2017	1.20	2.00	1.20	4	YES	X	Biennial	Biennial	Biennial 2019	Biennial 2019	Infiltration gallery monitoring well

NOTES:

The rationale for sampling frequency is presented in Section 6.2.

Bold text indicates changes in 2017 for recommendations for sampling frequency.

[1] The 2017 sampling frequencies shown are those recommended in the 2016 Annual Status Report for the Boomsnub/Airco Superfund Site.

[2] A summary of all 2018 recommended sampling frequencies is provided in Table 5.

[3] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC	= Contaminant of Concern.	NA	= Not applicable.
Cr	= Chromium.	NFS	= No further sampling (closure monitoring complete, or for a well excluded from closure monitoring, further sampling determined to be unnecessary)
E	= Extraction well.	TCE	= Trichloroethene.
E/M	= Extraction well with pump pulled; now sampled as a monitoring well.	U	= Analyte not detected above the reporting limit.
EPA	= U.S. Environmental Protection Agency.	µg/L	= Micrograms per liter.
M	= Monitoring well.	VOC	= Volatile organic compound.
M/D	= Monitoring well with dedicated pump installed.	X	= Never exceeded cleanup level.
Biennial sampling (every 2 years) - these wells will be sampled next in Fall 2019.			= Indicates a change in sampling frequency.

Every 5 years - these wells will be sampled next in Fall 2022.

On Hold - sampling on hold pending attainment monitoring; no sampling planned for 2018.

Wells not included in the Closure Monitoring Program and not determined to require sampling for another purpose have been deleted from this table.

Where no entries are present for one of the two constituents (TCE or Cr) for a given well, that constituent is not a COC for and has not been sampled in the well.

TCE summary data are presented as a representation of all VOCs.

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TABLE 3. CLOSURE MONITORING PROGRAM WELLS

Well Name	No longer Impacted by Treatment System/Under Steady State Conditions ? [1]	Remediation Phase Complete for VOCs?	VOCs Not Completing Remediation Phase	Currently Ready for Attainment Monitoring of VOCs?	Remediation Phase Complete for Chromium?	Currently Ready for Attainment Monitoring of Chromium?
Upgradient						
AMW-8A	No	Yes		NO	NA	NA
TCE Source Area [2]						
AMW-1A	No	No	Bromodichloromethane, Chlorodibromomethane, Trichloroethylene	No	NA	NA
AMW-1B	No	Yes		No	NA	NA
AMW-1C	No	Yes		No	NA	NA
AMW-2A	No	No	Trichloroethylene	No	NA	NA
AMW-2B	No	Yes		No	NA	NA
AMW-3A	Yes	No	Bromodichloromethane, Chlorodibromomethane	No	NA	NA
AMW-4A	Yes	No	Bromodichloromethane	No	NA	NA
AMW-12A	No	No	Trichloroethylene	No	NA	NA
AMW-13A	No	Yes		No	NA	NA
AMW-19A	No	Yes		No	NA	NA
AMW-26	No	Yes		No	NA	NA
AMW-52A	No	Yes		No	NA	NA
AMW-53A	No	No	Bromodichloromethane, Trichloroethylene	No	NA	NA
AMW-54A	Yes	Yes		Yes	NA	NA
AMW-55A	Yes	Yes		Yes	NA	NA
AMW-56A	Yes	Yes		Yes	NA	NA
MW-1A	No	No	Trichloroethylene	No	NA	NA
MW-1B	No	Yes		No	NA	NA
MW-1C	No	Yes		No	NA	NA
Proximal						
AMW-58	No	Yes		No	NA	NA [3]
MW-2A	No	Yes		No	No	No
MW-2B	No	No	Trichloroethylene	No	Yes	No
MW-2C	No	Yes		No	NA	NA [3]
MW-3A	No	Yes		NA [3]	No	No
MW-3B	No	Yes		No	Yes	No
MW-3C	No	No	Trichloroethylene	No	Yes	No
MW-4A	No	No	Trichloroethylene	No	No	No
MW-4B	No	Yes		No	No	No
MW-4BSHED	No	No	Trichloroethylene	No	No	No
MW-4C	No	No	Trichloroethylene	No	No	No
MW-6A	No	Yes		No	No	No
MW-6B	No	Yes		No	Yes	No
MW-6C	No	No	Trichloroethylene	No	Yes	No

TABLE 3. CLOSURE MONITORING PROGRAM WELLS

Well Name	No longer Impacted by Treatment System/Under Steady State Conditions ? [1]	Remediation Phase Complete for VOCs?	VOCs Not Completing Remediation Phase	Currently Ready for Attainment Monitoring of VOCs?	Remediation Phase Complete for Chromium?	Currently Ready for Attainment Monitoring of Chromium?
MW-6D	No	No	Trichloroethylene	No	Yes	No
MW-7B	No	No	1,1-Dichloroethylene, Trichloroethylene	No	Yes	No
MW-7C	No	Yes		No	Yes	No
MW-8B	No	Yes		No	Yes	No
MW-9B	No	Yes		No	Yes	No
MW-9C	No	No	Trichloroethylene	No	NA	NA [3]
MW-10B	No	No	Trichloroethylene	No	Yes	No
MW-10C	No	Yes		No	Yes	No
MW-12C	No	Yes		No	Yes	No
MW-13C	No	No	Trichloroethylene	No	Yes	No
PW-1B	No	Yes		No	Yes	No
Intermediate						
AMW-59	No	No	1,1-Dichloroethylene, Trichloroethylene	No	NA	NA [3]
AMW-60	No	No	1,1-Dichloroethylene	No	NA	NA [3]
CPU-14	No	No	Trichloroethylene	No	Yes	No
MW-14C	No	No	Trichloroethylene	No	Yes	No
MW-14E	No	No	1,1-Dichloroethylene, Trichloroethylene	No	Yes	No
MW-15E	No	Yes		No	Yes	No
MW-18D	No	No	Trichloroethylene	No	No	No
MW-18E	No	No	1,1-Dichloroethylene, Trichloroethylene	No	Yes	No
MW-19D	No	No	Trichloroethylene	No	No	No
MW-20D	No	No	1,1-Dichloroethylene, Trichloroethylene	No	Yes	No
MW-38	No	No	Trichloroethylene	No	NA	NA
MW-40	No	Yes		No	No	No
PZ-39	No	No	1,1-Dichloroethylene, Trichloroethylene	No	NA	NA [3]
Church of God						
AMW-27	Yes [Jan-13]	Yes		Yes	Yes	Yes
AMW-61	Yes	No	Trichloroethylene	No	No	No
CPU-12	No	Yes		No	Yes	No
CPU-13	Yes [May-13]	Yes		Yes	Yes	Yes
MW-21D	No	Yes		No	Yes	No
MW-22D	No	Yes		No	Yes	No
MW-25D	Yes [Jan-13]	Yes		Yes	Yes	Yes
MW-26D	Yes [Jan-13]	Yes		Yes	Yes	Yes

TABLE 3. CLOSURE MONITORING PROGRAM WELLS

Well Name	No longer Impacted by Treatment System/Under Steady State Conditions ? (1)	Remediation Phase Complete for VOCs?	VOCs Not Completing Remediation Phase	Currently Ready for Attainment Monitoring of VOCs?	Remediation Phase Complete for Chromium?	Currently Ready for Attainment Monitoring of Chromium?
MW-27D	Yes [Nov-09]	Yes		Yes	Yes	Yes
MW-49	Yes [Jan-13]	Yes		Yes	Yes	Yes
Toe of Plume						
AMW-42	Yes [Feb-05]	Yes		Yes	Yes	Yes
MW-41	Yes	Yes		Yes	Yes	Yes
MW-48	Yes [Jun-04]	Yes		Yes	NA	NA [3]
Troutdale						
AMW-24	Yes	No	1,1-Dichloroethylene, Trichloroethylene	No	NA	NA [3]
BENNETT	Yes	Yes		Yes	NA	NA [3]
MW-33	Yes	No	1,1-Dichloroethylene, Trichloroethylene	No	NA	NA [3]

Notes:

Table 4 presents attainment status for wells currently in attainment monitoring.

COC = Contaminant of Concern identified for the Site

NA = Not Applicable

VOC = Volatile organic compound

(1) Implies the well is no longer influenced by nearby extraction wells or by discharge to the infiltration gallery, and that groundwater at the well has achieved post-remediation steady-state conditions.

(2) Chromium is not a contaminant of concern (COC) for TCE Source Area wells

(3) Designated as NA since contaminant(s) never exceeded cleanup level.

Per the Closure Monitoring Plan, the determination of whether Remediation Phase is Complete is based on analysis of the most recent four samples for each COC.

Shaded cells indicate wells ready for attainment monitoring

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TABLE 4. ATTAINMENT MONITORING STATUS

Well Name	Date Pumping Ceased	Attainment Phase Complete for VOCs?	VOCs Not Completing Attainment Phase (# Results needed)	Attainment Phase Complete for Chromium? (# Results Needed)
TCE Source Area [a]				
AMW-54A		Yes		NA
AMW-55A		Yes		NA
AMW-56A		Yes		NA
Church of God				
AMW-27	Jan-13	No	Trichloroethene	No
CPU-13	May-13	Yes		Yes
MW-25D	Jan-13	Yes		Yes
MW-26D	Jan-13	Yes		Yes
MW-27D	Nov-09	Yes		Yes
MW-49	Jan-13	Yes		Yes
Toe of Plume				
AMW-42	Feb-05	Yes		Yes
MW-41		Yes		Yes
MW-48	Jun-04	Yes		NA

Notes:

[a] Chromium is not a COC for TCE Source Area wells.

This table includes wells from Table 3 that are ready for attainment monitoring for either VOCs and/or Chromium.

Per the Closure Monitoring Plan, the determination of whether Attainment Phase is complete is based on analysis of the most recent eight samples for each contaminant of concern.

NA = Not applicable

VOC = Volatile organic compound

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TABLE 5. SUMMARY OF 2018 WELL SAMPLING FREQUENCIES

Well Name	Recommendation						Rationale for Recommendation
	Well Type	Semi-annual	Annual	Biennial[a]	Every 5 Years[b]	On Hold[c]	
Closure Monitoring Program Wells							
Upgradient Wells							
AMW-8A	M			VOCs			TCE background well
TCE Source Wells							
AMW-1A	M	VOCs					OU-2 well; well cluster, remediation monitoring for VOCs
AMW-1B	M					VOCs	OU-2 well; remediation monitoring complete
AMW-1C	M					VOCs	OU-2 well; remediation monitoring complete
AMW-2A	M	VOCs					OU-2 well; well cluster - most impacted, remediation monitoring for VOCs
AMW-2B	M					VOCs	OU-2 well; well cluster - remediation monitoring complete
AMW-3A	M		VOCs				OU-2 well; remediation monitoring complete Cr but not for VOCs
AMW-4A	M		VOCs				OU-2 well; remediation monitoring complete Cr but not for VOCs
AMW-12A	M	VOCs					OU-2 well; remediation monitoring for VOCs
AMW-13A	M					VOCs	OU-2 well; remediation monitoring complete
AMW-19A	M				VOCs		OU-2 boundary well
AMW-26	M				VOCs		OU-2 boundary well
AMW-52A	M					VOCs	OU-2 well; remediation monitoring complete
AMW-53A	M	VOCs					OU-2 well - remediation monitoring for VOCs
AMW-54A	M				X		OU-2 boundary well; remediation and attainment monitoring complete
AMW-55A	M						OU-2 well; remediation and attainment monitoring complete
AMW-56A	M				VOCs		OU-2 well - well cluster; remediation and attainment monitoring completefor VOCs
MW-1A	M	VOCs					OU-2 well - well cluster; remediation monitoring for VOCs
MW-1B	M					VOCs	OU-2 well; remediation monitoring complete; well cluster
MW-1C	M					VOCs	OU-2 well; remediation monitoring complete; well cluster
Proximal Wells							
AMW-58	M					VOCs	Remediation monitoring complete for TCE; Cr never exceeded cleanup level
MW-2A	M		Cr			VOCs	Well cluster - remediation monitoring for Cr; remediation monitoring complete for VOCs.
MW-2B	M		VOCs			Cr	Well cluster - remediation monitoring for VOCs; remediation monitoring complete for Cr
MW-2C	M					VOCs	Well cluster - remediation monitoring complete for TCE; Cr never exceeded cleanup level
MW-3A	M			Cr			Well cluster - remediation monitoring for Cr; TCE never exceeded cleanup level

TABLE 5. SUMMARY OF 2018 WELL SAMPLING FREQUENCIES

Well Name	Recommendation						Rationale for Recommendation
	Well Type	Semi-annual	Annual	Biennial[a]	Every 5 Years[b]	On Hold[c]	
MW-3B	M					X	Well cluster - remediation monitoring complete
MW-3C	M		VOCs			Cr	Well cluster - not optimal depth; remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-4A	M		X				Well cluster - not optimal depth; remediation monitoring for VOCs and Cr
MW-4B	M		Cr			VOCs	Well cluster - remediation monitoring complete for VOCs and Cr
MW-4BSHED	M		Cr	VOCs			Well cluster - remediation monitoring for VOCs and Cr
MW-4C	M		X				Well cluster - not optimal depth; remediation monitoring for VOCs and Cr
MW-6A	M		X				Well cluster - not optimal depth; remediation monitoring complete for VOCs, remediation monitoring for Cr
MW-6B	E		X				Extraction well - active; remediation monitoring complete (also well cluster, previously most impacted)
MW-6C	M		VOCs			Cr	Well cluster - not optimal depth; remediation monitoring complete for Cr
MW-6D	M		VOCs			Cr	Well cluster - not optimal depth; remediation monitoring complete for Cr
MW-7B	M		VOCs			Cr	Well cluster - adjacent to MW-4 cluster; remediation monitoring complete for Cr
MW-7C	M					X	Well cluster - remediation monitoring complete
MW-8B	M					X	Remediation monitoring complete for Cr and TCE
MW-9B	M					X	Well cluster - previously most TCE impacted; Remediation monitoring complete for Cr and TCE
MW-9C	M		VOCs				Well cluster - not optimum depth; remediation monitoring for VOCs; Cr never exceeded cleanup level
MW-10B	E	VOCs	Cr				Extraction well - active (also well cluster); remediation monitoring complete for Cr
MW-10C	E		X				Extraction well - active (also well cluster); remediation monitoring complete
MW-12C	M			VOCs		Cr	TCE Plume boundary; remediation monitoring complete for VOCs, Cr
MW-13C	M			VOCs		Cr	TCE Plume boundary; remediation monitoring for VOCs; remediation monitoring complete for Cr
PW-1B	E		X				Extraction well - active; remediation monitoring complete
Intermediate Wells							
AMW-59	M/D			VOCs			Plume area - silt well; remediation monitoring for VOCs; Cr never exceeded cleanup level
AMW-60	M		VOCs				Silt well, remediation monitoring for VOCs, Cr never exceeded cleanup level
CPU-14	M		VOCs			Cr	Plume boundary; remediation monitoring for VOCs, remediation monitoring complete for Cr

TABLE 5. SUMMARY OF 2018 WELL SAMPLING FREQUENCIES

Well Name	Recommendation						Rationale for Recommendation
	Well Type	Semi-annual	Annual	Biennial[a]	Every 5 Years[b]	On Hold[c]	
MW-14C	E	VOCs	Cr				Extraction well - active (also well cluster); remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-14E	E	VOCs	Cr				Extraction well - active (also well cluster); remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-15E	M			VOCs		Cr	Remediation monitoring complete; monitoring potential **Northern Plume** impacts, but none noted to date
MW-18D	E	X					Extraction well - active (also well cluster)
MW-18E	M/D		VOCs			Cr	Plume area - remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-19D	E	X					Extraction well - active, remediation monitoring for VOCs, Cr
MW-20D	E	VOCs	Cr				Extraction well - active; remediation monitoring for VOCs, remediation monitoring complete for Cr
MW-38	M		VOCs				Plume area - silt well; remediation monitoring for VOCs
MW-40	M		X				Remediation monitoring for Cr, remediation monitoring complete for VOCs
PZ-39	M		VOCs				Monitoring for **Northern Plume** impacts; VOC concentrations decreasing; Cr never exceeded cleanup level
Church of God Wells							
AMW-27	E/M					VOCs	Extraction well - inactive; remediation monitoring complete for VOCs & Cr
AMW-61	M		VOCs		Cr		Plume area - silt well; remediation monitoring
CPU-12	M		Cr	VOCs			VOC Plume boundary; remediation monitoring complete for Cr and VOCs
CPU-13	E						Former sentinel well; remediation and attainment monitoring complete. No further sampling.
MW-21D	E	VOCs	Cr				Extraction well - active; remediation monitoring complete; monitor TCE for **Northern Plume** impacts
MW-22D	E		X				Extraction well - active; remediation monitoring complete
MW-25D	E						Former extraction well; remediation and attainment monitoring complete. No further sampling.
MW-26D	E						Former extraction well; remediation and attainment monitoring complete. No further sampling.
MW-27D	E						Former sentinel well; remediation and attainment monitoring complete. No further sampling.
MW-49	E						Former extraction well; remediation and attainment monitoring complete. No further sampling.

TABLE 5. SUMMARY OF 2018 WELL SAMPLING FREQUENCIES

Well Name	Recommendation						Rationale for Recommendation
	Well Type	Semi-annual	Annual	Biennial[a]	Every 5 Years[b]	On Hold[c]	
Toe Wells							
AMW-42	E						Troutdale well - remediation monitoring complete for TCE; Cr never exceeded cleanup level; No further sampling.
MW-41	E/M				X		Attainment monitoring complete for TCE and Cr. EPA request for sampling every 5 years to support Toe-of-Plume Pilot Study.
MW-48	E						Remediation and attainment monitoring complete; Cr never exceeded cleanup level. No further sampling.
Troutdale Wells							
AMW-24	M/D		VOCs				Troutdale well - TCE impacted; Cr never exceeded cleanup level
MW-33	M/D		VOCs				Troutdale well - TCE impacted; Cr never exceeded cleanup level
BENNETT	Other		VOCs				Troutdale well - remediation monitoring complete for TCE; Cr never exceeded cleanup level
Wells Excluded from Closure Monitoring Progr							
Northern Plume Wells							
AMW-16	M	VOCs					Northern Plume monitoring well
AMW-17	M/D	VOCs					Northern Plume monitoring well
AMW-18	M	VOCs					Northern Plume monitoring well
AMW-23	M		VOCs				New Northern Plume monitoring well
AMW-64	M	VOCs					Northern Plume monitoring well
MW-23D	M	VOCs					Northern Plume monitoring well
Toe Wells							
AMW-63	M				X		TCE and Cr never exceeded cleanup levels. EPA request for sampling every 5 years to support Toe-of-Plume Pilot Study.
Infiltration Gallery Wells							
AMW-6A	M/D			X			Infiltration gallery monitoring well
AMW-7A	M/D			X			Infiltration gallery monitoring well
AMW-10A	M/D			X			Infiltration gallery monitoring well
AMW-11A	M/D			X			Infiltration gallery monitoring well
Total Wells:		16	35	12	7	26	

(Note that TCE and Cr are on different sampling schedules in a number of wells.)

Notes:

Wells to be sampled once in 2018.

Wells to be sampled twice in 2018.

Wells excluded from the Closure Monitoring Program have been deleted from this table.

[a] Biennial sampling (every 2 years) - these wells will be sampled next in Fall 2019.

[b] Every 5 years - these wells will be sampled next in Fall 2022.

[c] On Hold - sampling on hold pending attainment monitoring; no sampling planned for 2018.

Cr	= Chromium	E	= Extraction well
EPA	= U.S. Environmental Protection Agency	E/M	= Extraction well with pump pulled; now sampled as a monitoring well
TCE	= Trichlorethene		
VOC	= Volatile organic compound	M	= Monitoring well
X	= Cr and VOCs	M/D	= Monitoring well with dedicated pump installed

APPENDIX A

CHROMIUM CONCENTRATIONS IN GROUNDWATER

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APPENDIX A-1

CHROMIUM CONCENTRATIONS – SUMMARY TABLE

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A-1. Chromium Concentrations Summary

Well Group	Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017*
Upgradient	AMW-6A	6.9 (Fall 2012)	9.6 (Fall 2014)	5.8 (Fall 2016)	3.6 J
	AMW-7A	2.9 J (Fall 2012)	0.7 J (Fall 2014)	1.1 J (Fall 2016)	1.9 J
	AMW-10A	18.7 (Fall 2012)	8.3 (Fall 2014)	3.7 J (Fall 2016)	4.8
	AMW-11A	2 J (Fall 2012)	1.7 J (Fall 2014)	1.2 J (Fall 2016)	1.2 J
TCE Source (OU-2)	AMW-54A	NS	11.8	NS	2.5 J
Proximal	MW-2A	**130** (Fall 2014)	39.8 (Fall 2015)	**91.9 J** (Fall 2016)	**40.4**
	MW-3A	72.1 (Fall 2013)	63.6 (Fall 2014)	**98.3** (Fall 2016)	**149**
	MW-4A	**505** (Spring 2013)	**376** (Fall 2013)	**495** (Fall 2014)	**490**
	MW-4B	**809** (Fall 2014)	**702** (Fall 2015)	**795** (Fall 2016)	**438**
	MW-4BSHED	**85.9** (Fall 2009)	65.5 (Spring 2013)	68.3 (Fall 2013)	65
	MW-4C	**107** (Spring 2004)	**126** (Fall 2004)	61 (Fall 2009)	55.5
	MW-6A	**167** (Fall 2009)	52.6 (Spring 2013)	**133** (Fall 2013)	20.1
	MW-6B	27.1	11.4	30.7	9.6
	MW-10B	36.5	28.4	31.7	26.3
	MW-10C	75.6	53.1	78.5	53.6
	PW-1B	56.4	38.7	41.8	30.7
Intermediate	**MW-14C**	62.6	51.5	52.3	44.2
	MW-14E	49.3	42.1	31.4	27.1
	MW-18D	**86.5**	74	79.7	72
	MW-19D	**91.6**	79.5	**85.3**	72.3
	MW-20D	58.1	50	56.2	43.5
	MW-40	**330** (Fall 2003)	**271** (Fall 2004)	**126** (Fall 2008)	35.1**
Church of God	AMW-61	**1410** (Fall 2006)	17.3 (Fall 2008)	35.2 (Fall 2010)	39.7
	CPU-12	6.5 (Fall 2008)	8 (Fall 2009)	5 U (Fall 2010)	3.3 J
	MW-21D	9.6	8.7	9.2	8.3
	MW-22D	19.1	15.1	17.3	15.1
Toe of Plume	AMW-63	12.4 (Fall 2009)	6.8 (Fall 2010)	11.4 UJ (Fall 2014)	14.3
	MW-41	5 U (Fall 2010)	5 U (Fall 2011)	4 U (Fall 2014)	0.9 U
Troutdale	BENNETT	4 U	4 U	4.2 U	NS

NOTES:

Only wells sampled for chromium the 2017 reporting year are included in this table.
Results are in micrograms per liter (µg/L).
Results are for total chromium, unless otherwise noted.
Active extractions wells are shown in **bold.**
Results shown in **blue bold** exceed the cleanup level of 80 µg/L.
NS = Not sampled.
* = Unless otherwise noted.
** = Due to turbidity in the well a filtered sample was also collected in Fall (34 µg/L).
J = The result is an estimated concentration that is less than the method reporting limit but greater than or equal to the method detection limit.
U = Analyte not detected above the specified reporting limit.

APPENDIX A-2

CHROMIUM CONCENTRATIONS – BY WELL GROUPING

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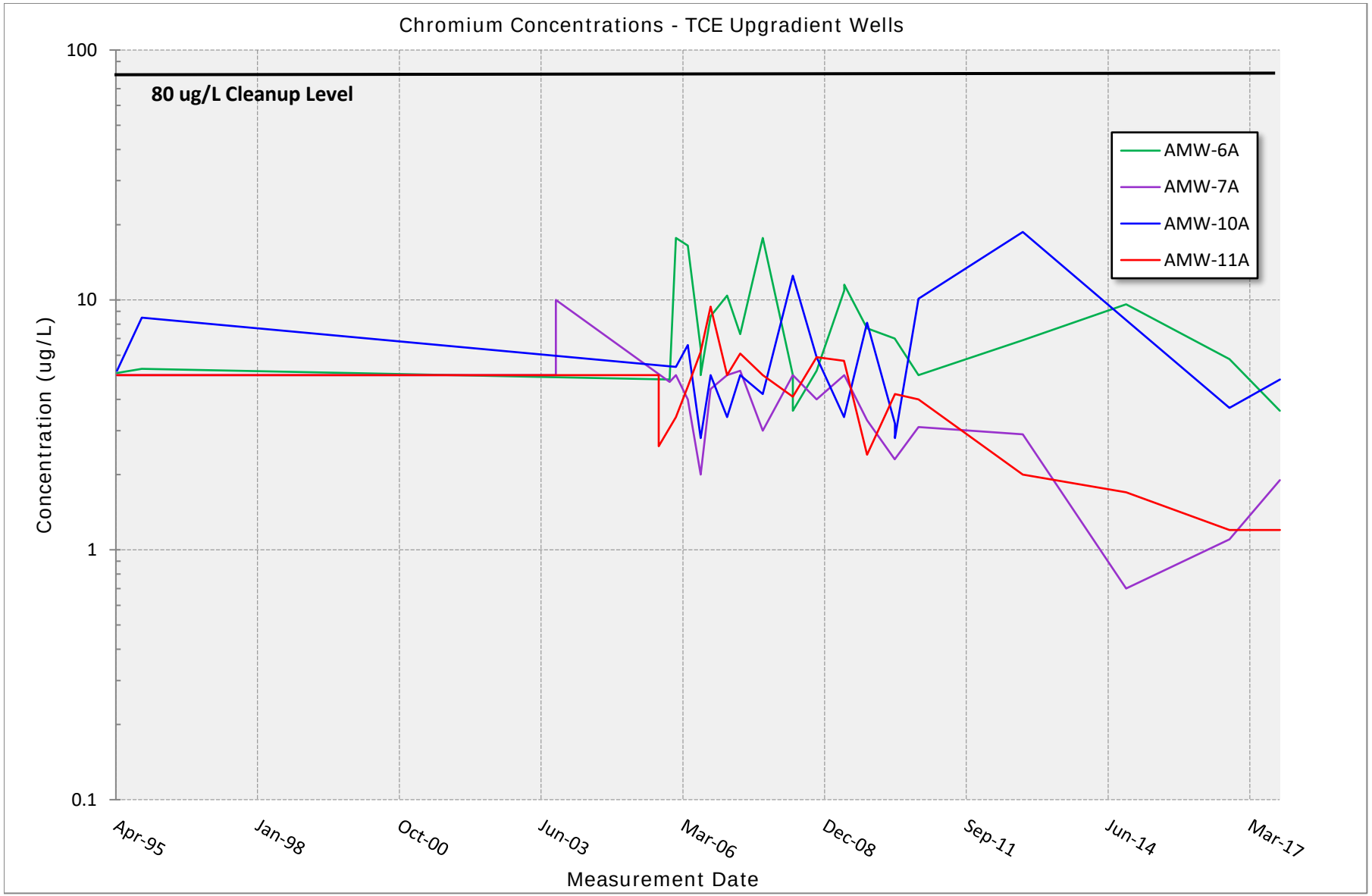
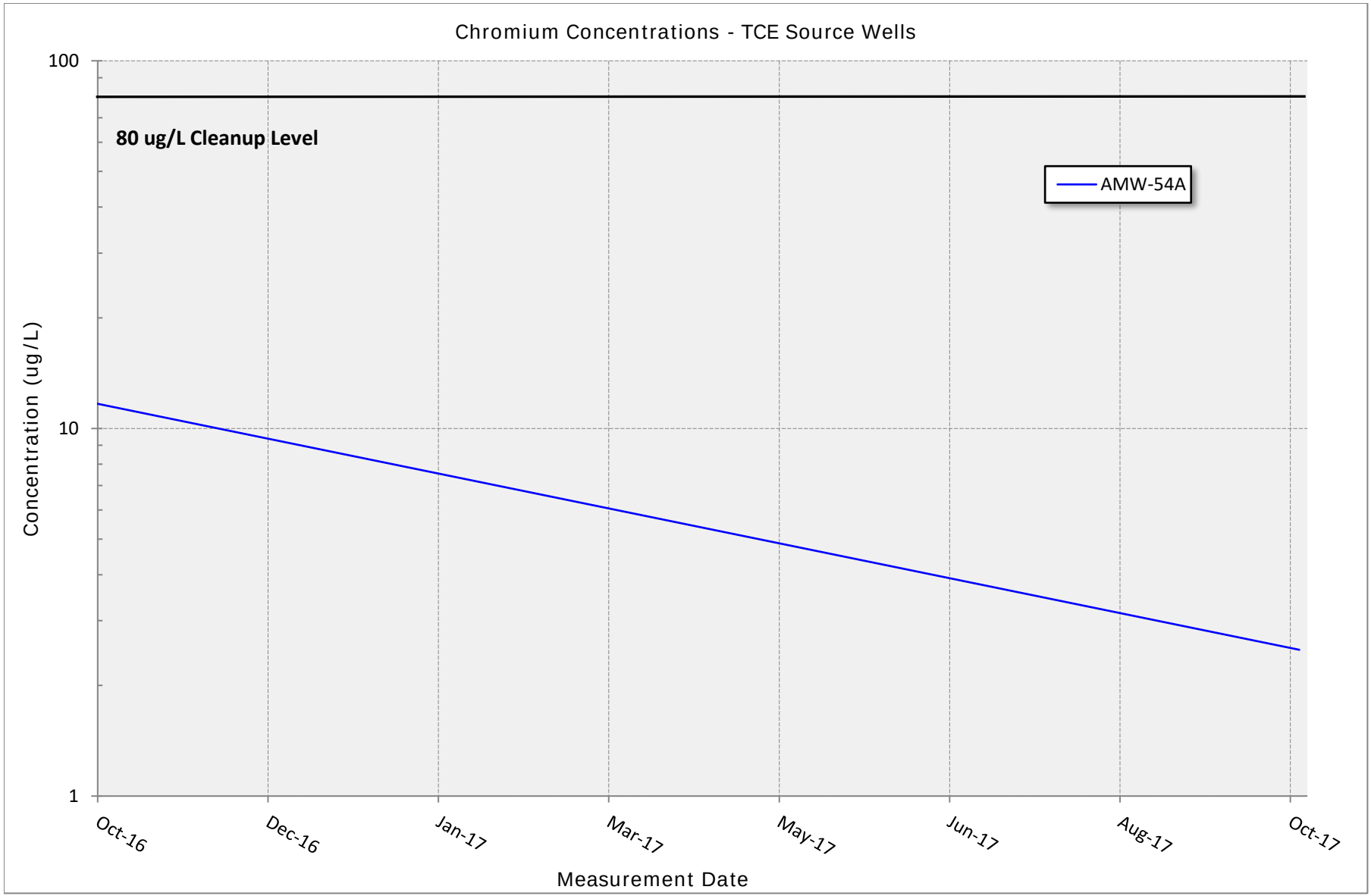
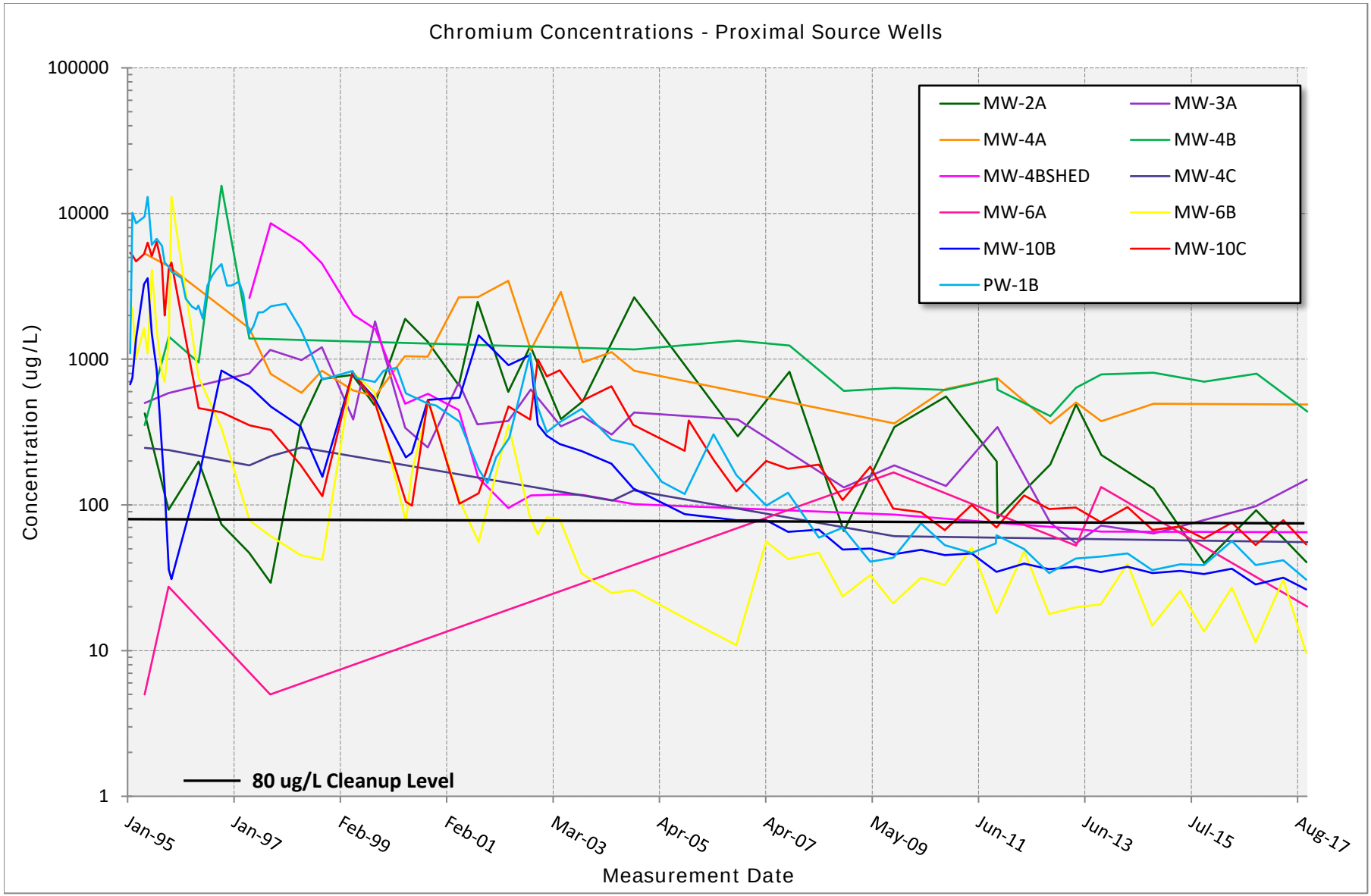
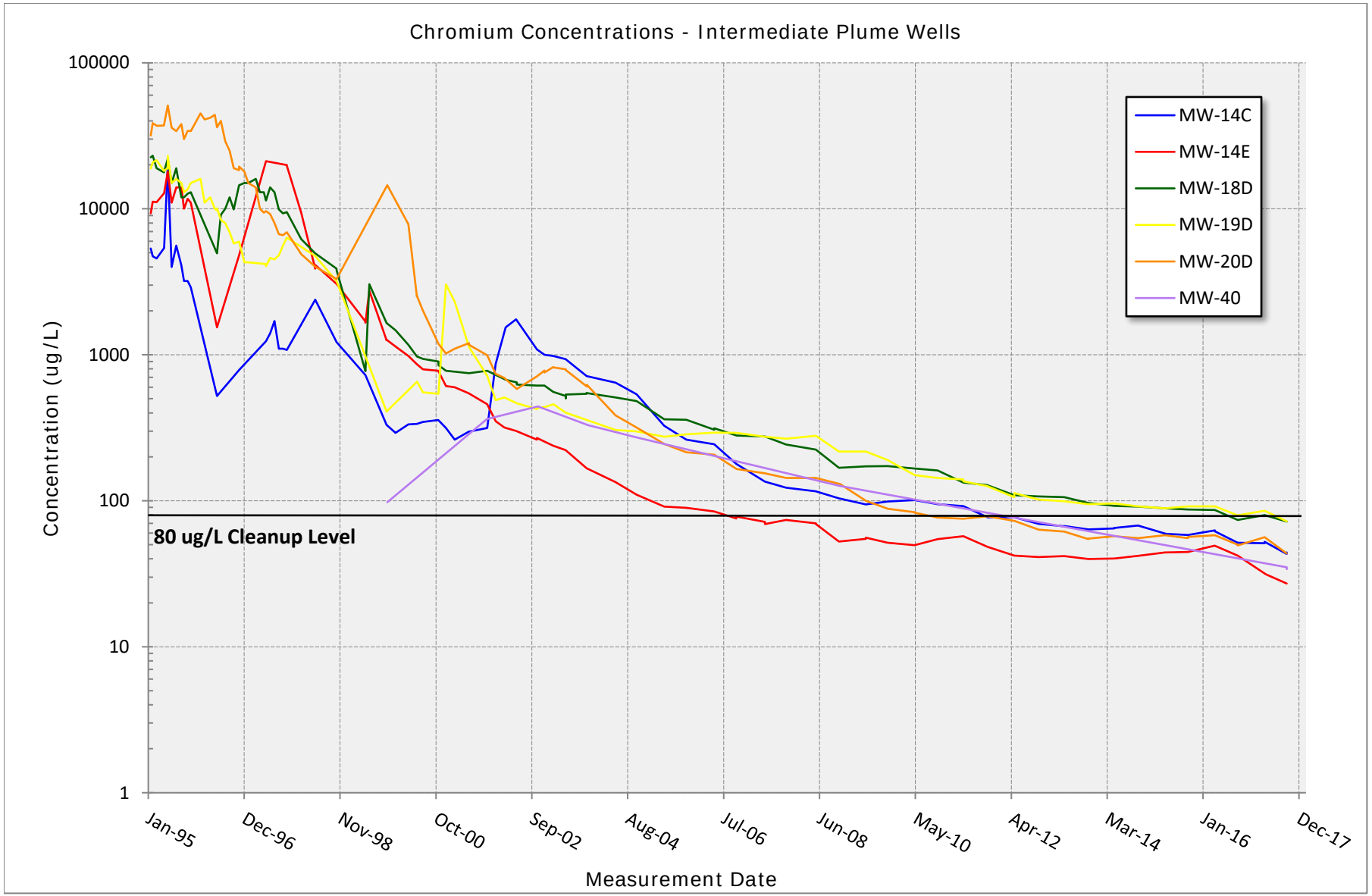
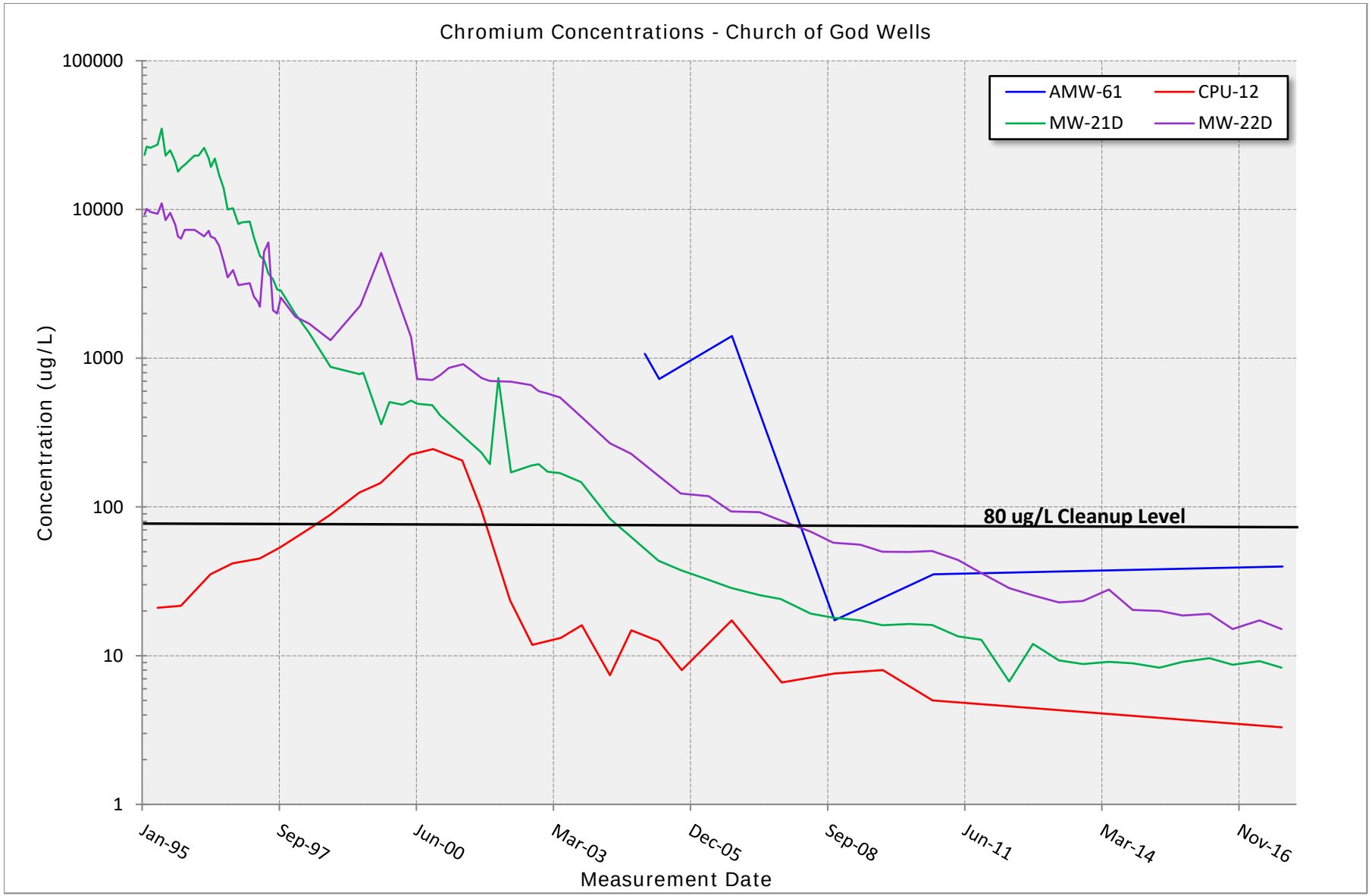
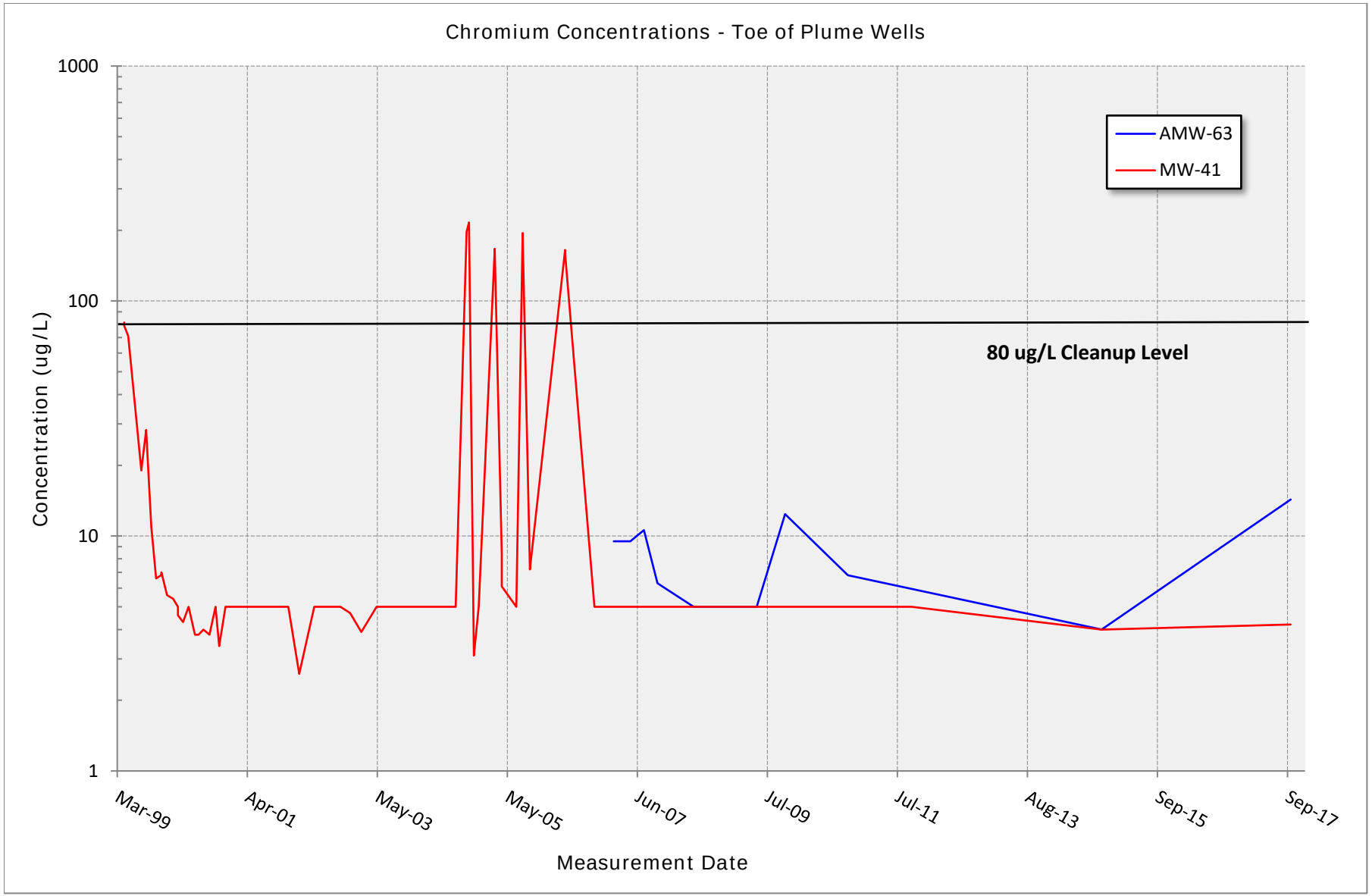

Chromium Concentrations - TCE Upgradient Wells
80 ug/L Cleanup Level
AMW-6A
AMW-7A
AMW-10A
AMW-11A
Concentration (ug/L)
100
10
1
0.1
Apr-95
Jan-98
Oct-00
Jun-03
Mar-06
Dec-08
Sep-11
Jun-14
Mar-17
Measurement Date

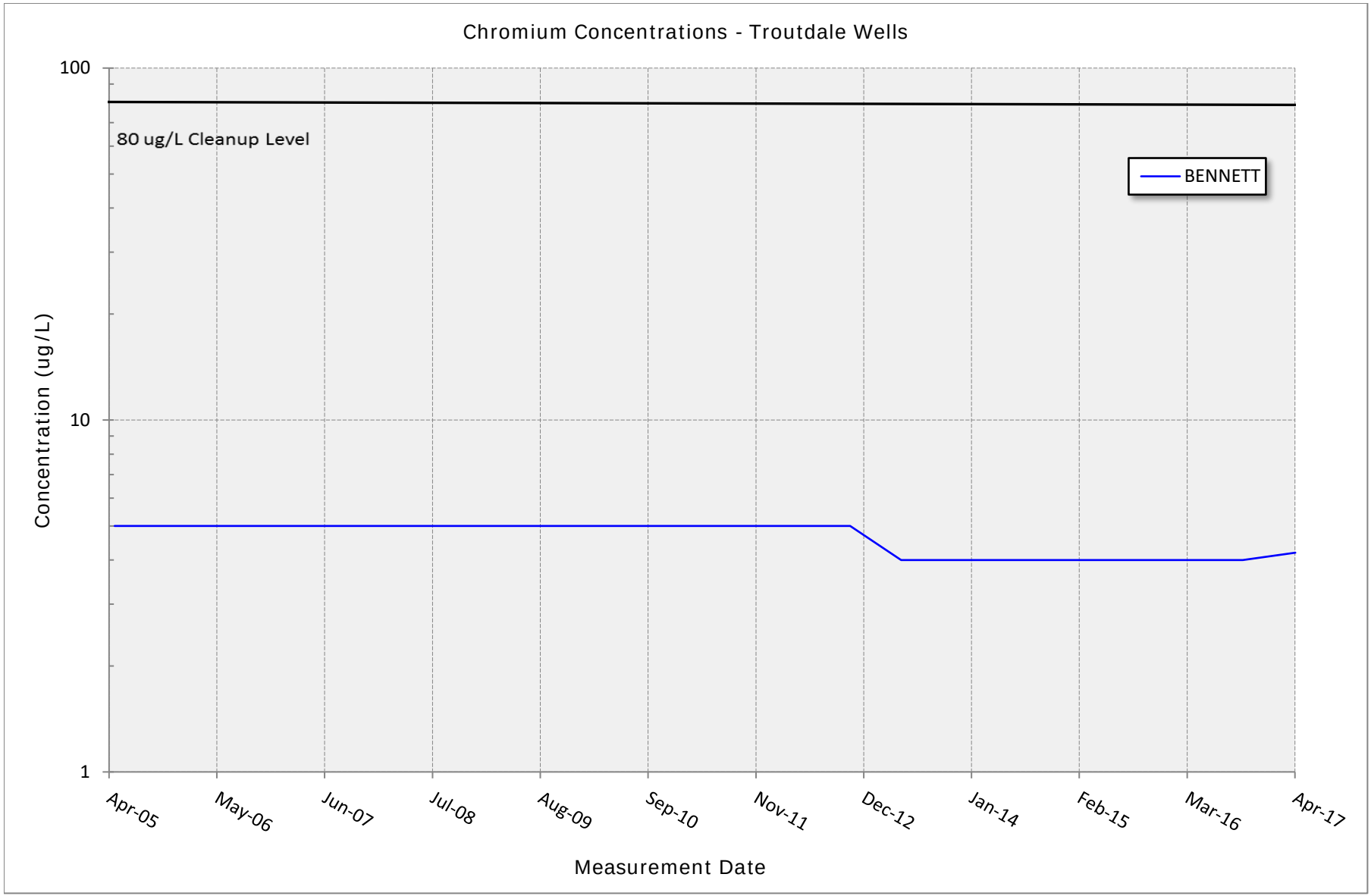

Chromium Concentrations - TCE Source Wells
100
10
1
Concentration (ug/L)
80 ug/L Cleanup Level
AMW-54A
Oct-16
Dec-16
Jan-17
Mar-17
May-17
Jun-17
Aug-17
Oct-17
Measurement Date


Chromium Concentrations - Proximal Source Wells
Concentration (ug/L)
100000
10000
1000
100
10
1
MW-2A
MW-3A
MW-4A
MW-4B
MW-4BSHED
MW-4C
MW-6A
MW-6B
MW-10B
MW-10C
PW-1B
80 ug/L Cleanup Level
Jan-95
Jan-97
Feb-99
Feb-01
Mar-03
Apr-05
Apr-07
May-09
Jun-11
Jun-13
Jul-15
Aug-17
Measurement Date


Chromium Concentrations - Intermediate Plume Wells
Concentration (ug/L)
100000
10000
1000
100
10
1
80 ug/L Cleanup Level
MW-14C
MW-14E
MW-18D
MW-19D
MW-20D
MW-40
Jan-95
Dec-96
Nov-98
Oct-00
Sep-02
Aug-04
Jul-06
Jun-08
May-10
Apr-12
Mar-14
Jan-16
Dec-17
Measurement Date


Chromium Concentrations - Church of God Wells
AMW-61
CPU-12
MW-21D
MW-22D
80 ug/L Cleanup Level
Concentration (ug/L)
100000
10000
1000
100
10
1
Jan-95
Sep-97
Jun-00
Mar-03
Dec-05
Sep-08
Jun-11
Mar-14
Nov-16
Measurement Date


Chromium Concentrations - Toe of Plume Wells
1000
100
10
1
Concentration (ug/L)
AMW-63
MW-41
80 ug/L Cleanup Level
Mar-99
Apr-01
May-03
May-05
Jun-07
Jul-09
Jul-11
Aug-13
Sep-15
Sep-17
Measurement Date


Chromium Concentrations - Troutdale Wells
100
10
1
Concentration (ug/L)
80 ug/L Cleanup Level
BENNETT
Apr-05
May-06
Jun-07
Jul-08
Aug-09
Sep-10
Nov-11
Dec-12
Jan-14
Feb-15
Mar-16
Apr-17
Measurement Date

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APPENDIX A-3

CHROMIUM CONCENTRATIONS – INDIVIDUAL WELLS

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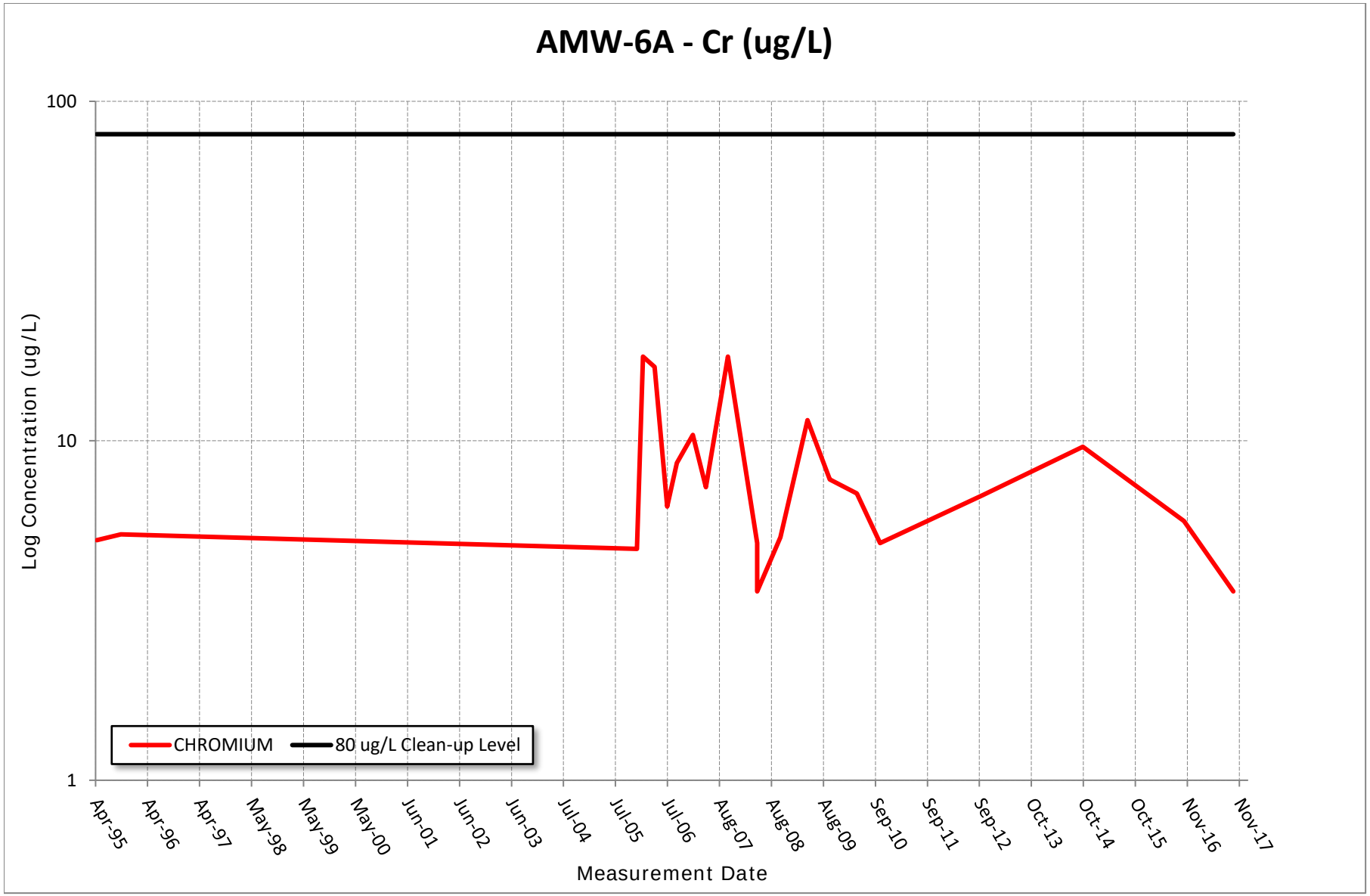
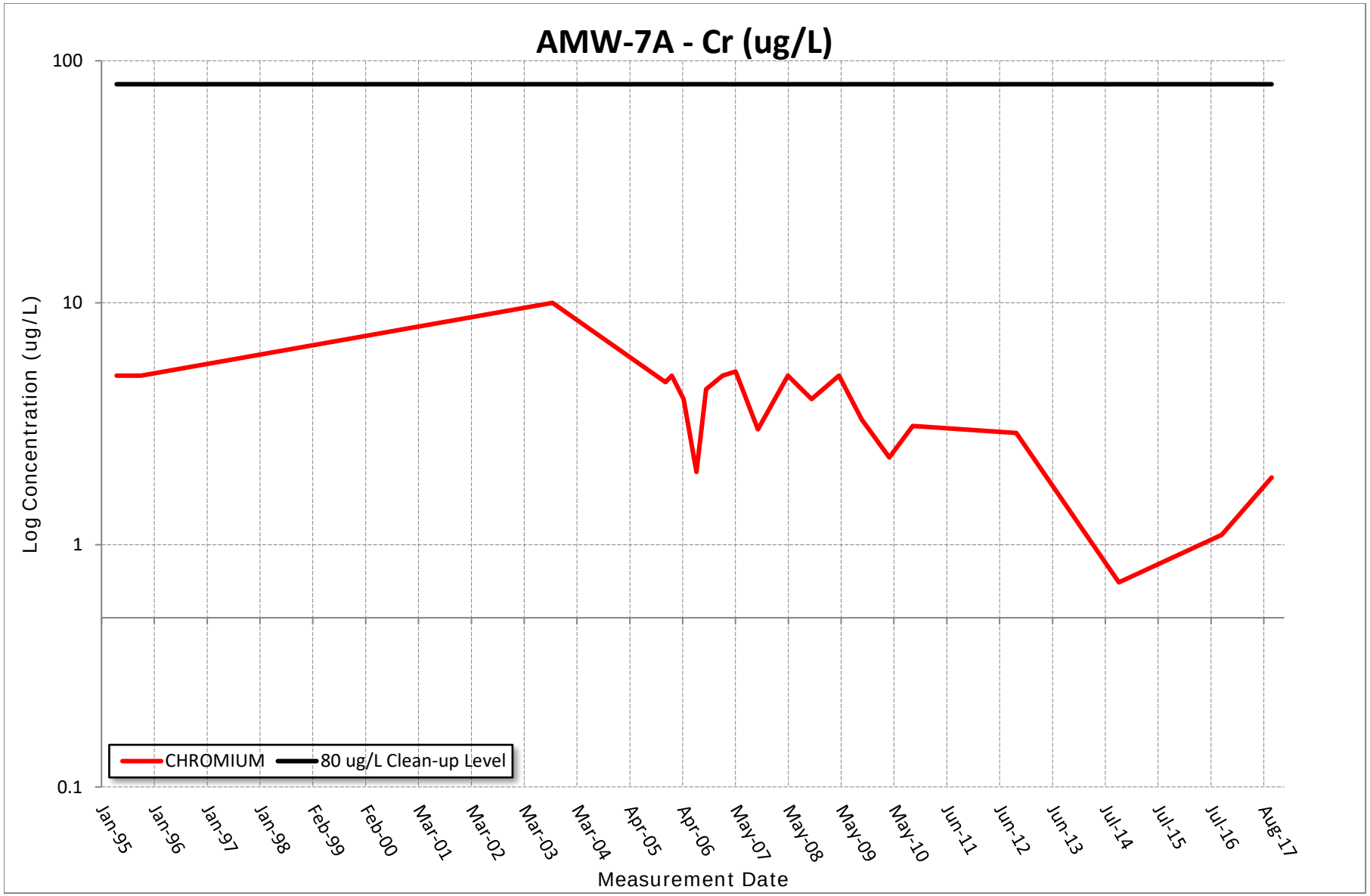
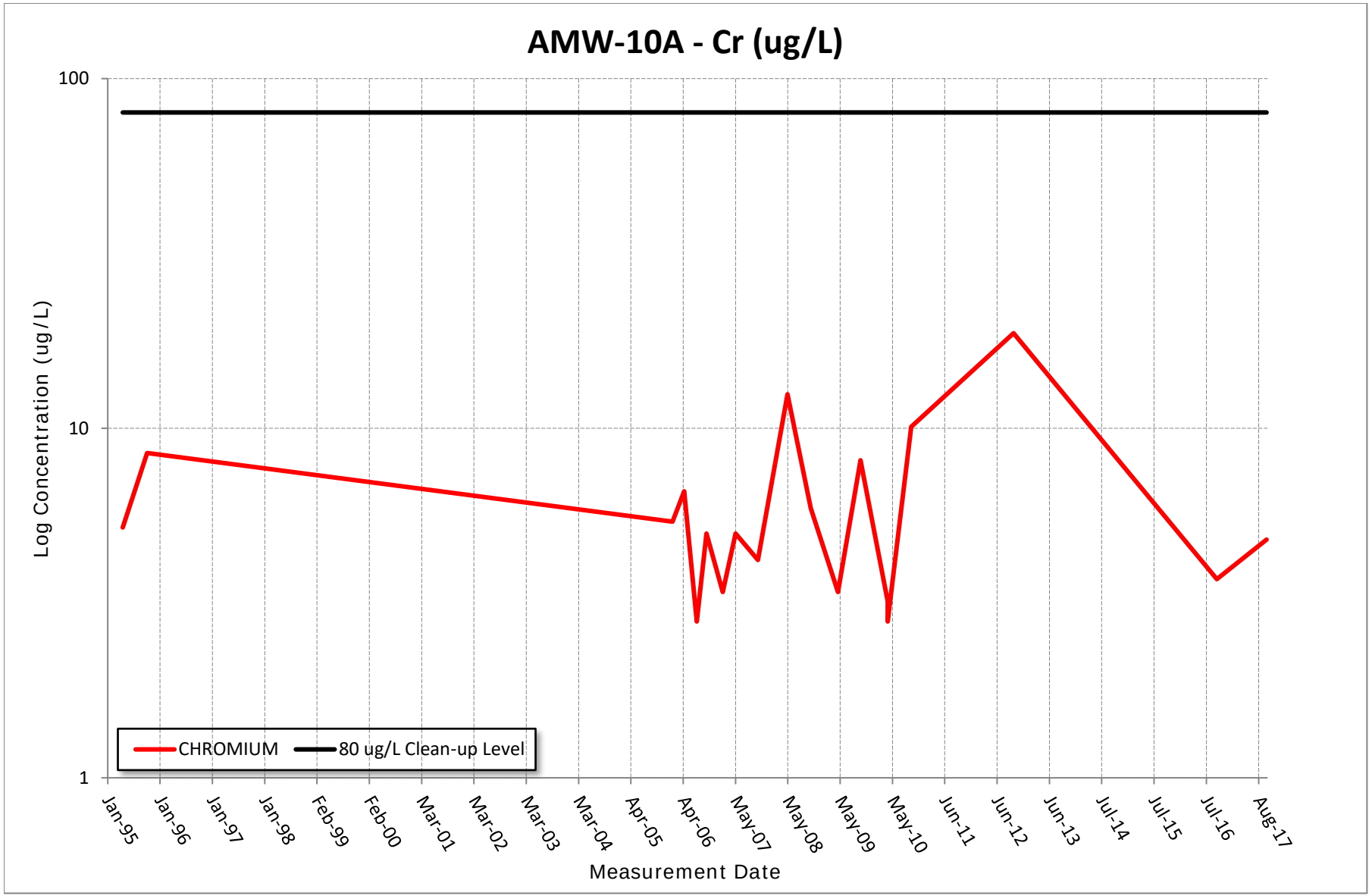
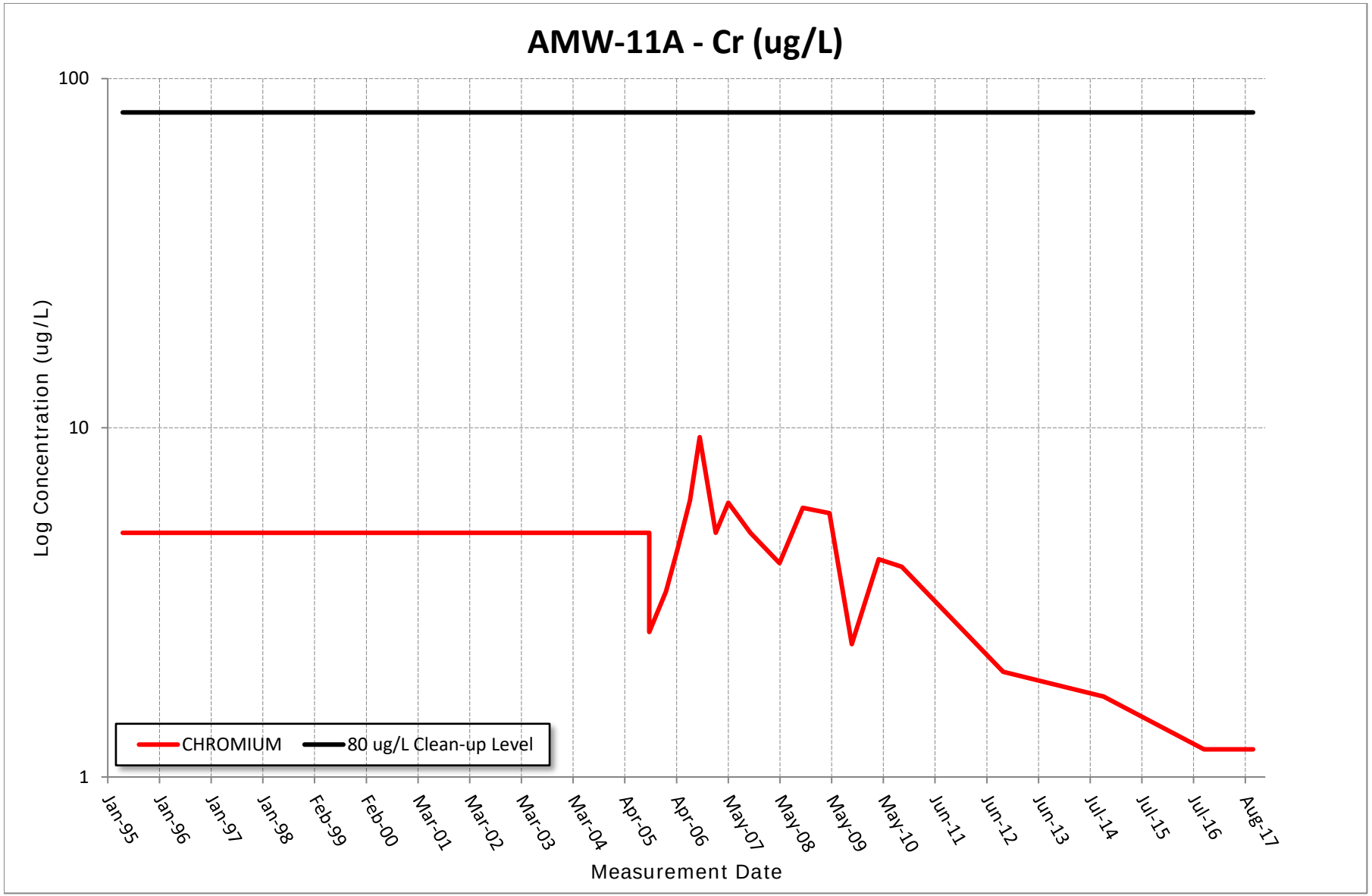
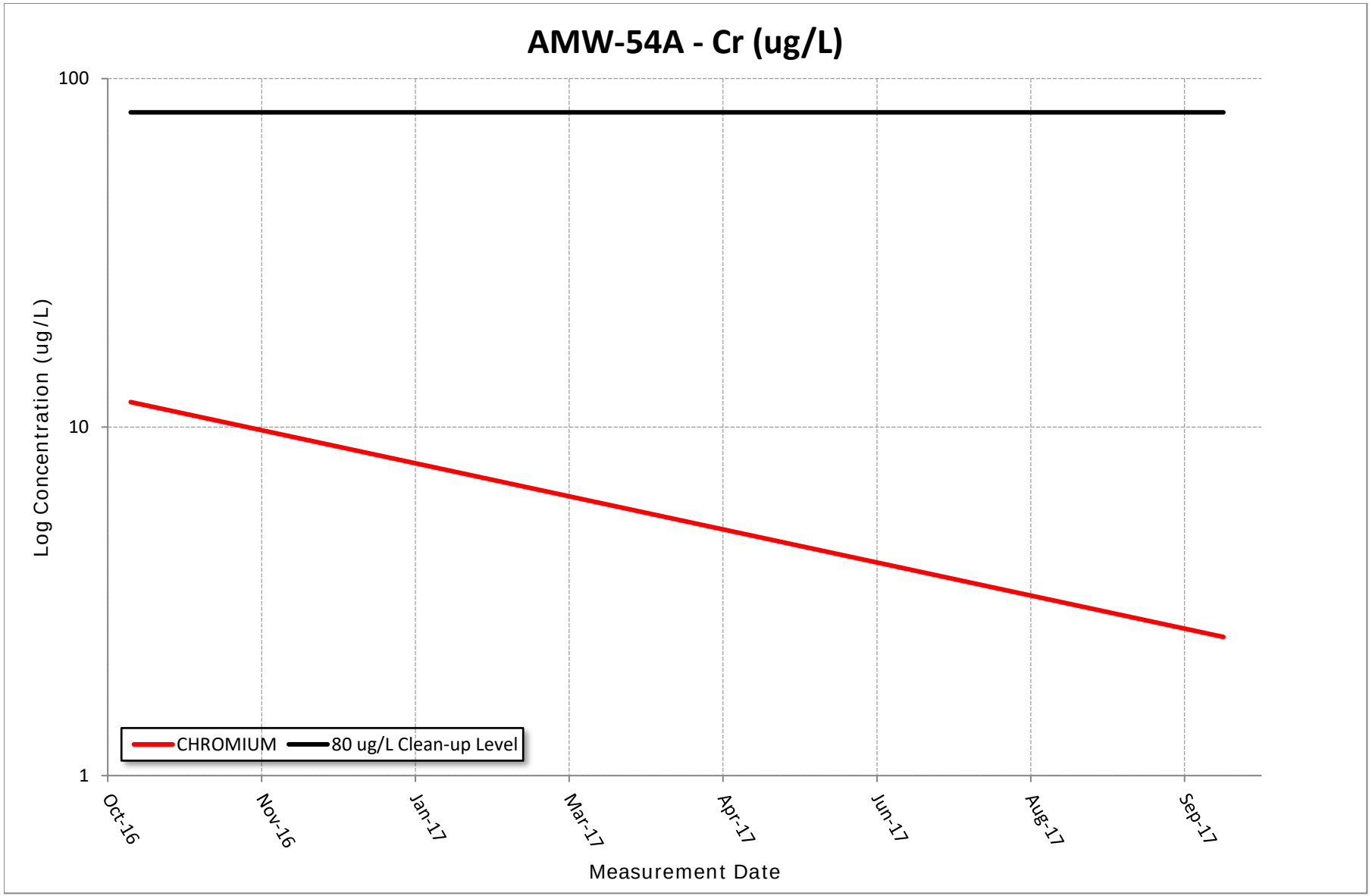
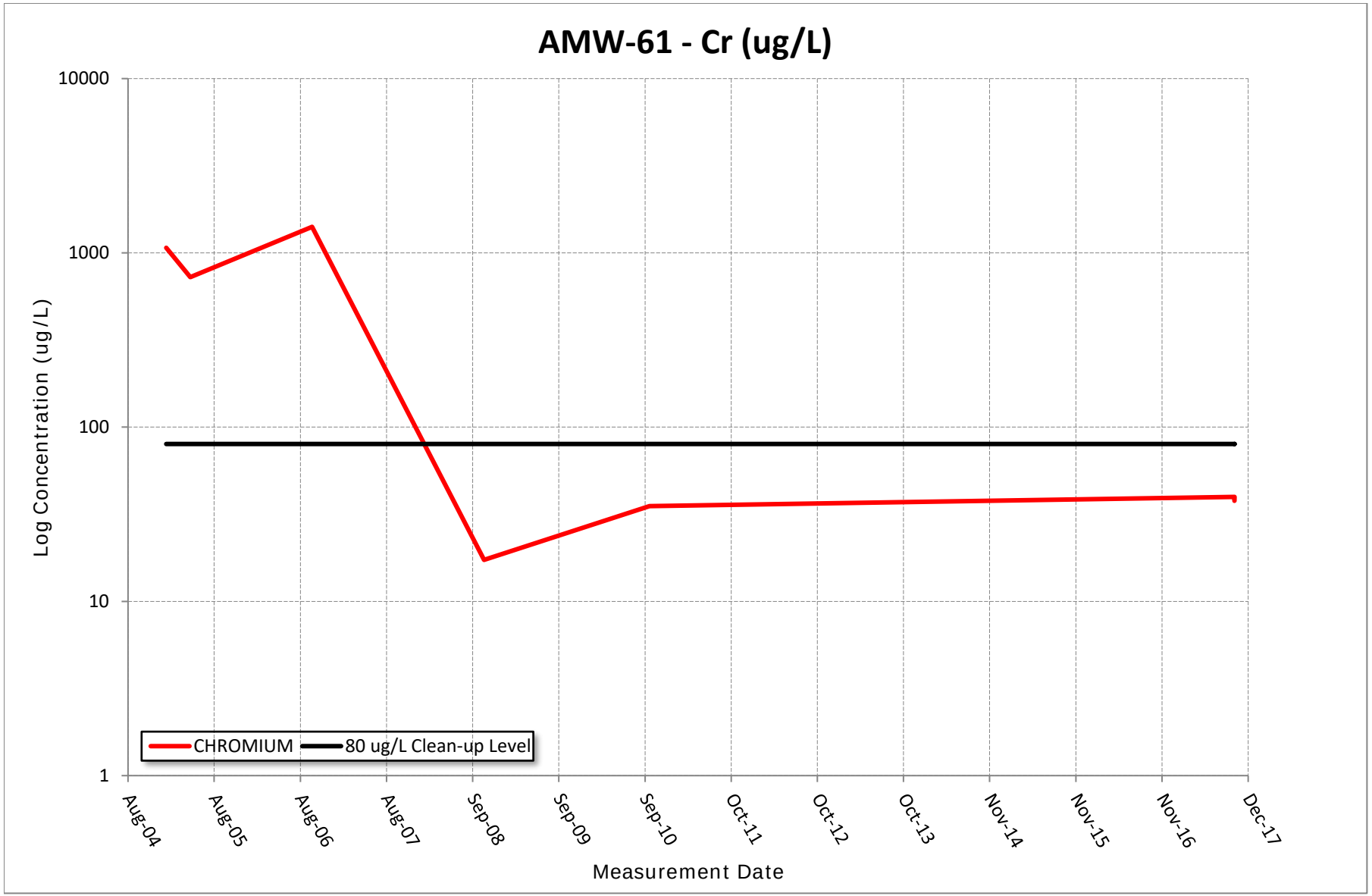

AMW-6A - Cr (ug/L)
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Apr-95
Apr-96
Apr-97
May-98
May-99
May-00
Jun-01
Jun-02
Jun-03
Jul-04
Jul-05
Jul-06
Aug-07
Aug-08
Aug-09
Sep-10
Sep-11
Sep-12
Oct-13
Oct-14
Oct-15
Nov-16
Nov-17
Measurement Date

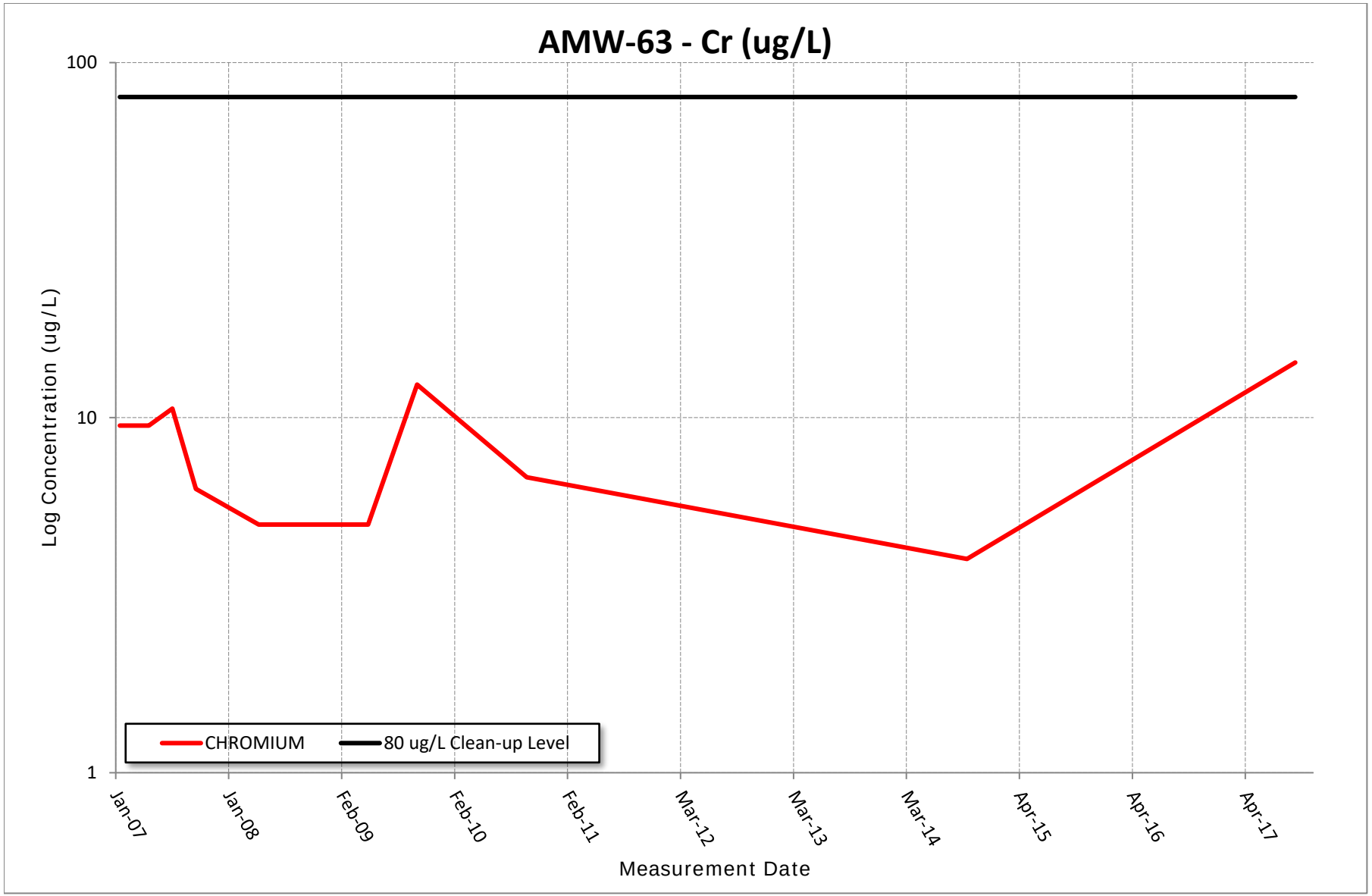

AMW-7A - Cr (ug/L)
100
10
1
0.1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

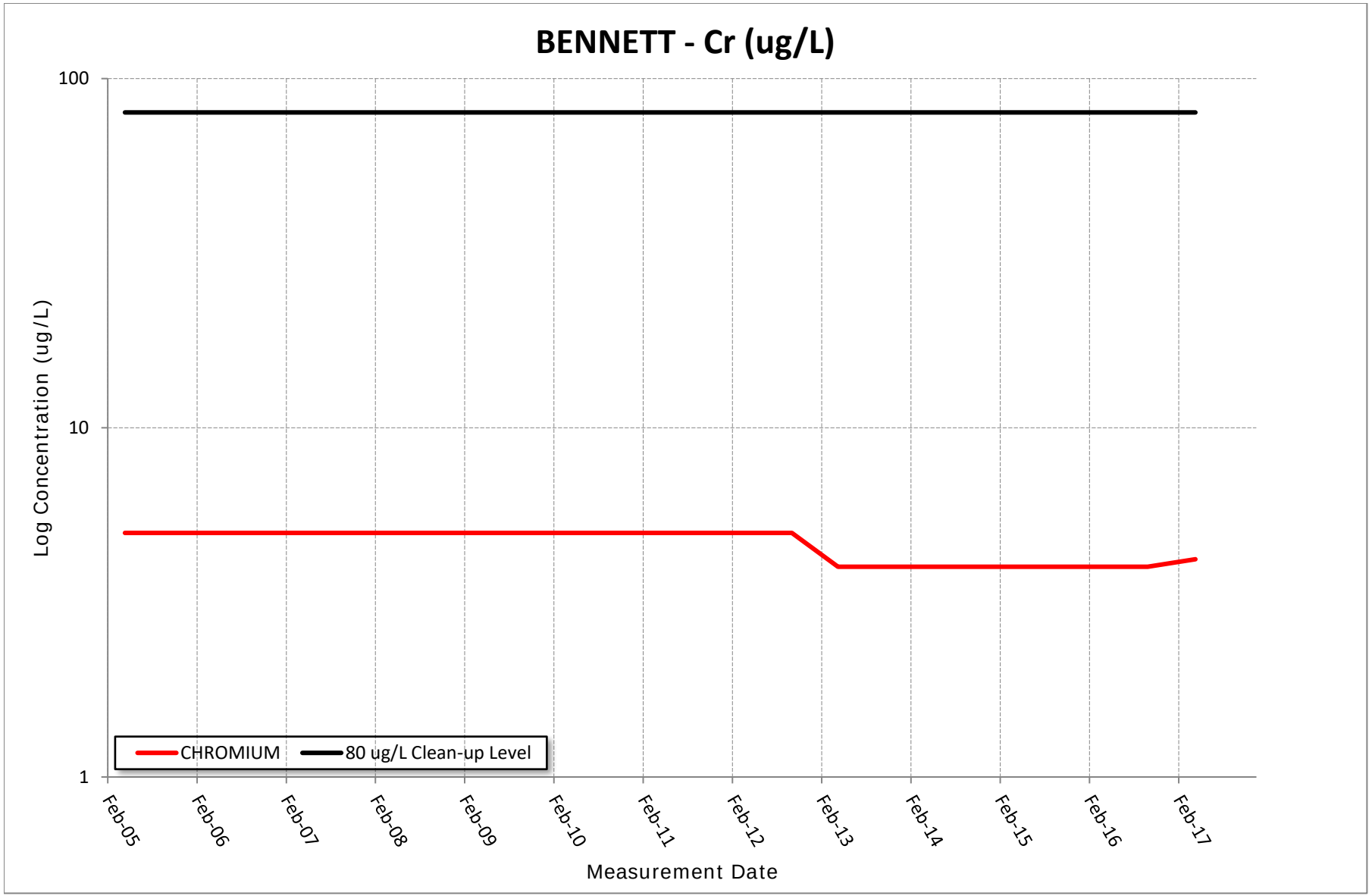

AMW-10A - Cr (ug/L)
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

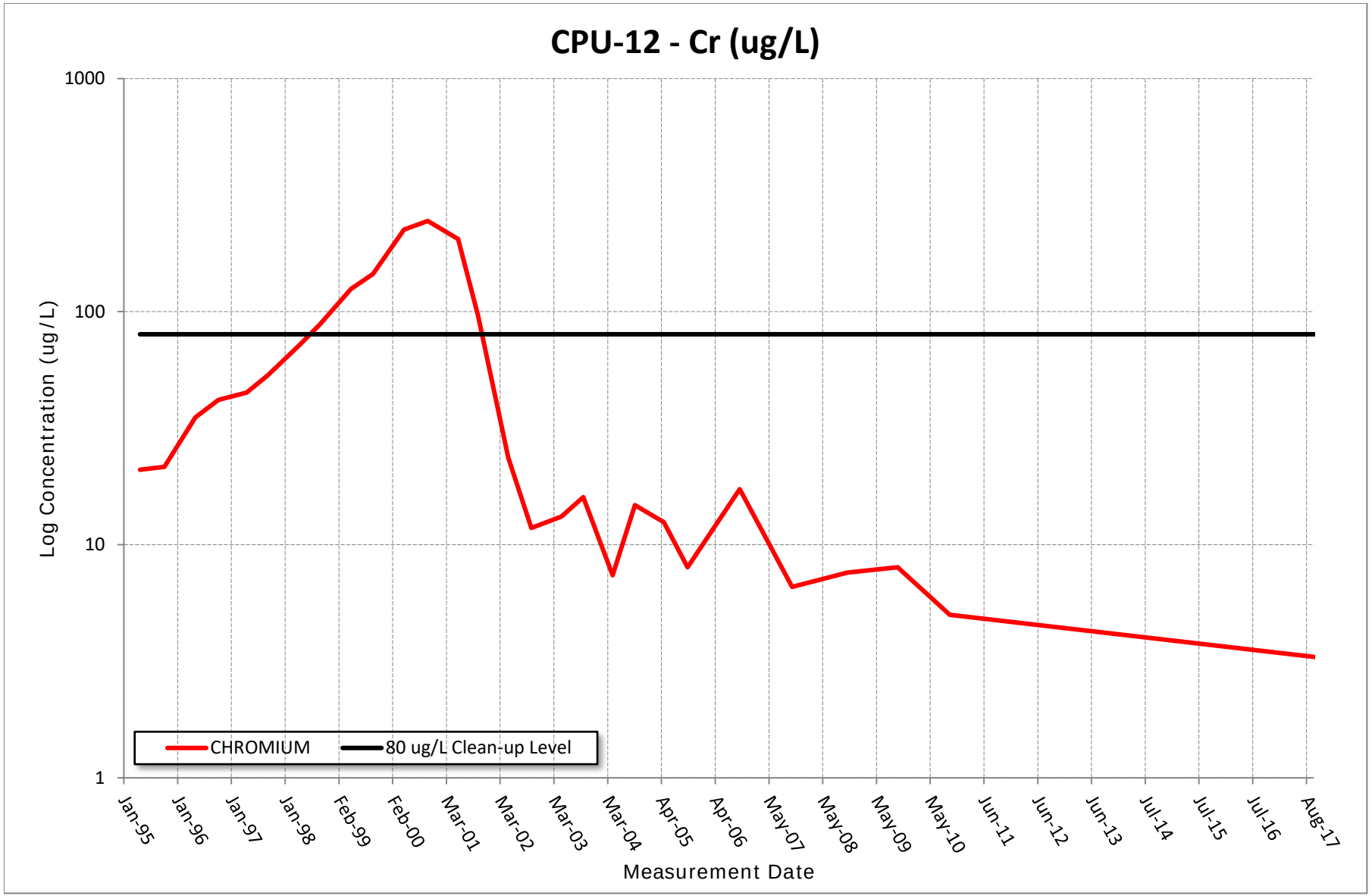

AMW-11A - Cr (ug/L)
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

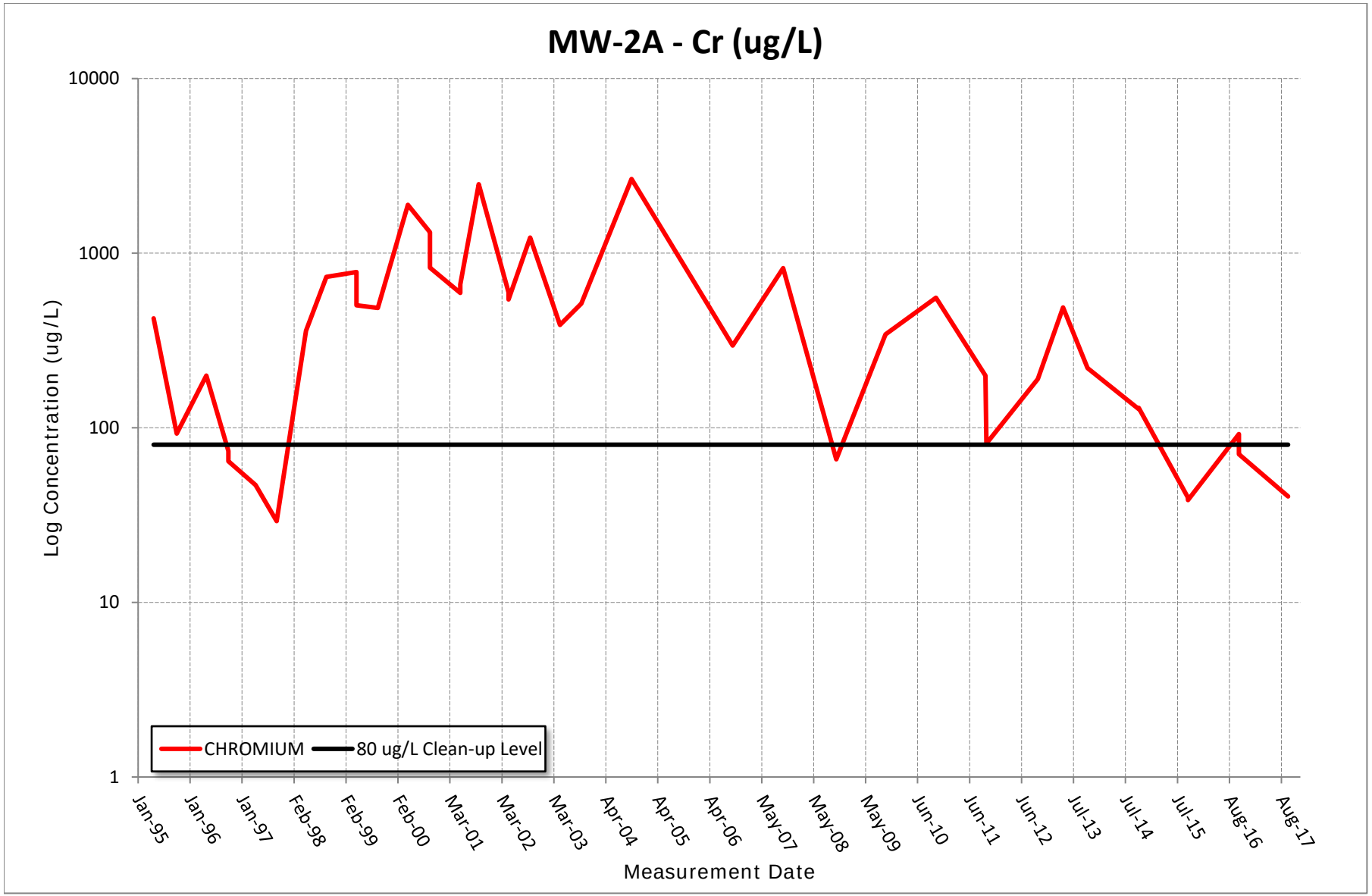

AMW-54A - Cr (ug/L)
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Oct-16
Nov-16
Jan-17
Mar-17
Apr-17
Jun-17
Aug-17
Sep-17
Measurement Date

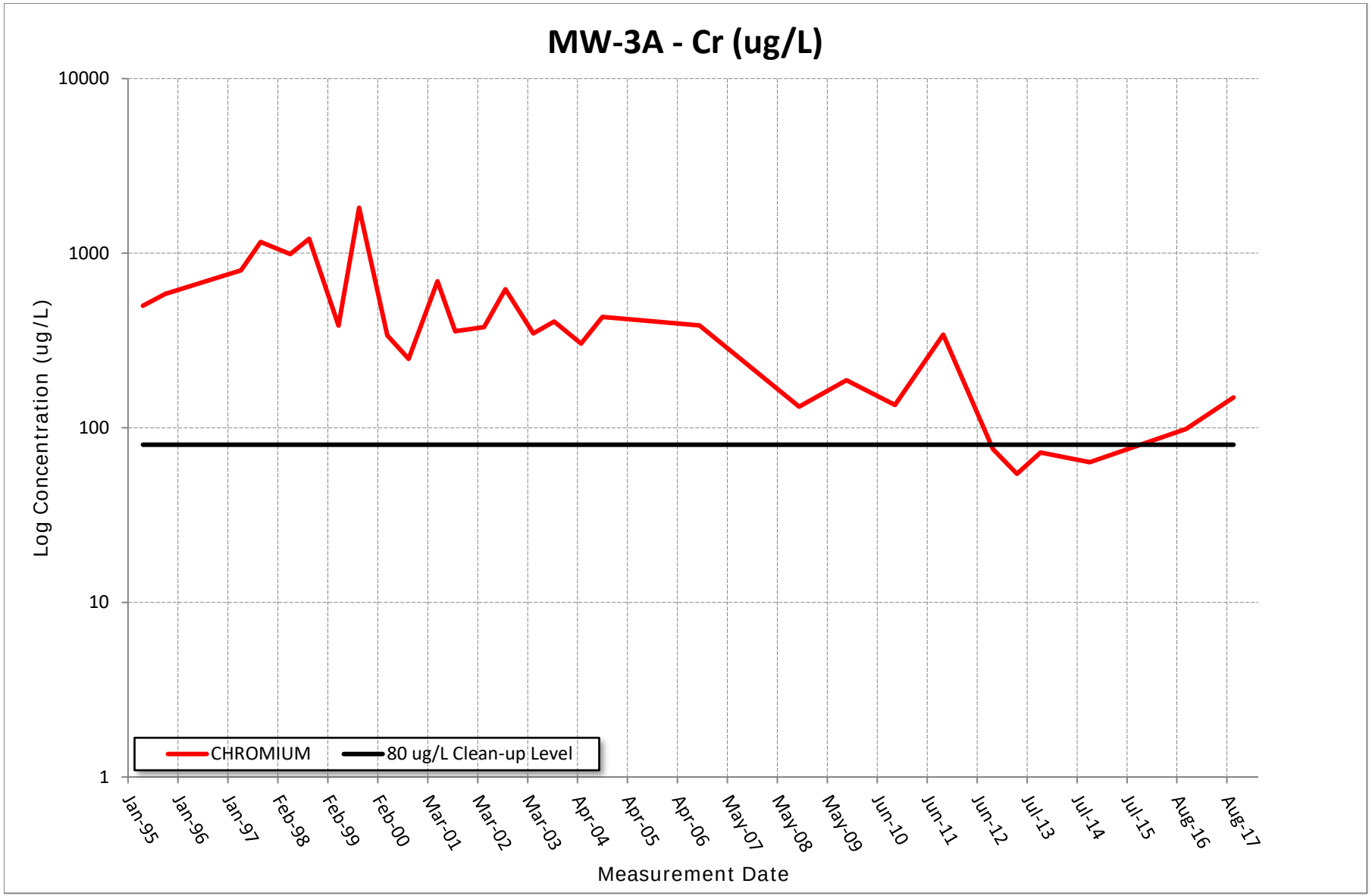

AMW-61 - Cr (ug/L)
10000
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Aug-04
Aug-05
Aug-06
Aug-07
Sep-08
Sep-09
Sep-10
Oct-11
Oct-12
Oct-13
Nov-14
Nov-15
Nov-16
Dec-17
Measurement Date

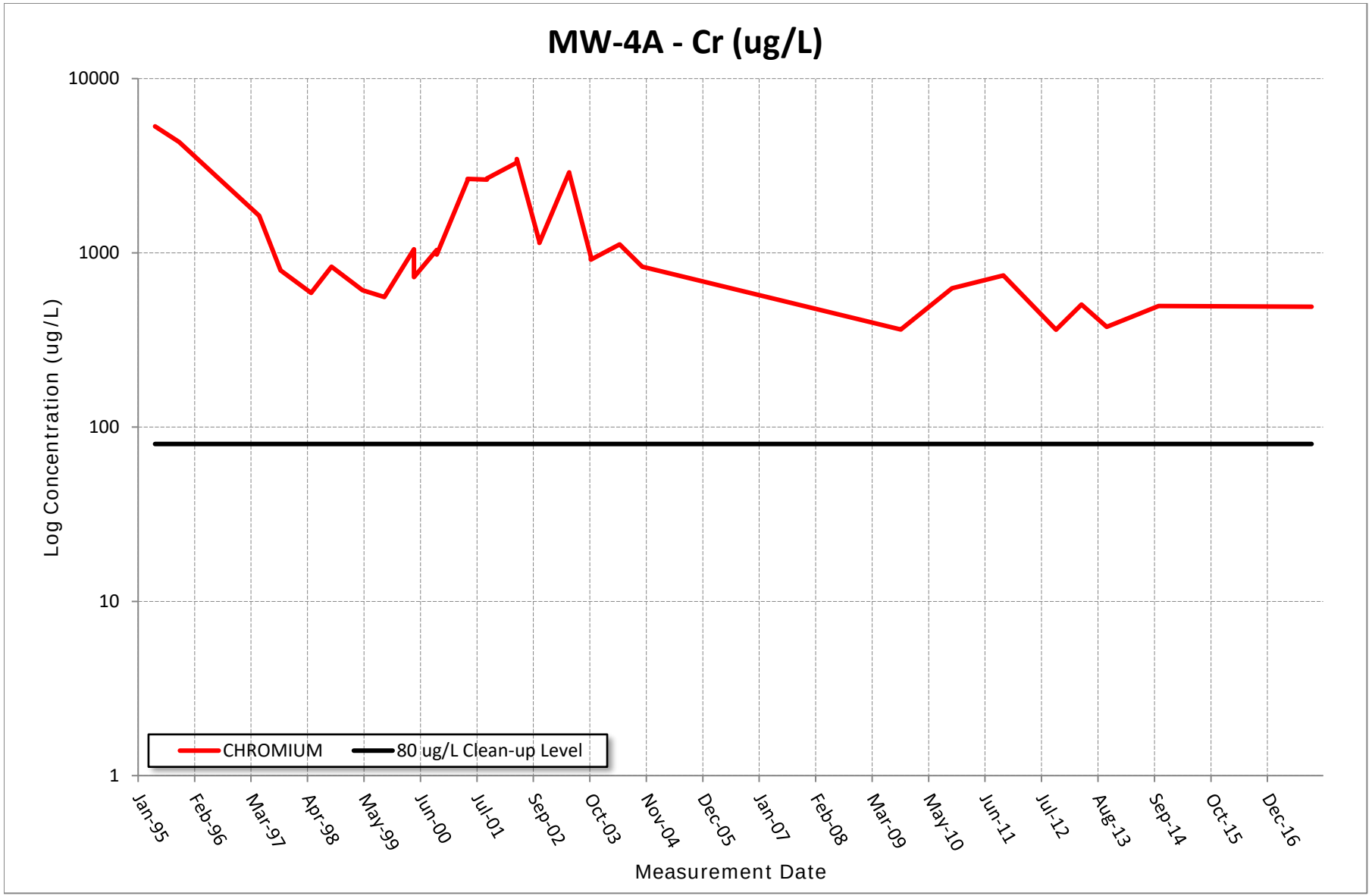

AMW-63 - Cr (ug/L)
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-07
Jan-08
Feb-09
Feb-10
Feb-11
Mar-12
Mar-13
Mar-14
Apr-15
Apr-16
Apr-17
Measurement Date

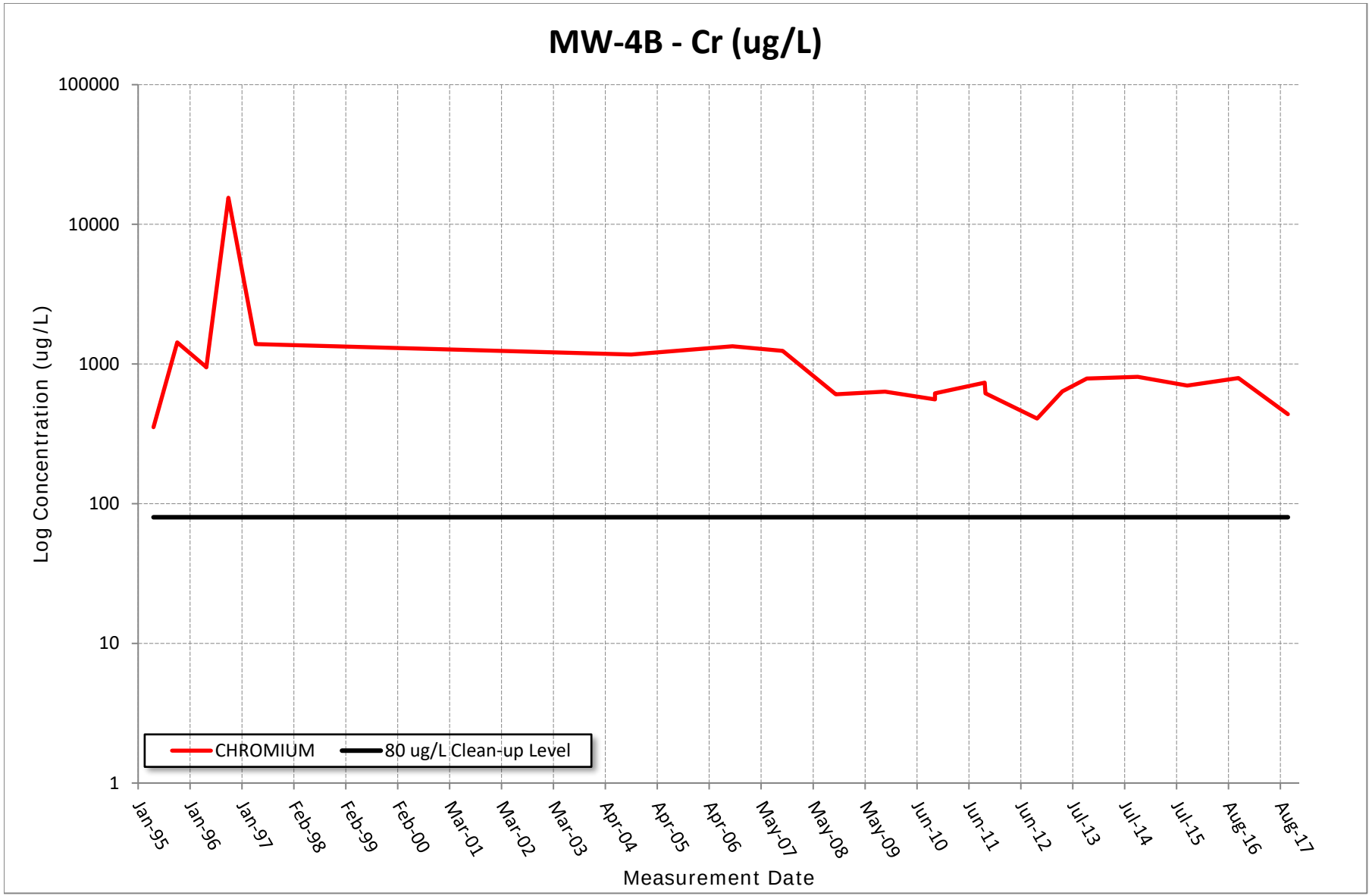

BENNETT - Cr (ug/L)
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Feb-05
Feb-06
Feb-07
Feb-08
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
Feb-14
Feb-15
Feb-16
Feb-17
Measurement Date

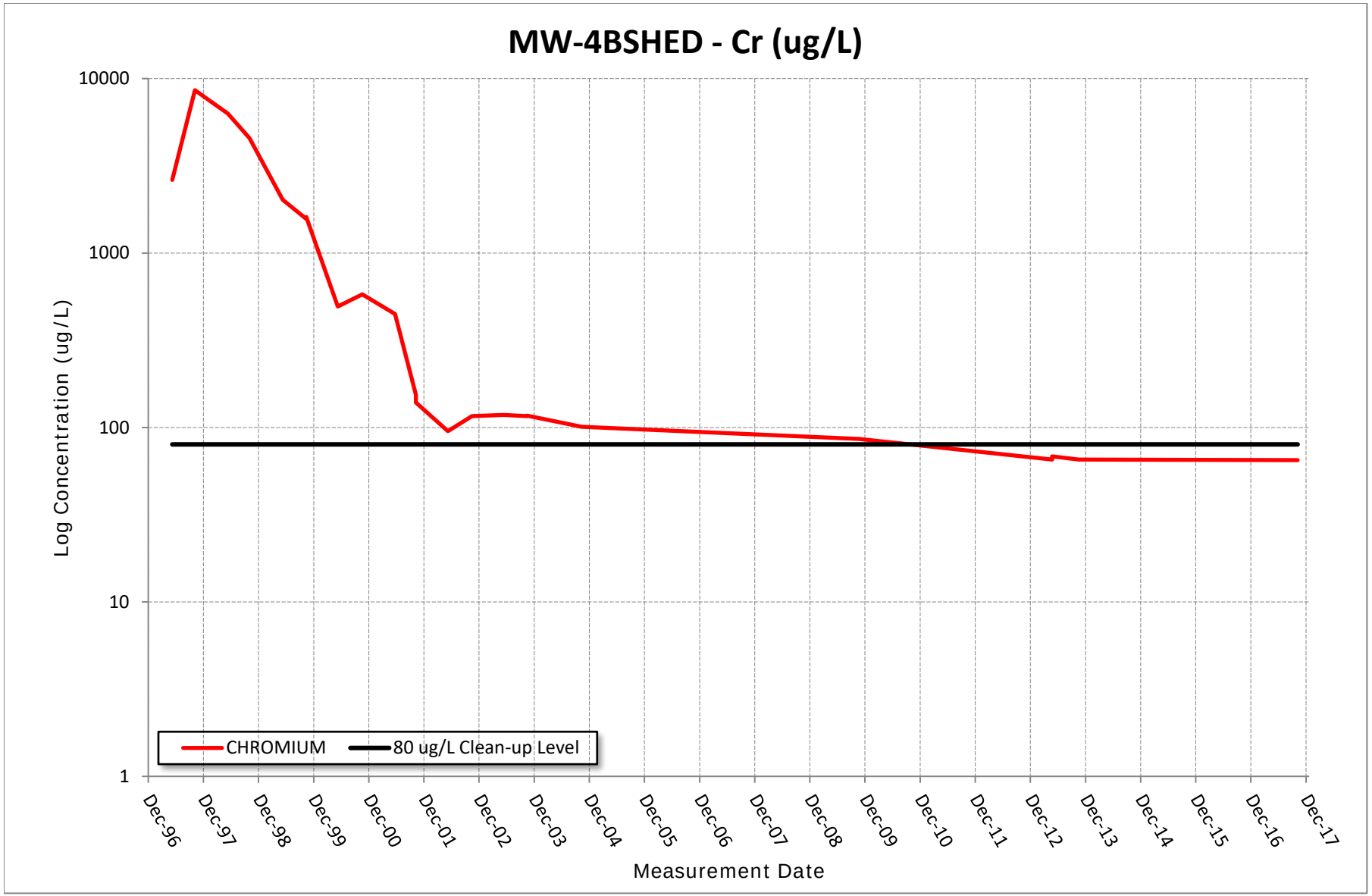

CPU-12 - Cr (ug/L)
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

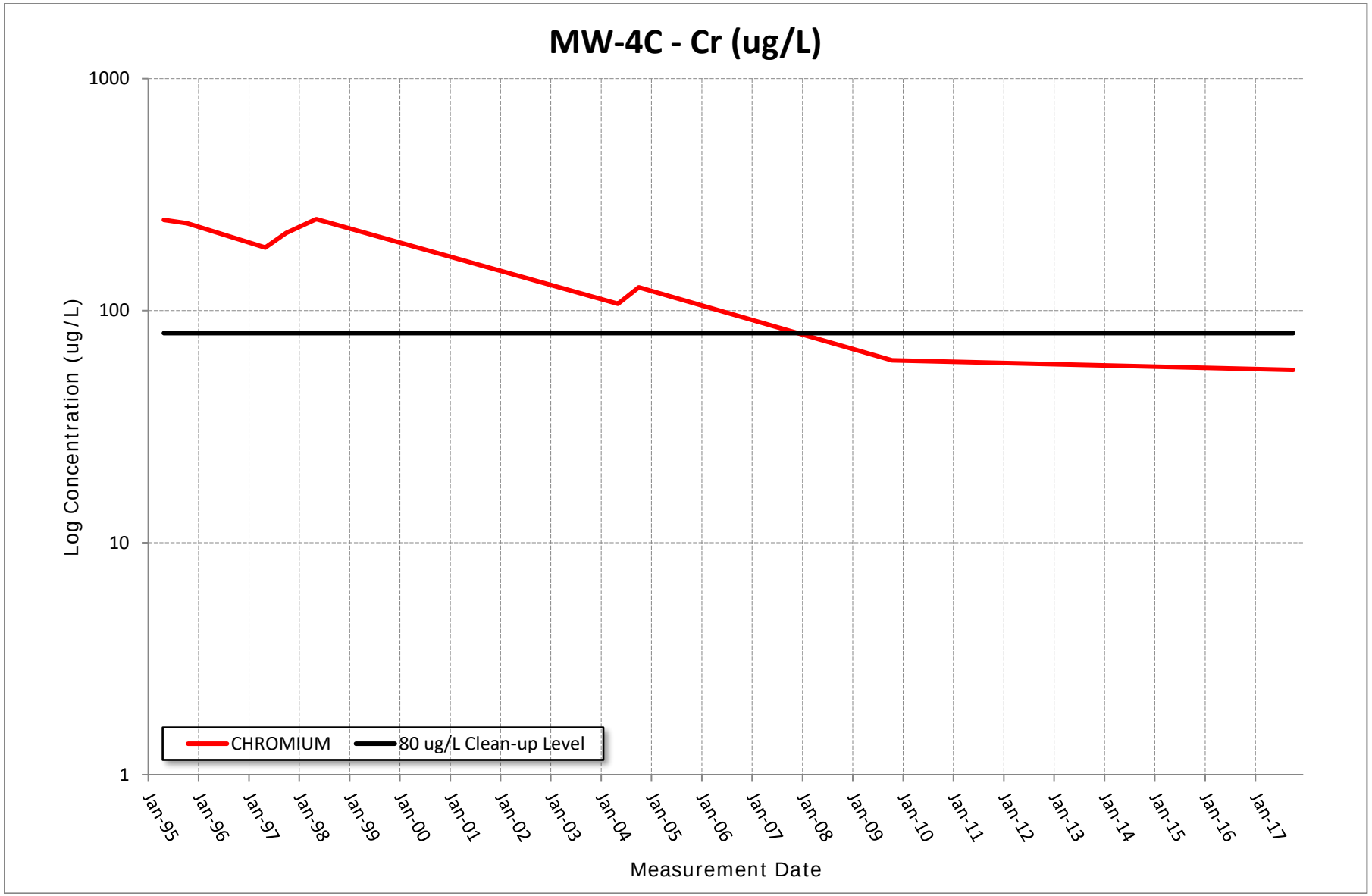

MW-2A - Cr (ug/L)
10000
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

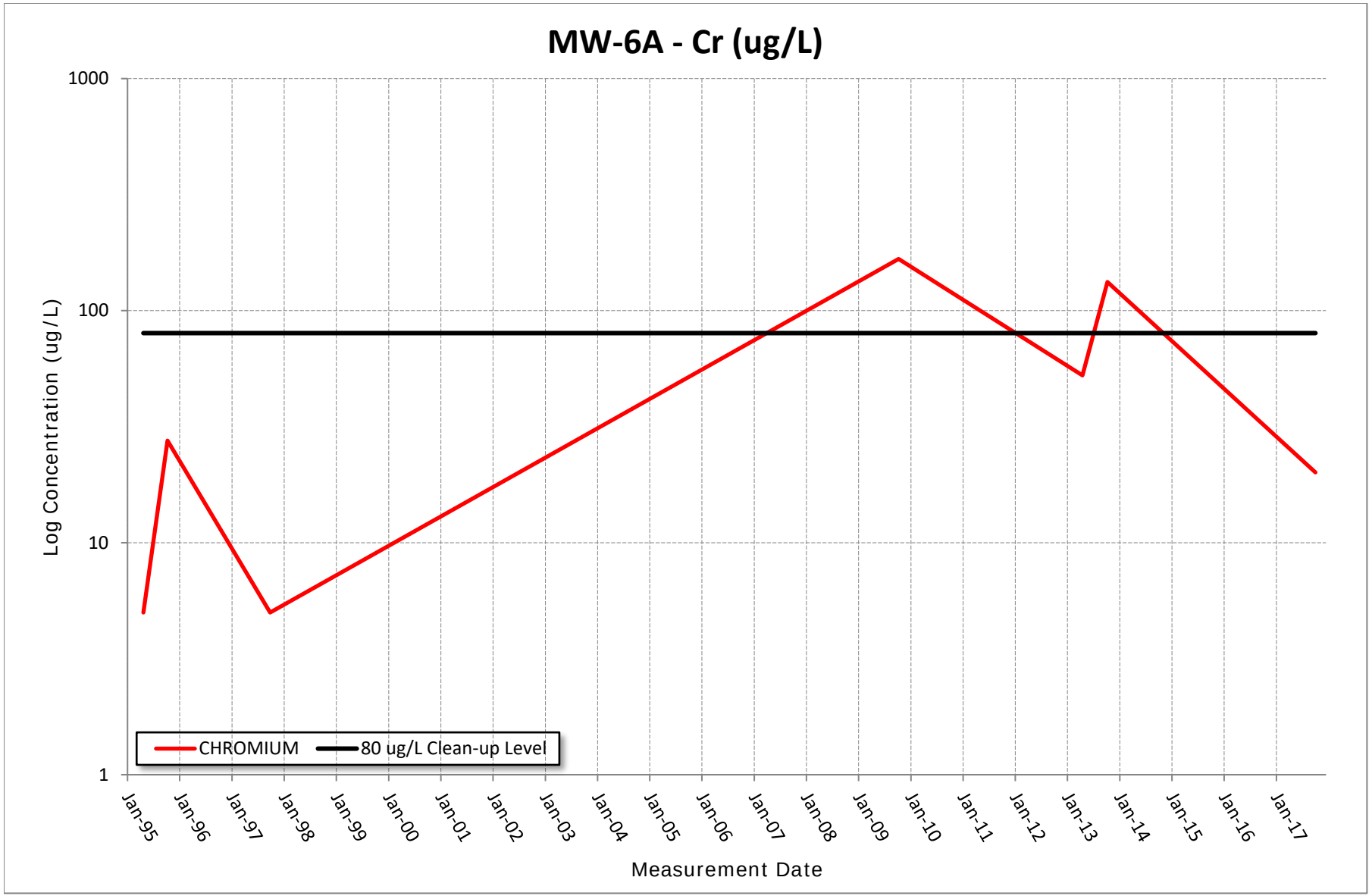

MW-3A - Cr (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

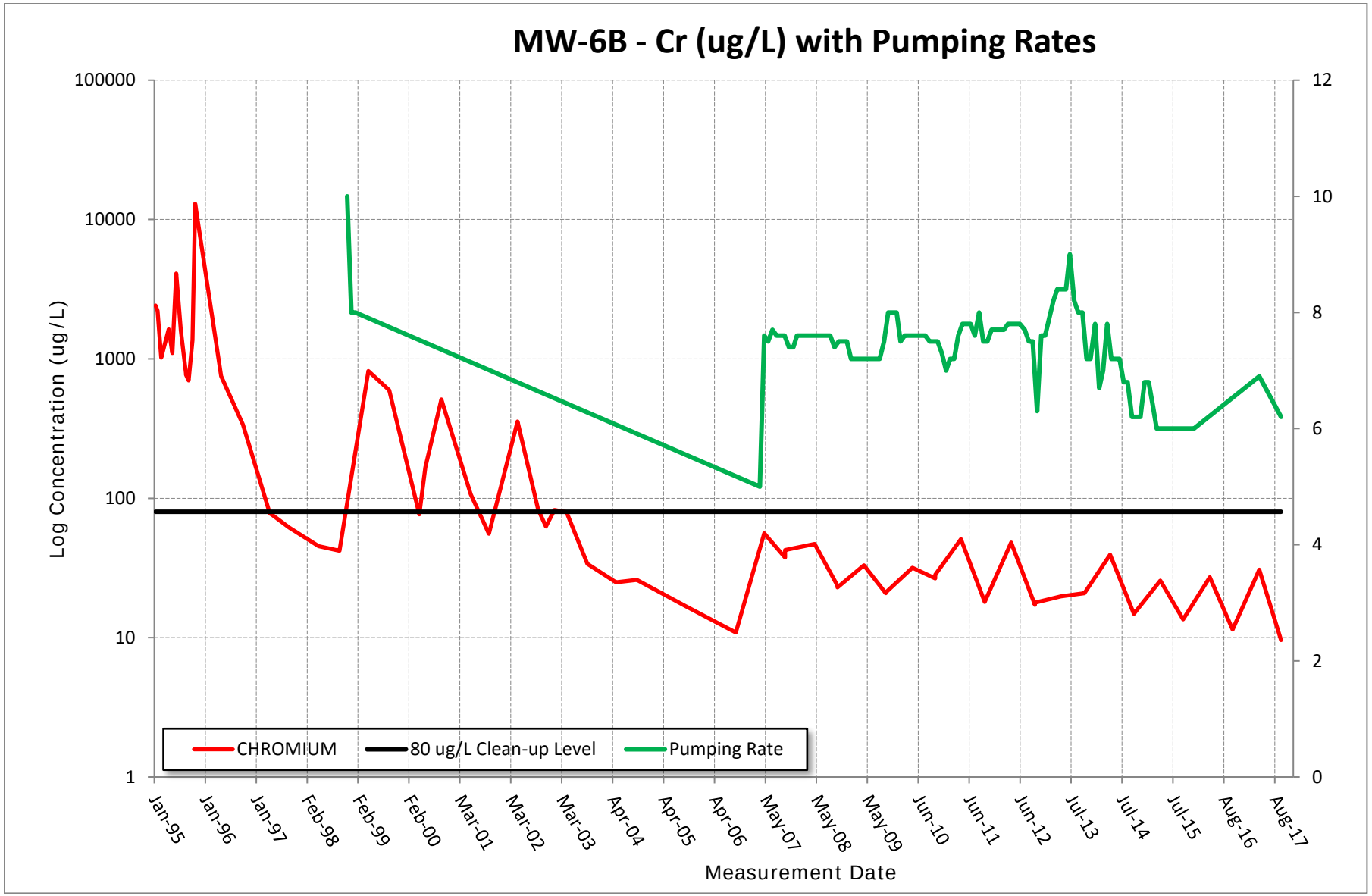

MW-4A - Cr (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Feb-96
Mar-97
Apr-98
May-99
Jun-00
Jul-01
Sep-02
Oct-03
Nov-04
Dec-05
Jan-07
Feb-08
Mar-09
May-10
Jun-11
Jul-12
Aug-13
Sep-14
Oct-15
Dec-16
Measurement Date

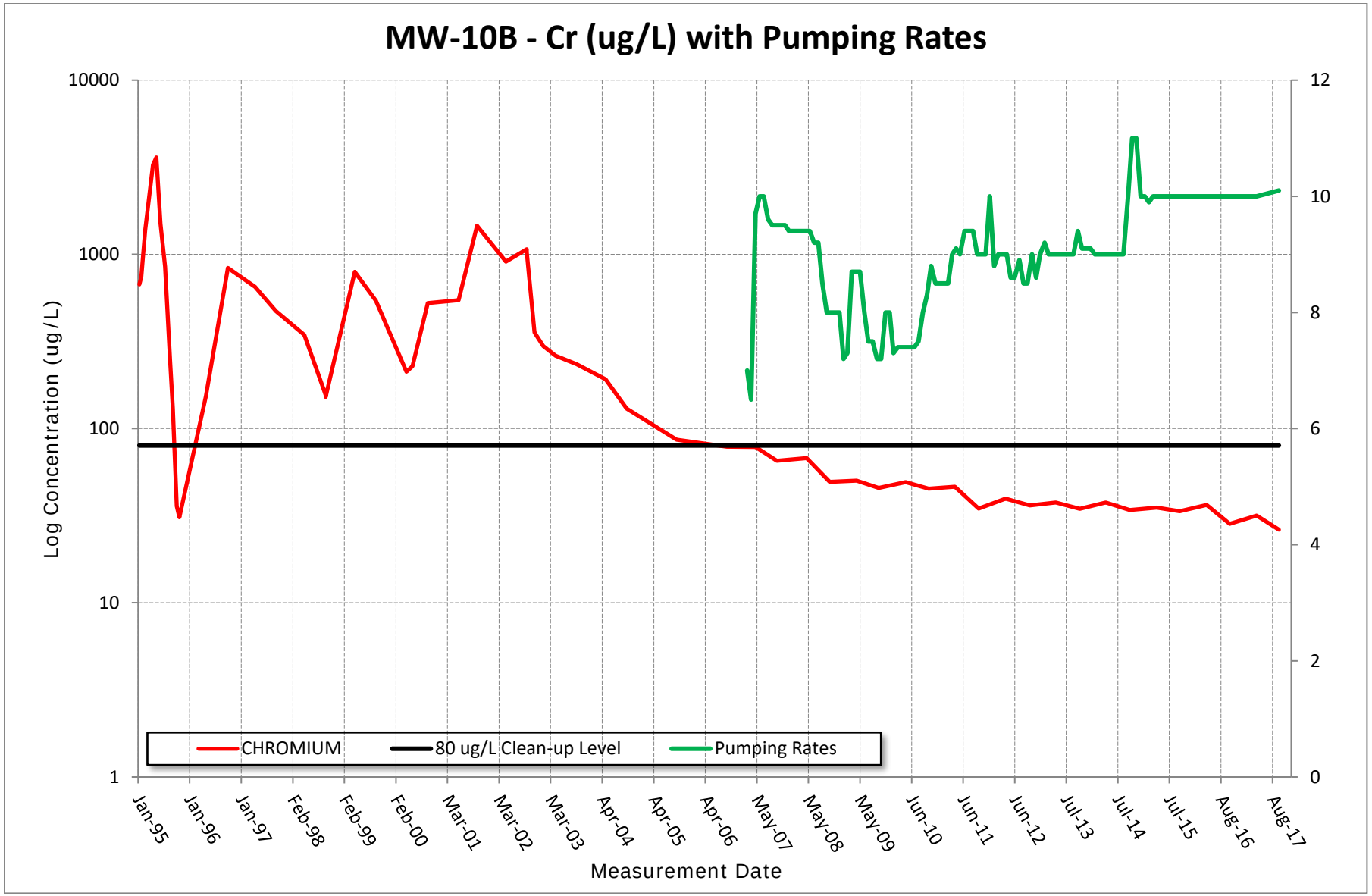

MW-4B - Cr (ug/L)
Log Concentration (ug/L)
100000
10000
1000
100
10
1
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

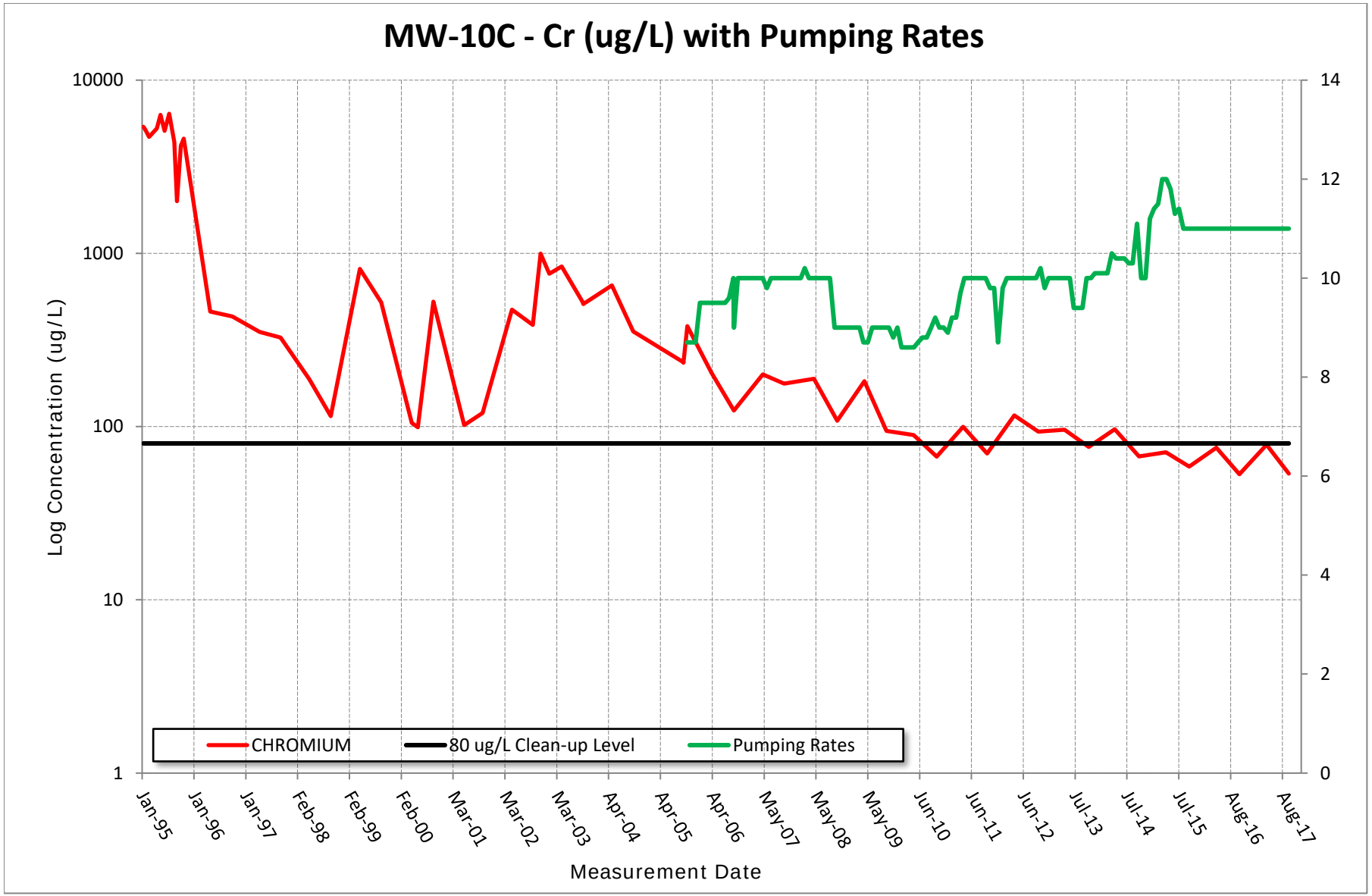

MW-4BSHED - Cr (ug/L)
10000
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17
Measurement Date

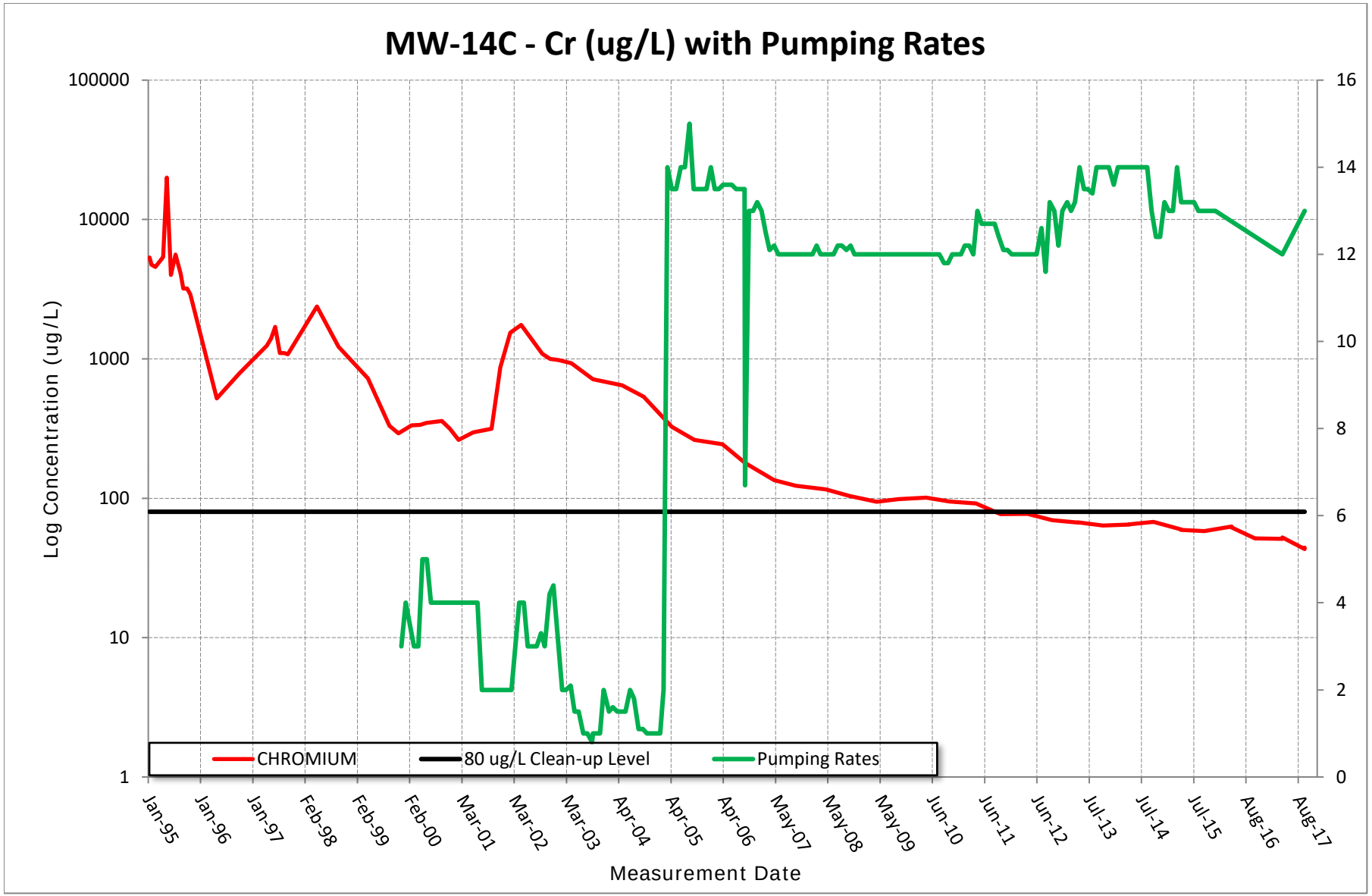

MW-4C - Cr (ug/L)
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

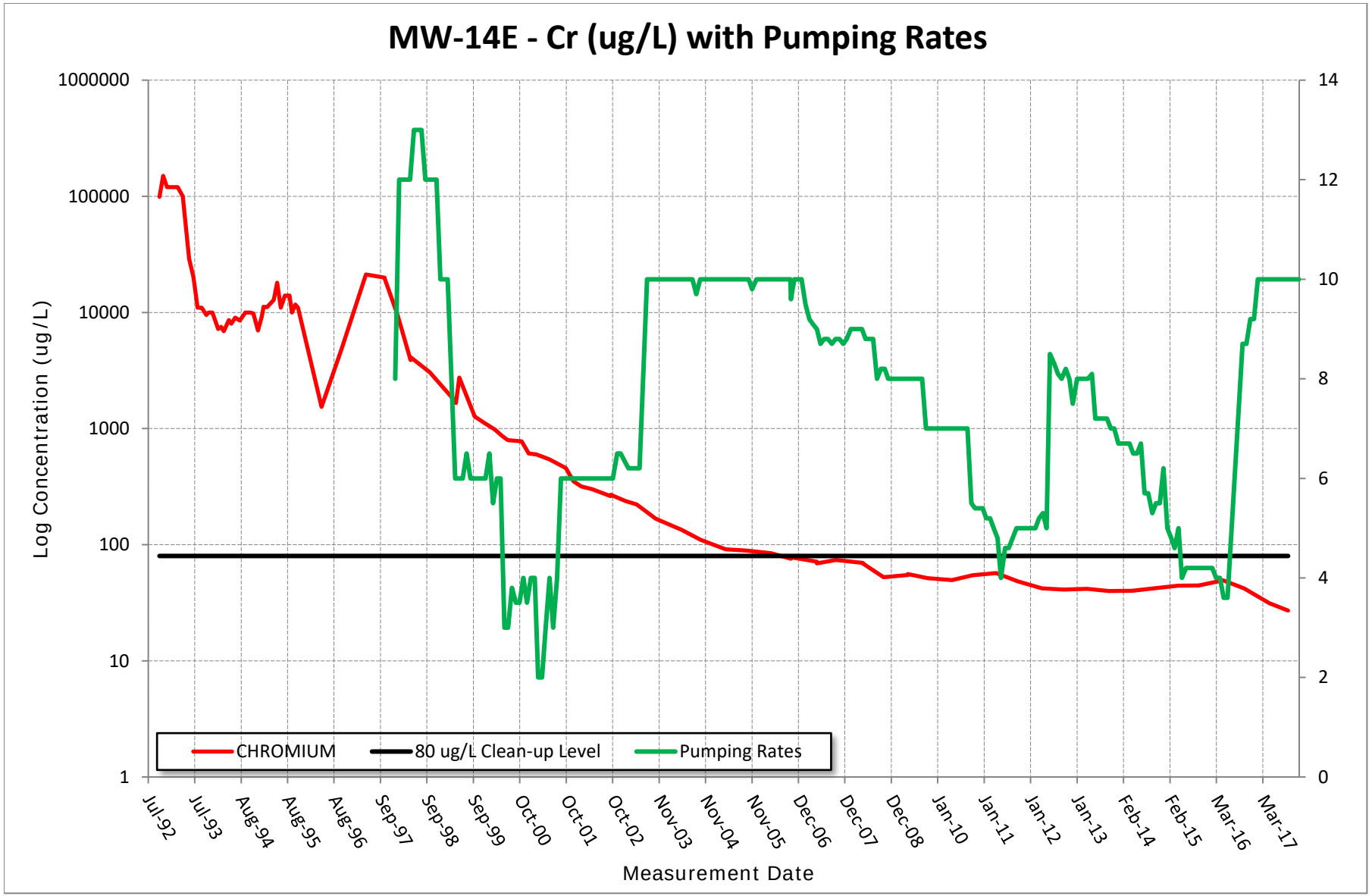

MW-6A - Cr (ug/L)
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

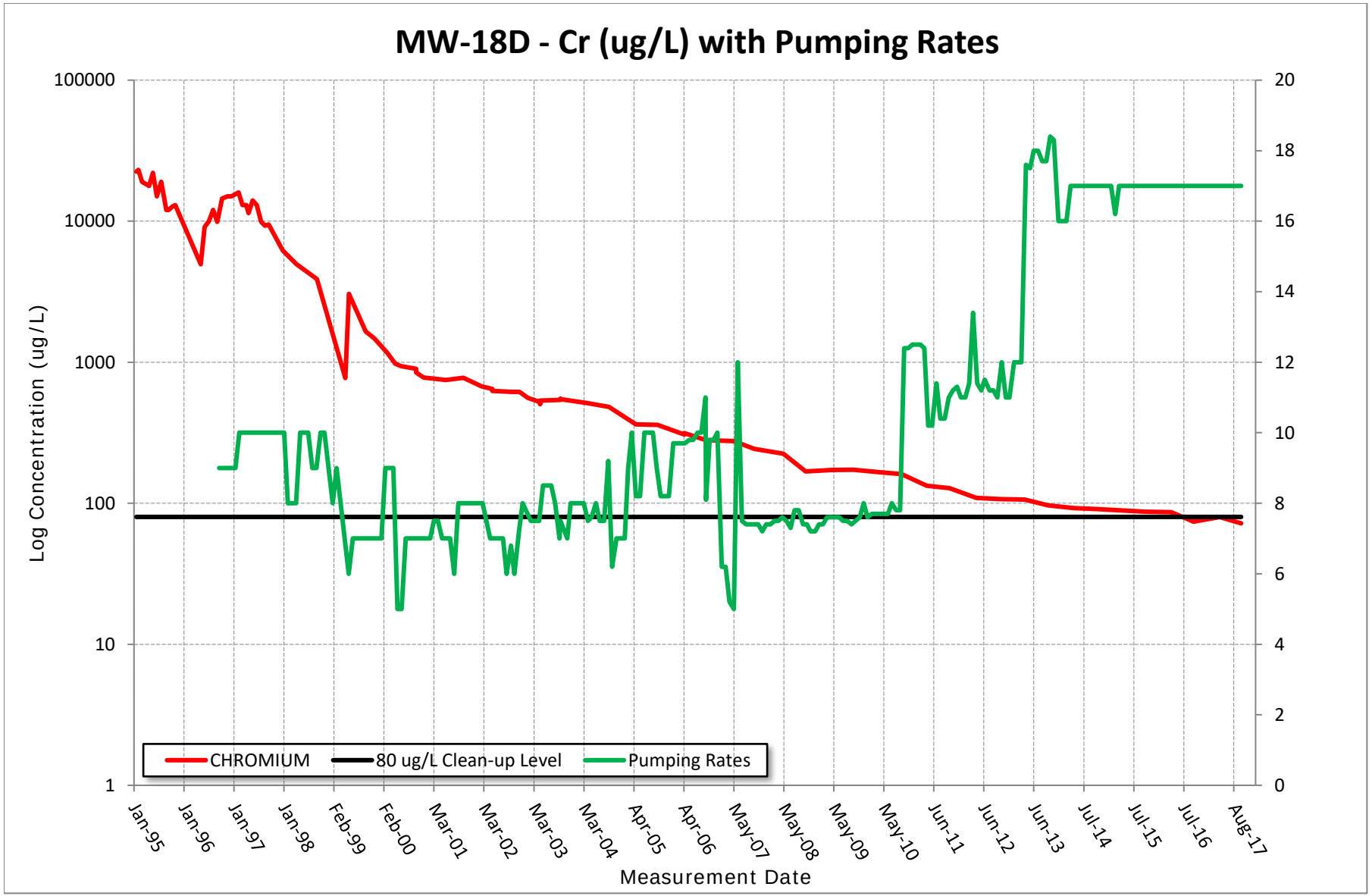

MW-6B - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rate
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

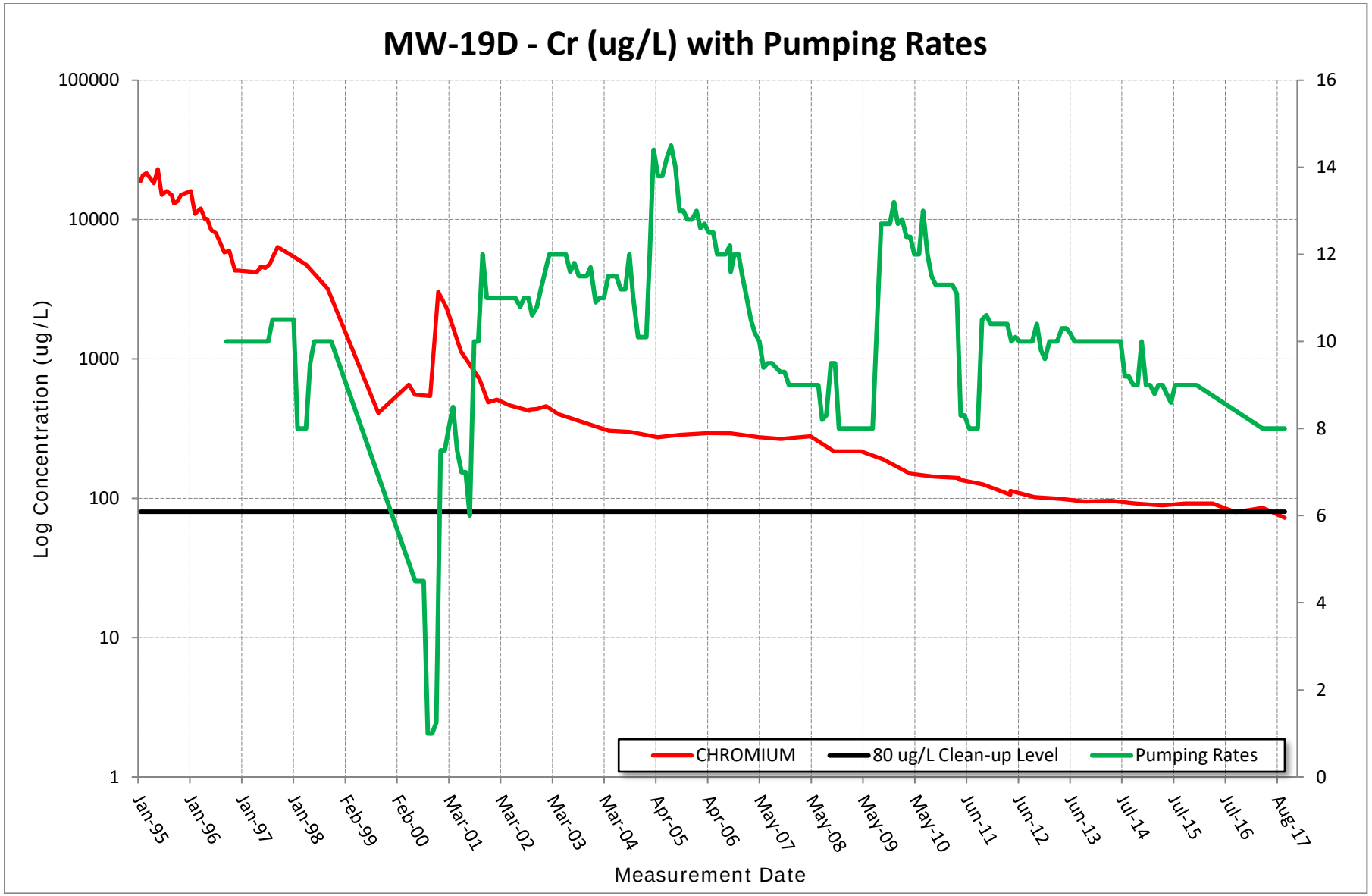

MW-10B - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

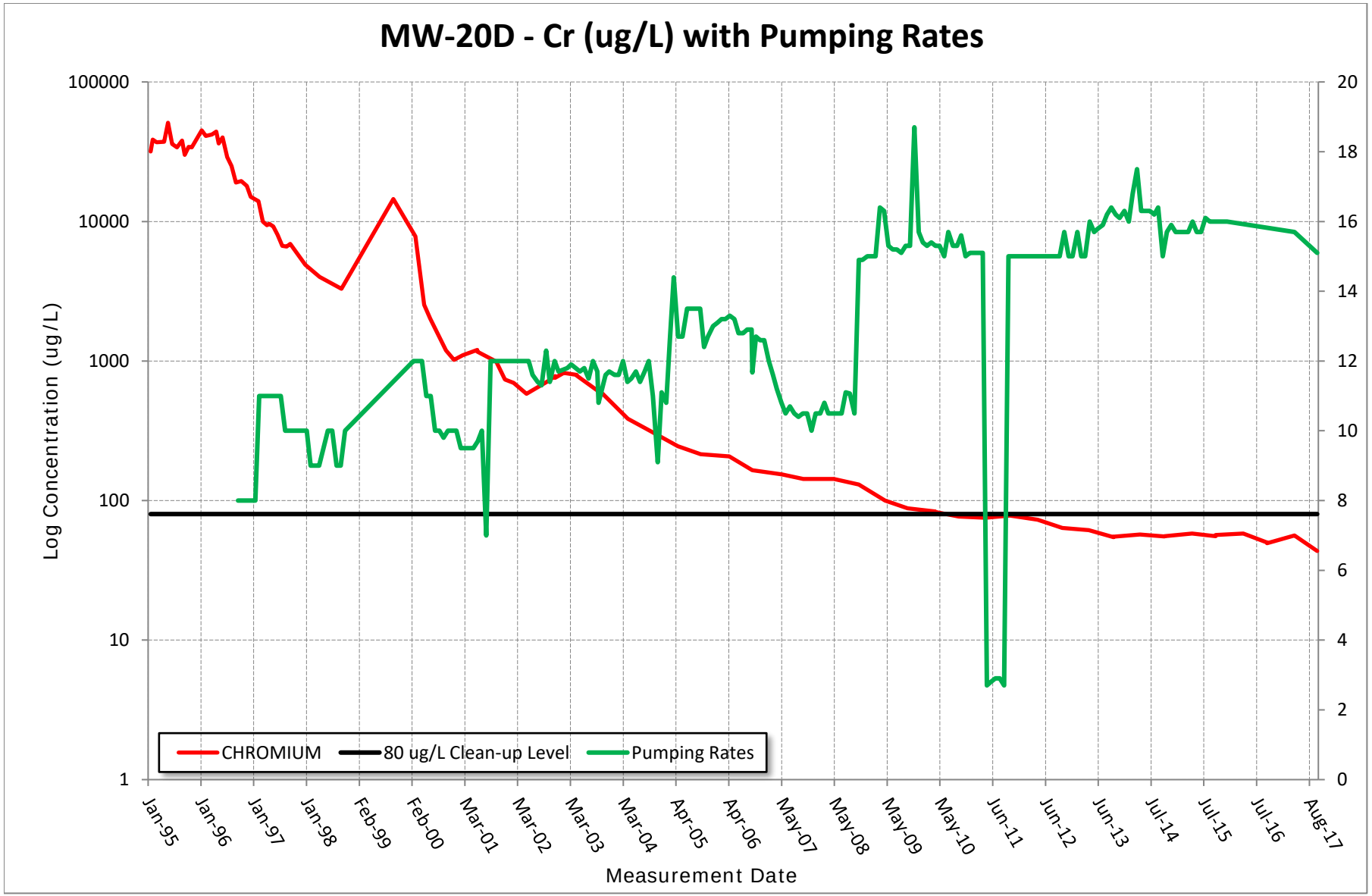

MW-10C - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
14
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

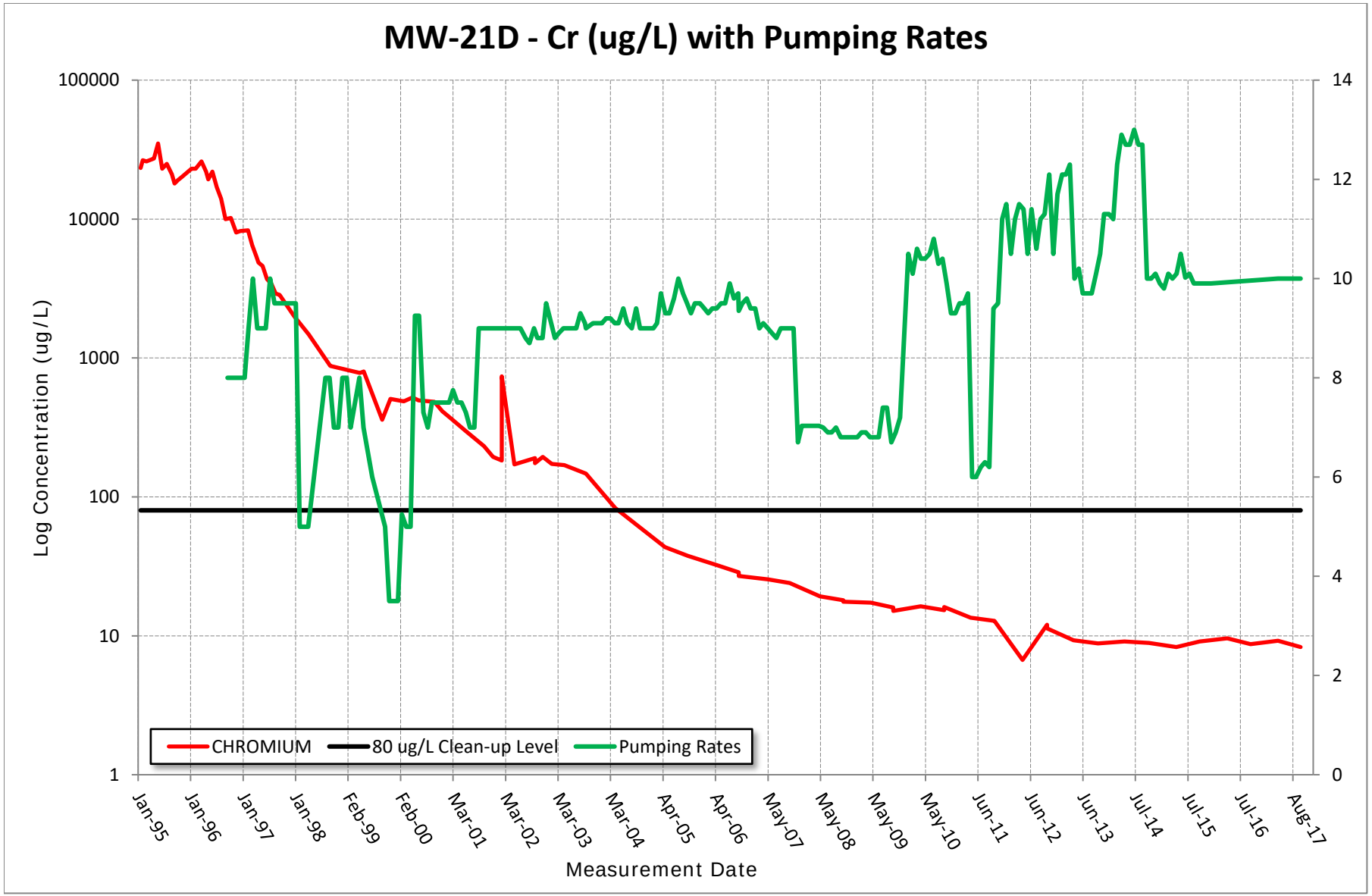

MW-14C - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
16
14
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

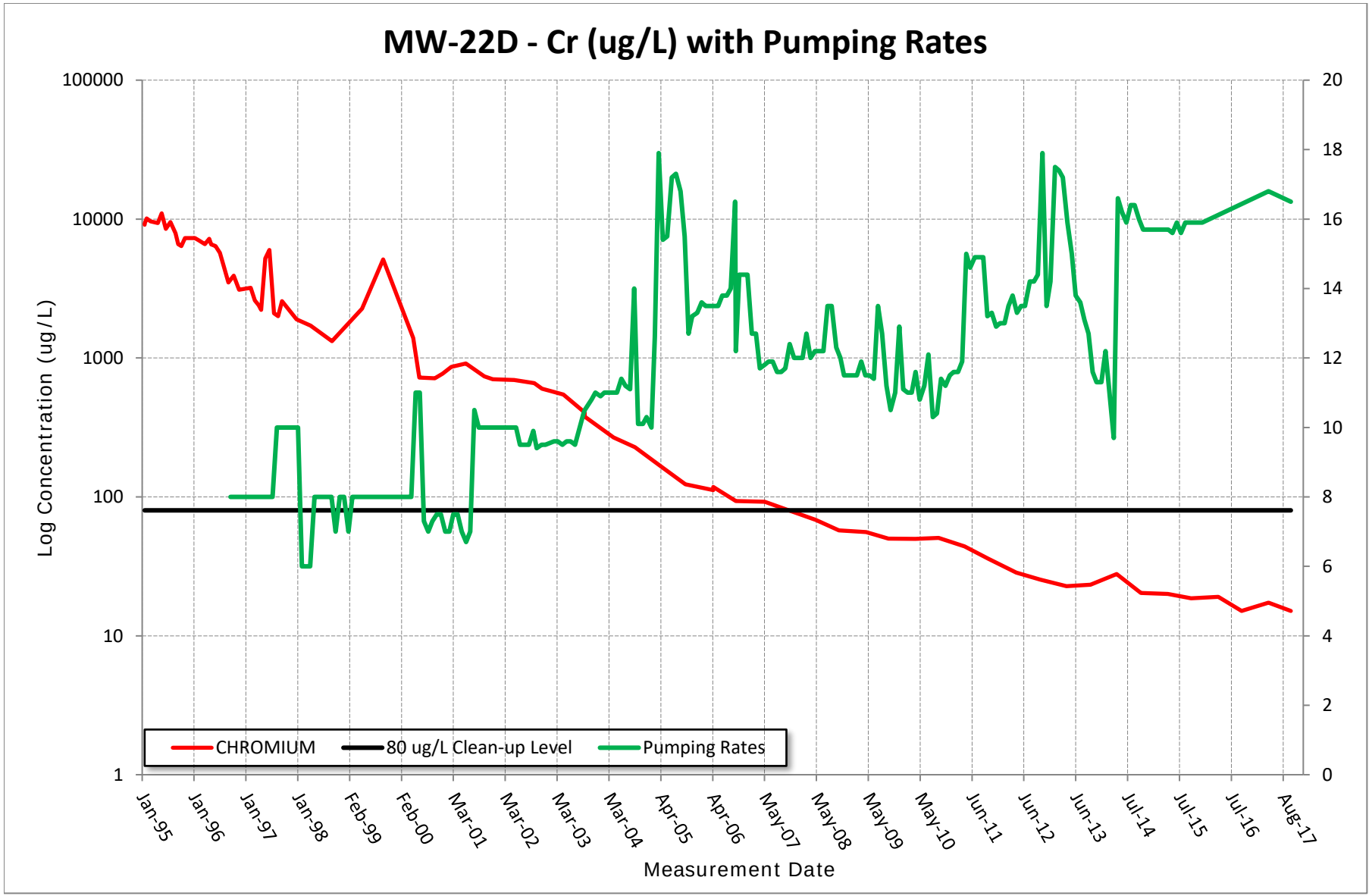

MW-14E - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
1000000
100000
10000
1000
100
10
1
14
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jul-92
Jul-93
Aug-94
Aug-95
Aug-96
Sep-97
Sep-98
Sep-99
Oct-00
Oct-01
Oct-02
Nov-03
Nov-04
Nov-05
Dec-06
Dec-07
Dec-08
Jan-10
Jan-11
Jan-12
Jan-13
Feb-14
Feb-15
Mar-16
Mar-17
Measurement Date

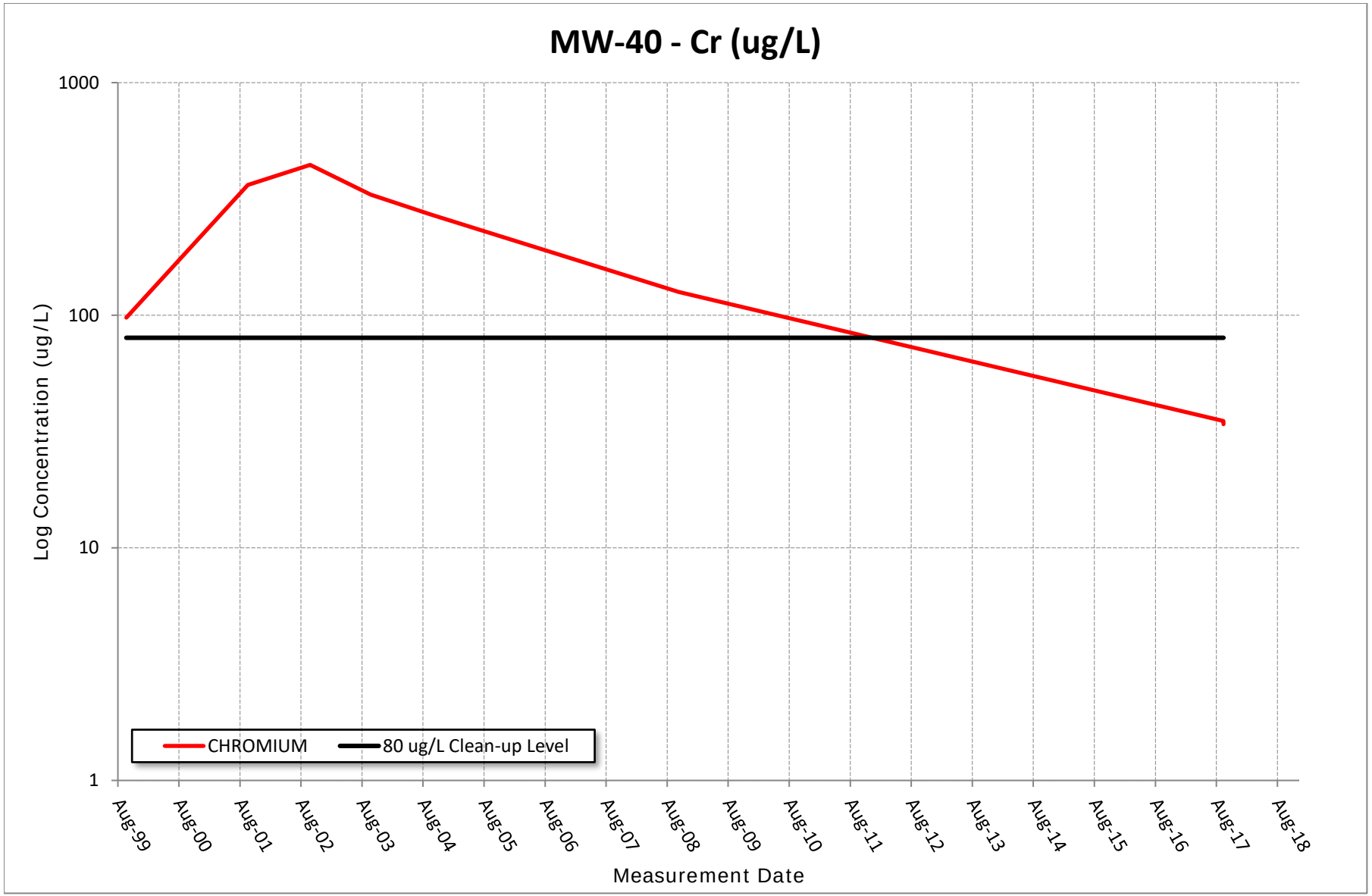

MW-18D - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
20
18
16
14
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

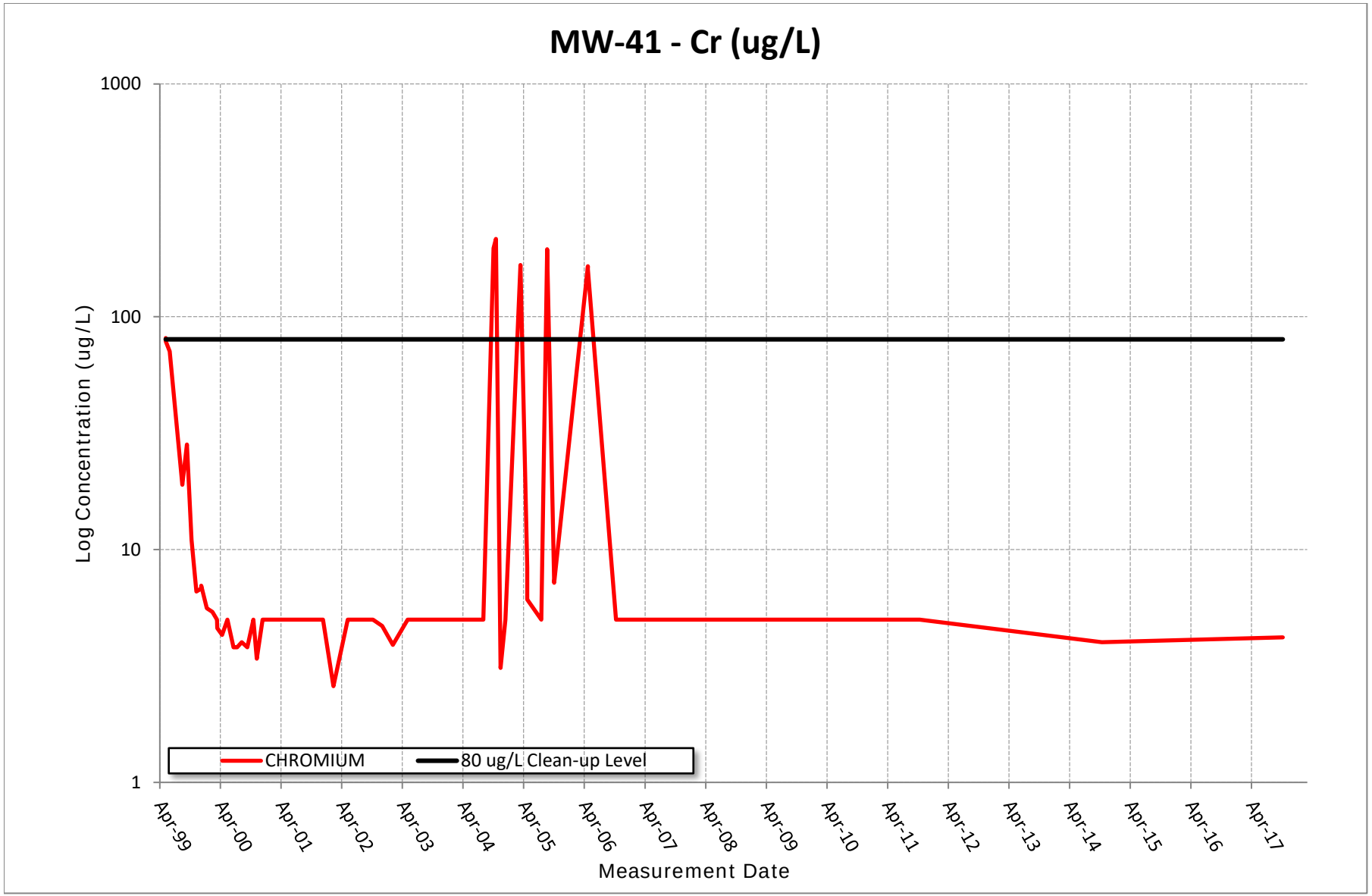

MW-19D - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
16
14
12
10
8
6
4
2
0
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates

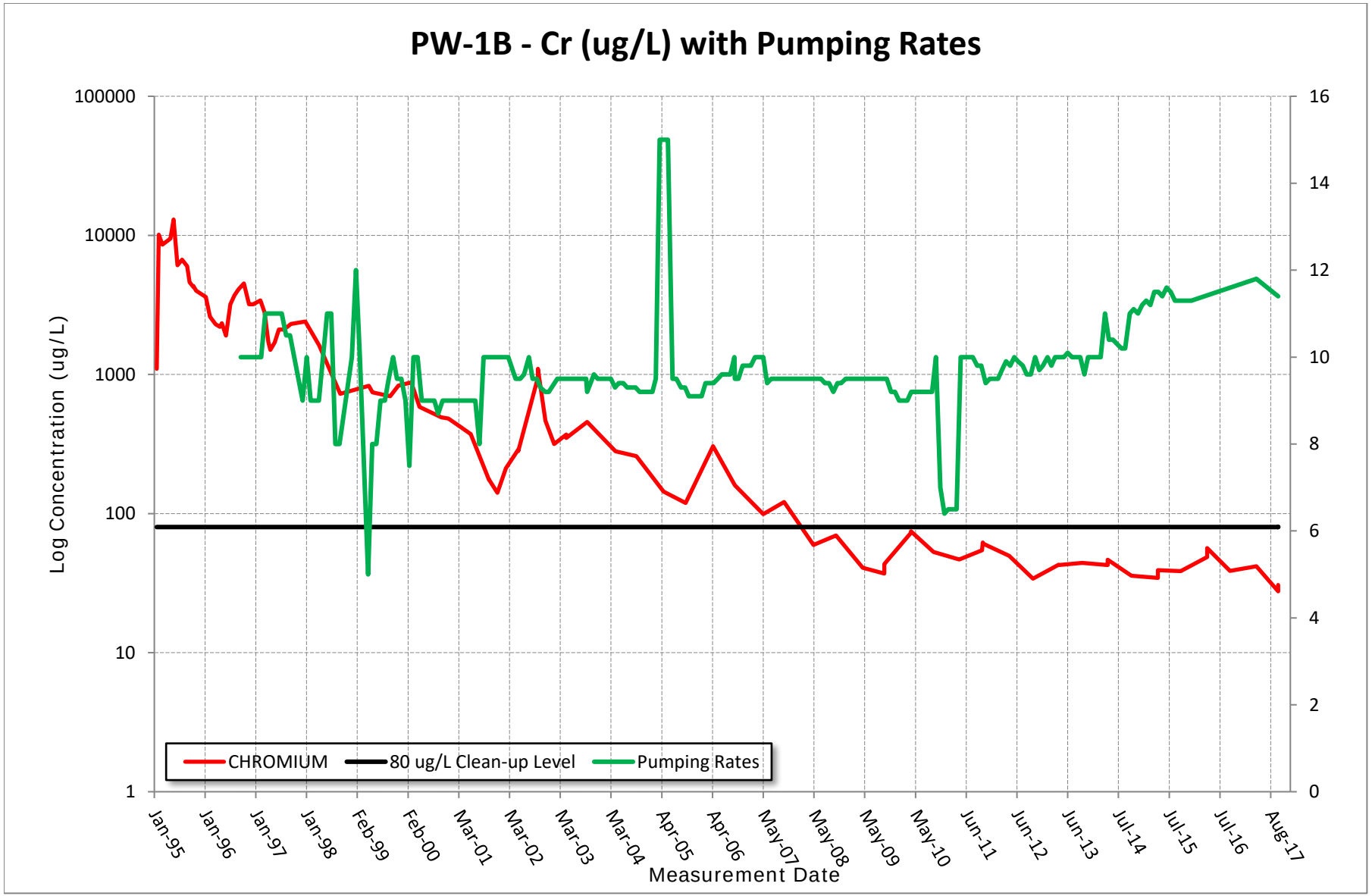

MW-20D - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
20
18
16
14
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date


MW-21D - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
14
12
10
8
6
4
2
0
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates


MW-22D - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
20
18
16
14
12
10
8
6
4
2
0
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date


MW-40 - Cr (ug/L)
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Aug-99
Aug-00
Aug-01
Aug-02
Aug-03
Aug-04
Aug-05
Aug-06
Aug-07
Aug-08
Aug-09
Aug-10
Aug-11
Aug-12
Aug-13
Aug-14
Aug-15
Aug-16
Aug-17
Aug-18
Measurement Date


MW-41 - Cr (ug/L)
1000
100
10
1
Log Concentration (ug/L)
CHROMIUM
80 ug/L Clean-up Level
Apr-99
Apr-00
Apr-01
Apr-02
Apr-03
Apr-04
Apr-05
Apr-06
Apr-07
Apr-08
Apr-09
Apr-10
Apr-11
Apr-12
Apr-13
Apr-14
Apr-15
Apr-16
Apr-17
Measurement Date


PW-1B - Cr (ug/L) with Pumping Rates
Log Concentration (ug/L)
100000
10000
1000
100
10
1
16
14
12
10
8
6
4
2
0
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date
CHROMIUM
80 ug/L Clean-up Level
Pumping Rates

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APPENDIX B

TCE CONCENTRATIONS IN GROUNDWATER

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APPENDIX B-1

TCE CONCENTRATIONS – SUMMARY TABLE

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B-1. TCE Concentrations Summary

Well Group	Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017*
Upgradient	AMW-6A	0.42 J (Fall 2012)	0.24 J (Fall 2014)	0.23 J (Fall 2016)	0.26 J
	AMW-7A	0.24 J (Fall 2012)	0.21 J (Fall 2014)	0.21 J (Fall 2016)	0.1 J
	AMW-8A	0.4 J (Fall 2013)	0.46 J (Fall 2014)	0.37 J (Fall 2016)	0.22 J
	AMW-10A	0.32 J (Fall 2012)	0.14 J (Fall 2014)	0.5 U (Fall 2016)	0.12 J
	AMW-11A	0.41 J (Fall 2012)	0.27 J (Fall 2014)	0.25 J (Fall 2016)	0.17 J
TCE Source (OU-2)	AMW-1A	0.50 U	0.44 J	**5.2**	**39**
	AMW-2A	**80**	**120**	**170**	**86**
	AMW-3A	0.44 J (Fall 2013)	0.34 J (Fall 2014)	0.53 (Fall 2015)	0.71
	AMW-4A	0.5 U (Fall 2004)	0.16 J (Fall 2008)	0.23 J (Fall 2009)	0.11 J
	AMW-12A	**18**	**19**	**23**	**22**
	AMW-19A	1.1 (Fall 2013)	1.2 (Fall 2014)	1.4 (Fall 2015)	1.3
	AMW-26	0.24 J (Fall 2010)	0.52 (Fall 2012)	0.7 (Fall 2014)	4.3
	AMW-53A	0.26 J	1.1	0.66	**5.4**
	AMW-54A	1.8 (Fall 2013)	2.9 (Fall 2014)	3 (Fall 2015)	2.1
	AMW-56A	2.4 (Fall 2013)	1.7 (Fall 2014)	1.7 (Fall 2015)	3.7
	MW-1A	2.2	**51**	**24**	**110**
Proximal	MW-2B	**5.9** (Fall 2003)	**6.5** (Fall 2004)	2.4 (Fall 2009)	2
	MW-3C	**6.8** (Fall 2002)	**5.6** (Fall 2003)	3.8 (Fall 2004)	1.8
	MW-4A	4.7 (Spring 2004)	3.5 (Fall 2004)	**5.5** (Fall 2009)	2.1
	MW-4BSHED	**7.2** (Fall 2003)	**5.2** (Fall 2004)	4.1 (Fall 2009)	2.1
	MW-4C	**10** (Spring 2004)	**11** (Fall 2004)	3.8 (Fall 2009)	2
	MW-6A	1.5 (Fall 1995)	0.3 U (Fall 1997)	0.5 U (Fall 2009)	0.5 U
	MW-6B	3.3	3.6	3.3	2.5
	MW-6C	**16** (Fall 2003)	**9.7** (Fall 2004)	0.54 (Fall 2009)	0.19 UJ
	MW-6D	**17** (Fall 1999)	**6.7** (Fall 2004)	4.3 (Fall 2009)	1.5 UJ
	MW-7B	**110** (Fall 2004)	**7.3** (Fall 2009)	3.6 (Fall 2014)	**6.1**

B-1. TCE Concentrations Summary

Well Group	Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017*
Proximal Cont.	MW-8B	3.3 (Fall 2010)	2.4 (Fall 2012)	1.8 (Fall 2014)	1.8
	MW-9B	3.7 (Fall 2012)	2.8 (Fall 2014)	2.4 (Fall 2016)	2
	MW-9C	**37** (Fall 1998)	**10** (Fall 2004)	3.8 (Fall 2009)	**5.8**
	MW-10B	**10**	**10**	**9.6**	**7**
	MW-10C	1.6	1.8	1.6	1.2
	MW-12C	1.4 (Fall 2012)	0.89 (Fall 2014)	0.69 (Fall 2016)	0.71
	MW-13C	**5.8** (Fall 2012)	2.4 (Fall 2014)	3.5 (Fall 2016)	2.2
	PW-1B	1.8	2.9	4.1	3.1 J
Intermediate	AMW-59	**92** (Fall 2012)	**58** (Fall 2014)	**56** (Fall 2016)	**53**
	AMW-60	0.72 (Winter 2005)	0.94 (Spring 2005)	0.5 U (Fall 2009)	0.22 J
	CPU-14	**5.5** (Spring 2015)	**5.5** (Fall 2015)	4.9 (Fall 2016)	3.9
	MW-14C	**10**	**9.2**	**8**	**6.1**
	MW-14E	**61**	**63**	**49**	**37**
	MW-15E	2.3 (Fall 2014)	2.4 (Fall 2015)	2.1 (Fall 2016)	2.5
	MW-18D	**29**	**27**	**24**	**21**
	MW-18E	**96** (Fall 2014)	**69** (Fall 2015)	**76** (Fall 2016)	**180**
	MW-19D	**22**	**23**	**22**	**20**
	MW-20D	**26**	**23**	**25**	**20**
	MW-38	**29**	**23**	**19**	**9.5**
	MW-40	4.8 (Fall 2003)	2.7 (Fall 2004)	1.2 (Fall 2008)	0.44 J
	PZ-39	**28**	**29**	**25**	**19**
Northern Plume	AMW-16	**71**	**67**	**53**	**41**
	AMW-17	**64**	**96**	**70**	**79**
	AMW-18	**40**	**40**	**43**	**28**
	AMW-64	**28**	**24**	**22**	**15**
	MW-23D	**140**	**140**	**180**	**140**

B-1. TCE Concentrations Summary

Well Group	Well	Spring 2016*	Fall 2016*	Spring 2017*	Fall 2017*
Church of God	AMW-23	0.5 U (Fall 2002)	0.5 U (Fall 2003)	0.5 U (Fall 2016)	0.1 J
	AMW-61	**5.5** (Fall 2015)	**5.9**	**7.1**	**5.1**
	CPU-12	4 (Spring 2015)	2.2 (Fall 2015)	2.5 (Fall 2016)	2.6
	MW-21D	2.5	2.4	2.2	2.4
	MW-22D	2.7	2.3	2.3	1.7
Toe of Plume	AMW-63	0.17 J (Fall 2009)	0.5 U (Fall 2010)	0.17 U (Fall 2014)	0.17 J
	MW-35	3.0	3.4	3.6	NS
	MW-41	0.5 U (Fall 2010)	0.5 U (Fall 2011)	0.5 U (Fall 2014)	0.5 U
Troutdale Aquifer	AMW-24	**10** (Fall 2014)	**9.9** (Fall 2015)	**8.3** (Fall 2016)	**7.8**
	BENNETT	1.8	1.7	1.4	1.7
	MW-33	**11** (Fall 2014)	**8.5** (Fall 2015)	**6.3** (Fall 2016)	**5.1**

NOTES:
Only wells sampled for TCE during the 2017 reporting year are included in this table.
Active extraction wells shown are in **bold**.
Results are in micrograms per liter (µg/L).
Results shown in **blue bold** exceed the cleanup level of 5 µg/L.
* = Unless otherwise noted.
J = The result is an estimated concentration that is less than the method reporting limit but greater than or equal to the method detection limit.
NS = Not Sampled.
TCE = Trichloroethene.
U = Analyte not detected above the specified reporting limit.

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APPENDIX B-2

TCE CONCENTRATIONS –
BY WELL GROUPING

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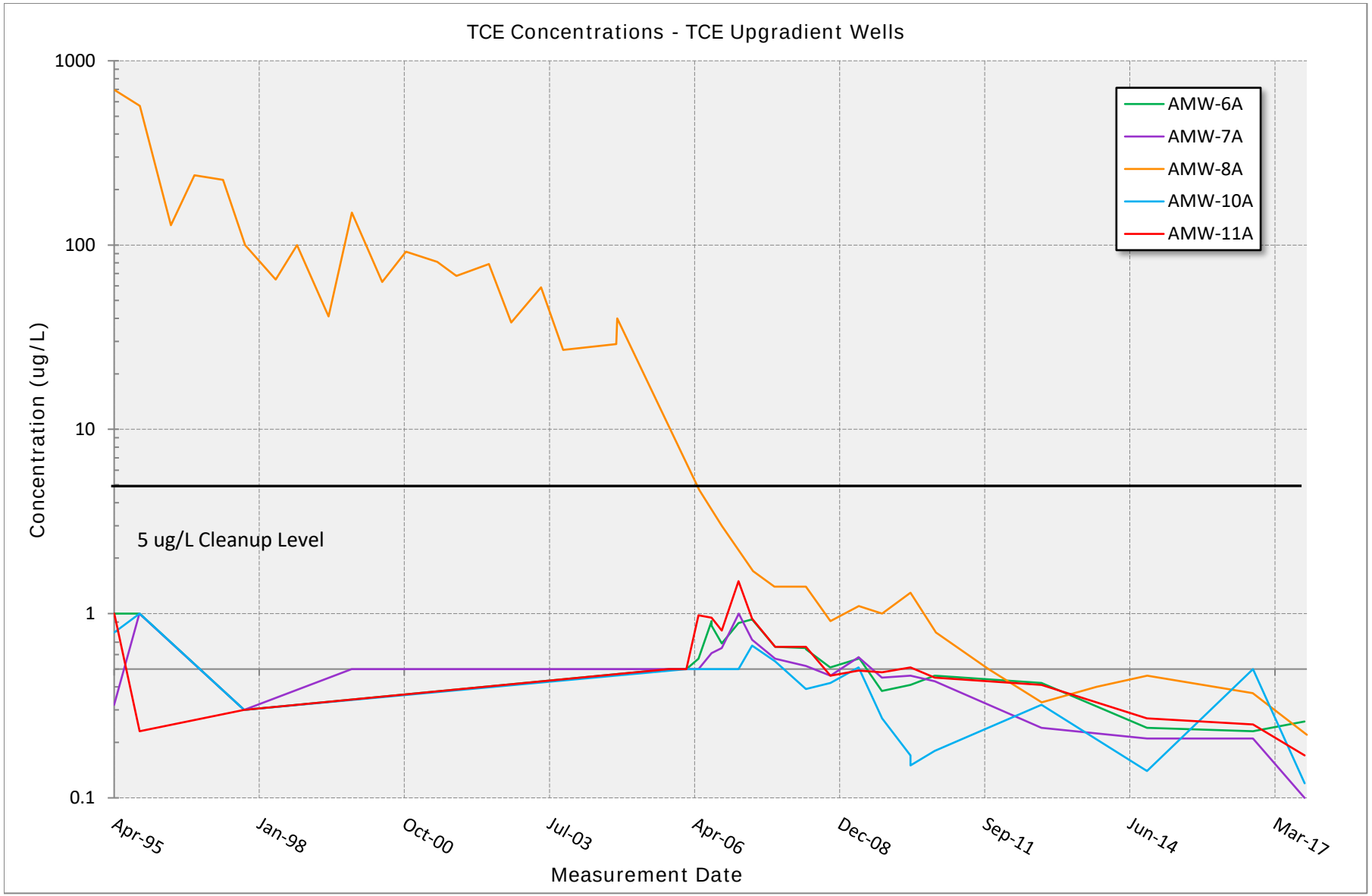
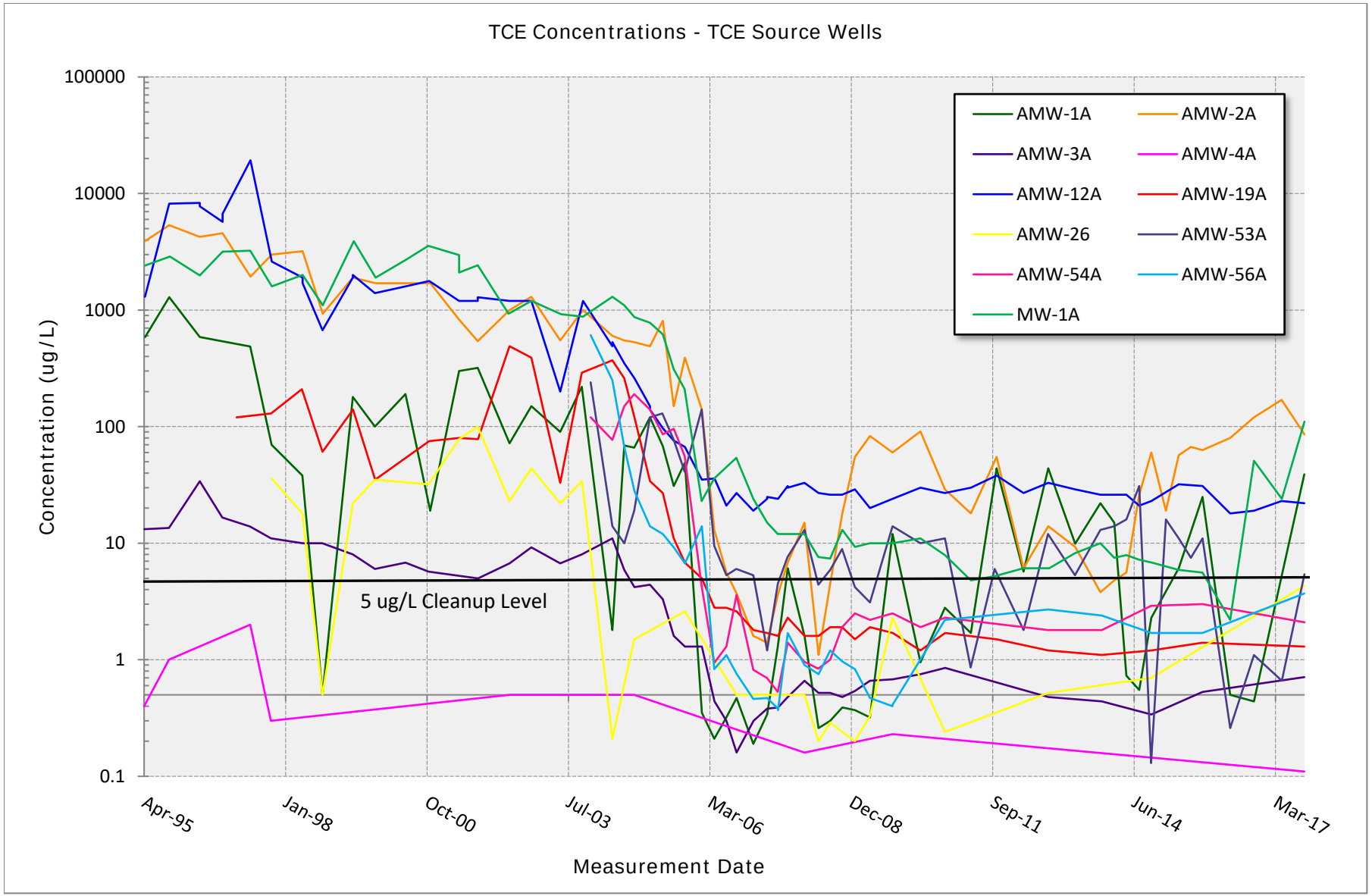
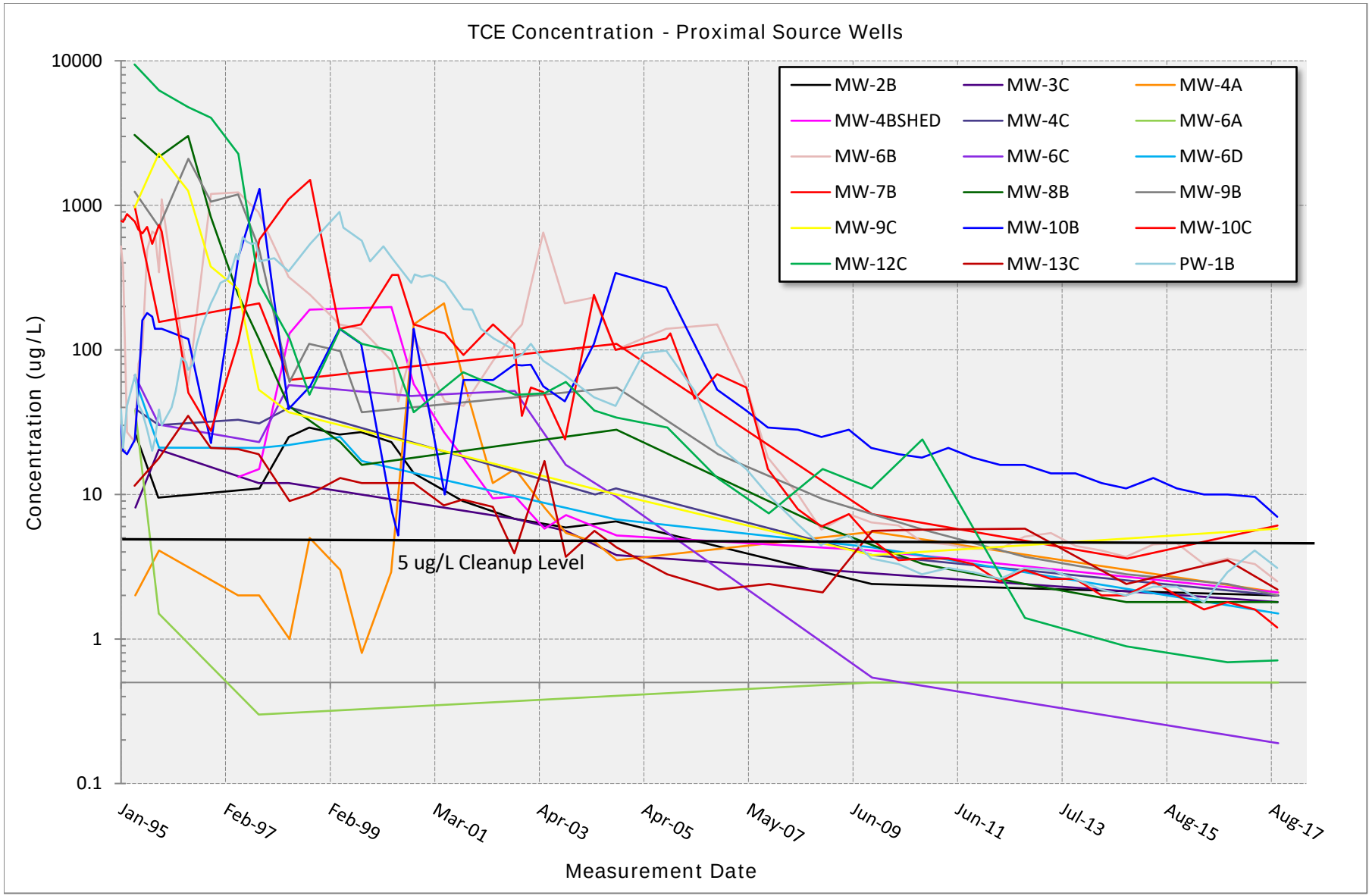
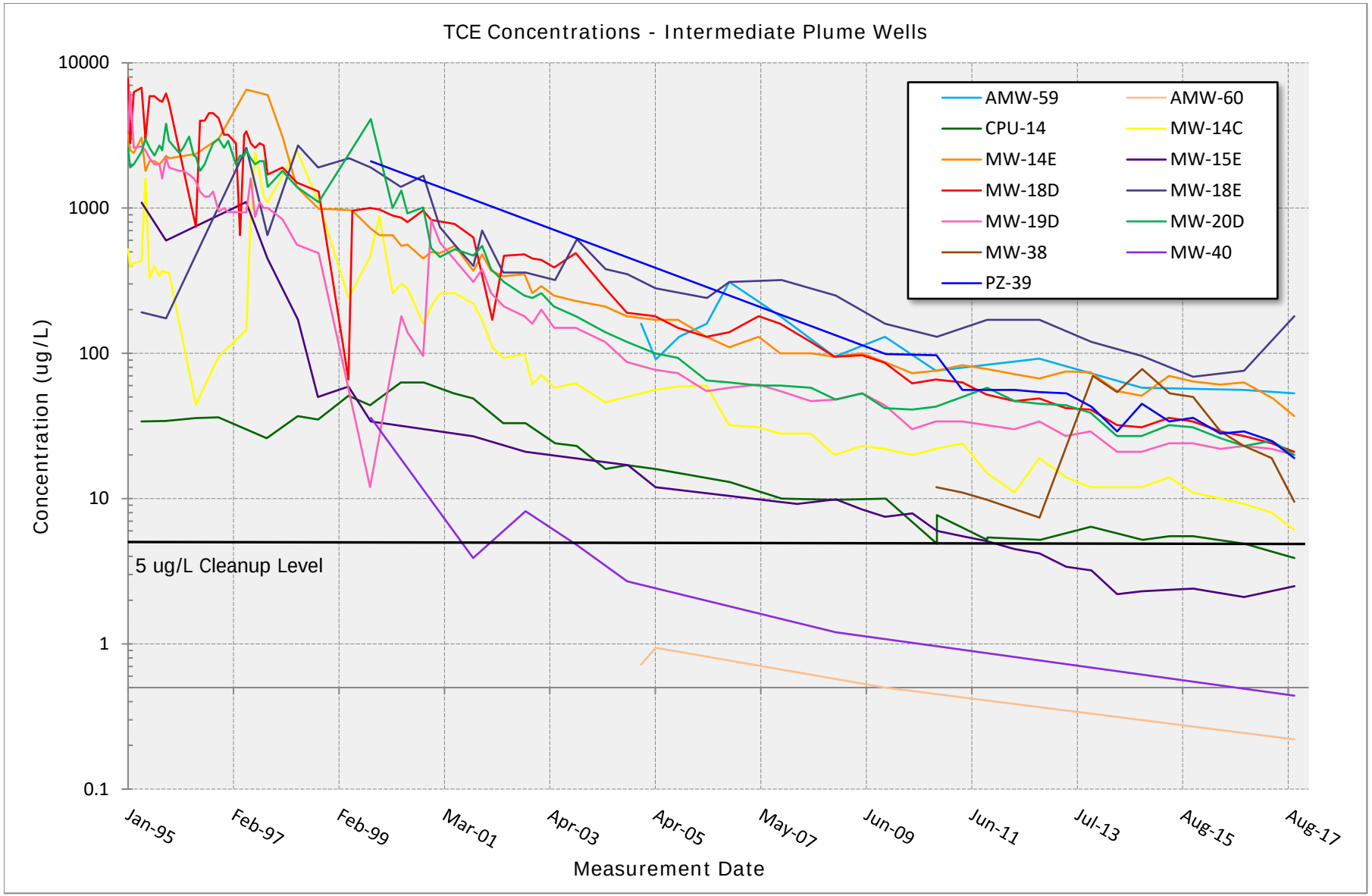
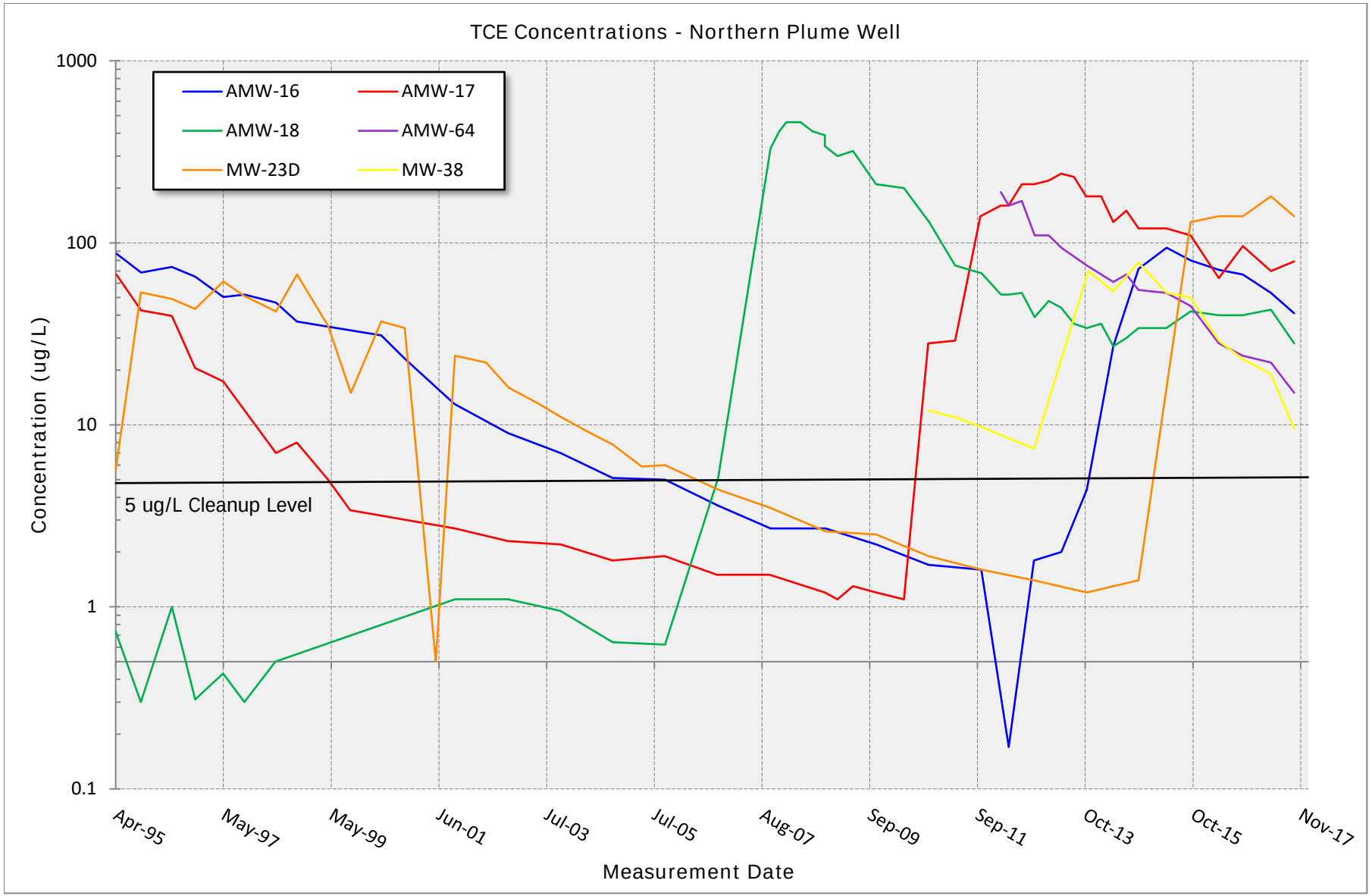
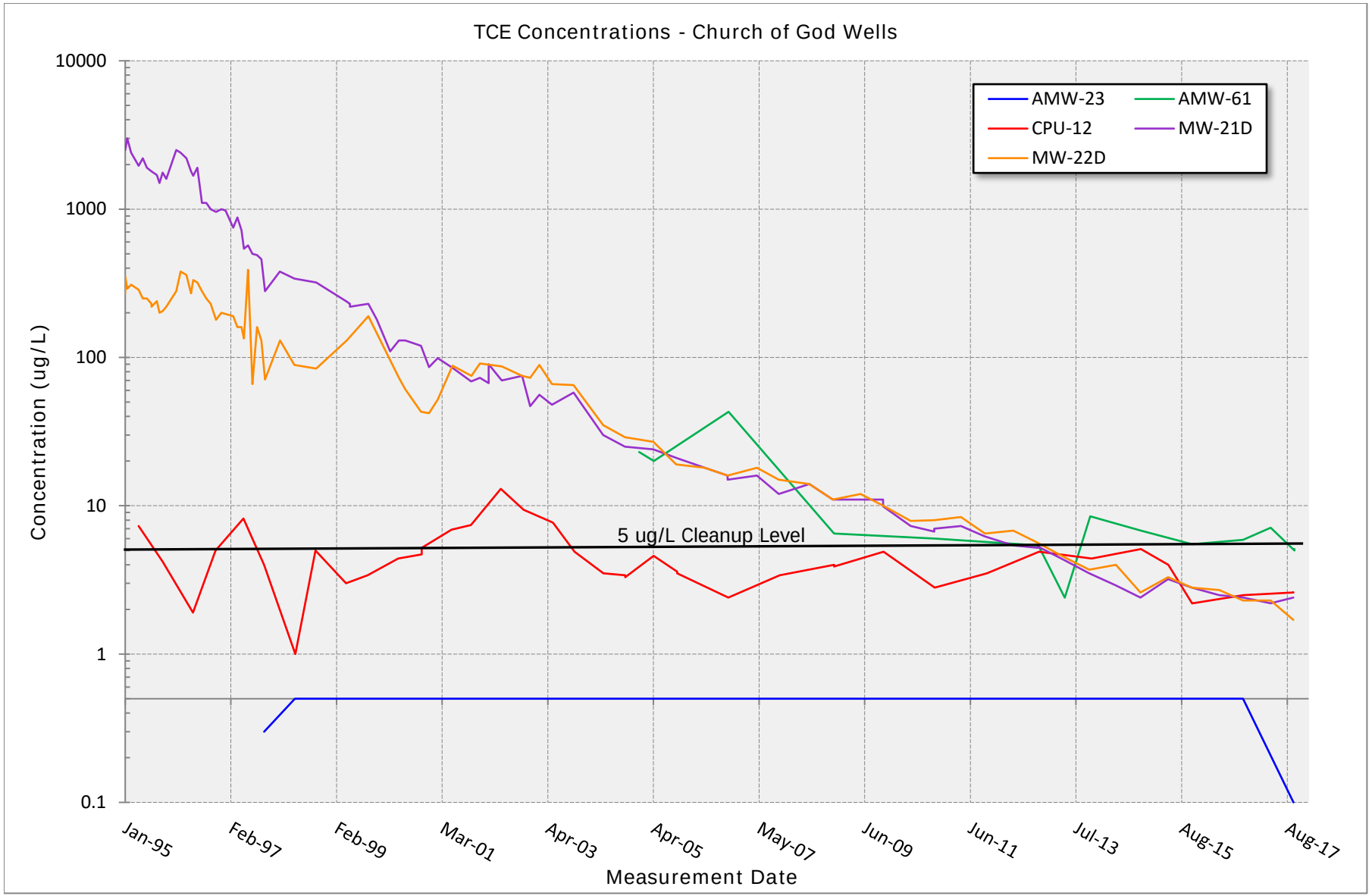

TCE Concentrations - TCE Upgradient Wells
1000
100
10
1
0.1
Concentration (ug/L)
5 ug/L Cleanup Level
AMW-6A
AMW-7A
AMW-8A
AMW-10A
AMW-11A
Apr-95
Jan-98
Oct-00
Jul-03
Apr-06
Dec-08
Sep-11
Jun-14
Mar-17
Measurement Date

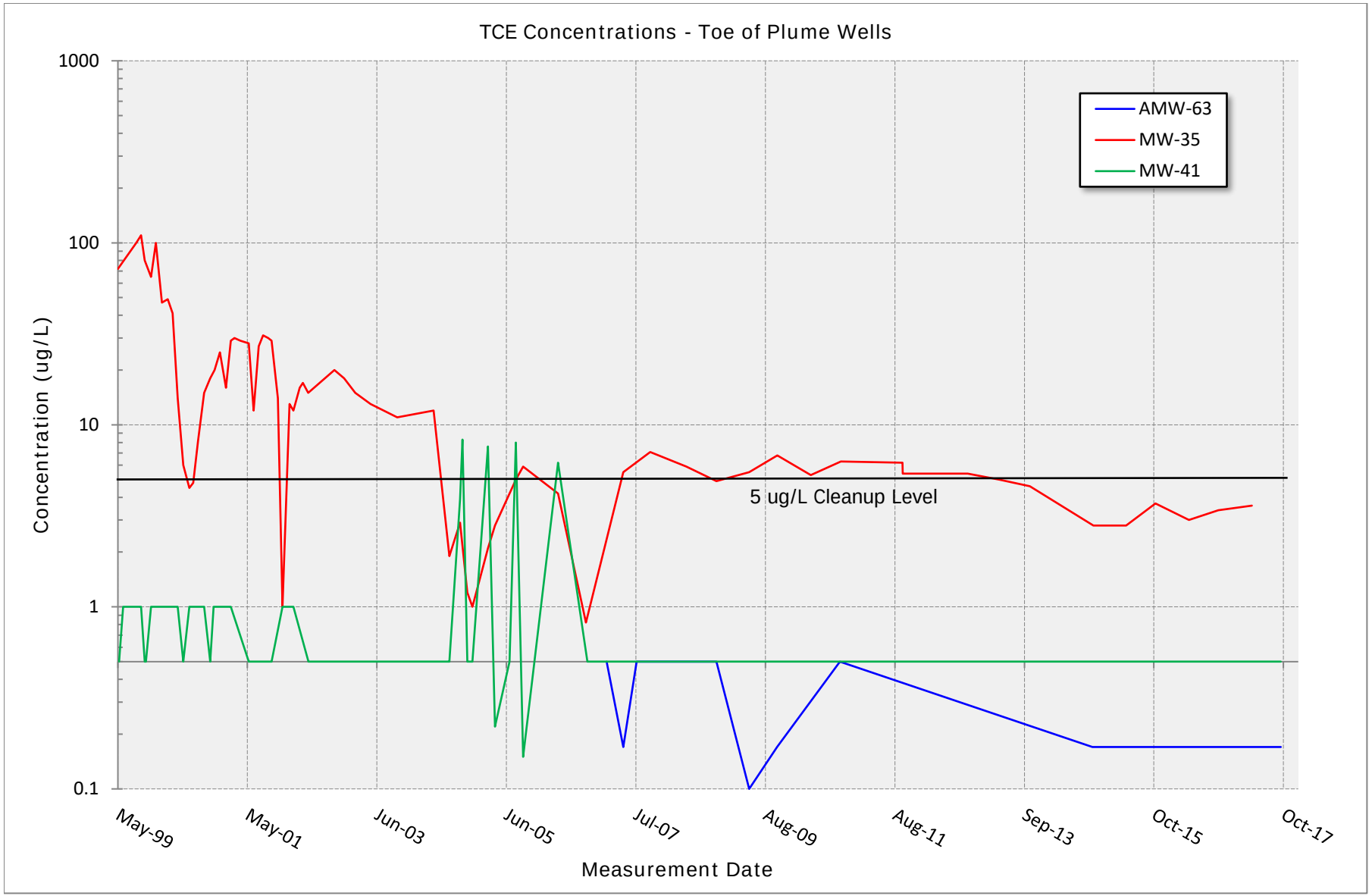

TCE Concentrations - TCE Source Wells
Concentration (ug/L)
100000
10000
1000
100
10
1
0.1
5 ug/L Cleanup Level
Apr-95
Jan-98
Oct-00
Jul-03
Mar-06
Dec-08
Sep-11
Jun-14
Mar-17
Measurement Date
AMW-1A
AMW-2A
AMW-3A
AMW-4A
AMW-12A
AMW-19A
AMW-26
AMW-53A
AMW-54A
AMW-56A
MW-1A

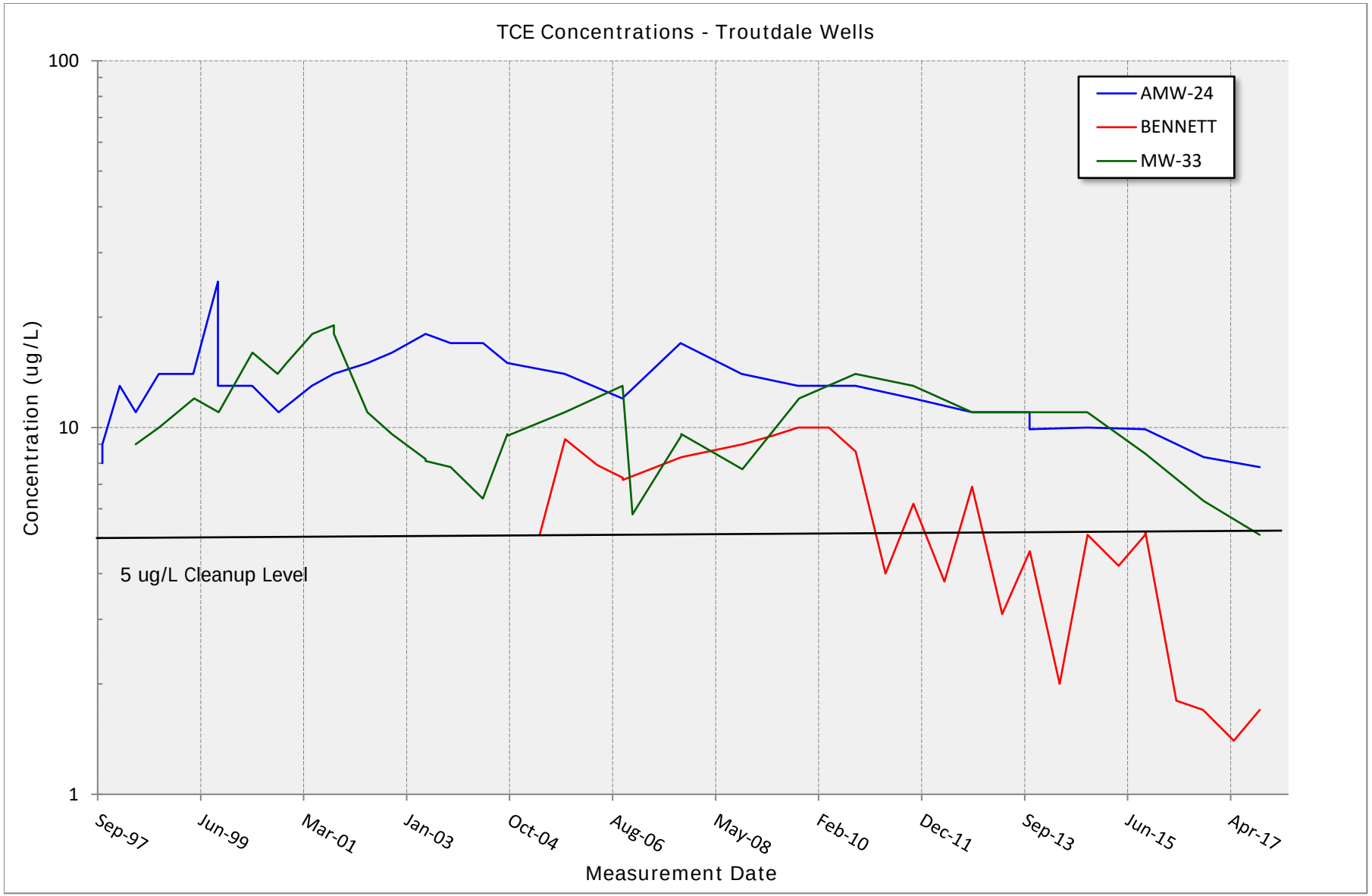

TCE Concentration - Proximal Source Wells
Concentration (ug/L)
10000
1000
100
10
1
0.1
5 ug/L Cleanup Level
Jan-95
Feb-97
Feb-99
Mar-01
Apr-03
Apr-05
May-07
Jun-09
Jun-11
Jul-13
Aug-15
Aug-17
Measurement Date
MW-2B
MW-3C
MW-4A
MW-4BSHED
MW-4C
MW-6A
MW-6B
MW-6C
MW-6D
MW-7B
MW-8B
MW-9B
MW-9C
MW-10B
MW-10C
MW-12C
MW-13C
PW-1B


TCE Concentrations - Intermediate Plume Wells
Concentration (ug/L)
10000
1000
100
10
1
0.1
5 ug/L Cleanup Level
Jan-95
Feb-97
Feb-99
Mar-01
Apr-03
Apr-05
May-07
Jun-09
Jun-11
Jul-13
Aug-15
Aug-17
Measurement Date
AMW-59
AMW-60
CPU-14
MW-14C
MW-14E
MW-15E
MW-18D
MW-18E
MW-19D
MW-20D
MW-38
MW-40
PZ-39


TCE Concentrations - Northern Plume Well
AMW-16
AMW-17
AMW-18
AMW-64
MW-23D
MW-38
1000
100
10
1
0.1
Concentration (ug/L)
5 ug/L Cleanup Level
Apr-95
May-97
May-99
Jun-01
Jul-03
Jul-05
Aug-07
Sep-09
Sep-11
Oct-13
Oct-15
Nov-17
Measurement Date


TCE Concentrations - Church of God Wells
AMW-23
AMW-61
CPU-12
MW-21D
MW-22D
5 ug/L Cleanup Level
Concentration (ug/L)
10000
1000
100
10
1
0.1
Jan-95
Feb-97
Feb-99
Mar-01
Apr-03
Apr-05
May-07
Jun-09
Jun-11
Jul-13
Aug-15
Aug-17
Measurement Date


TCE Concentrations - Toe of Plume Wells
1000
100
10
1
0.1
Concentration (ug/L)
AMW-63
MW-35
MW-41
5 ug/L Cleanup Level
May-99
May-01
Jun-03
Jun-05
Jul-07
Aug-09
Aug-11
Sep-13
Oct-15
Oct-17
Measurement Date


TCE Concentrations - Troutdale Wells
100
10
1
Concentration (ug/L)
AMW-24
BENNETT
MW-33
5 ug/L Cleanup Level
Sep-97
Jun-99
Mar-01
Jan-03
Oct-04
Aug-06
May-08
Feb-10
Dec-11
Sep-13
Jun-15
Apr-17
Measurement Date

APPENDIX B-3

TCE CONCENTRATIONS – INDIVIDUAL WELLS

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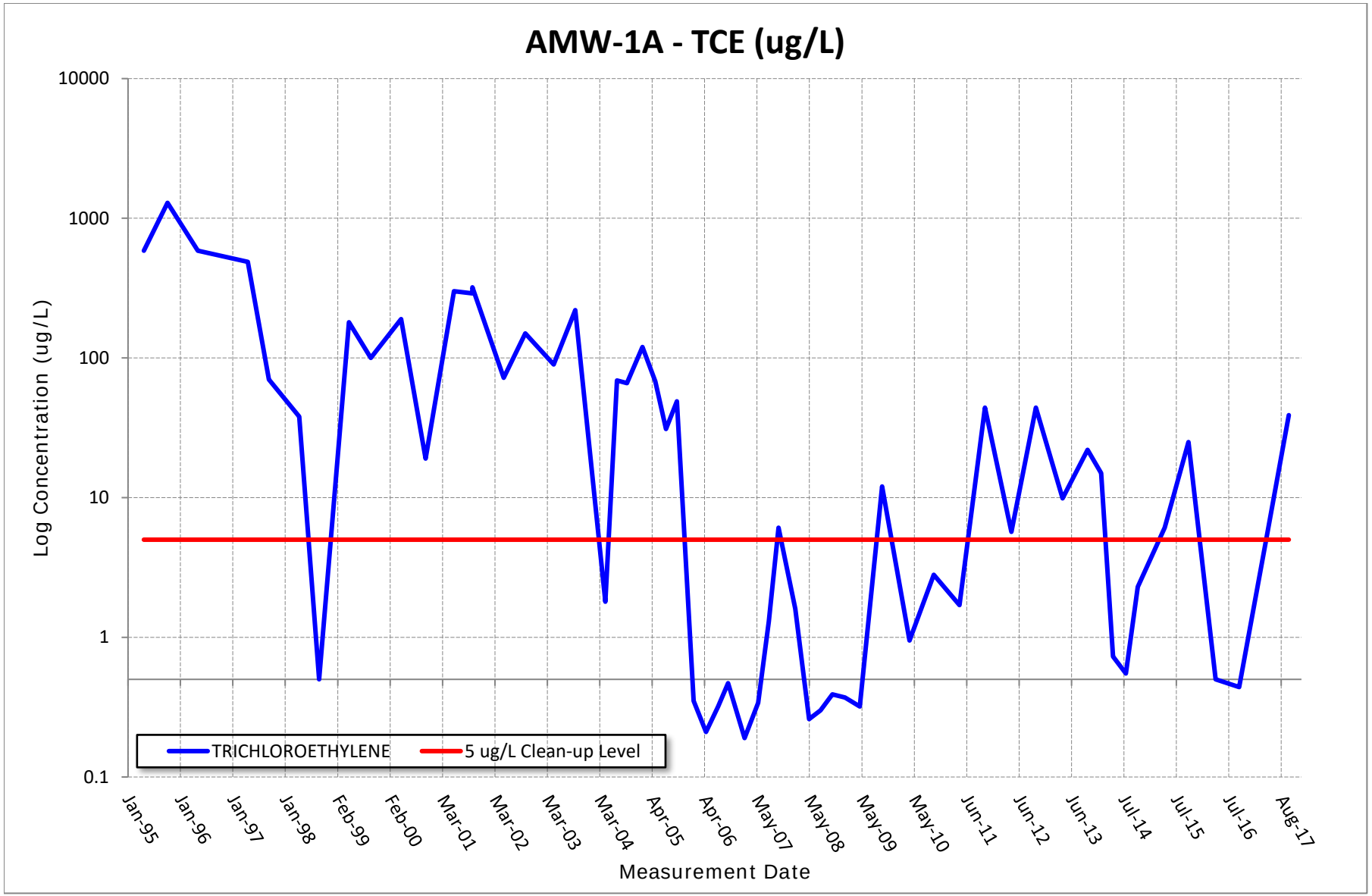
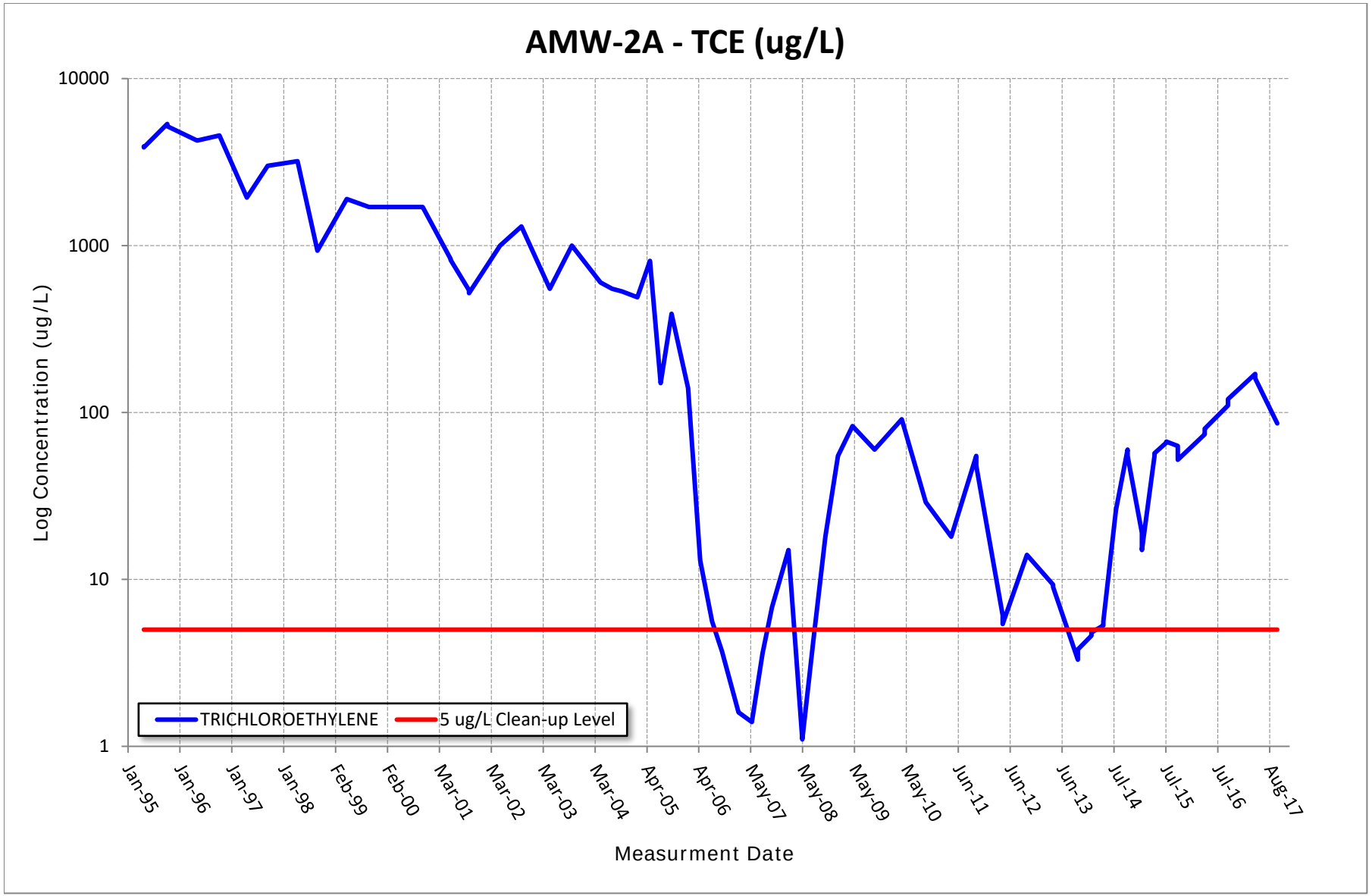
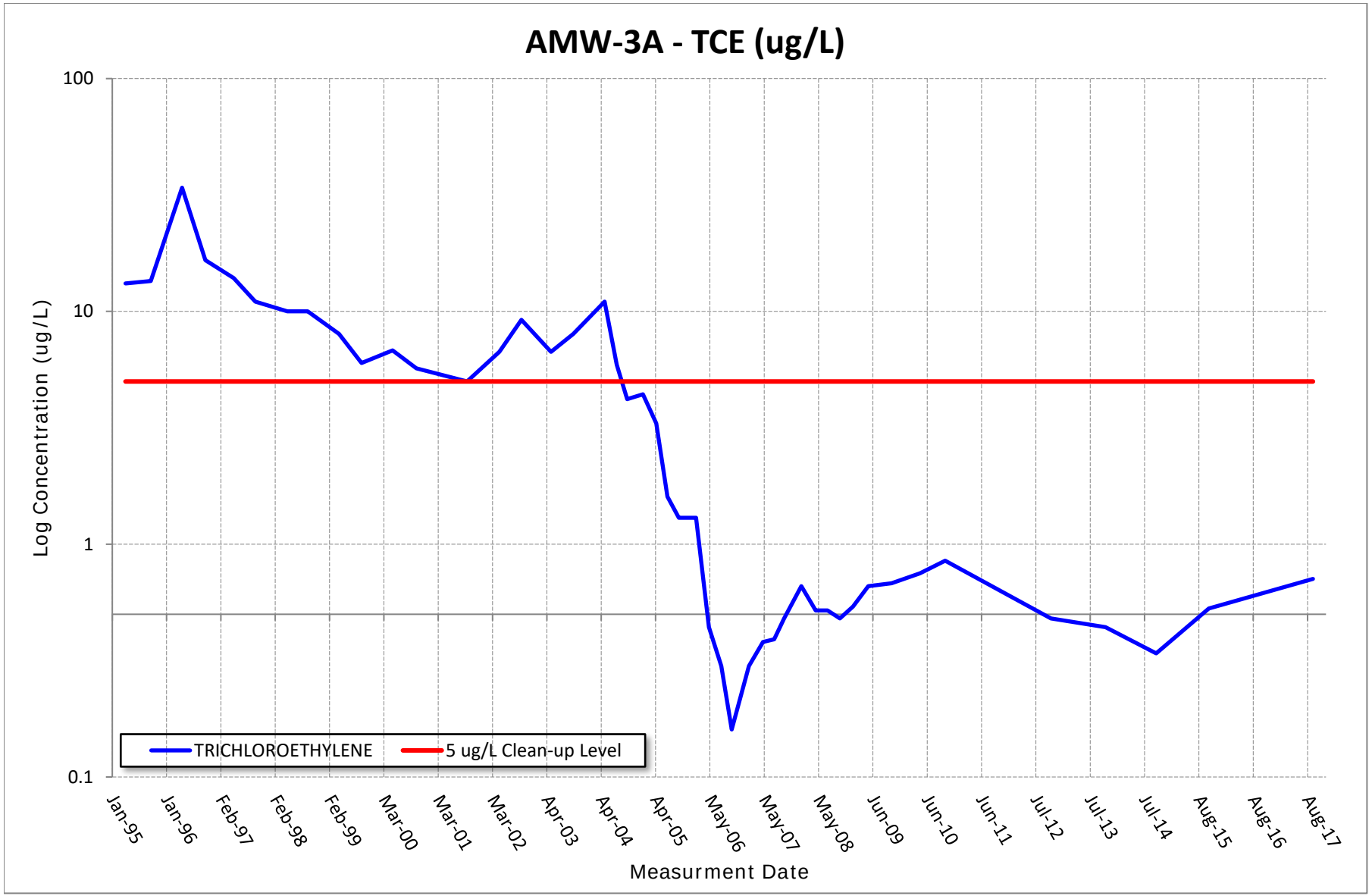
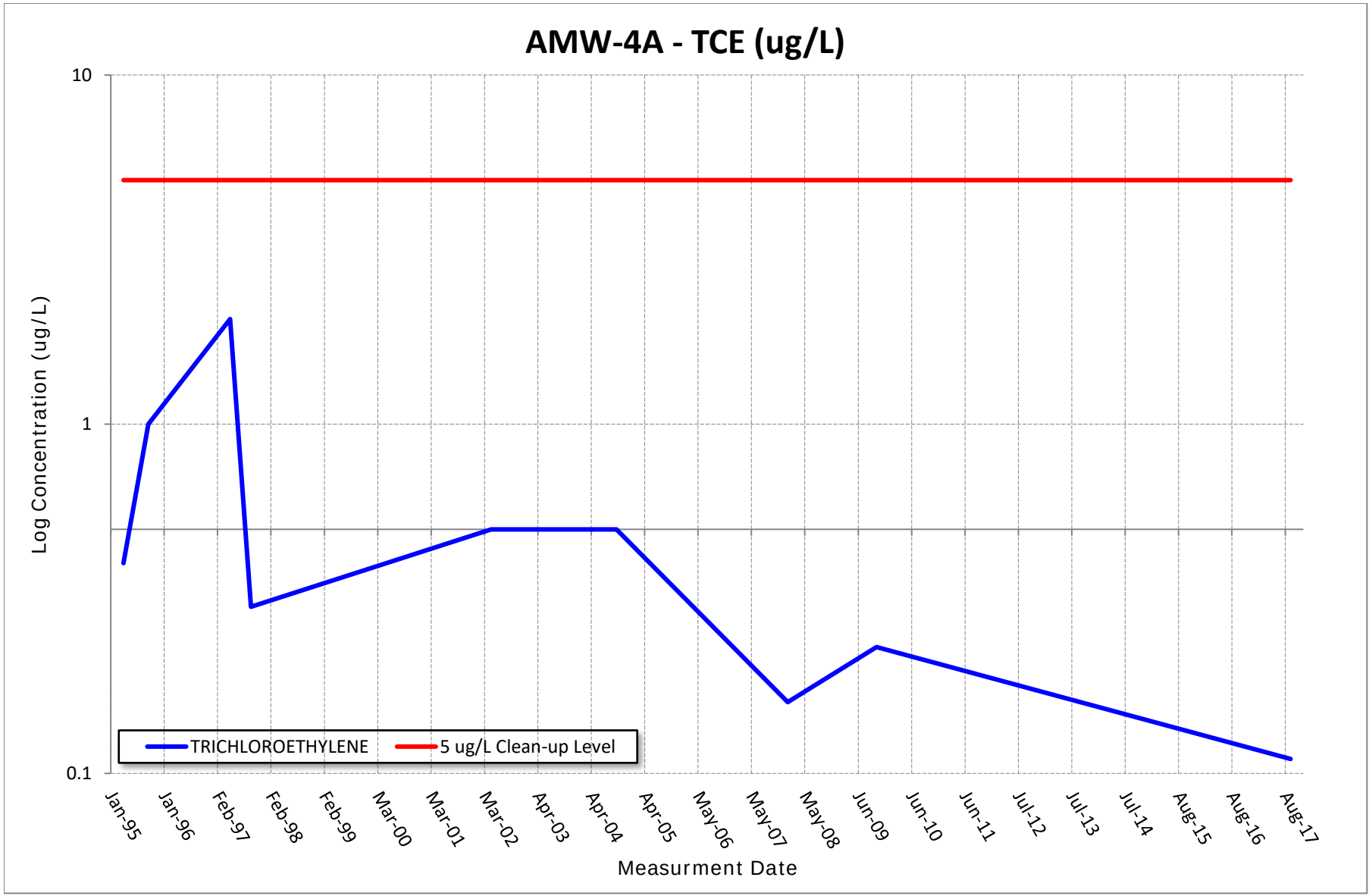
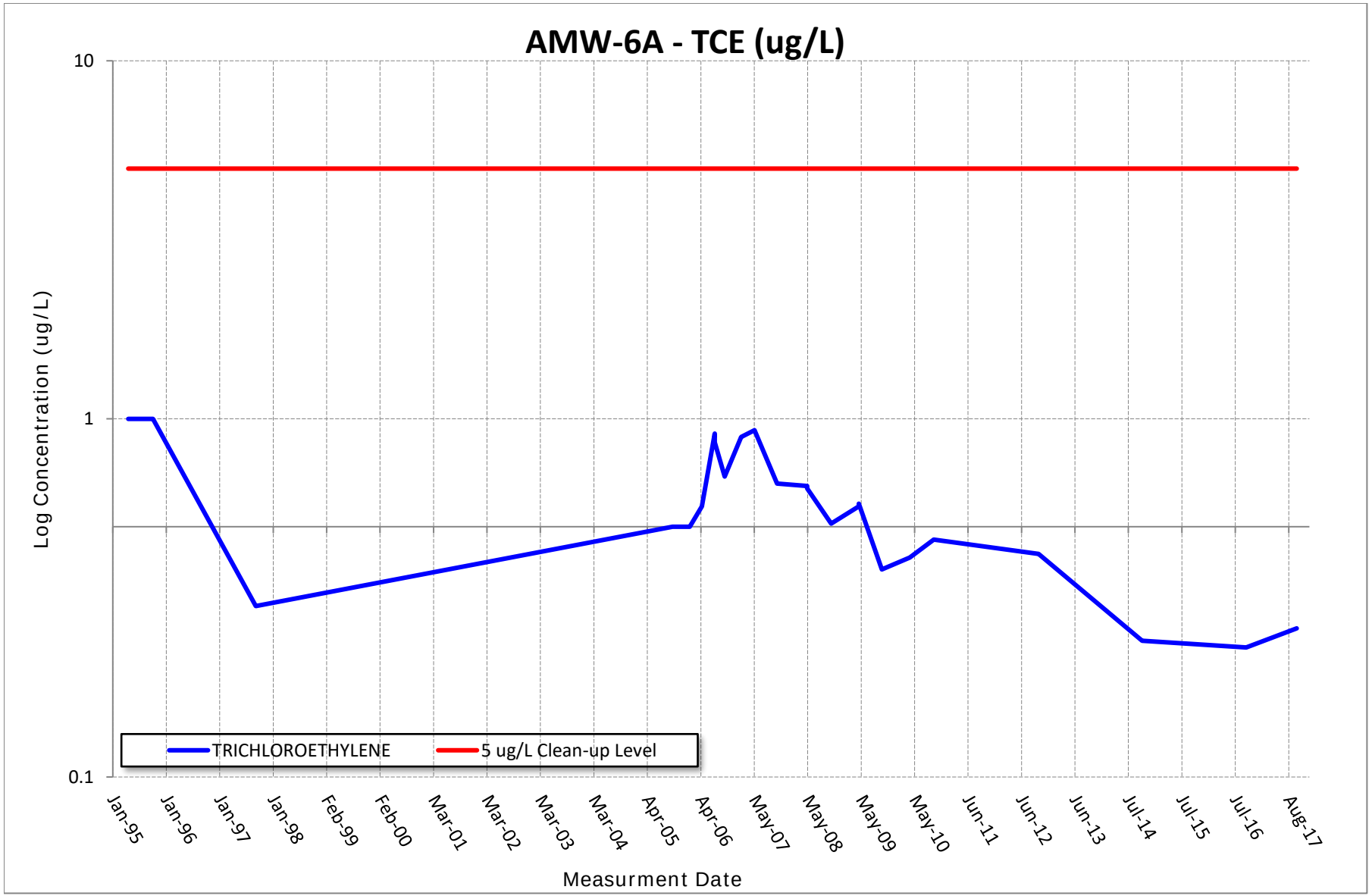
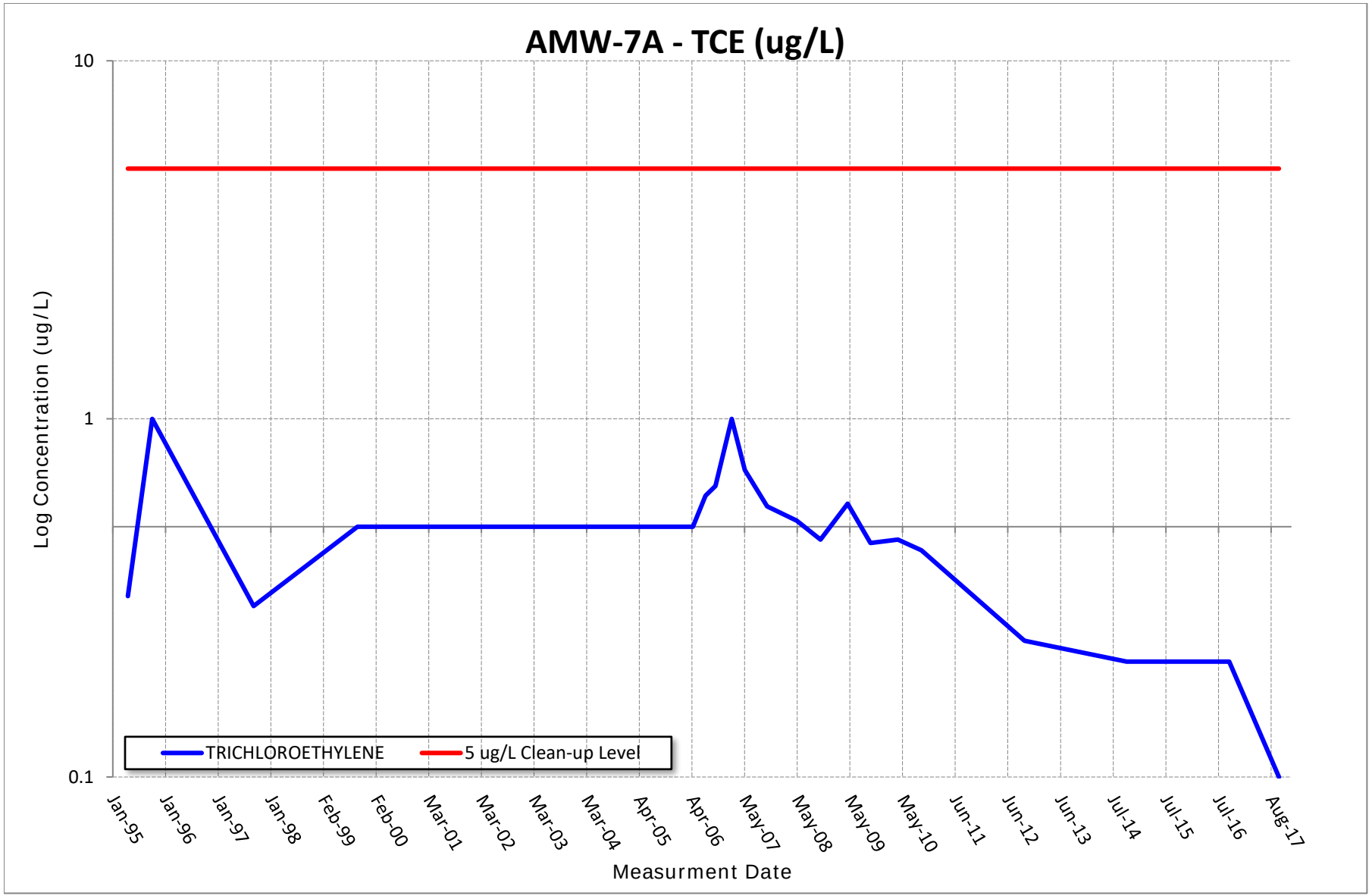

AMW-1A - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
0.1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

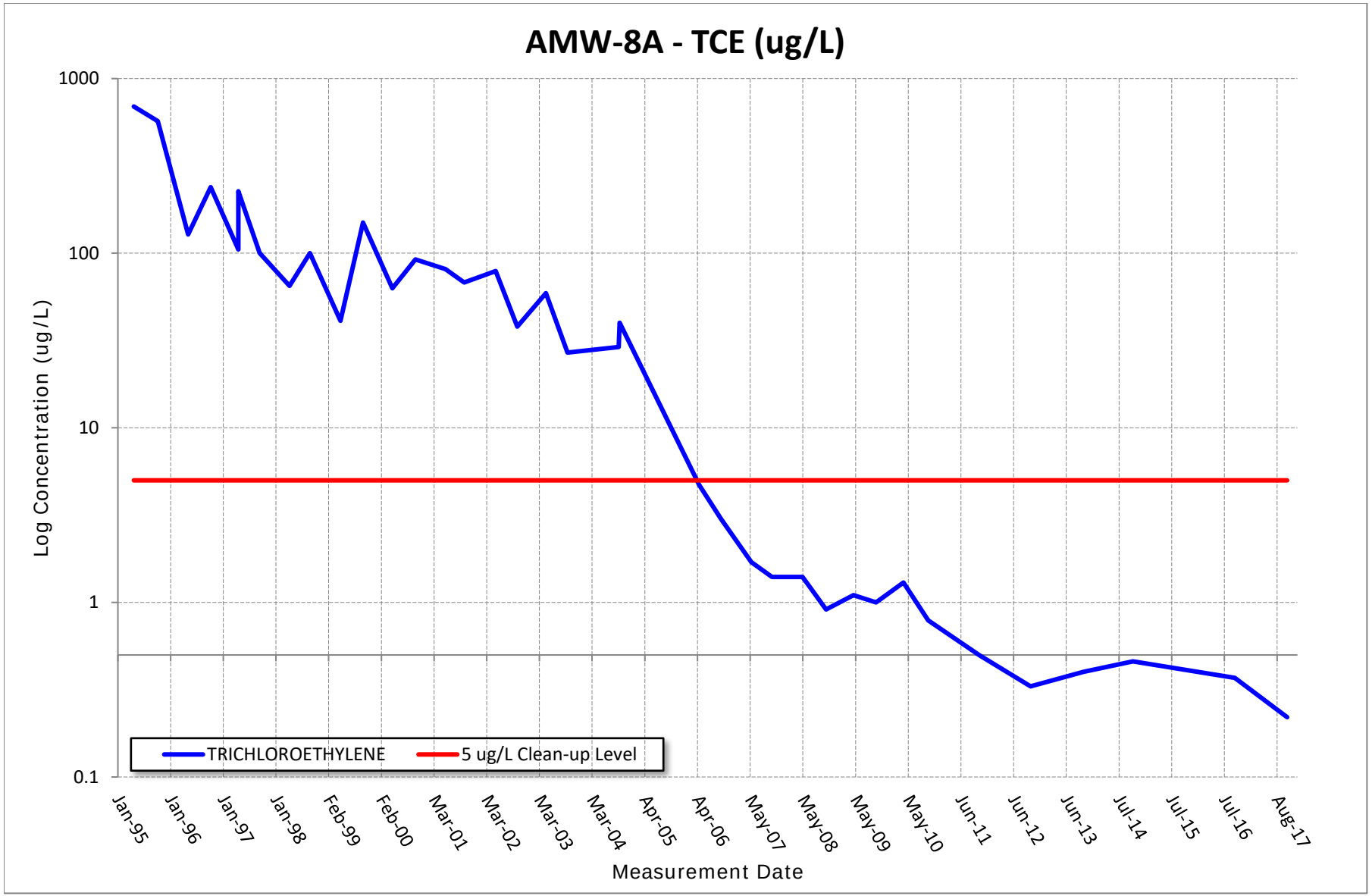

AMW-2A - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

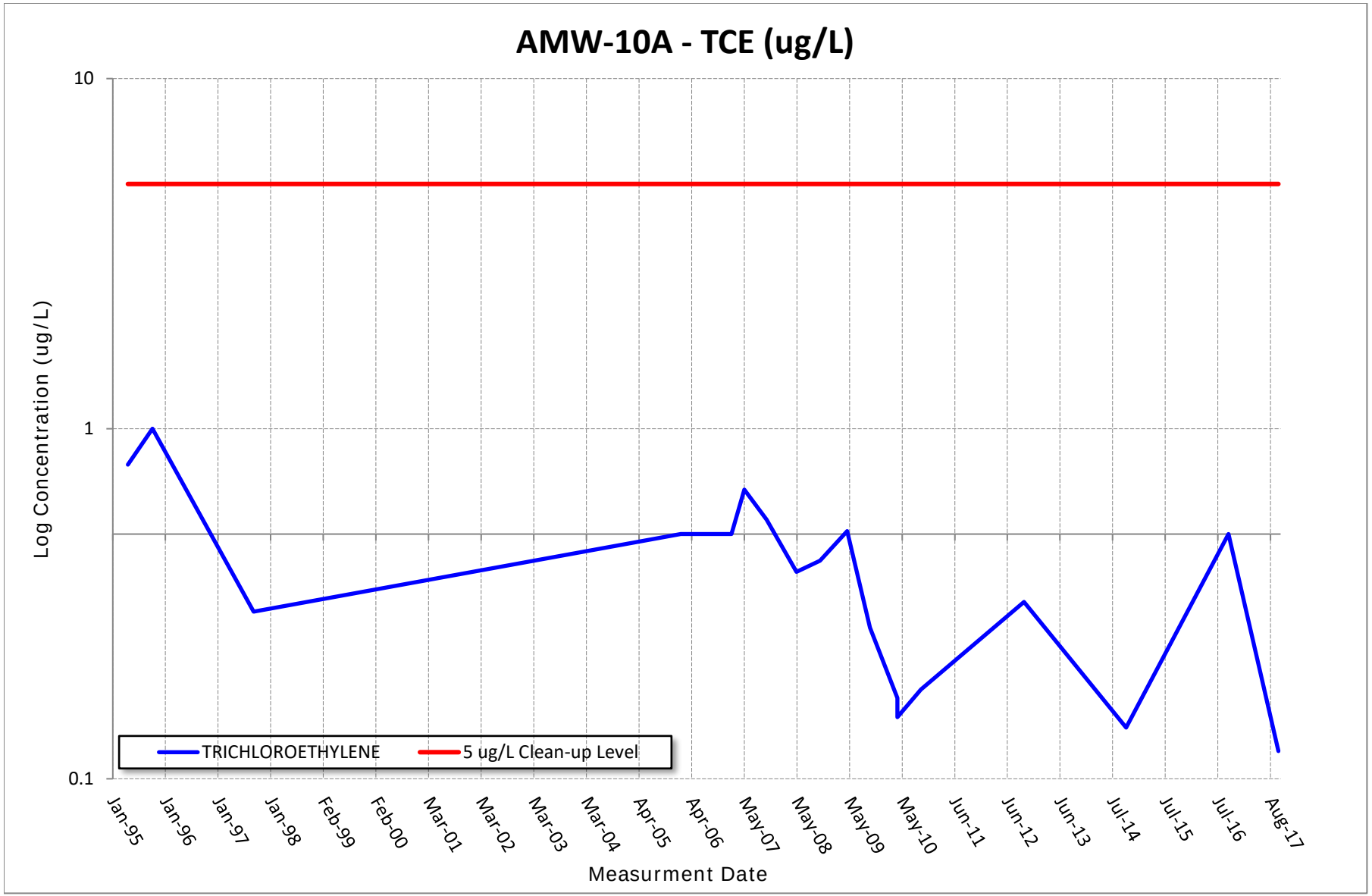

AMW-3A - TCE (ug/L)
Log Concentration (ug/L)
100
10
1
0.1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Feb-97
Feb-98
Feb-99
Mar-00
Mar-01
Mar-02
Apr-03
Apr-04
Apr-05
May-06
May-07
May-08
Jun-09
Jun-10
Jun-11
Jul-12
Jul-13
Jul-14
Aug-15
Aug-16
Aug-17
Measurment Date

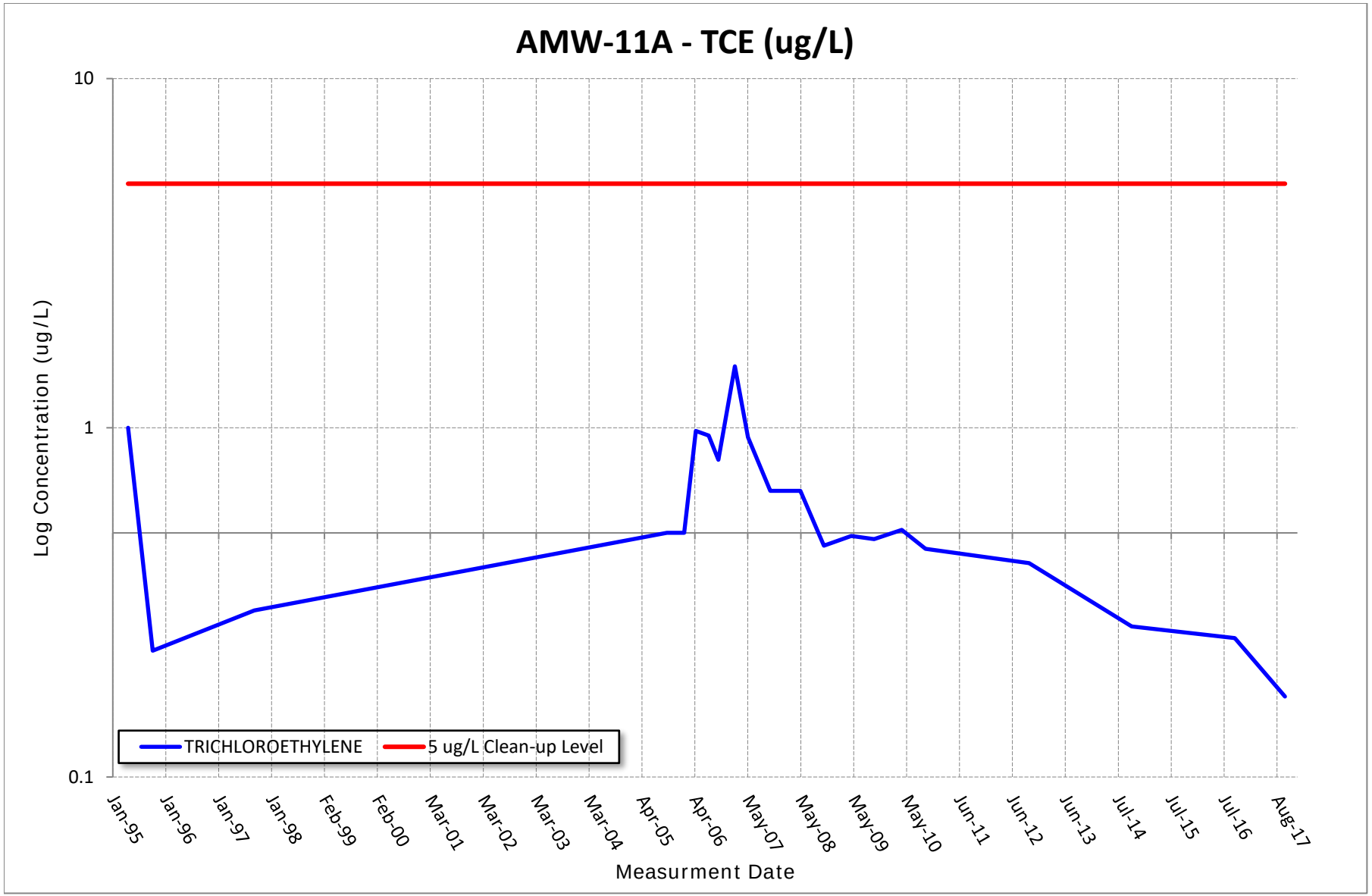

AMW-4A - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Feb-97
Feb-98
Feb-99
Mar-00
Mar-01
Mar-02
Apr-03
Apr-04
Apr-05
May-06
May-07
May-08
Jun-09
Jun-10
Jun-11
Jul-12
Jul-13
Jul-14
Aug-15
Aug-16
Aug-17
Measurment Date

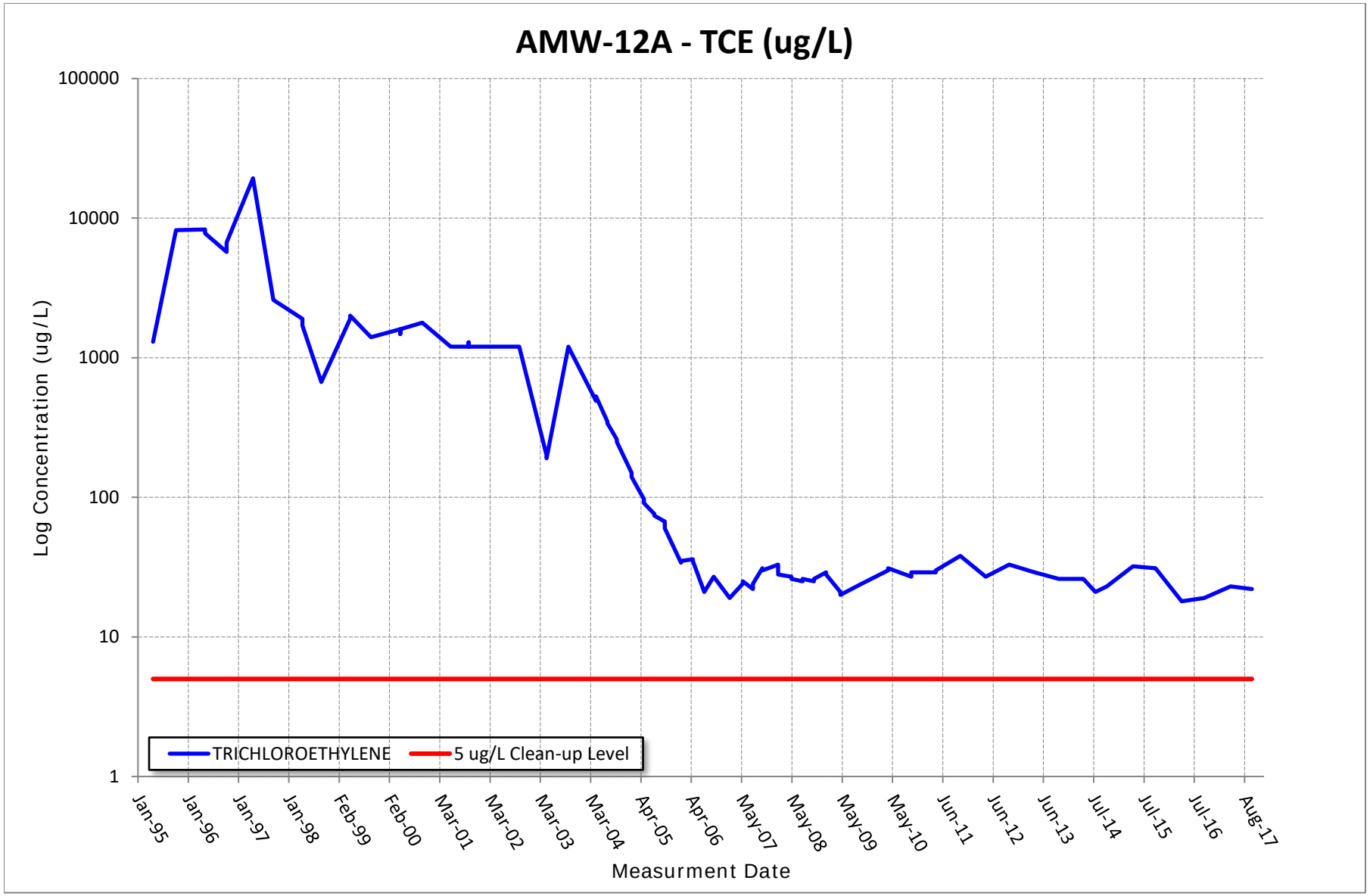

AMW-6A - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

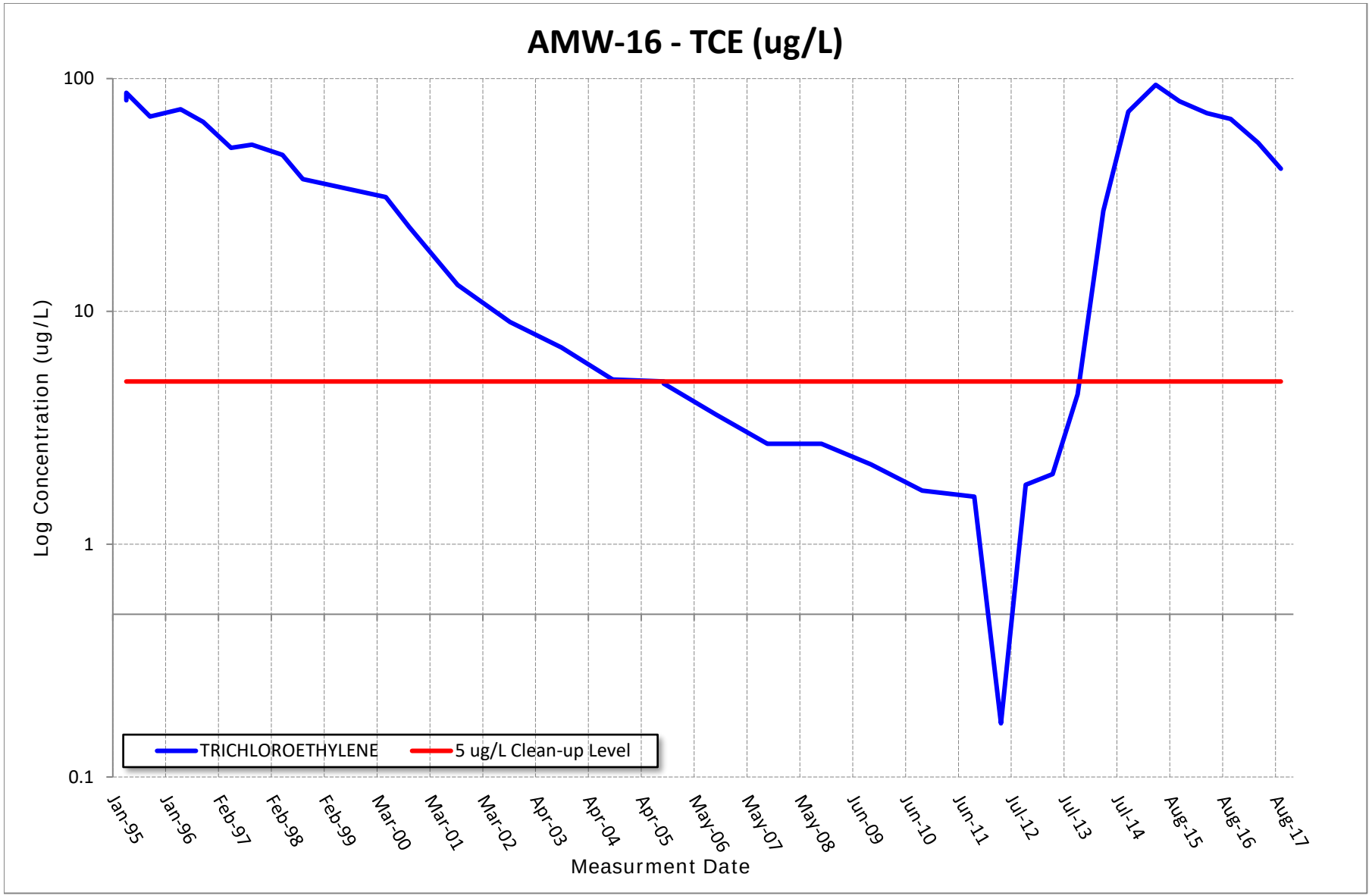

AMW-7A - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

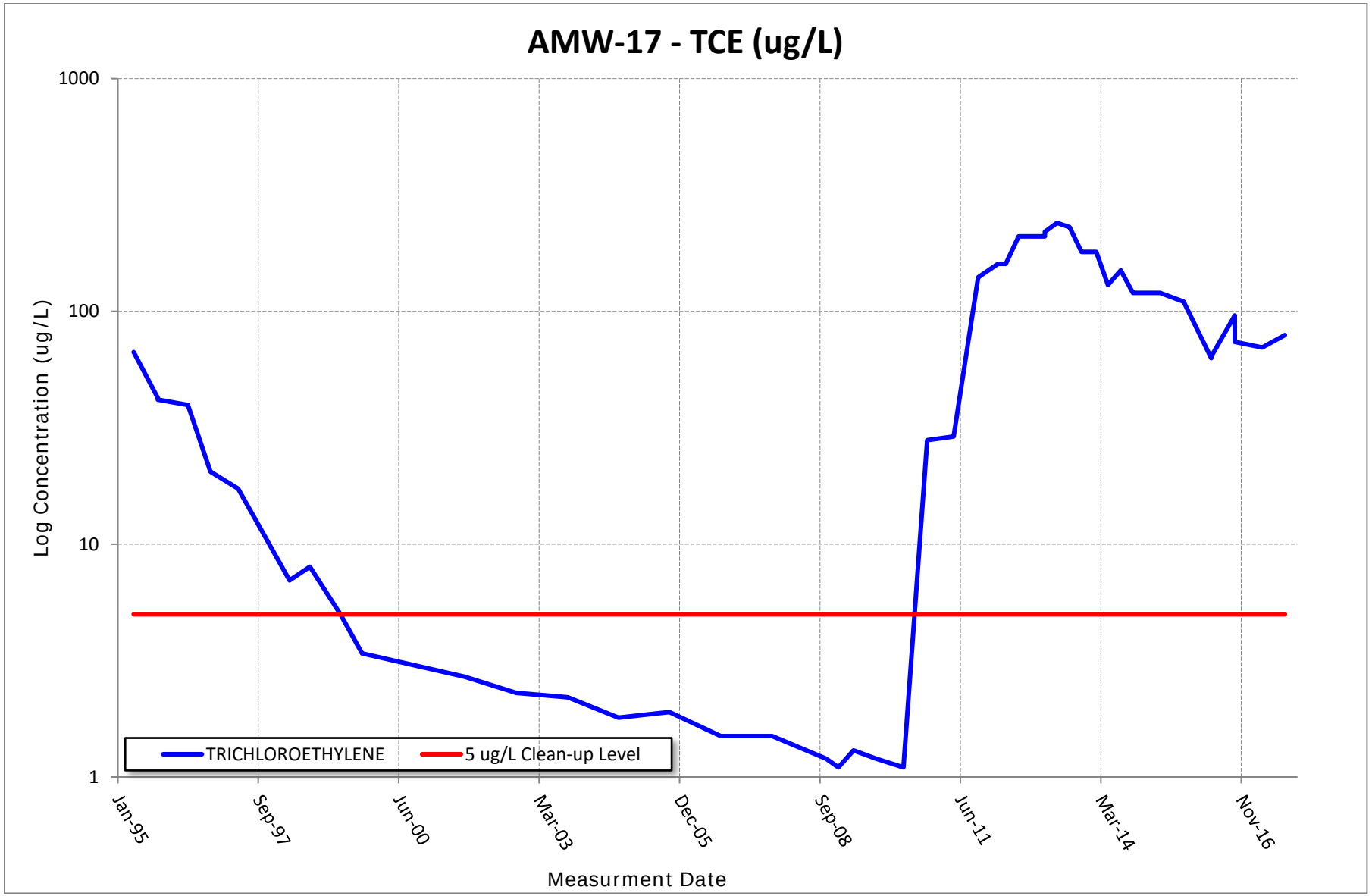

AMW-8A - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

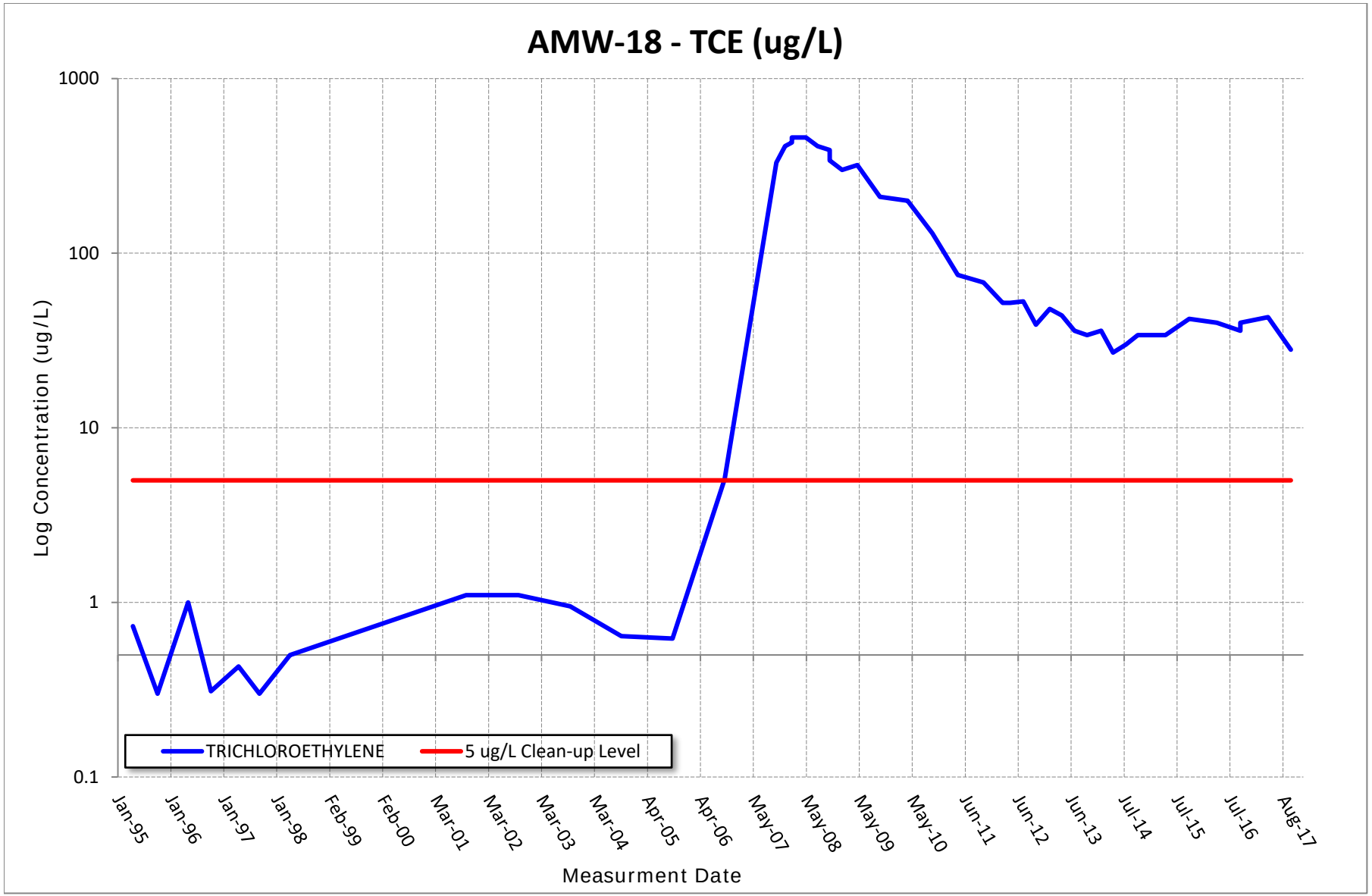

AMW-10A - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

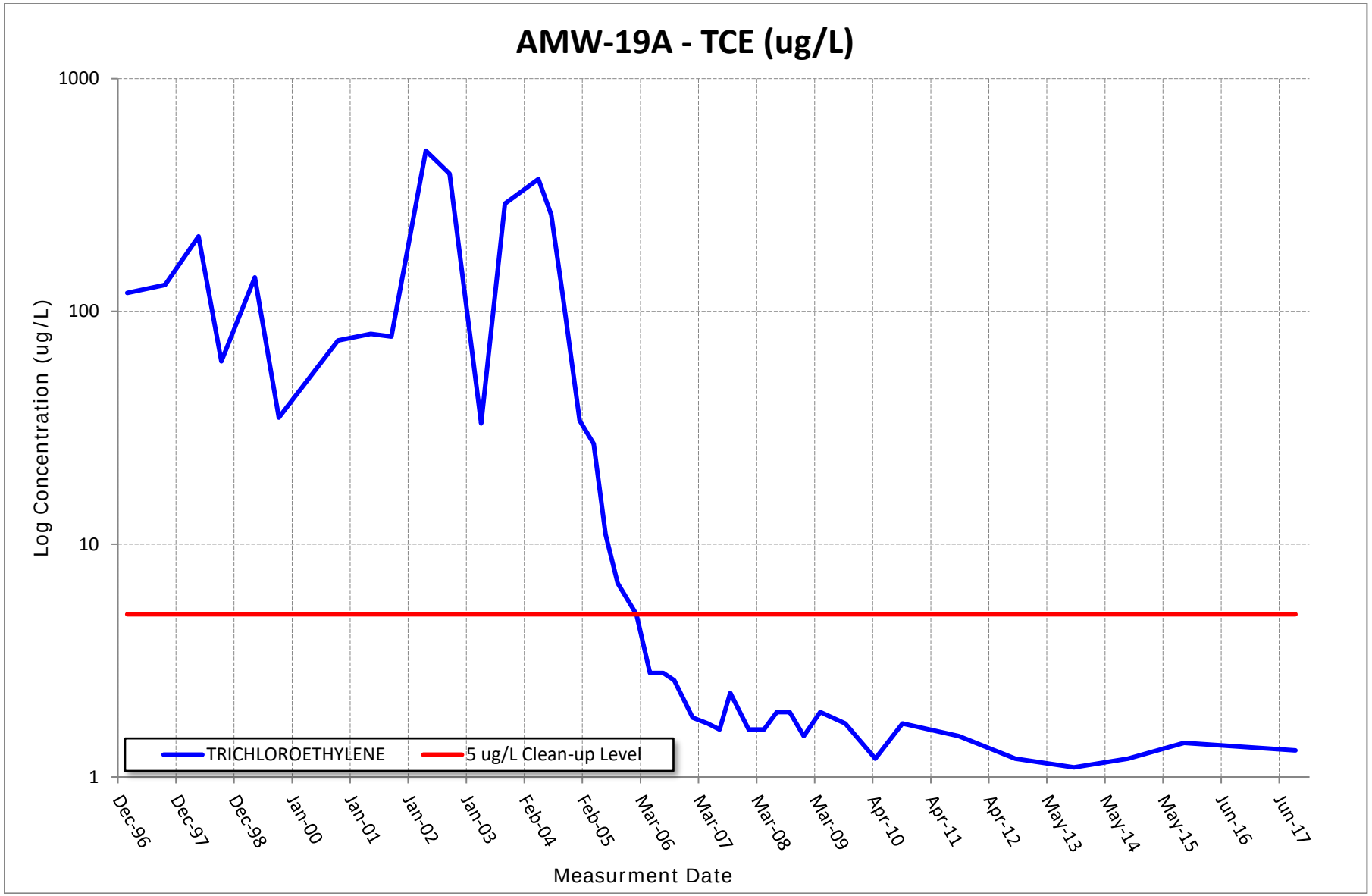

AMW-11A - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

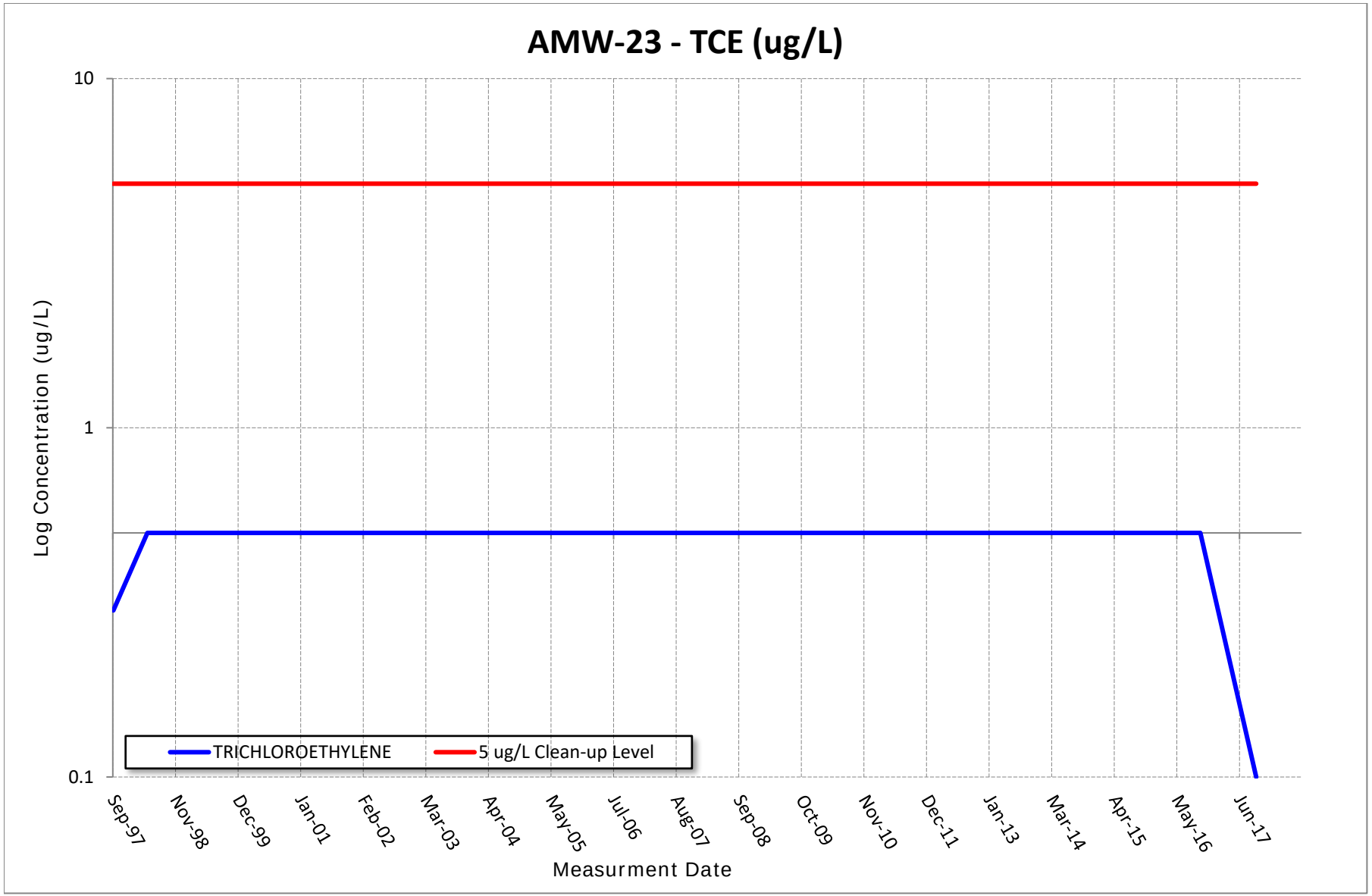

AMW-12A - TCE (ug/L)
Log Concentration (ug/L)
100000
10000
1000
100
10
1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

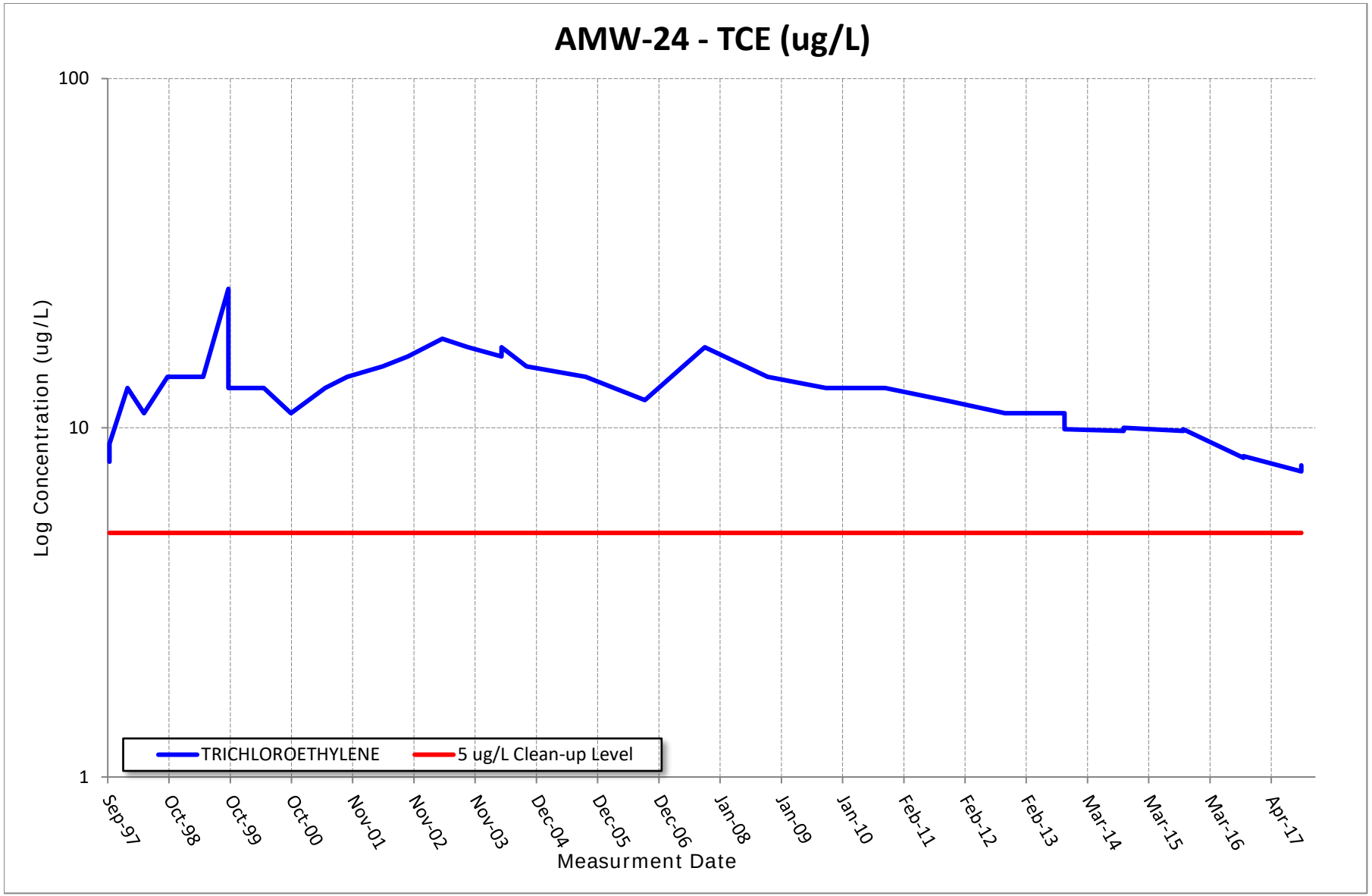

AMW-16 - TCE (ug/L)
Log Concentration (ug/L)
100
10
1
0.1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Feb-97
Feb-98
Feb-99
Mar-00
Mar-01
Mar-02
Apr-03
Apr-04
Apr-05
May-06
May-07
May-08
Jun-09
Jun-10
Jun-11
Jul-12
Jul-13
Jul-14
Aug-15
Aug-16
Aug-17
Measurment Date

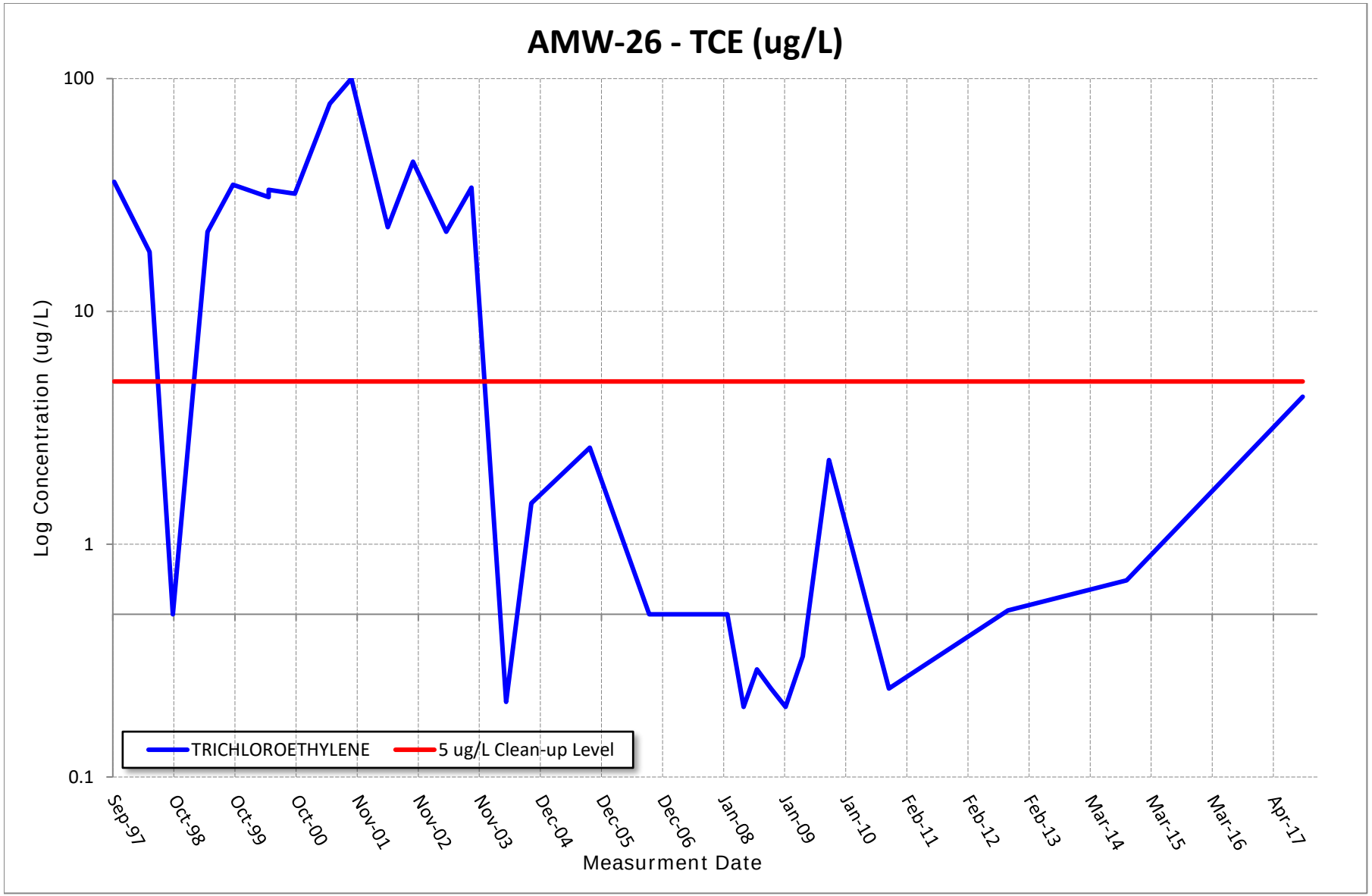

AMW-17 - TCE (ug/L)
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Sep-97
Jun-00
Mar-03
Dec-05
Sep-08
Jun-11
Mar-14
Nov-16
Measurment Date

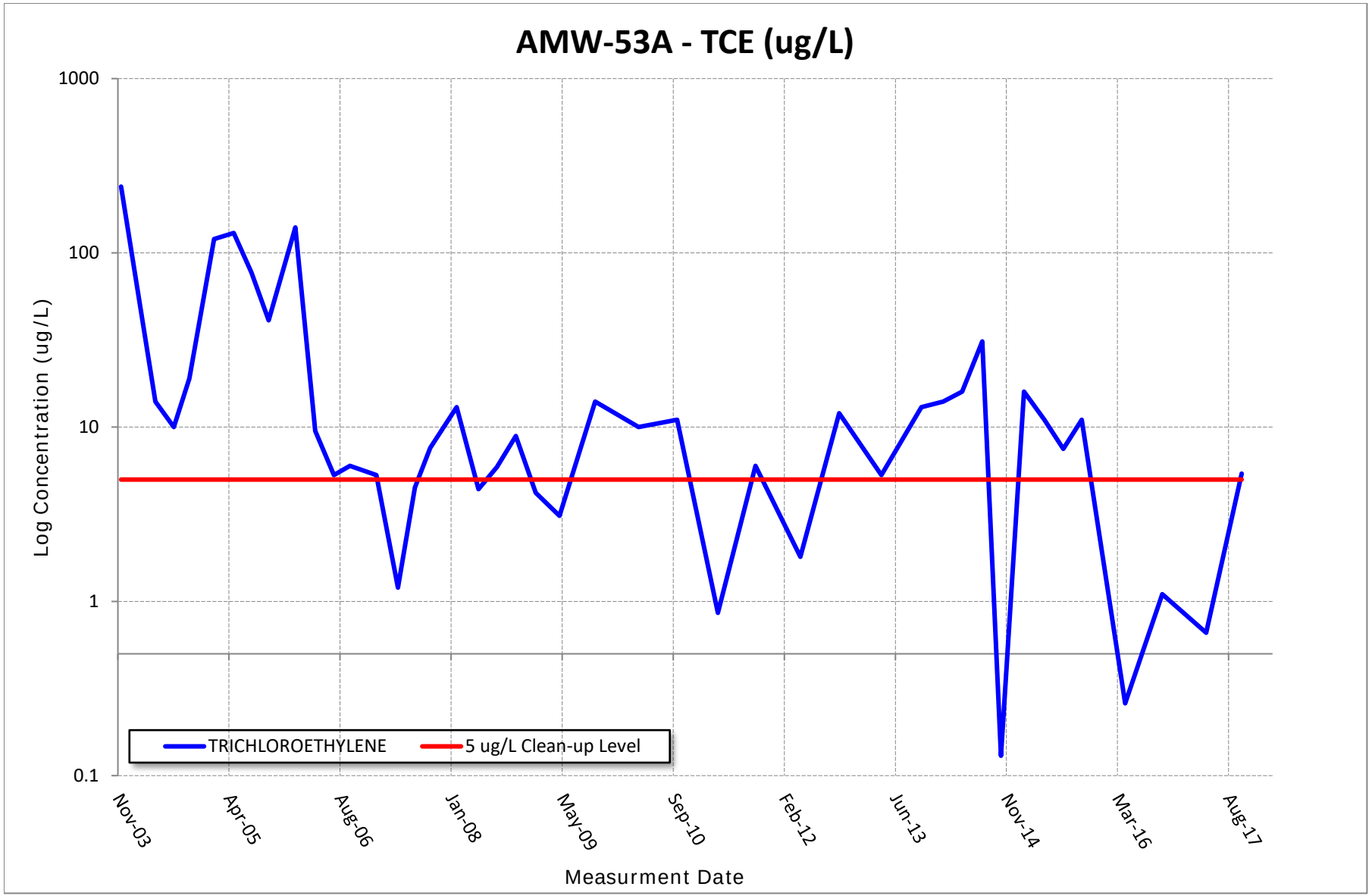

AMW-18 - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

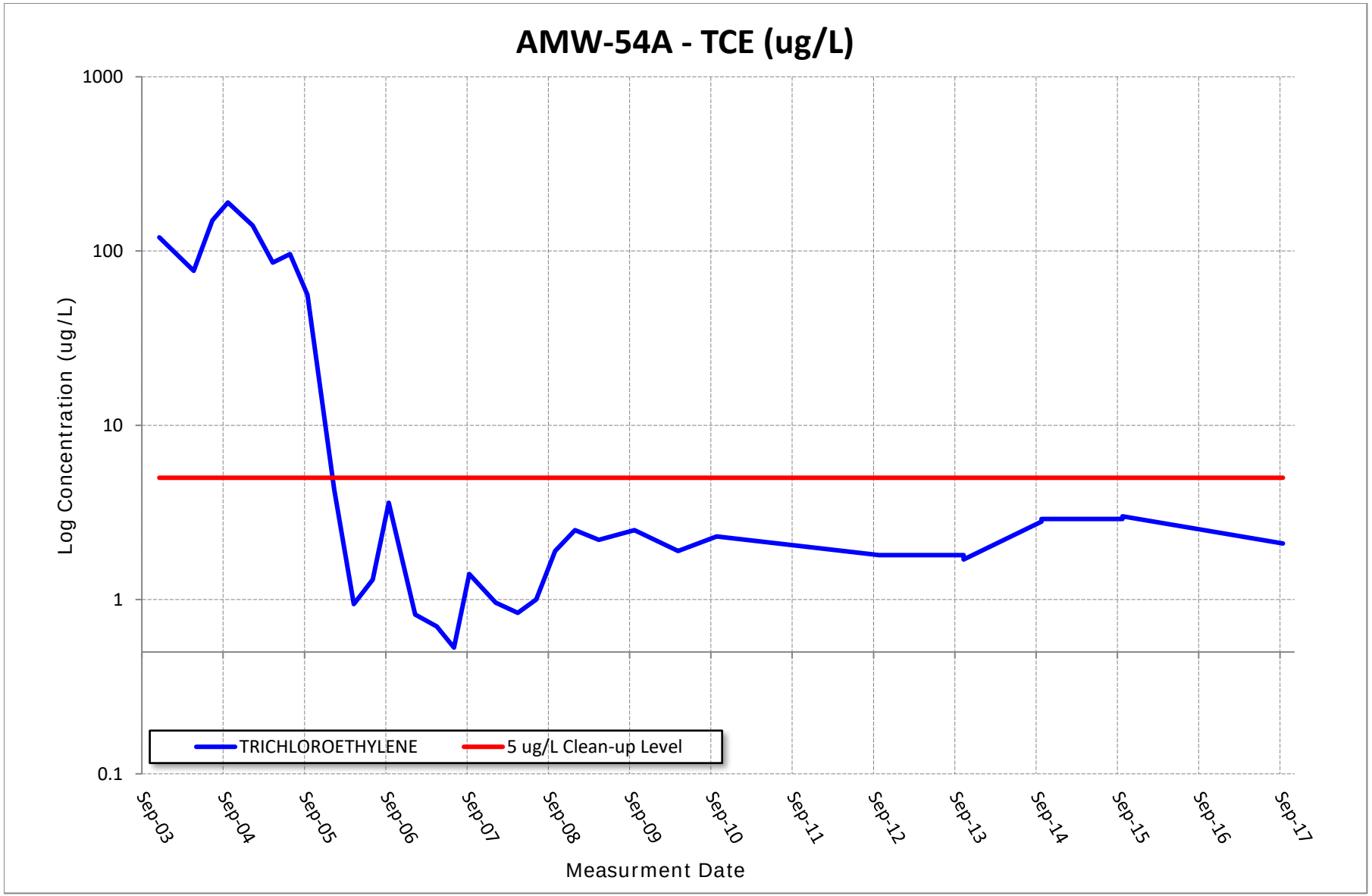

AMW-19A - TCE (ug/L)
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Dec-96
Dec-97
Dec-98
Jan-00
Jan-01
Jan-02
Jan-03
Feb-04
Feb-05
Mar-06
Mar-07
Mar-08
Mar-09
Apr-10
Apr-11
Apr-12
May-13
May-14
May-15
Jun-16
Jun-17
Measurment Date

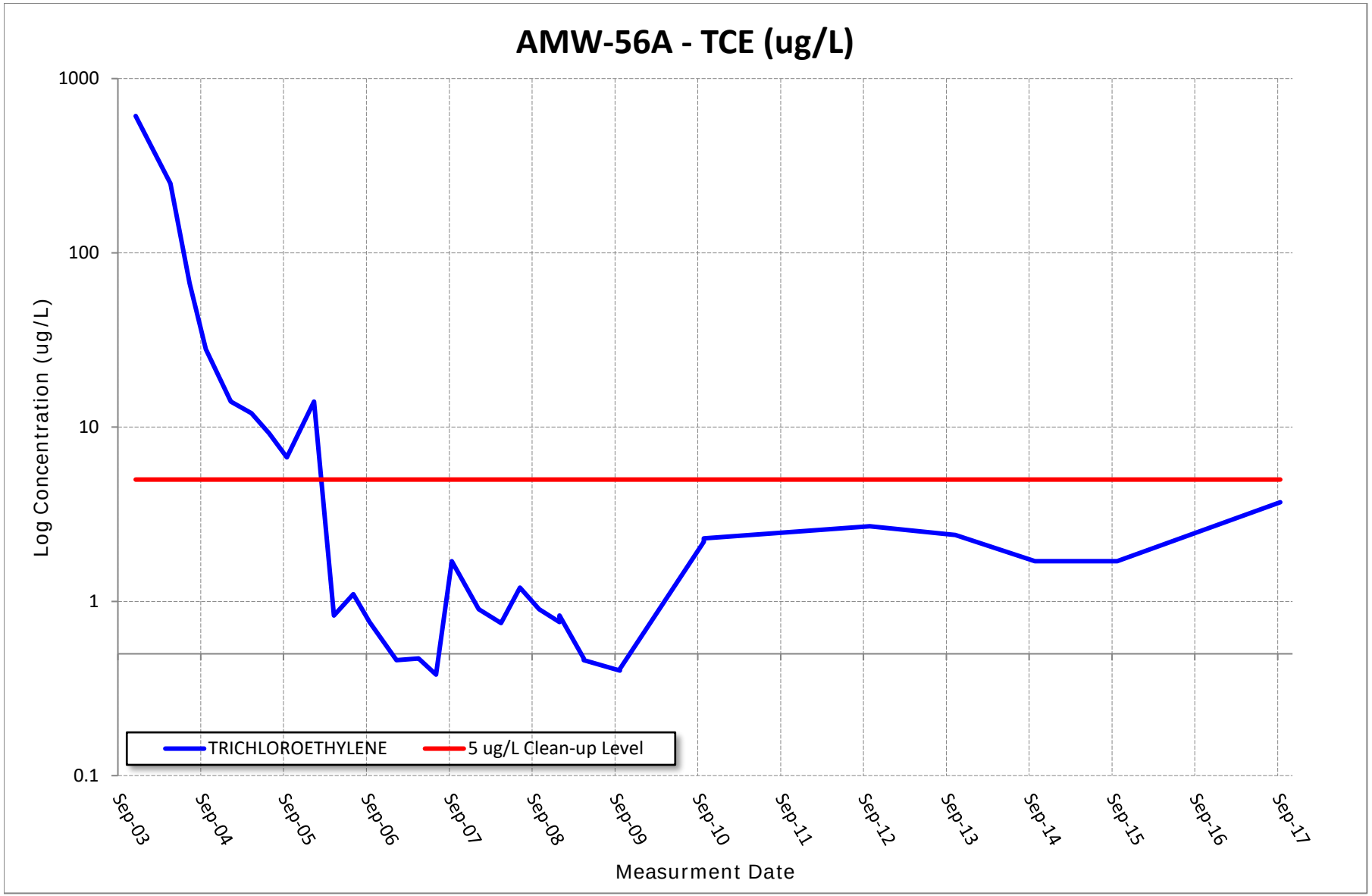

AMW-23 - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Sep-97
Nov-98
Dec-99
Jan-01
Feb-02
Mar-03
Apr-04
May-05
Jul-06
Aug-07
Sep-08
Oct-09
Nov-10
Dec-11
Jan-13
Mar-14
Apr-15
May-16
Jun-17
Measurment Date

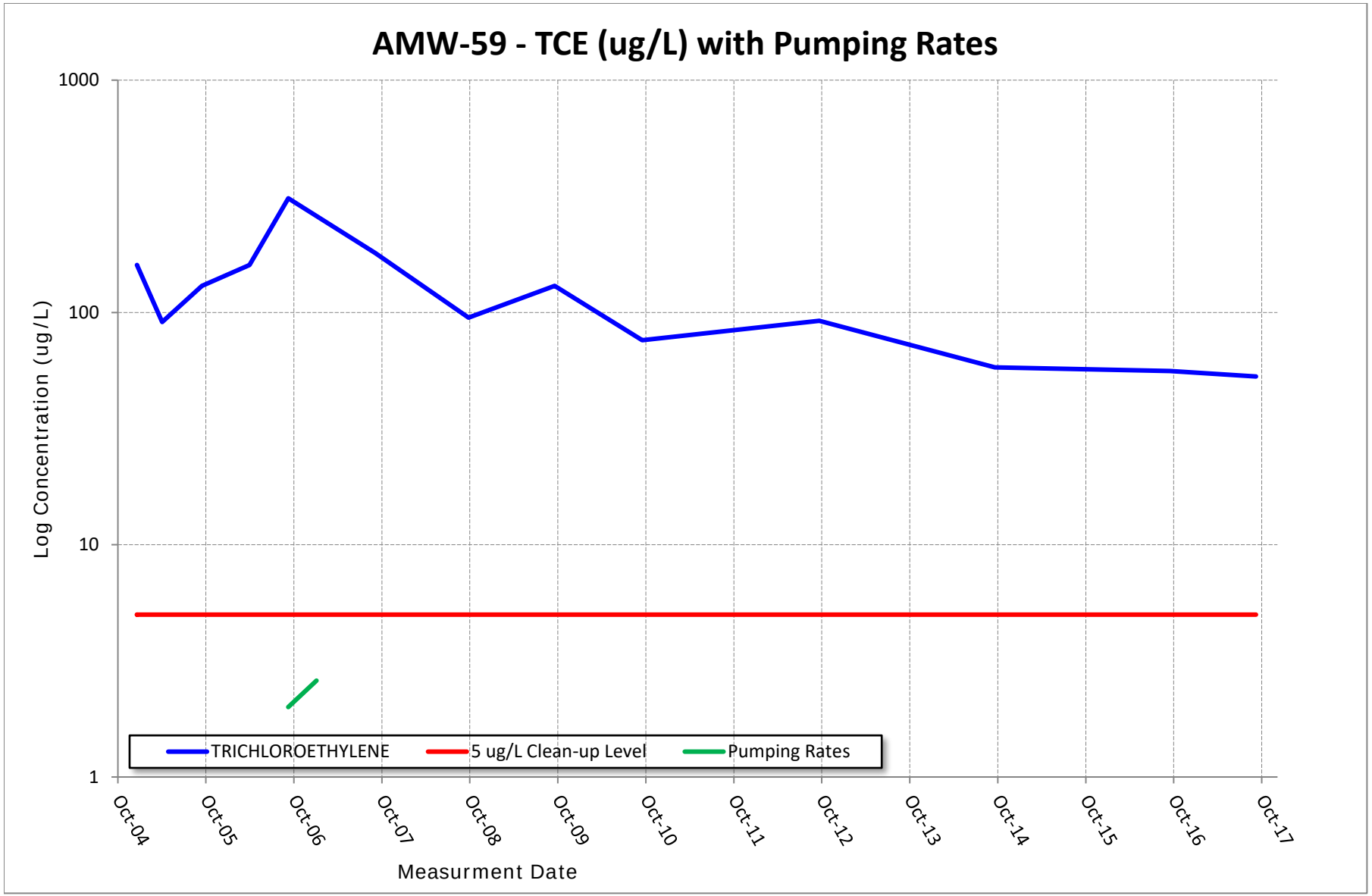

AMW-24 - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Sep-97
Oct-98
Oct-99
Oct-00
Nov-01
Nov-02
Nov-03
Dec-04
Dec-05
Dec-06
Jan-08
Jan-09
Jan-10
Feb-11
Feb-12
Feb-13
Mar-14
Mar-15
Mar-16
Apr-17
Measurment Date

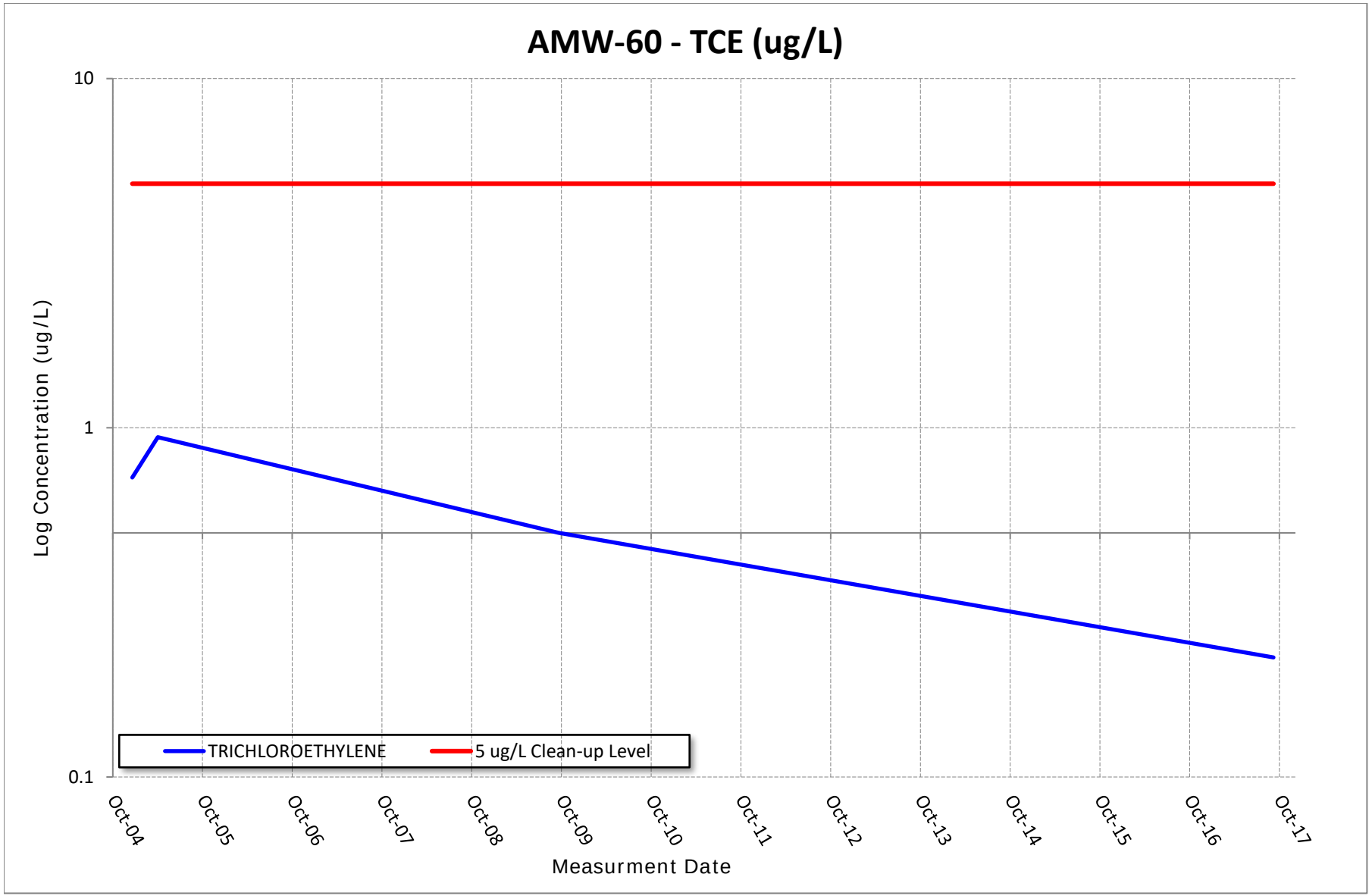

AMW-26 - TCE (ug/L)
Log Concentration (ug/L)
100
10
1
0.1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Sep-97
Oct-98
Oct-99
Oct-00
Nov-01
Nov-02
Nov-03
Dec-04
Dec-05
Dec-06
Jan-08
Jan-09
Jan-10
Feb-11
Feb-12
Feb-13
Mar-14
Mar-15
Mar-16
Apr-17
Measurment Date

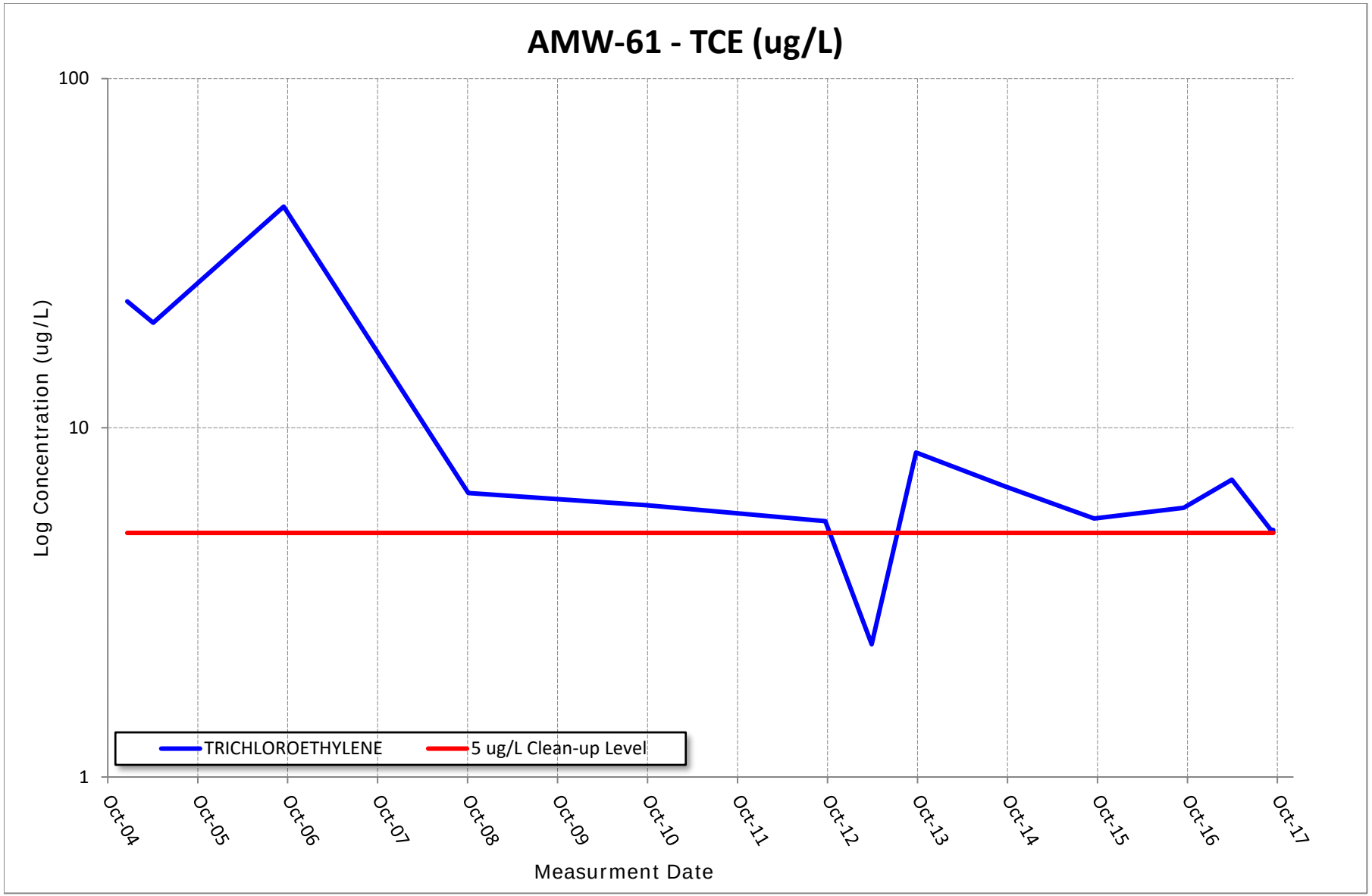

AMW-53A - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Nov-03
Apr-05
Aug-06
Jan-08
May-09
Sep-10
Feb-12
Jun-13
Nov-14
Mar-16
Aug-17
Measurment Date

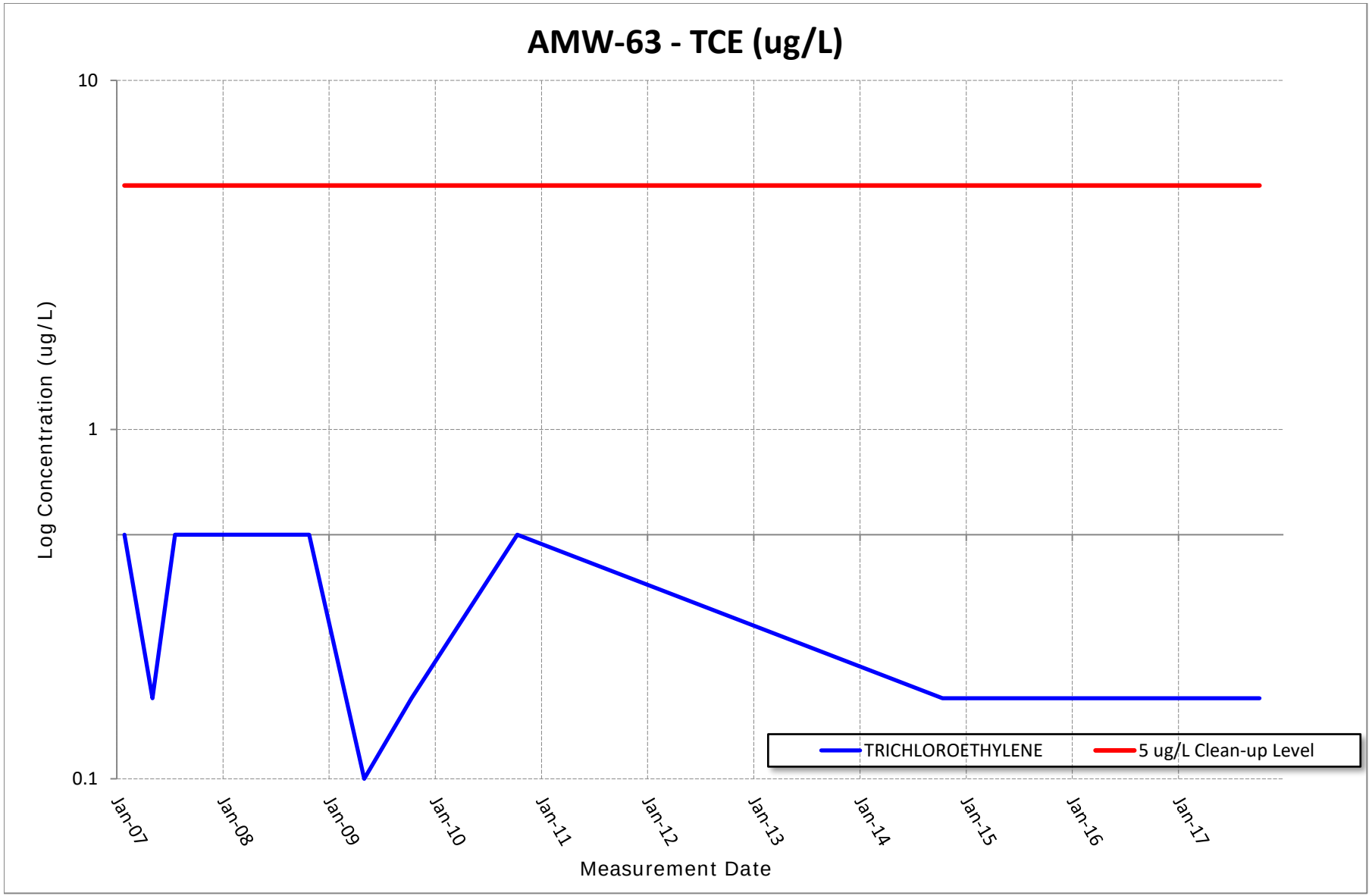

AMW-54A - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Measurment Date

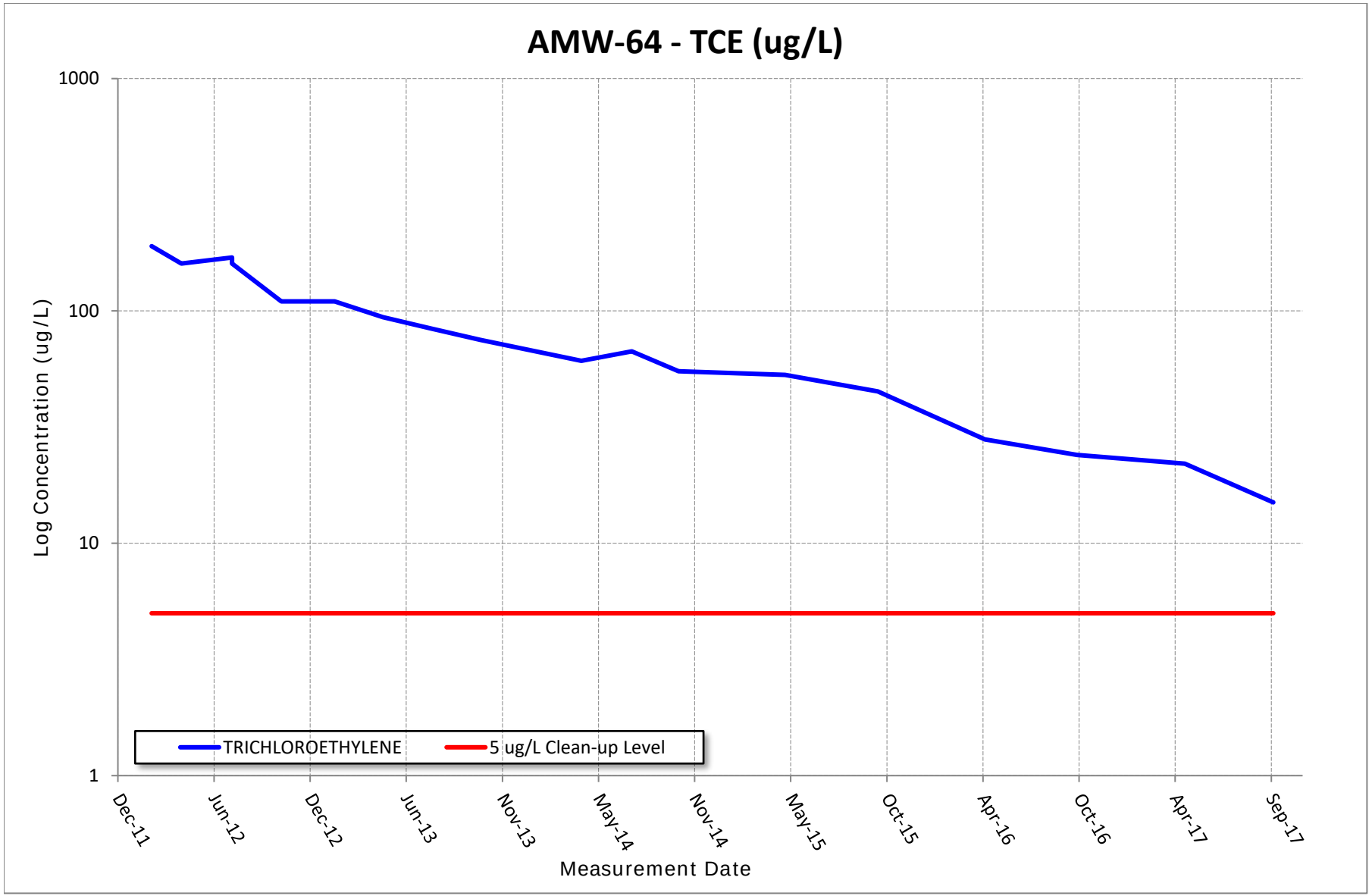

AMW-56A - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Sep-03
Sep-04
Sep-05
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Measurment Date

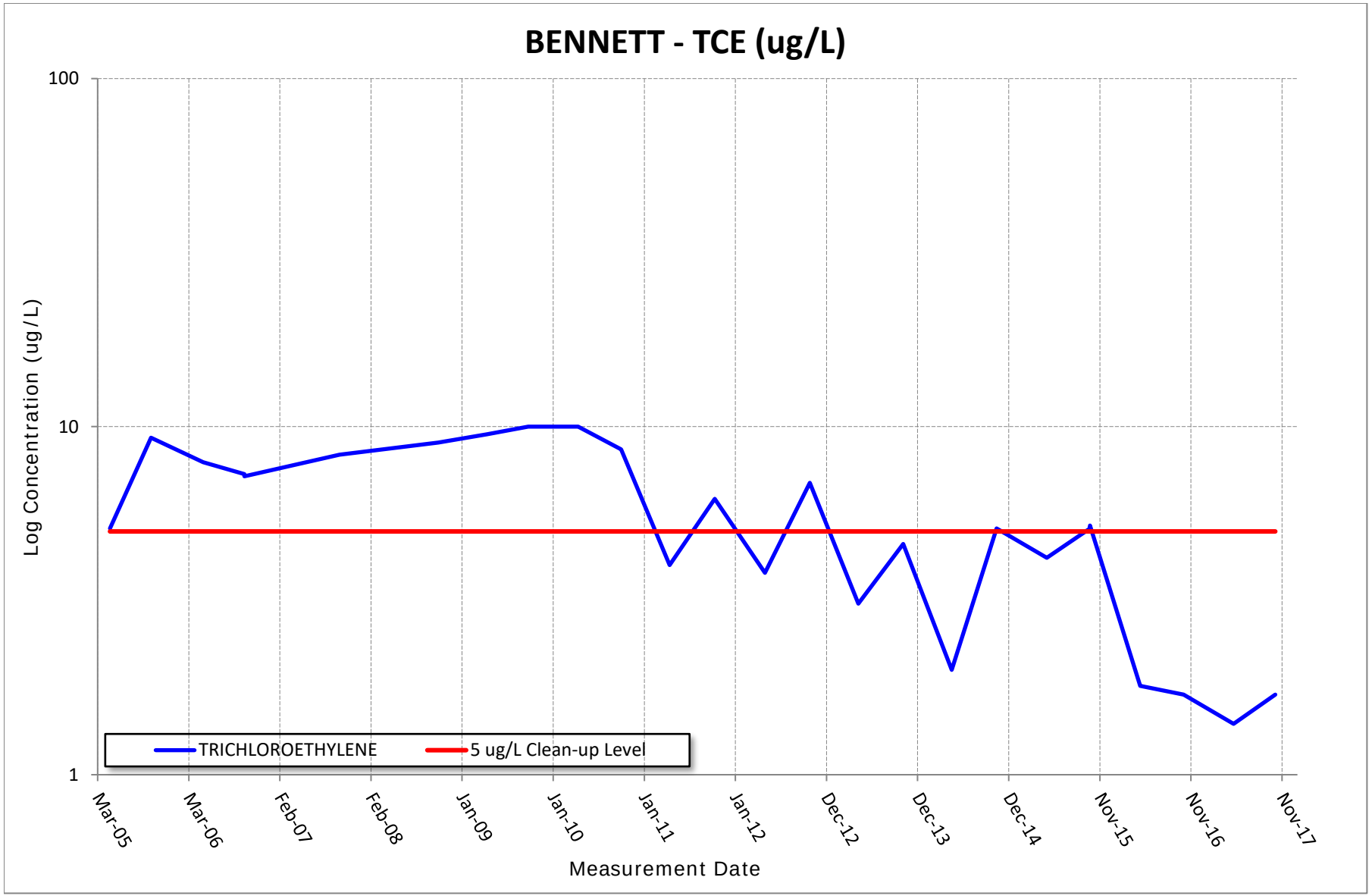

AMW-59 - TCE (ug/L) with Pumping Rates
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Oct-04
Oct-05
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Oct-13
Oct-14
Oct-15
Oct-16
Oct-17
Measurment Date

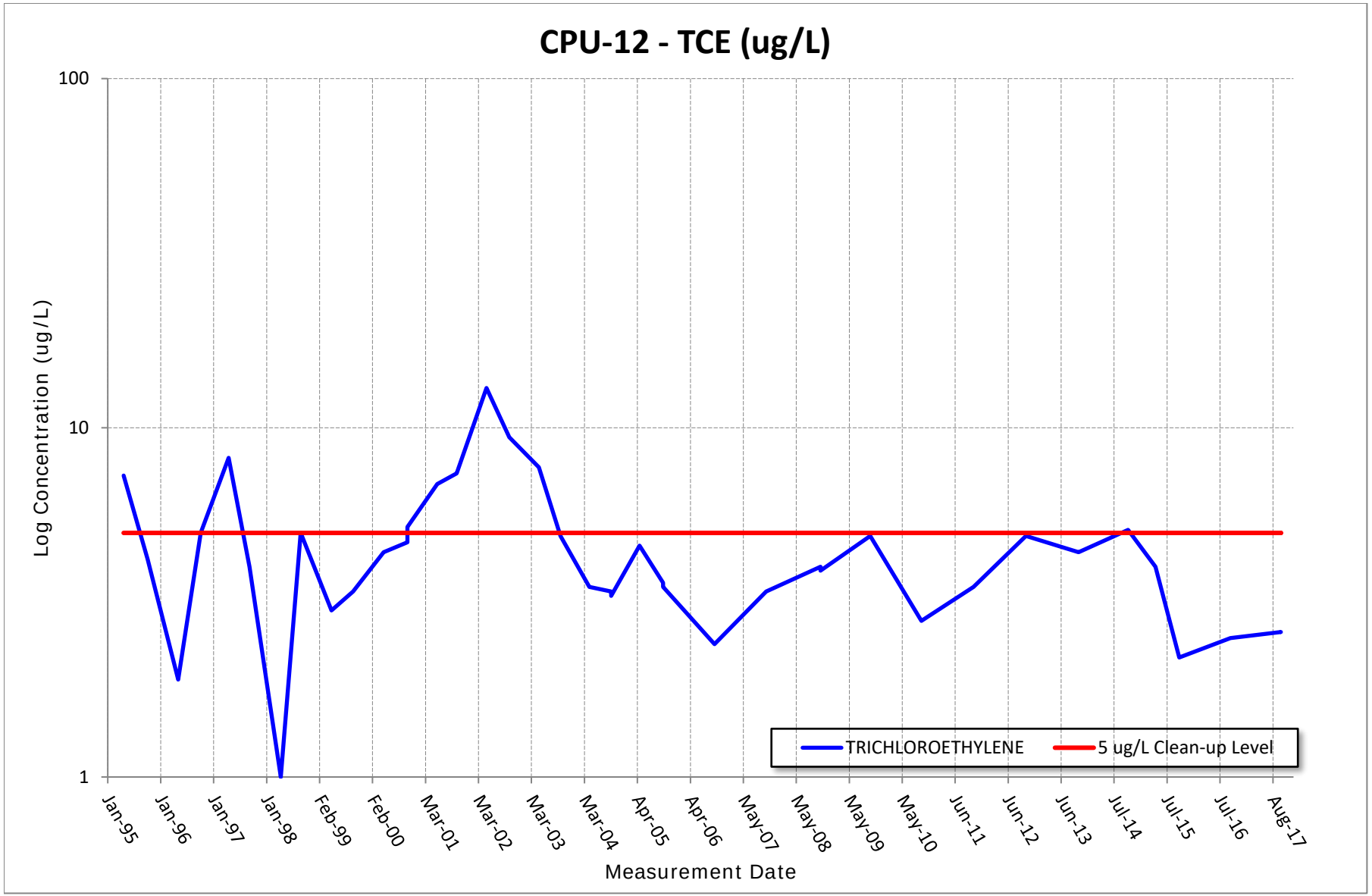

AMW-60 - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Oct-04
Oct-05
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Oct-13
Oct-14
Oct-15
Oct-16
Oct-17
Measurment Date

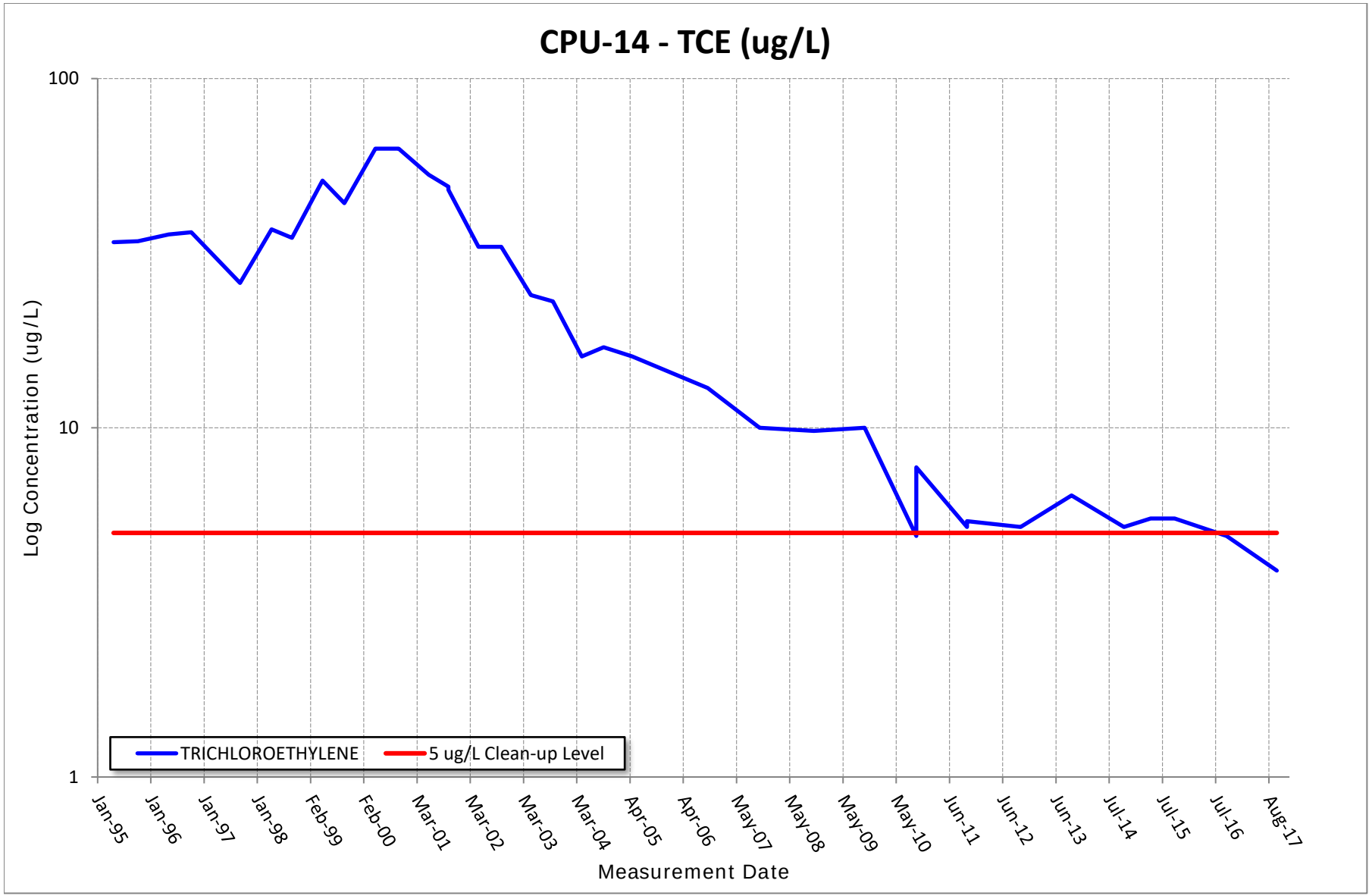

AMW-61 - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Oct-04
Oct-05
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Oct-13
Oct-14
Oct-15
Oct-16
Oct-17
Measurment Date

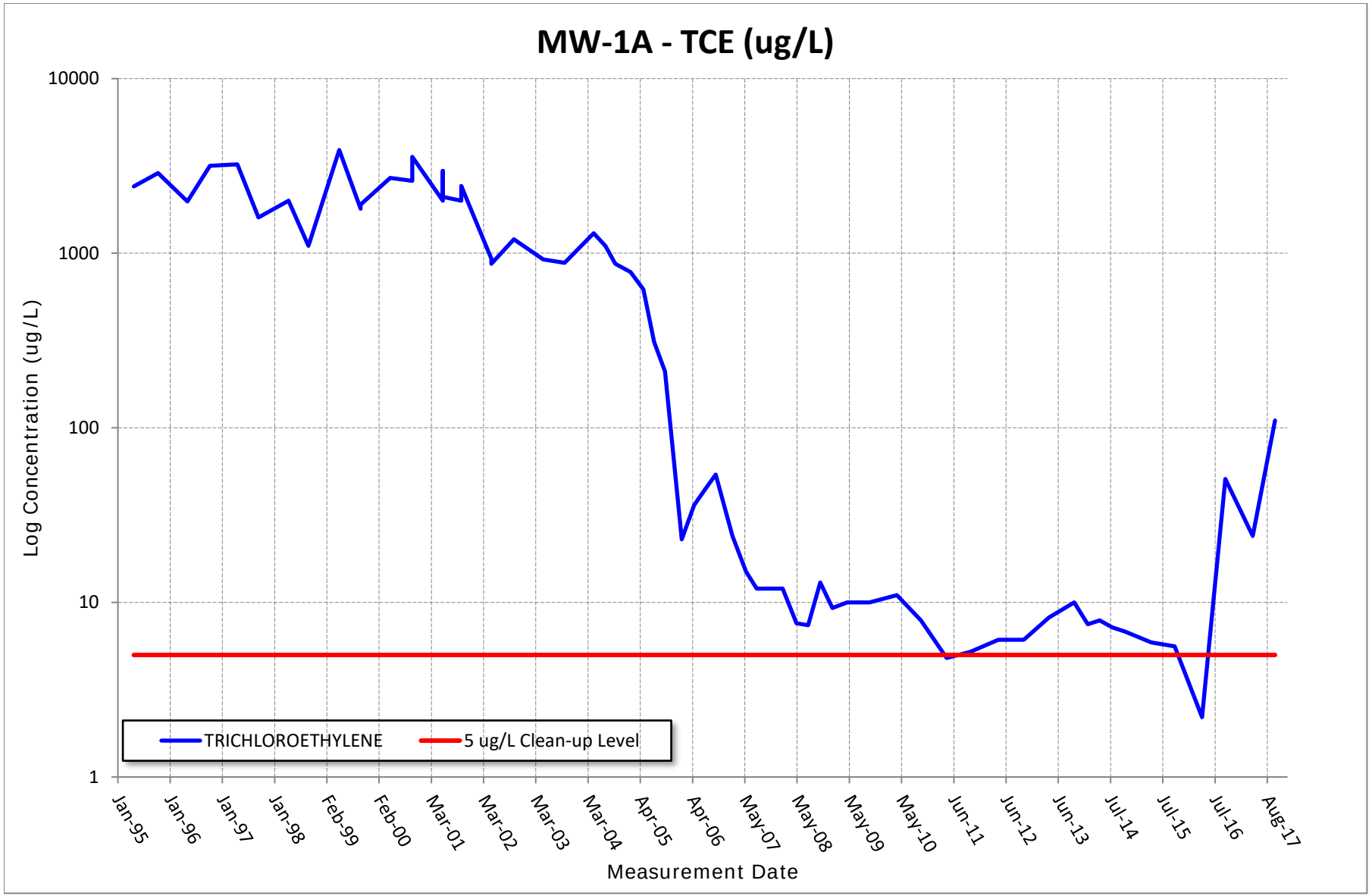

AMW-63 - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date
TRICHLOROETHYLENE
5 ug/L Clean-up Level

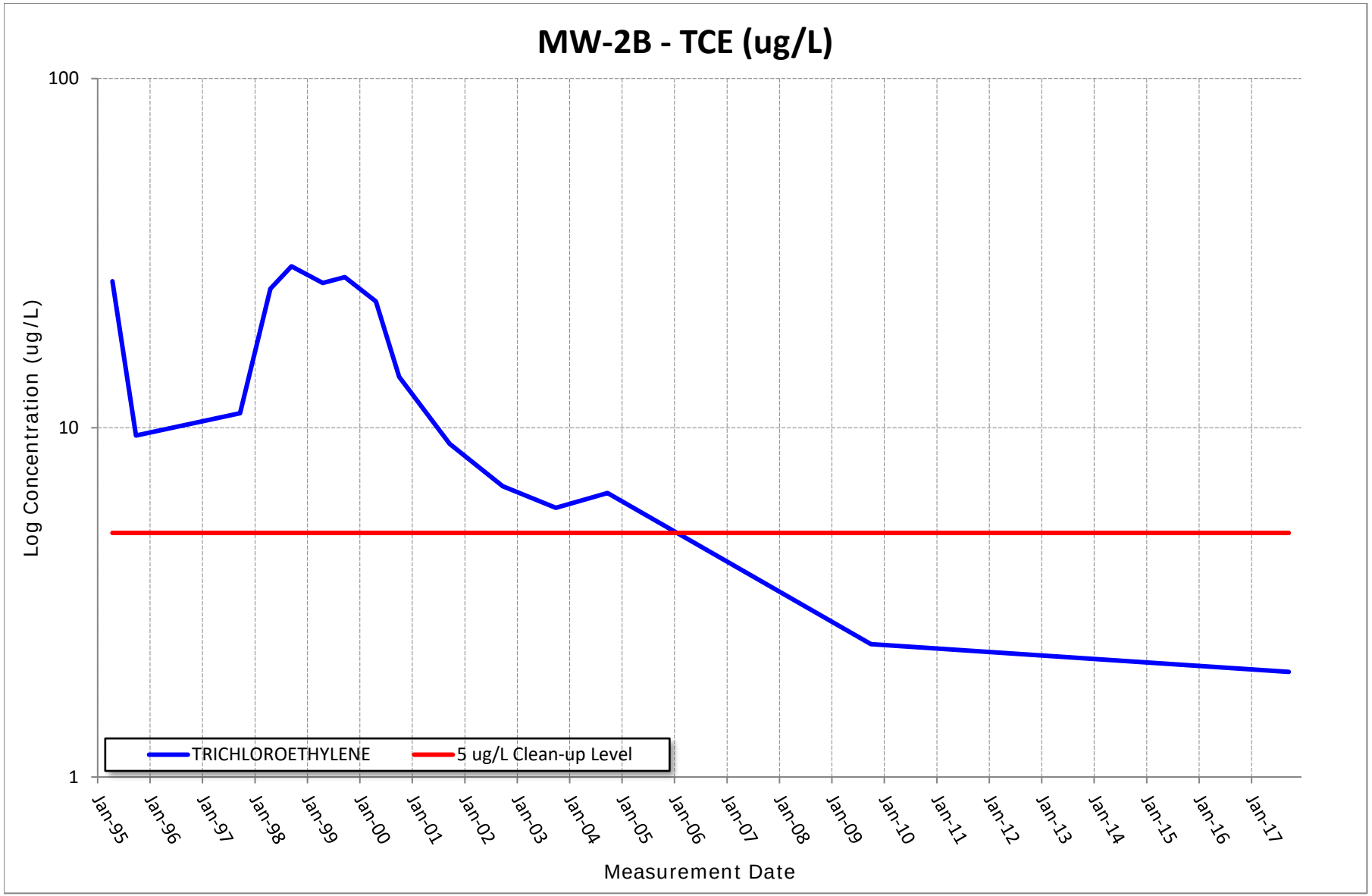

AMW-64 - TCE (ug/L)
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Dec-11
Jun-12
Dec-12
Jun-13
Nov-13
May-14
Nov-14
May-15
Oct-15
Apr-16
Oct-16
Apr-17
Sep-17
Measurement Date

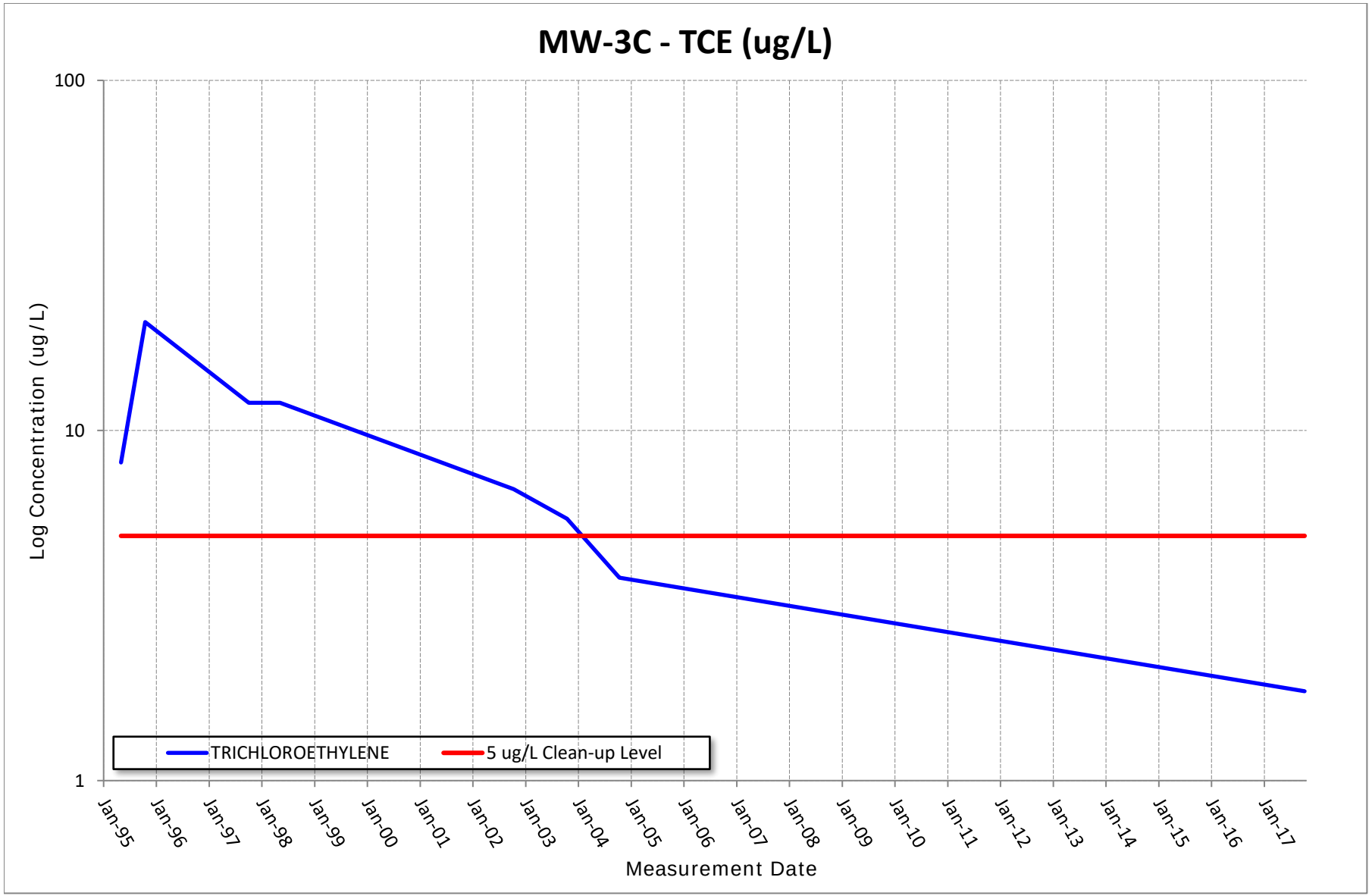

BENNETT - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Mar-05
Mar-06
Feb-07
Feb-08
Jan-09
Jan-10
Jan-11
Jan-12
Dec-12
Dec-13
Dec-14
Nov-15
Nov-16
Nov-17
Measurement Date

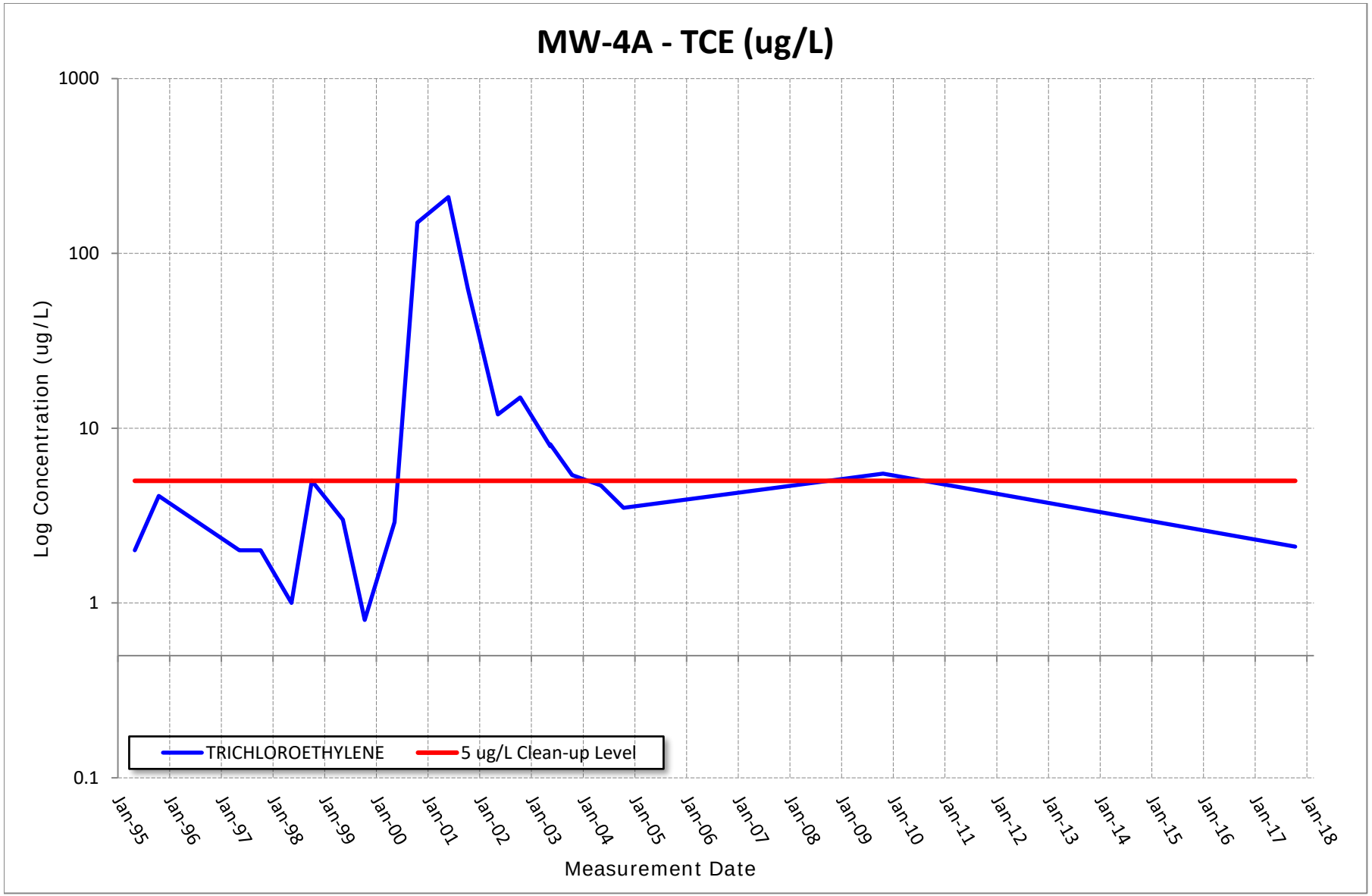

CPU-12 - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date


CPU-14 - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date


MW-1A - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date


MW-2B - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date


MW-3C - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date


MW-4A - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
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Jan-08
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Jan-11
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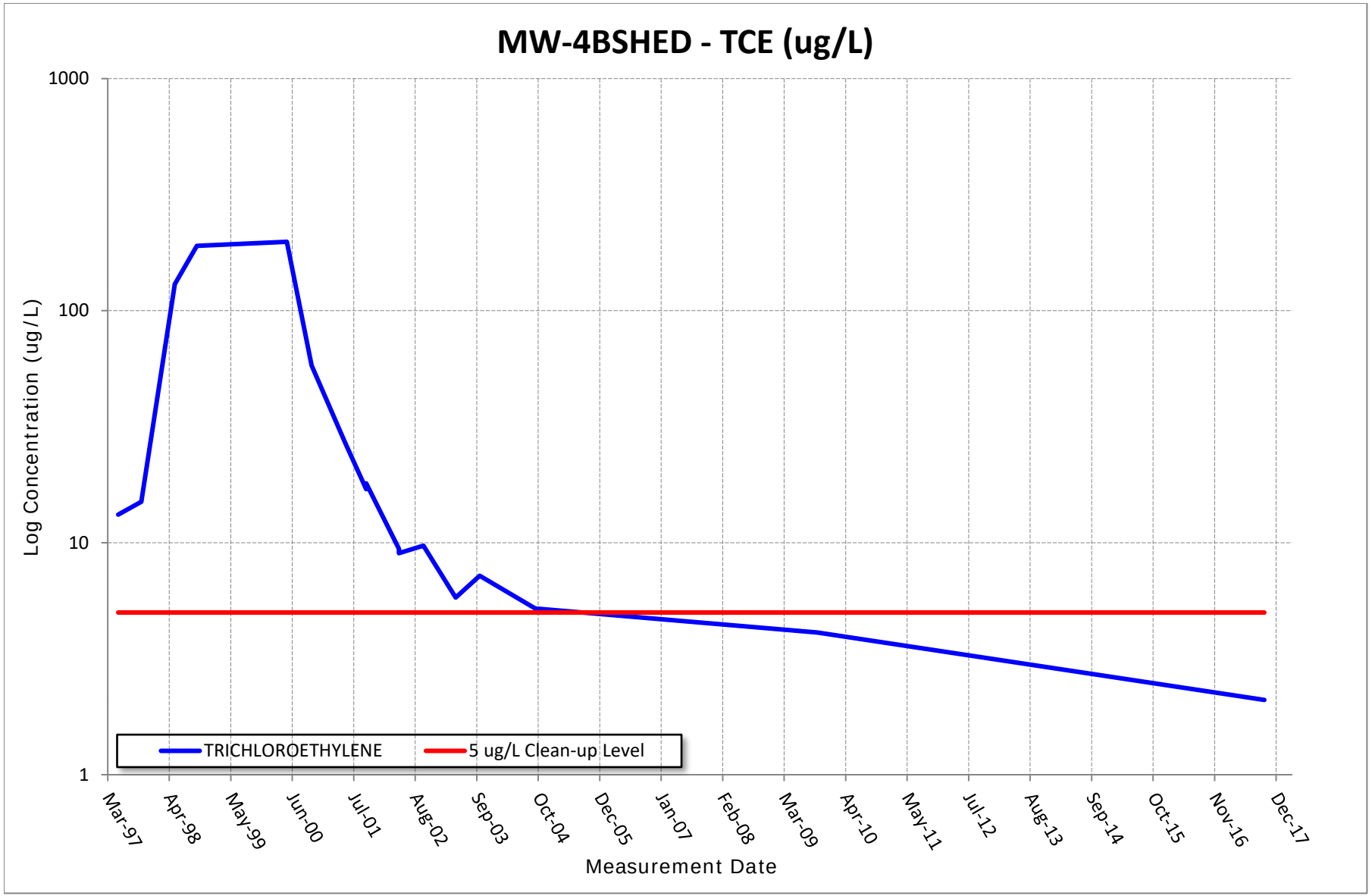
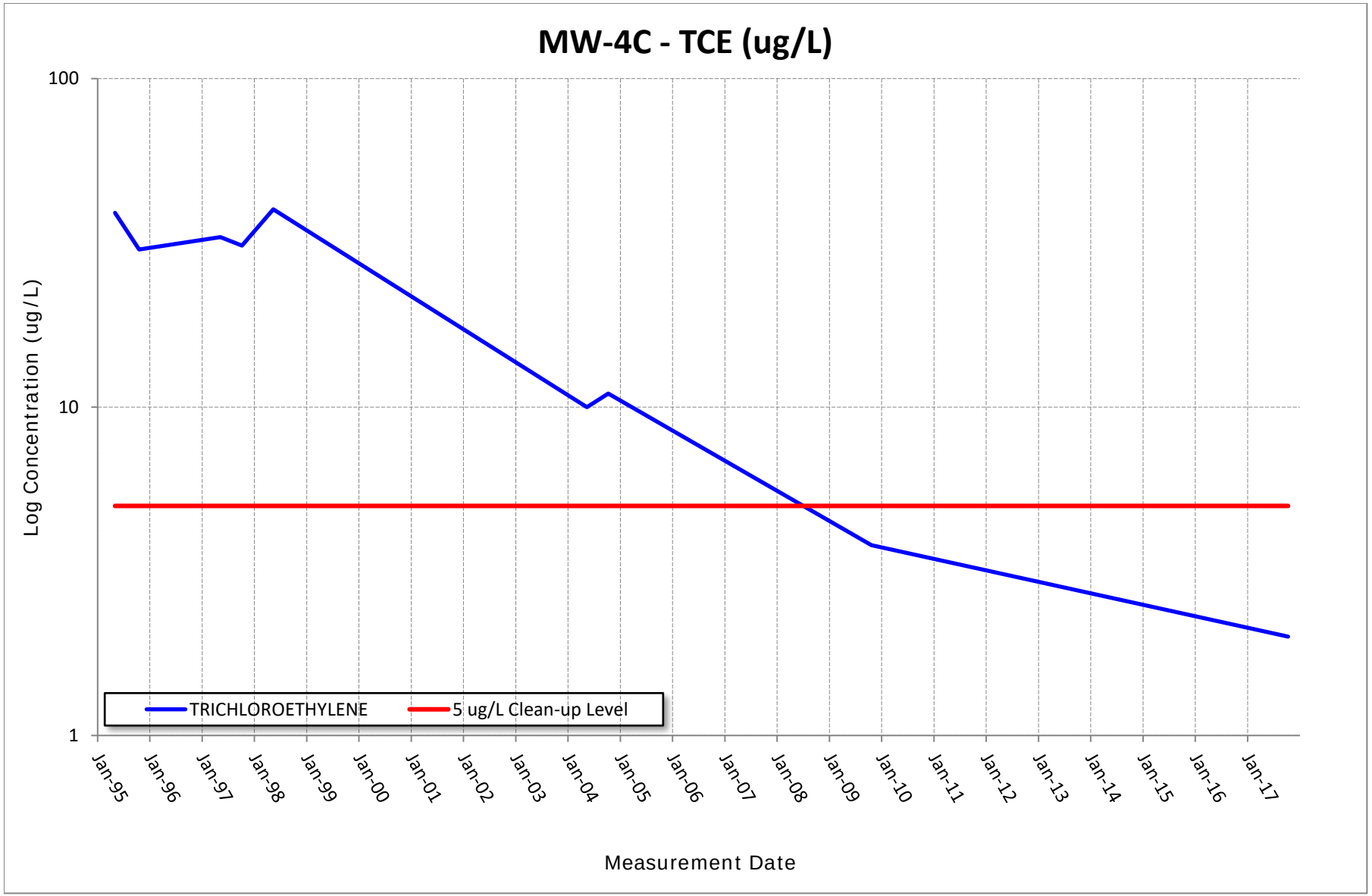
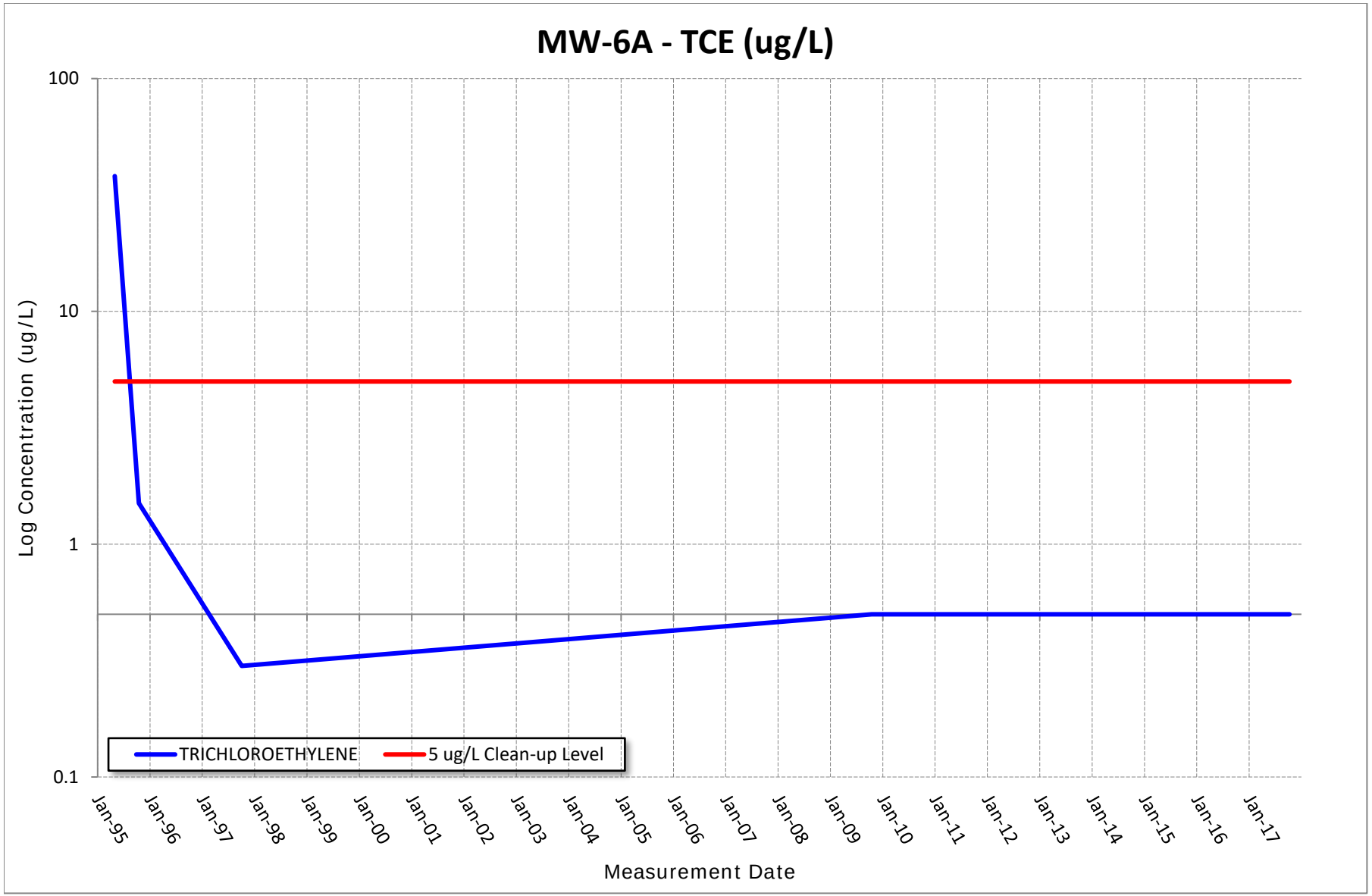
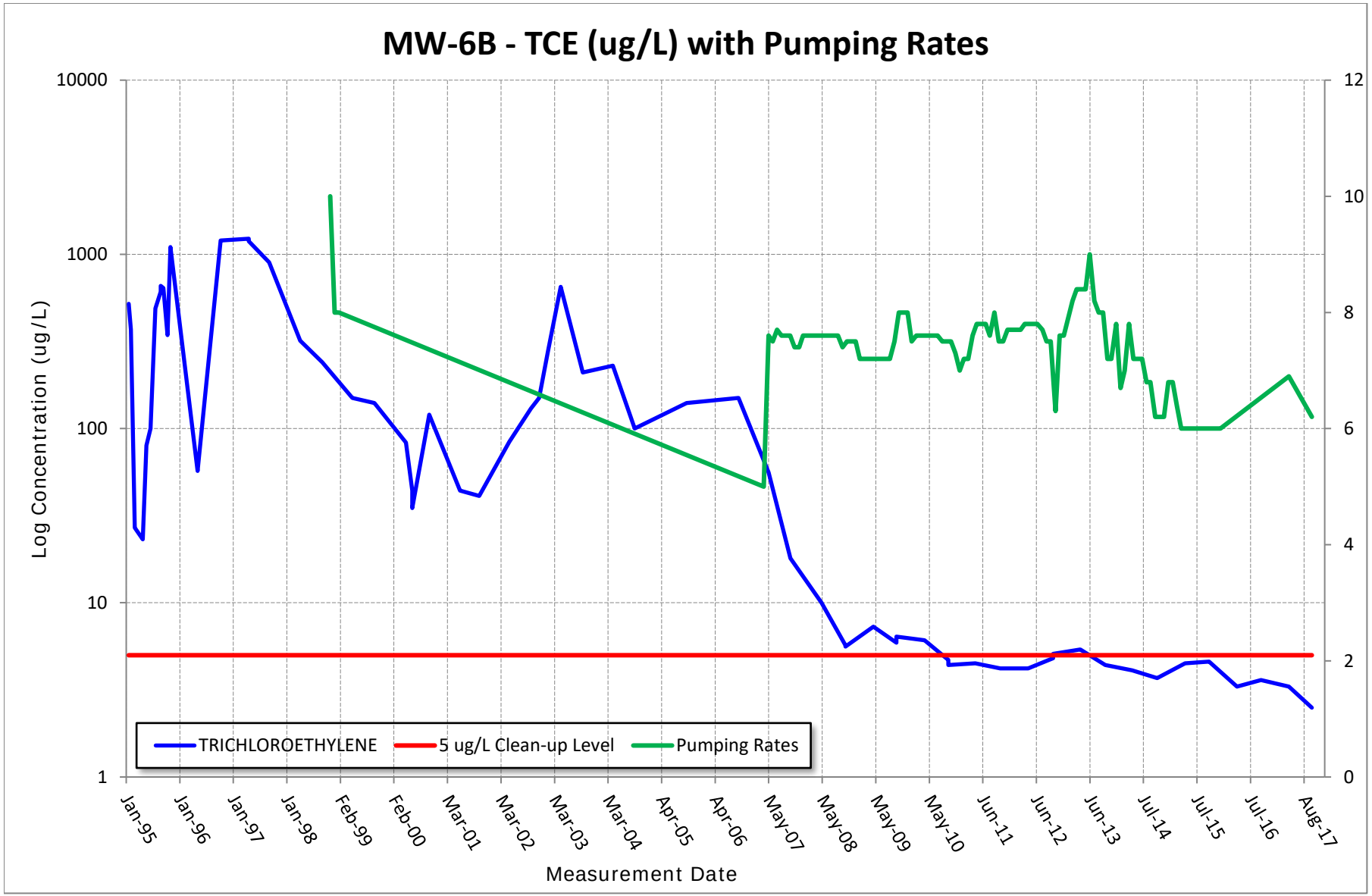
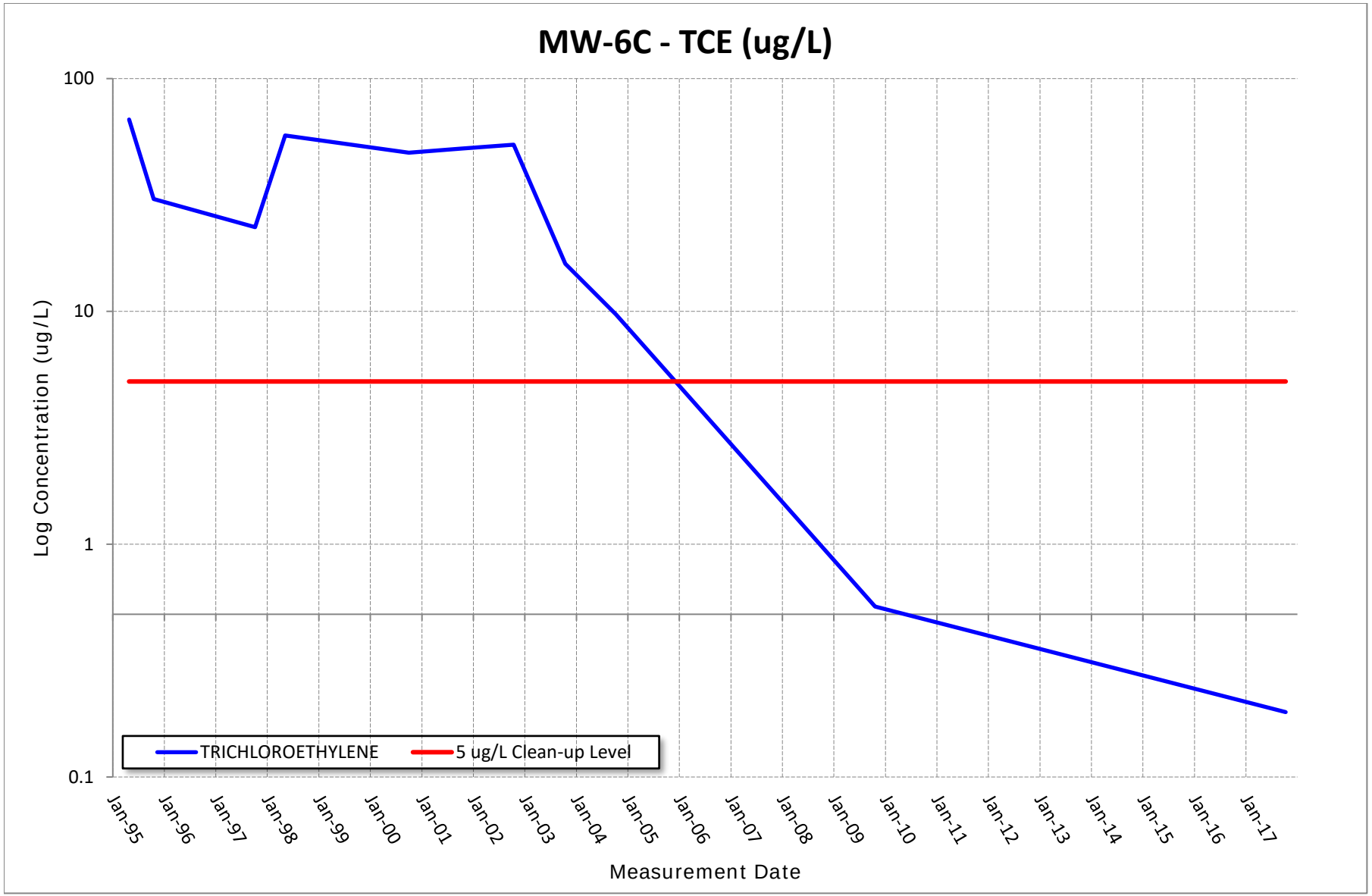
Jan-15
Jan-16
Jan-17
Jan-18
Measurement Date

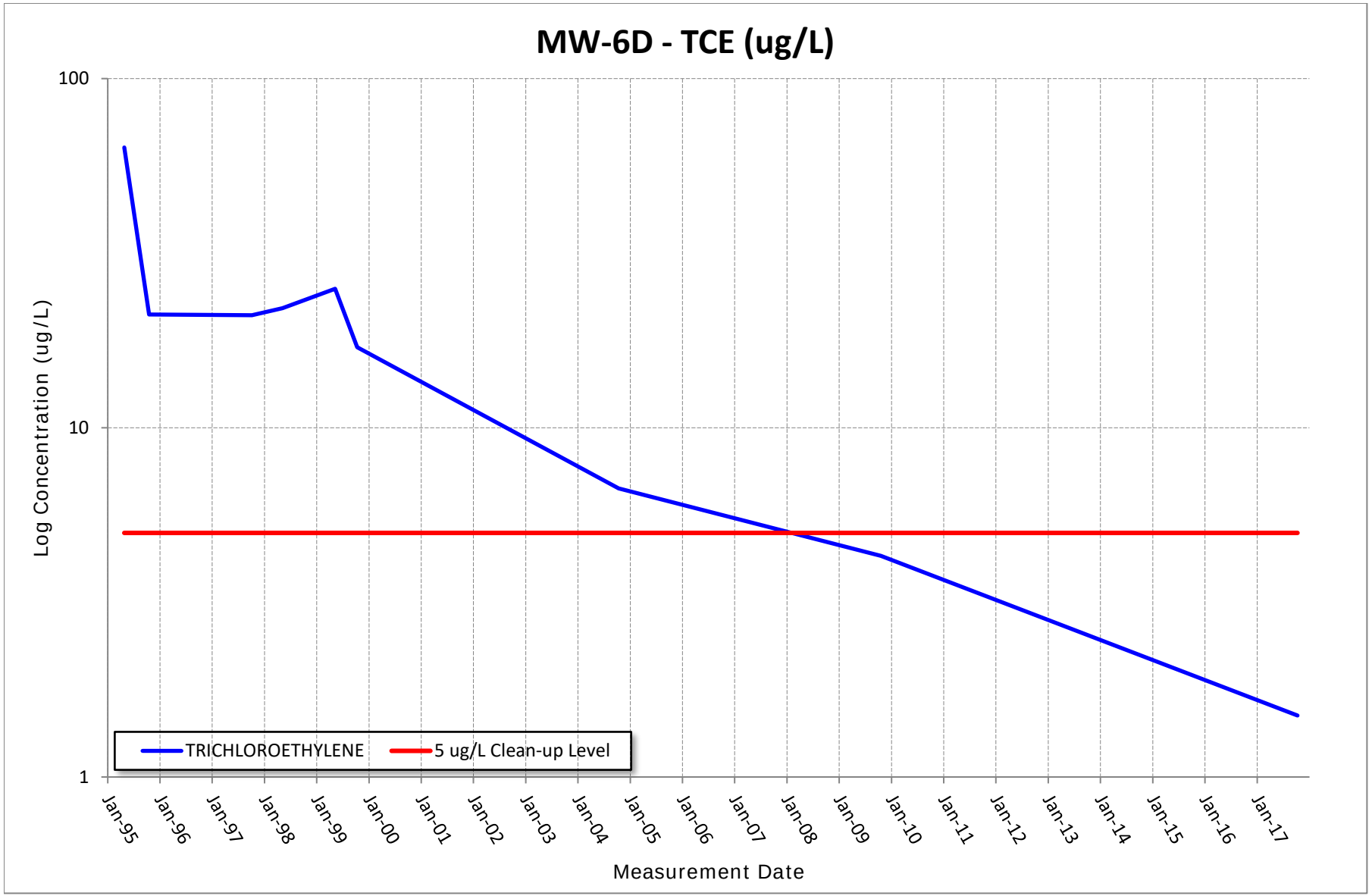

MW-4BSHED - TCE (ug/L)
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Mar-97
Apr-98
May-99
Jun-00
Jul-01
Aug-02
Sep-03
Oct-04
Dec-05
Jan-07
Feb-08
Mar-09
Apr-10
May-11
Jul-12
Aug-13
Sep-14
Oct-15
Nov-16
Dec-17
Measurement Date

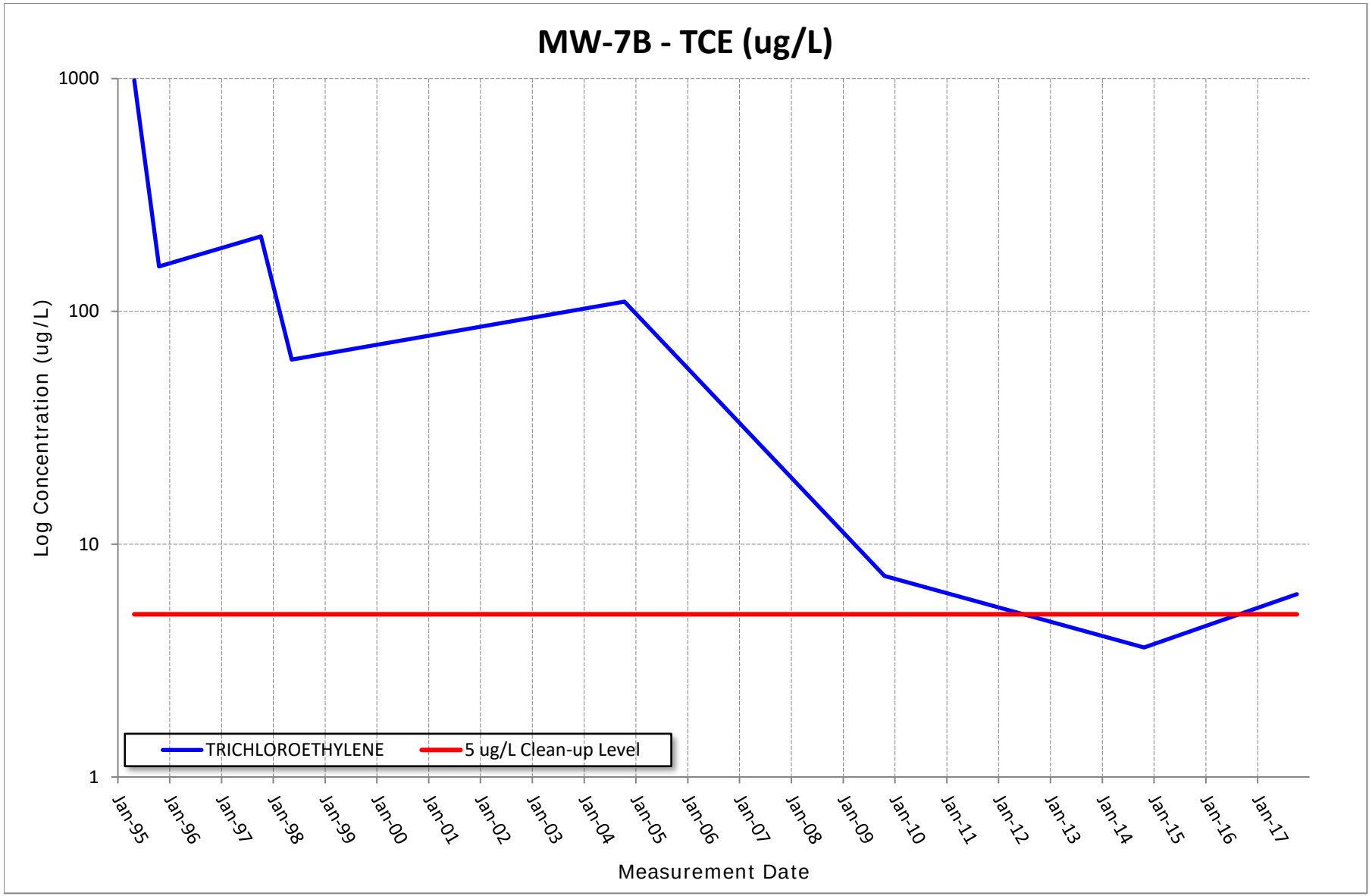

MW-4C - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

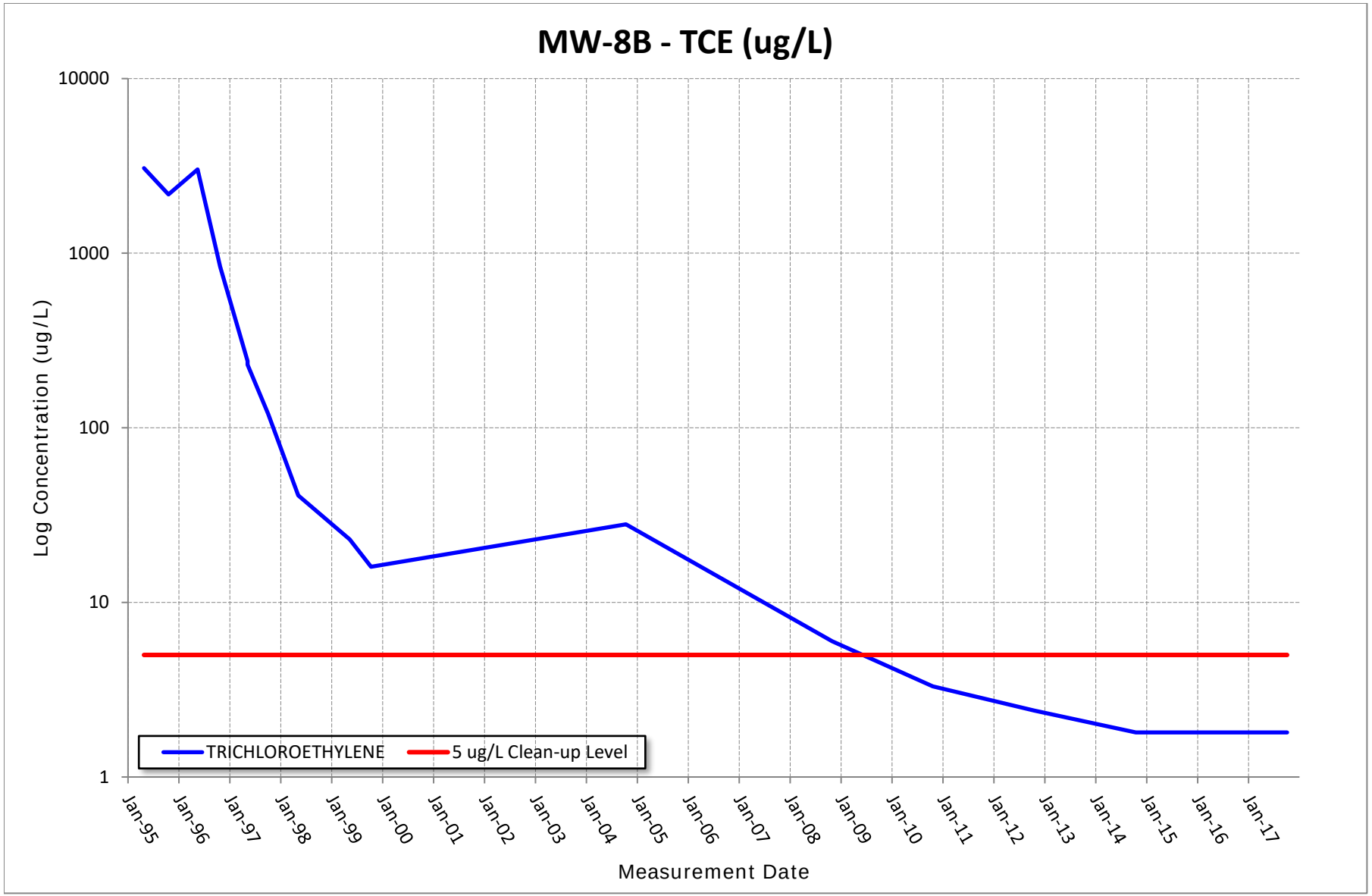

MW-6A - TCE (ug/L)
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

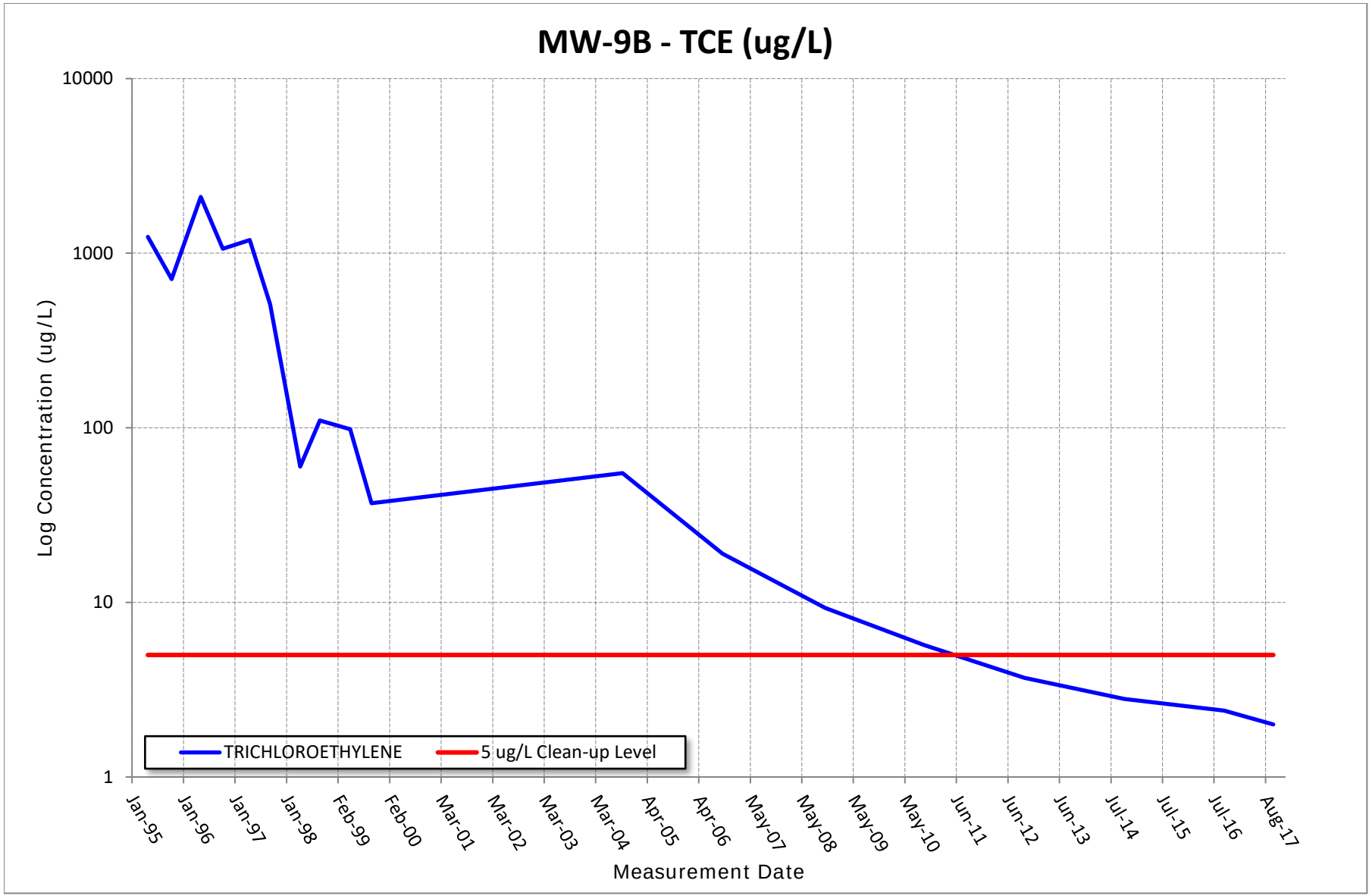

MW-6B - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

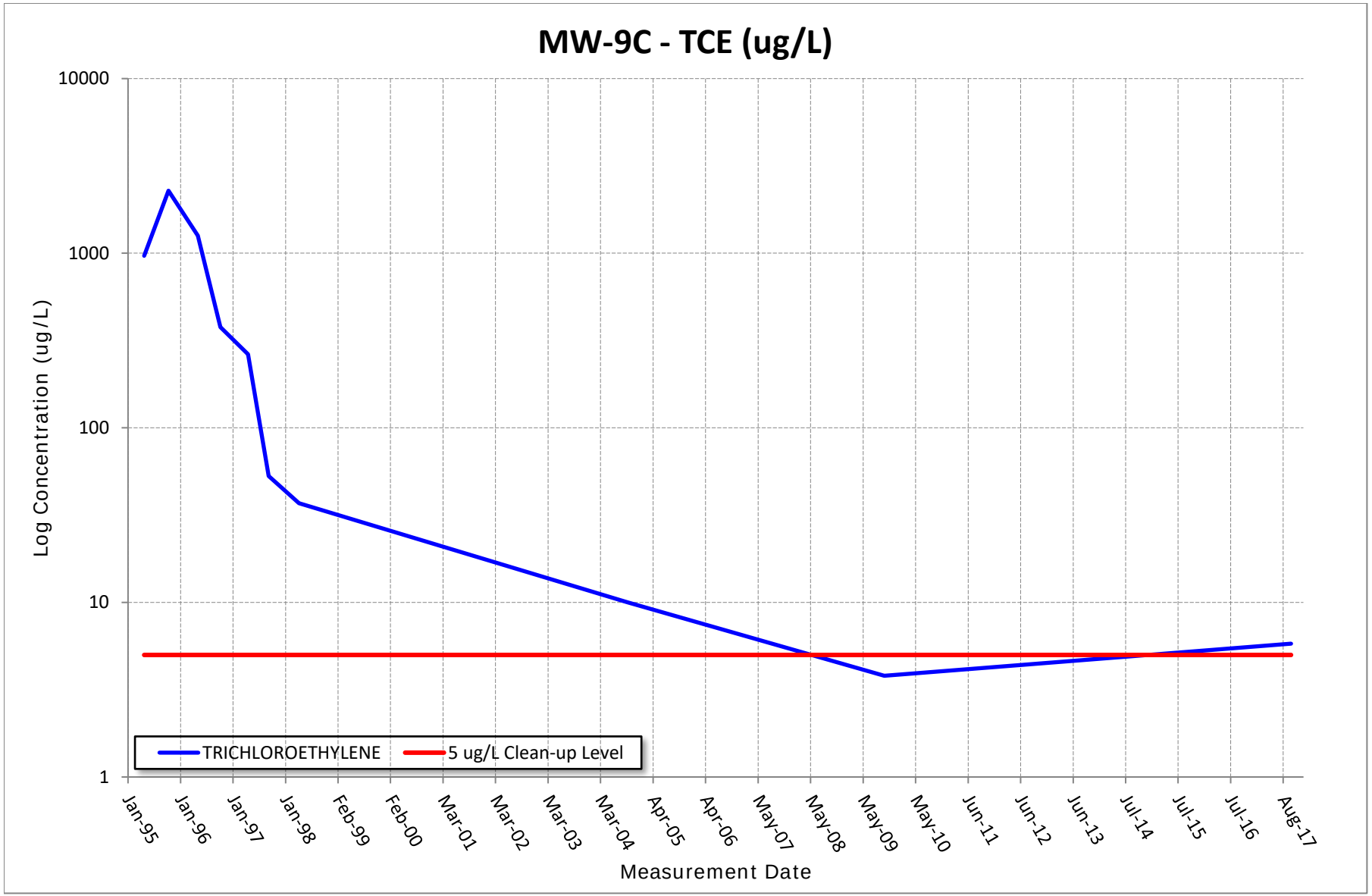

MW-6C - TCE (ug/L)
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

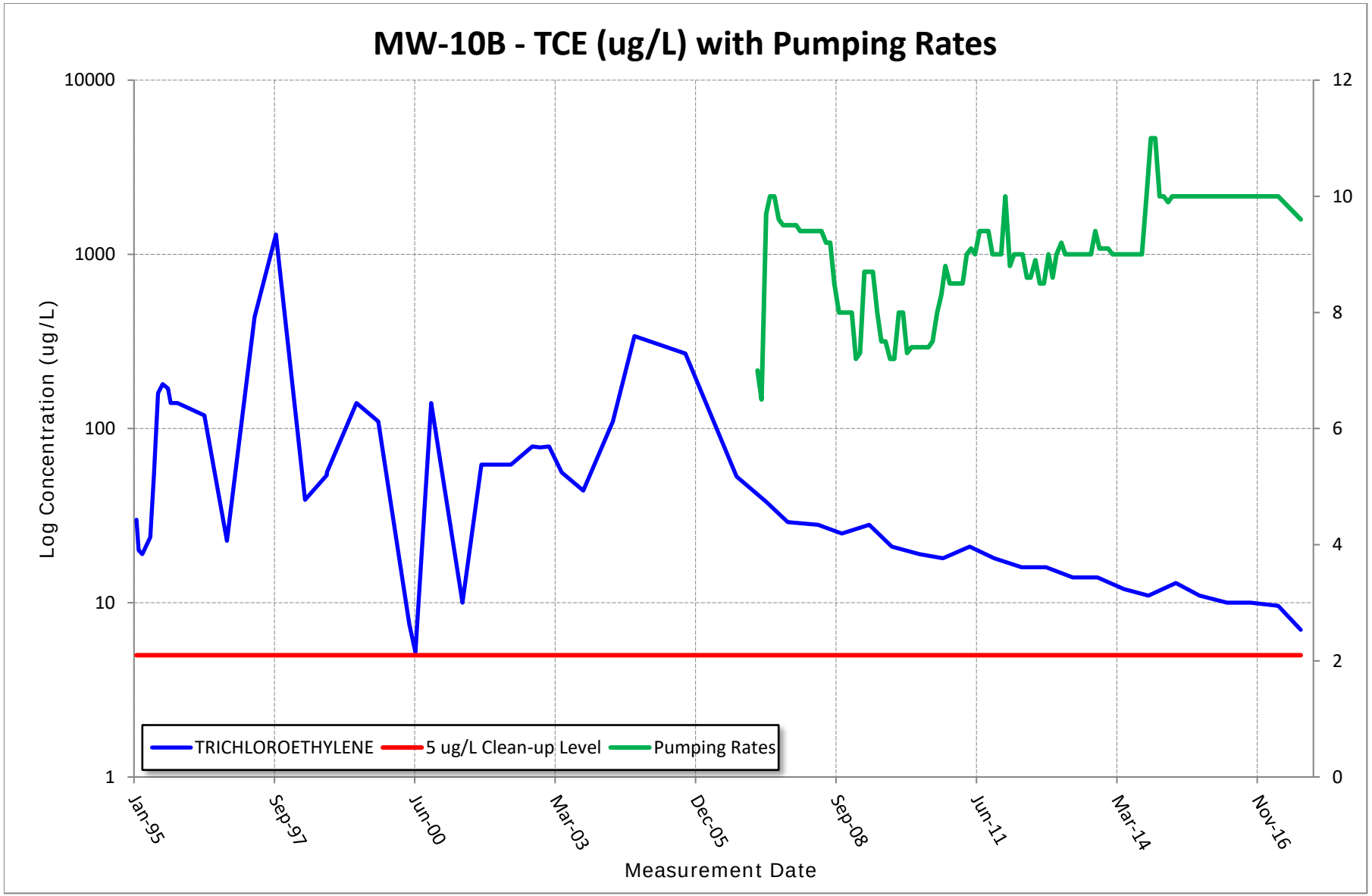

MW-6D - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

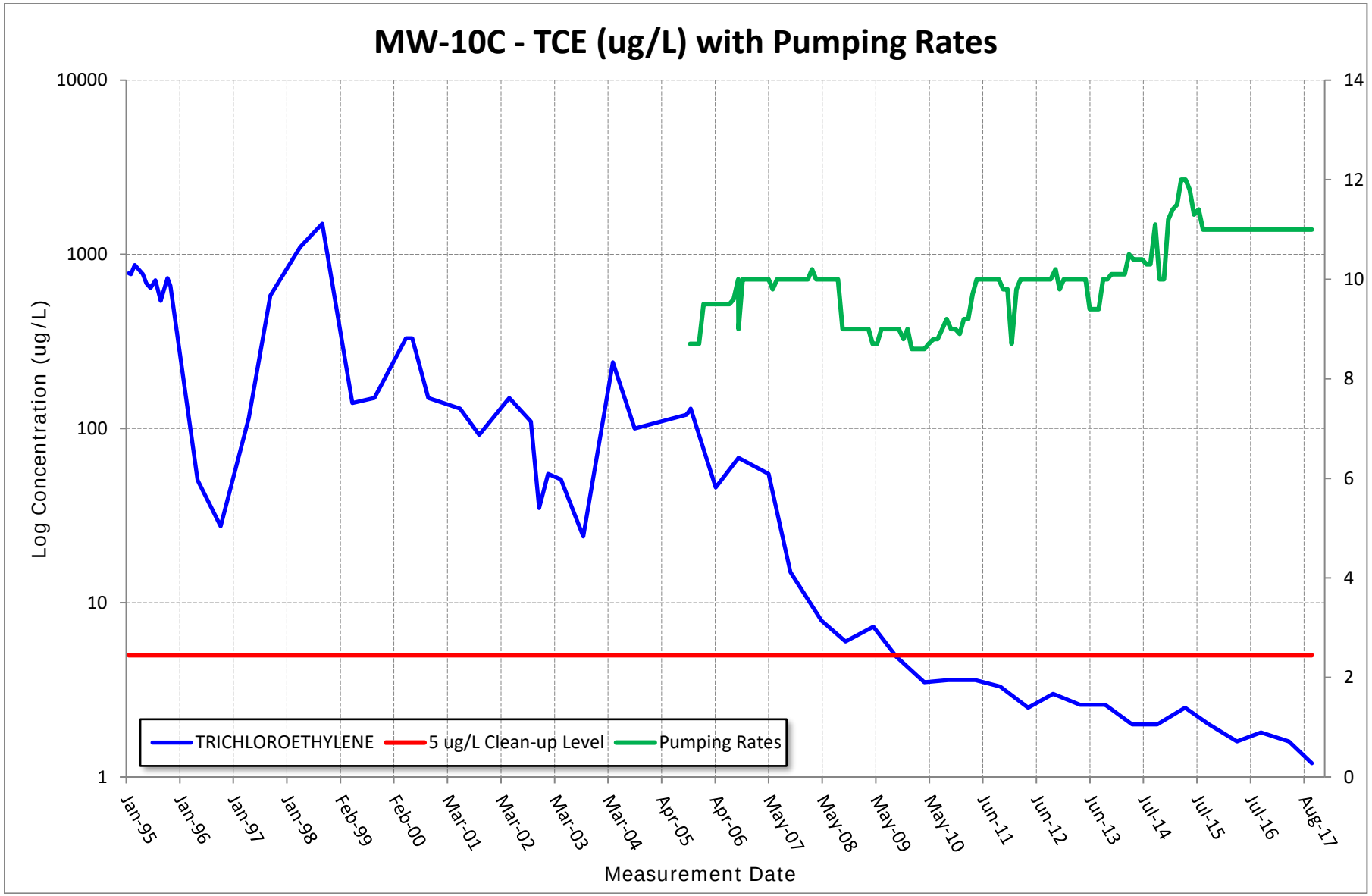

MW-7B - TCE (ug/L)
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

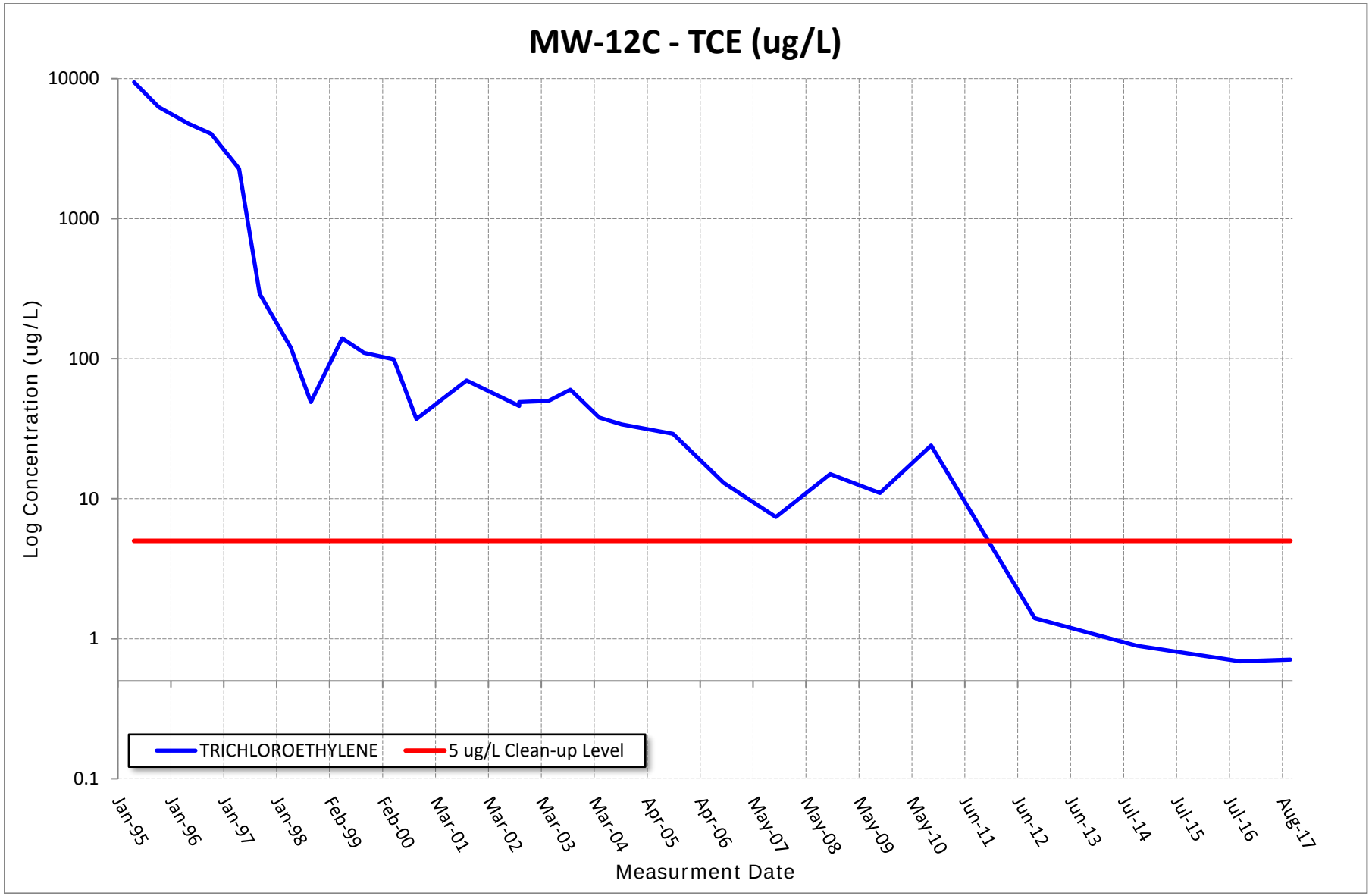

MW-8B - TCE (ug/L)
10000
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

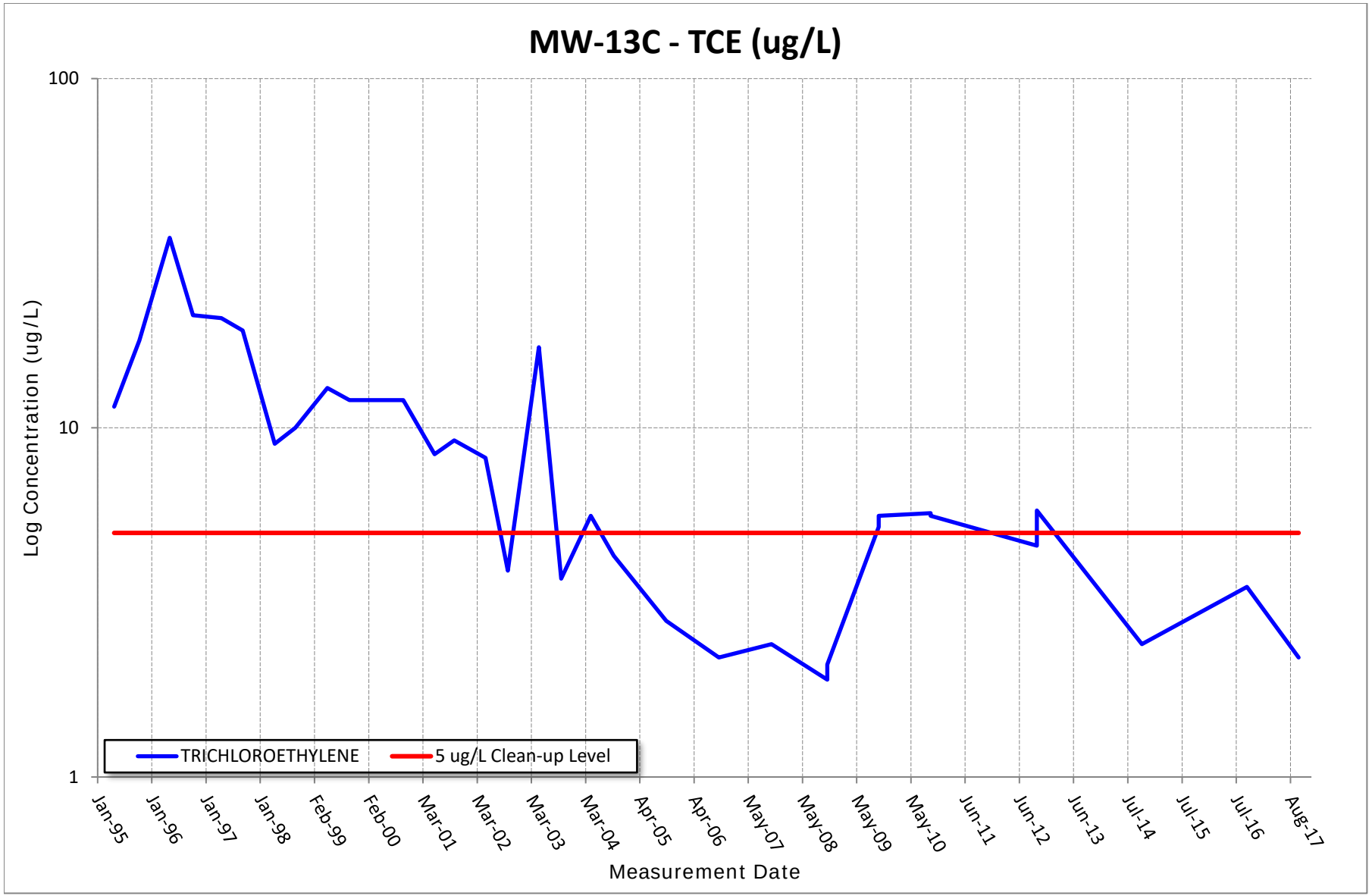

MW-9B - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

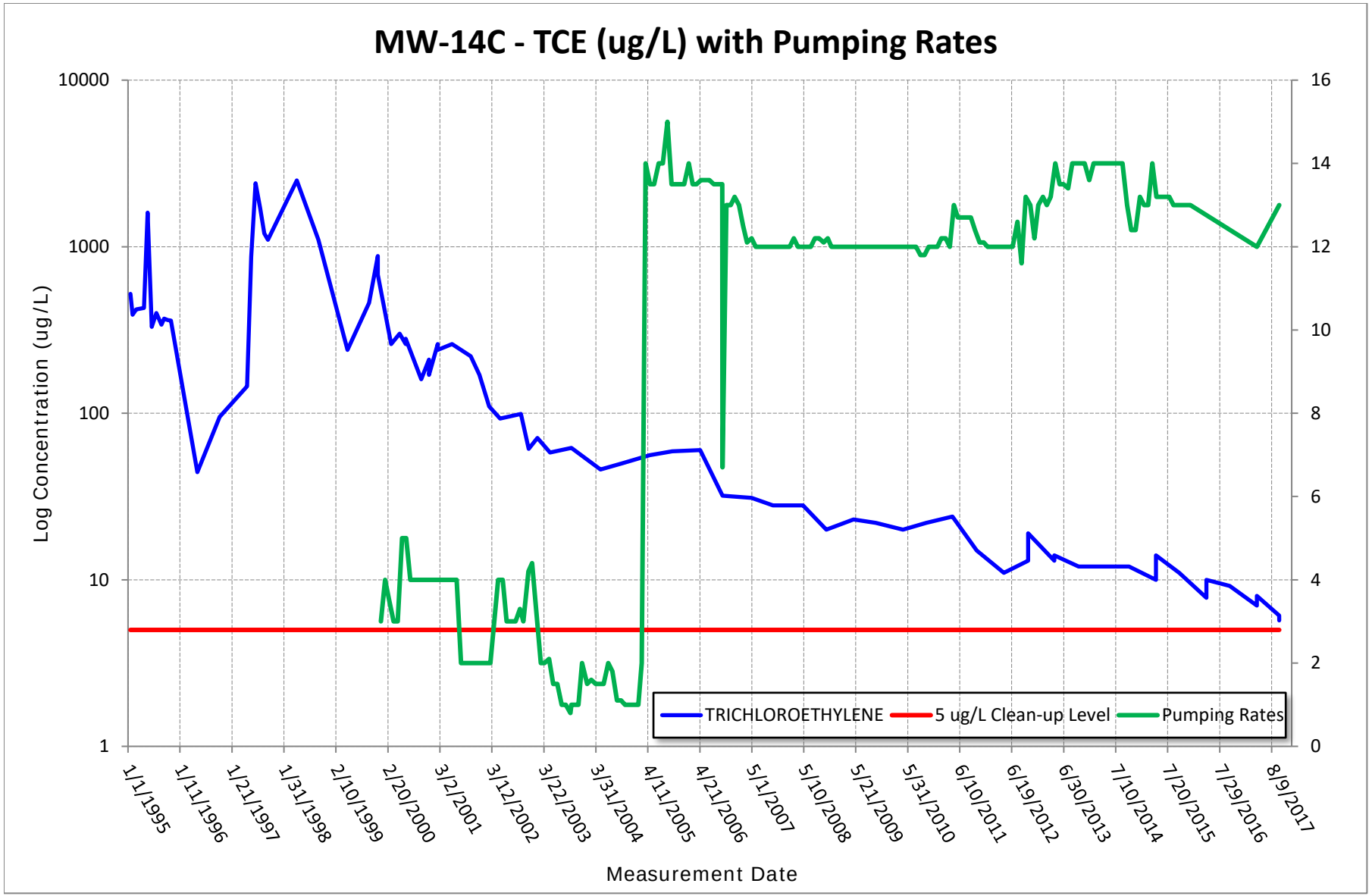

MW-9C - TCE (ug/L)
10000
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

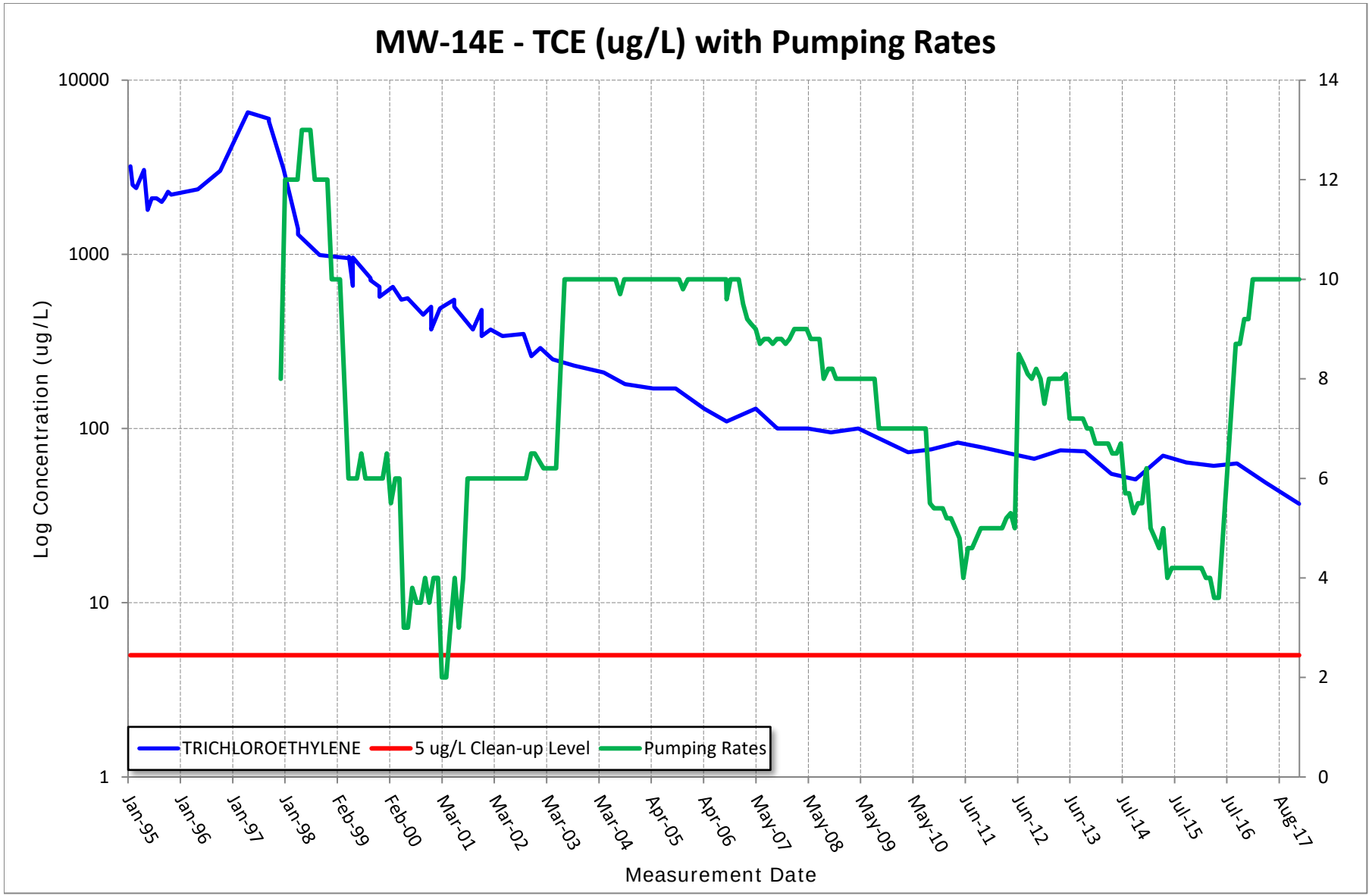

MW-10B - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
12
10
8
6
4
2
0
Jan-95
Sep-97
Jun-00
Mar-03
Dec-05
Sep-08
Jun-11
Mar-14
Nov-16
Measurement Date
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates

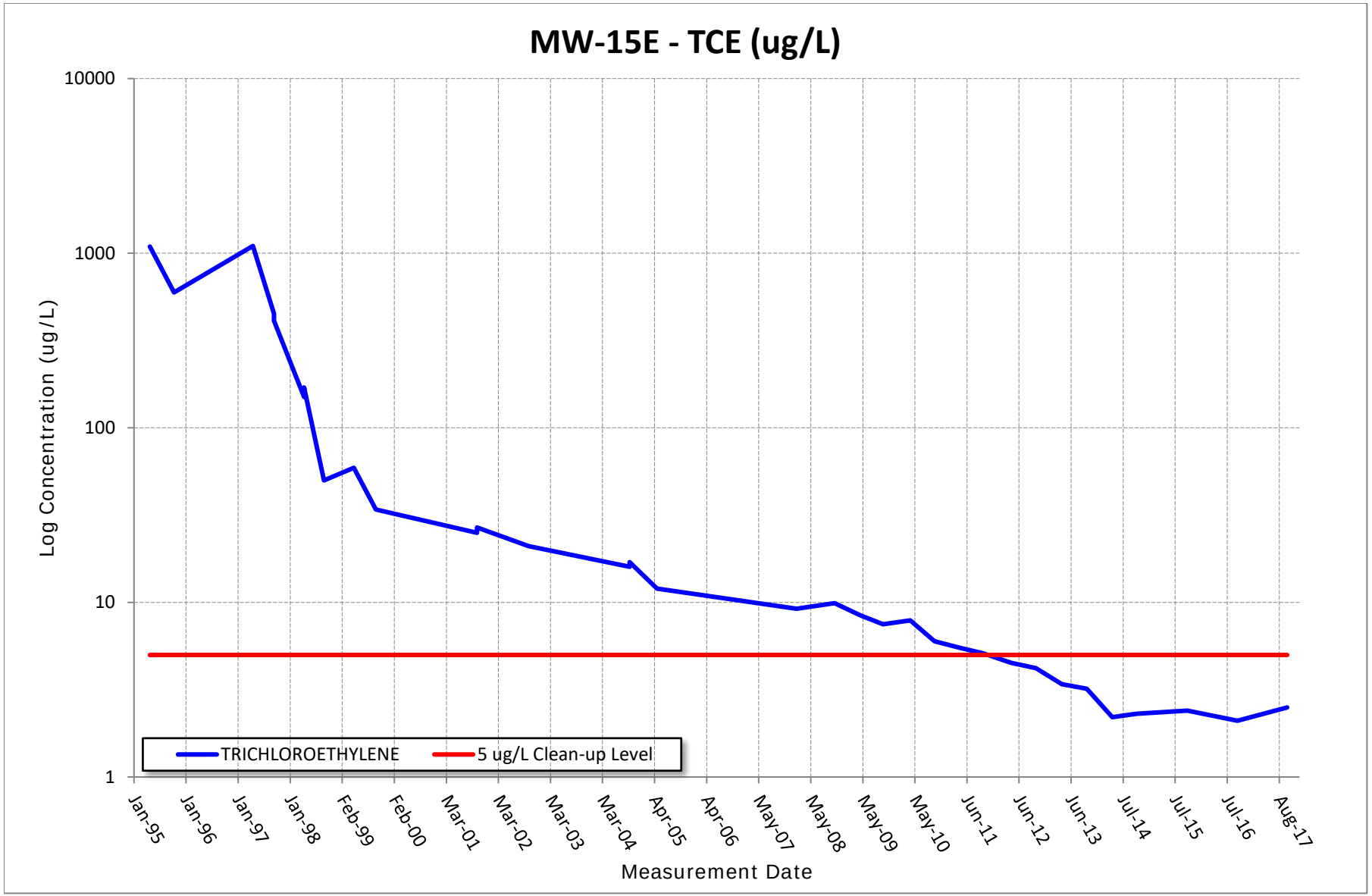

MW-10C - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

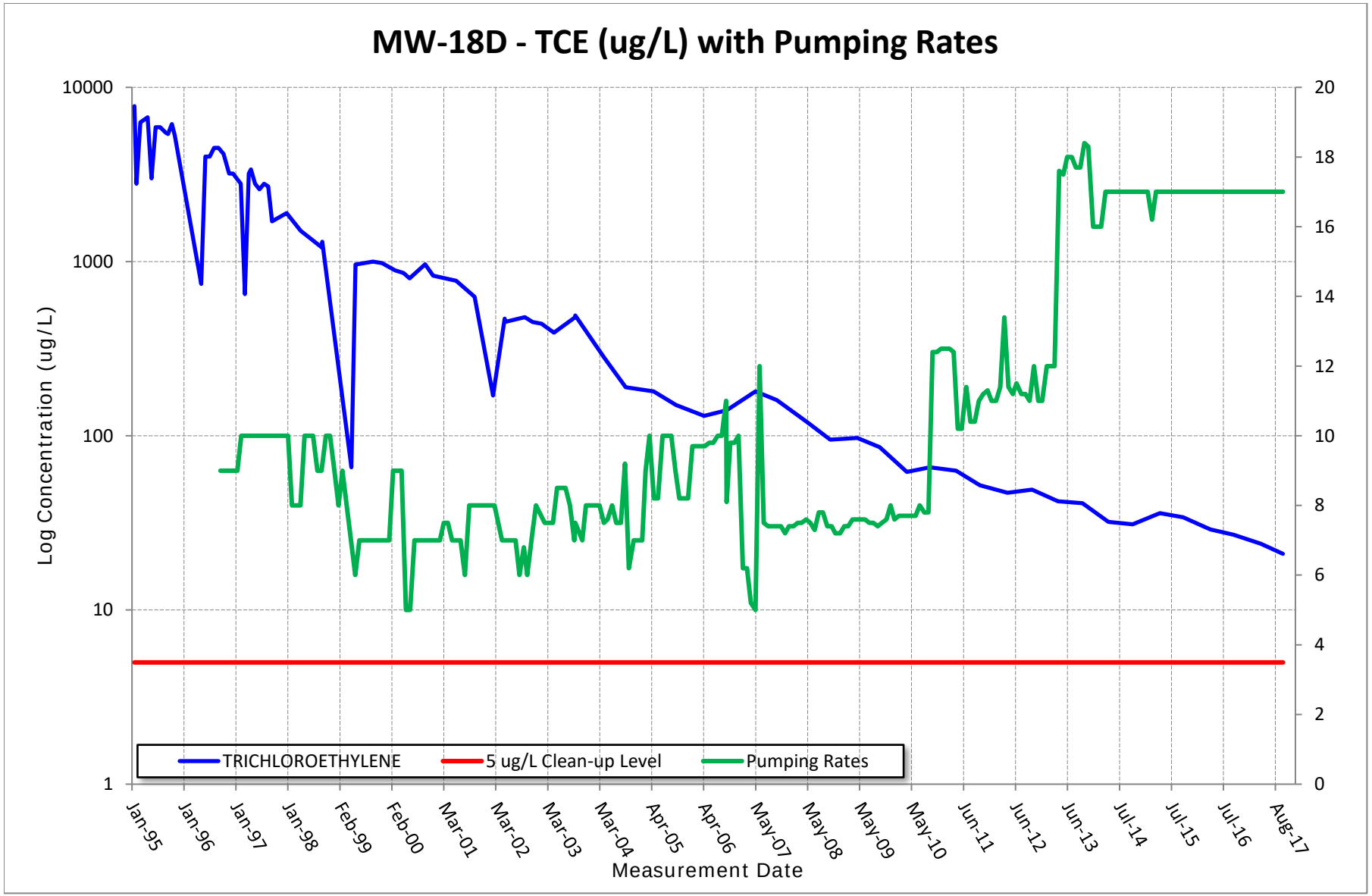

MW-12C - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
0.1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurment Date

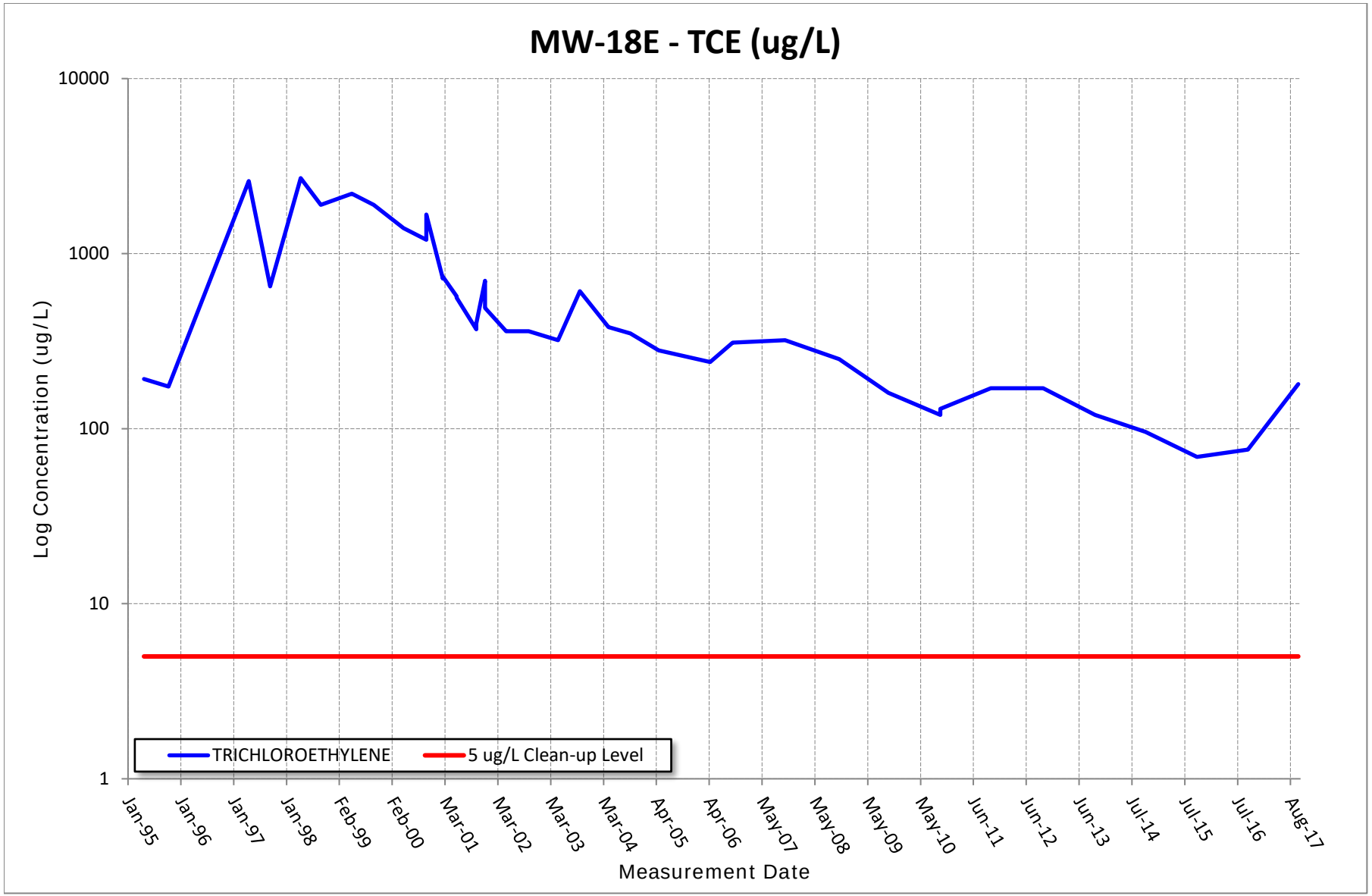

MW-13C - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

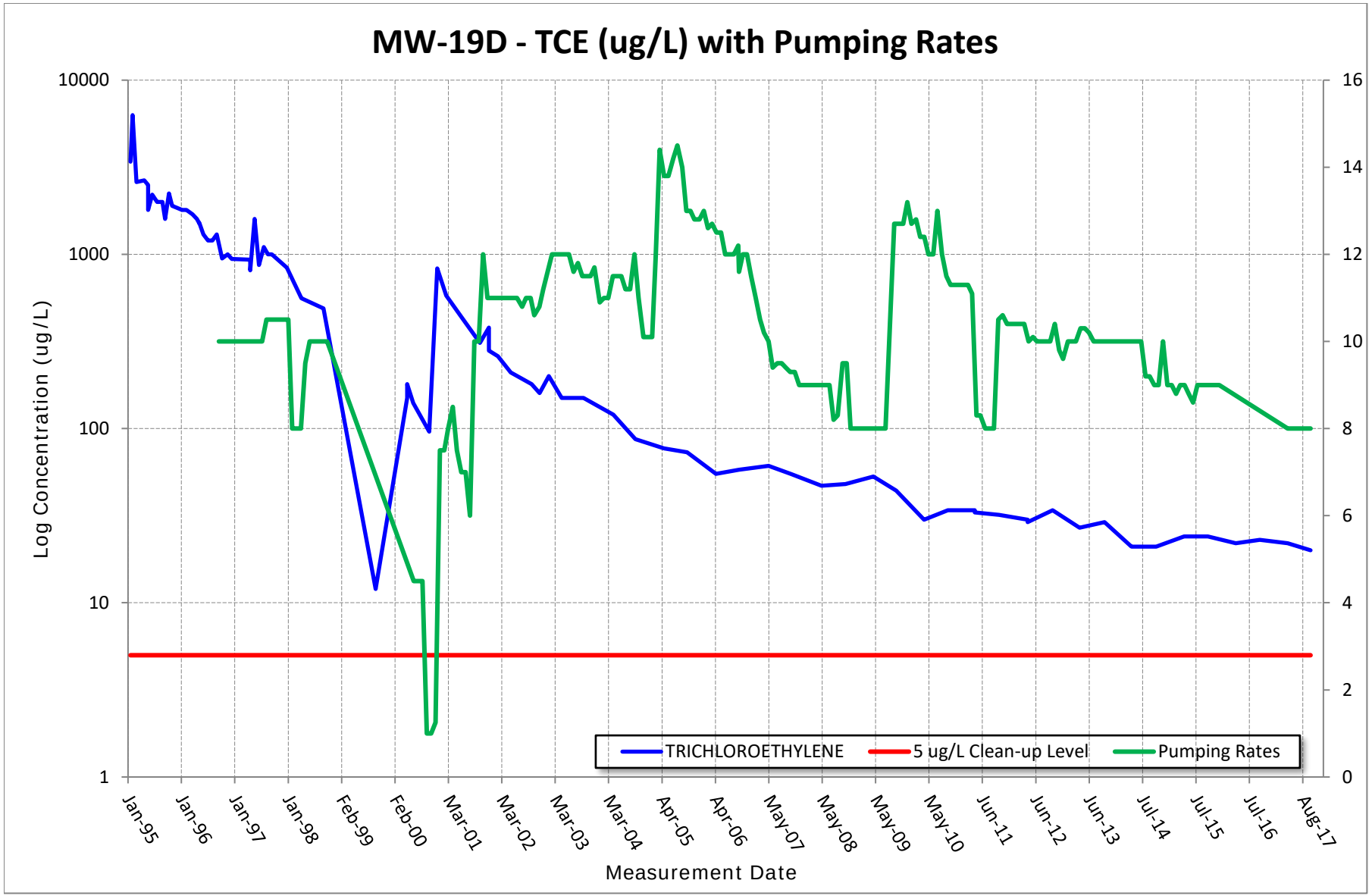

MW-14C - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
16
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
1/1/1995
1/11/1996
1/21/1997
1/31/1998
2/10/1999
2/20/2000
3/2/2001
3/12/2002
3/22/2003
3/31/2004
4/11/2005
4/21/2006
5/1/2007
5/10/2008
5/21/2009
5/31/2010
6/10/2011
6/19/2012
6/30/2013
7/10/2014
7/20/2015
7/29/2016
8/9/2017
Measurement Date

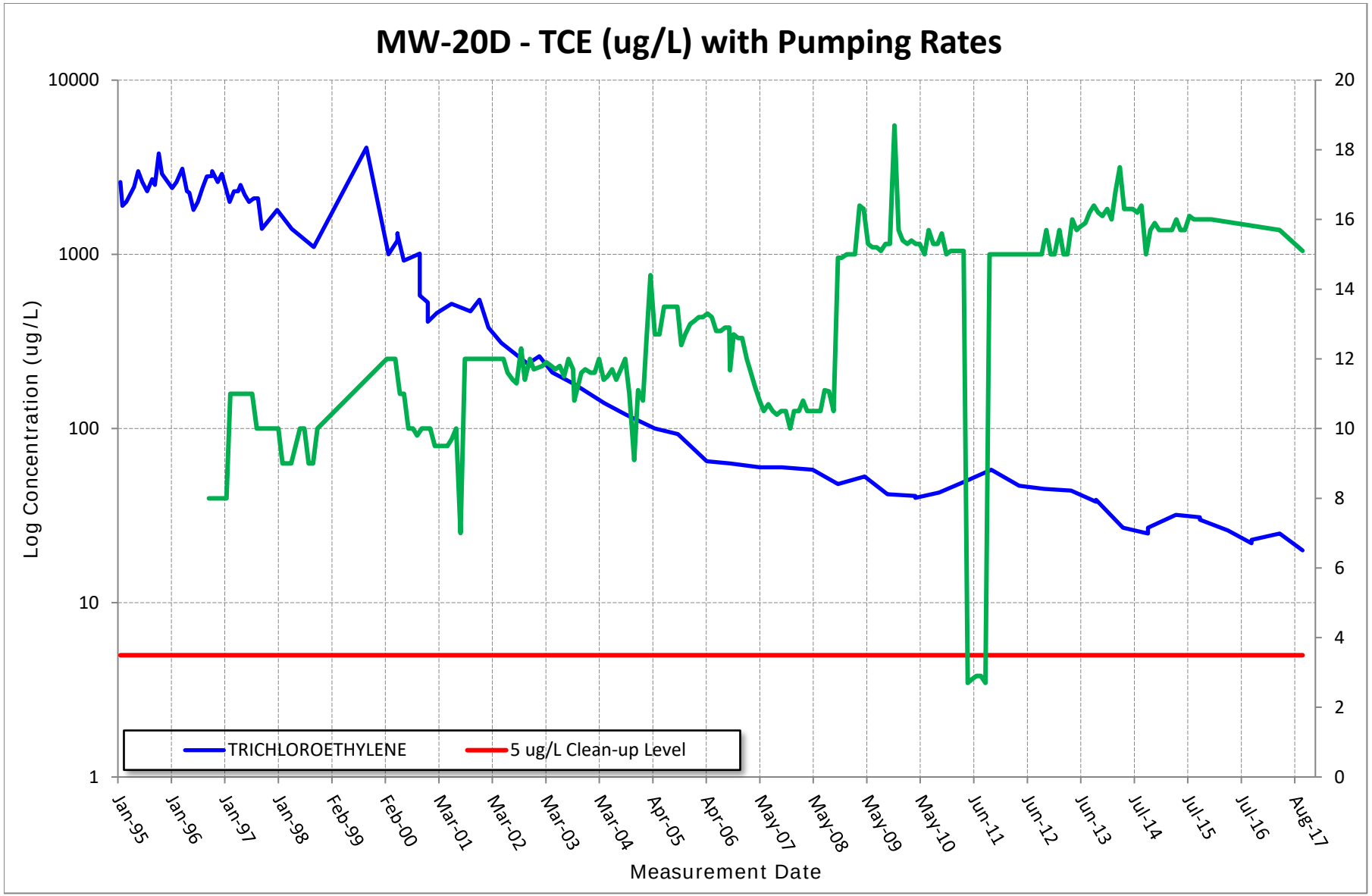

MW-14E - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

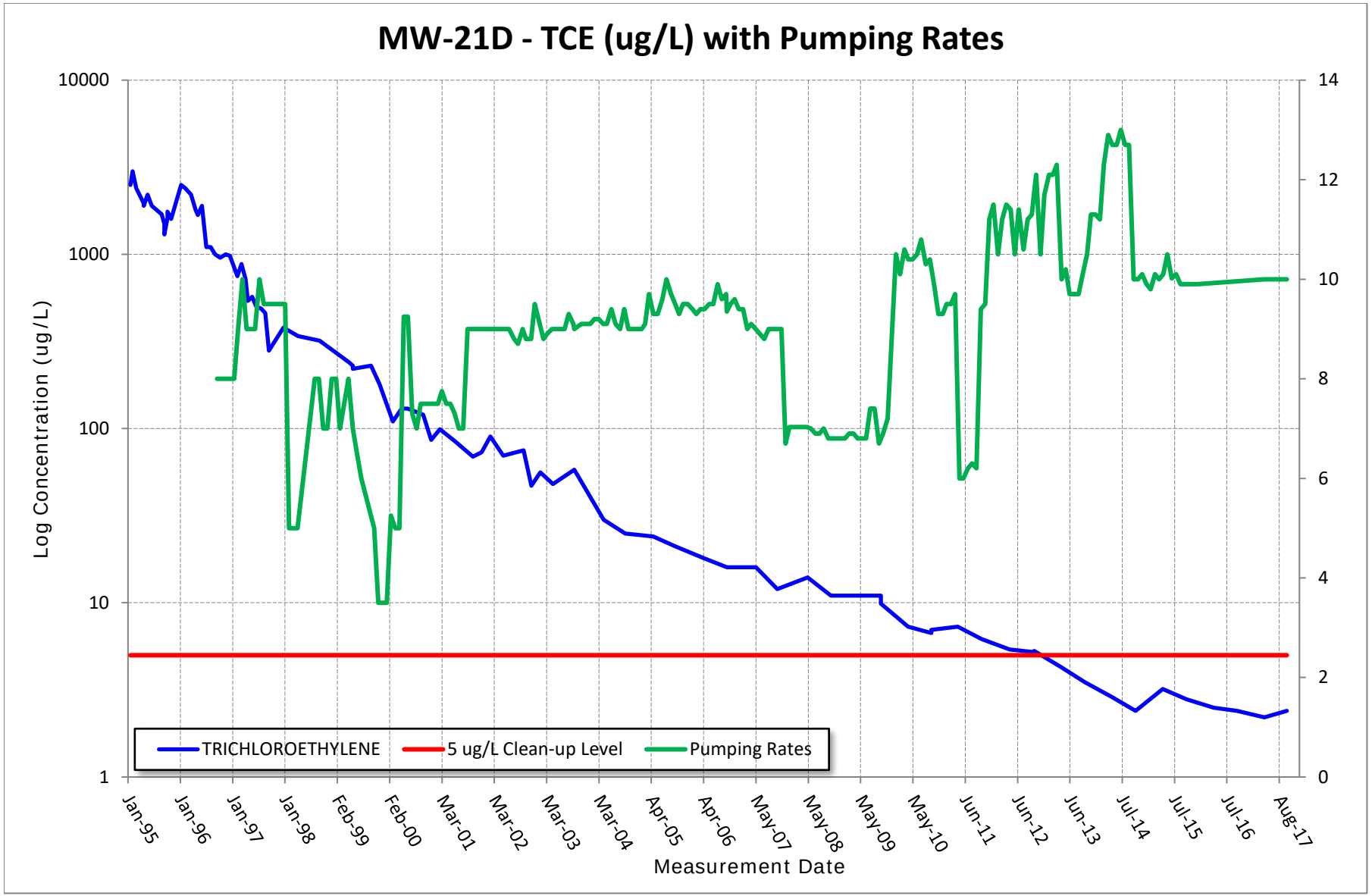

MW-15E - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

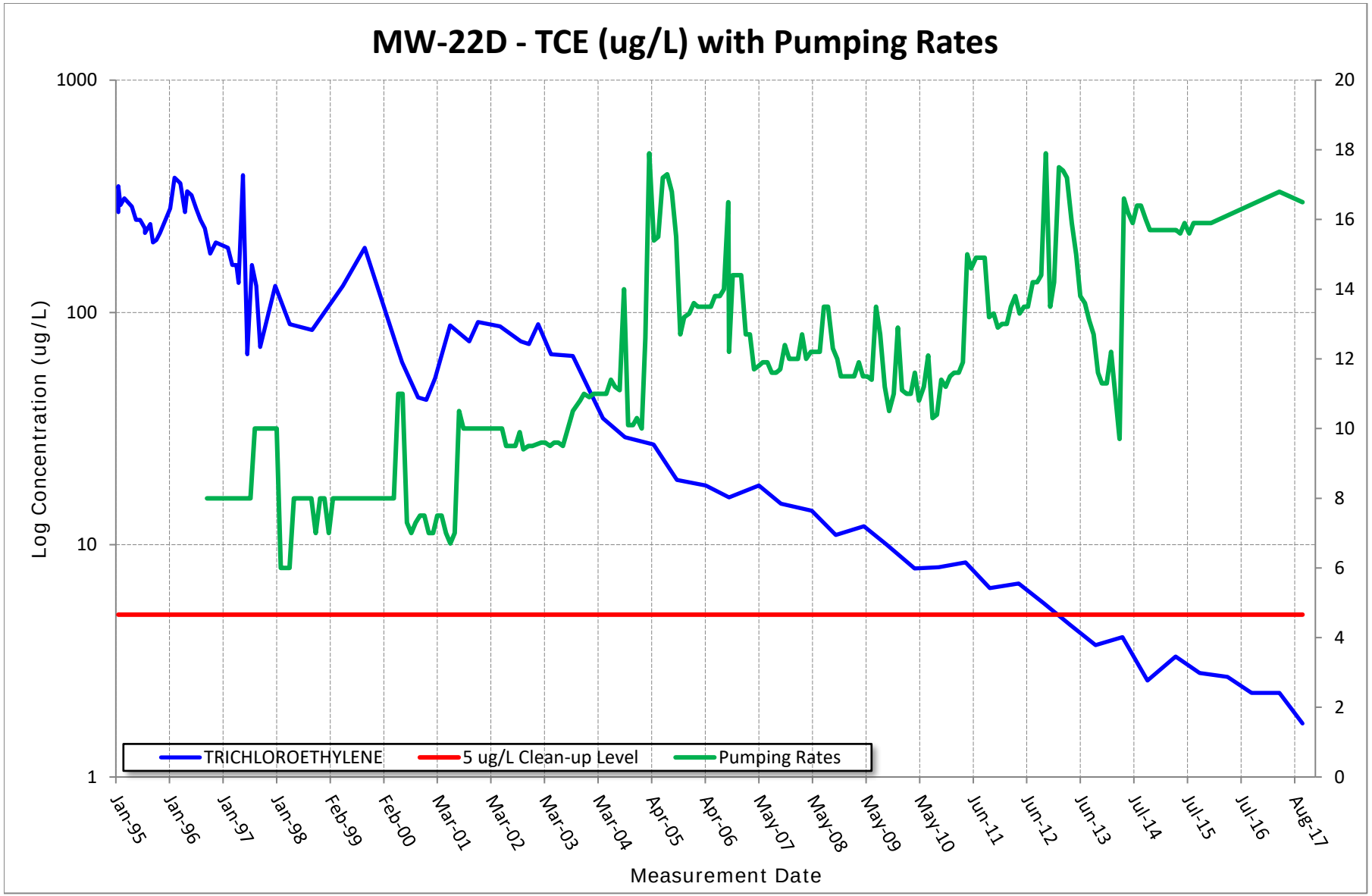

MW-18D - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
20
18
16
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

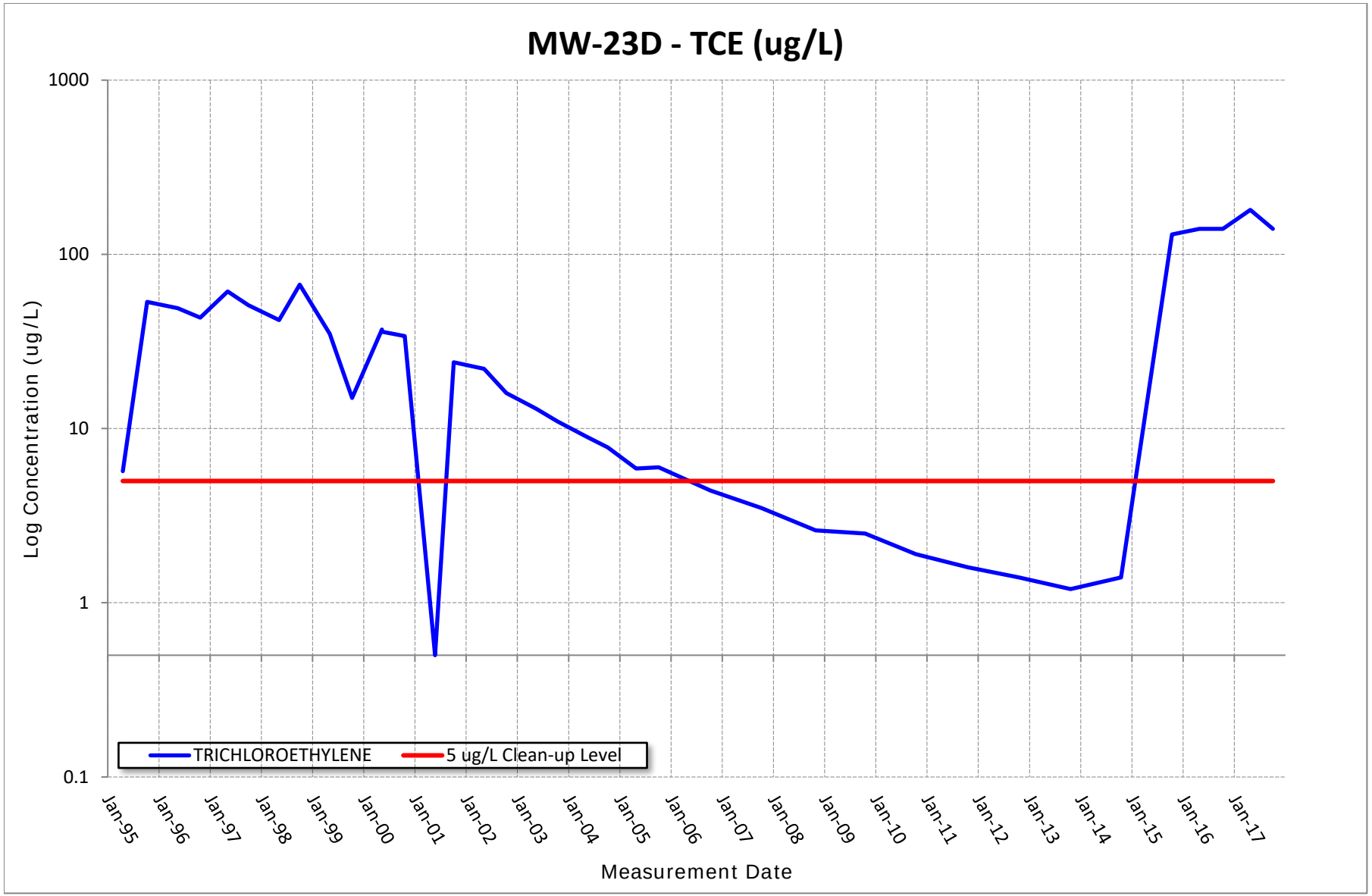

MW-18E - TCE (ug/L)
Log Concentration (ug/L)
10000
1000
100
10
1
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

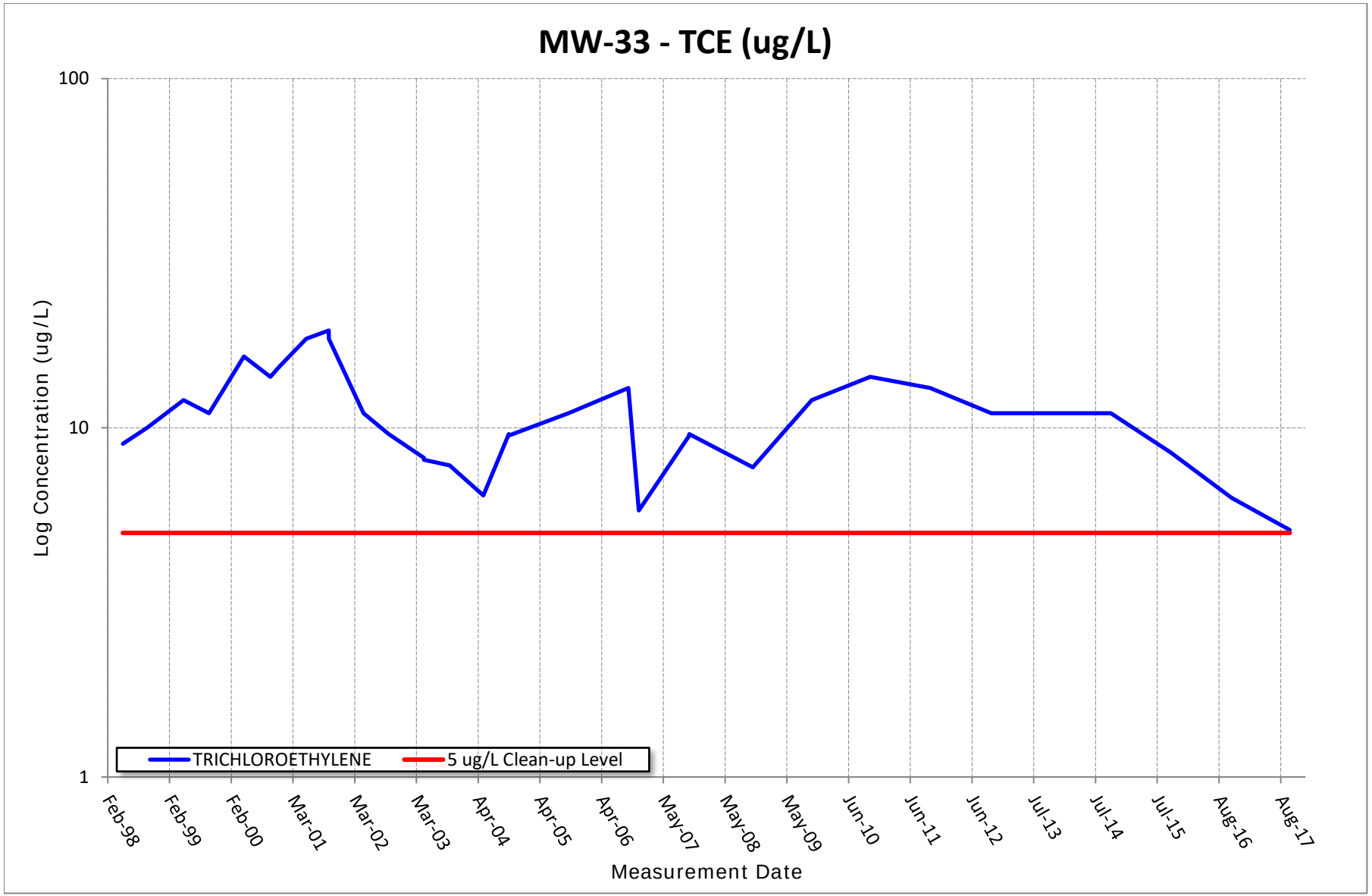

MW-19D - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
16
14
12
10
8
6
4
2
0
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates

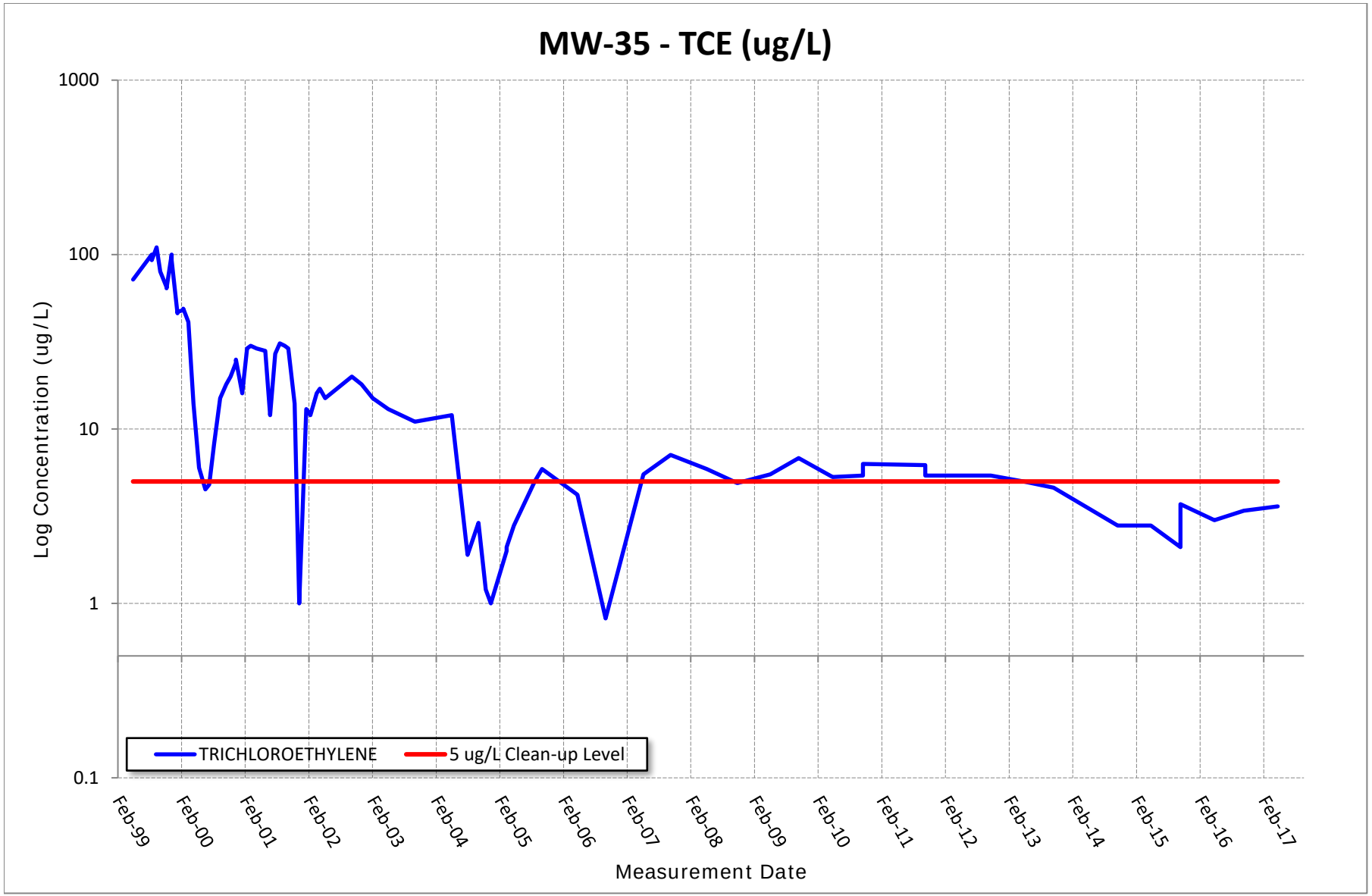

MW-20D - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
20
18
16
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

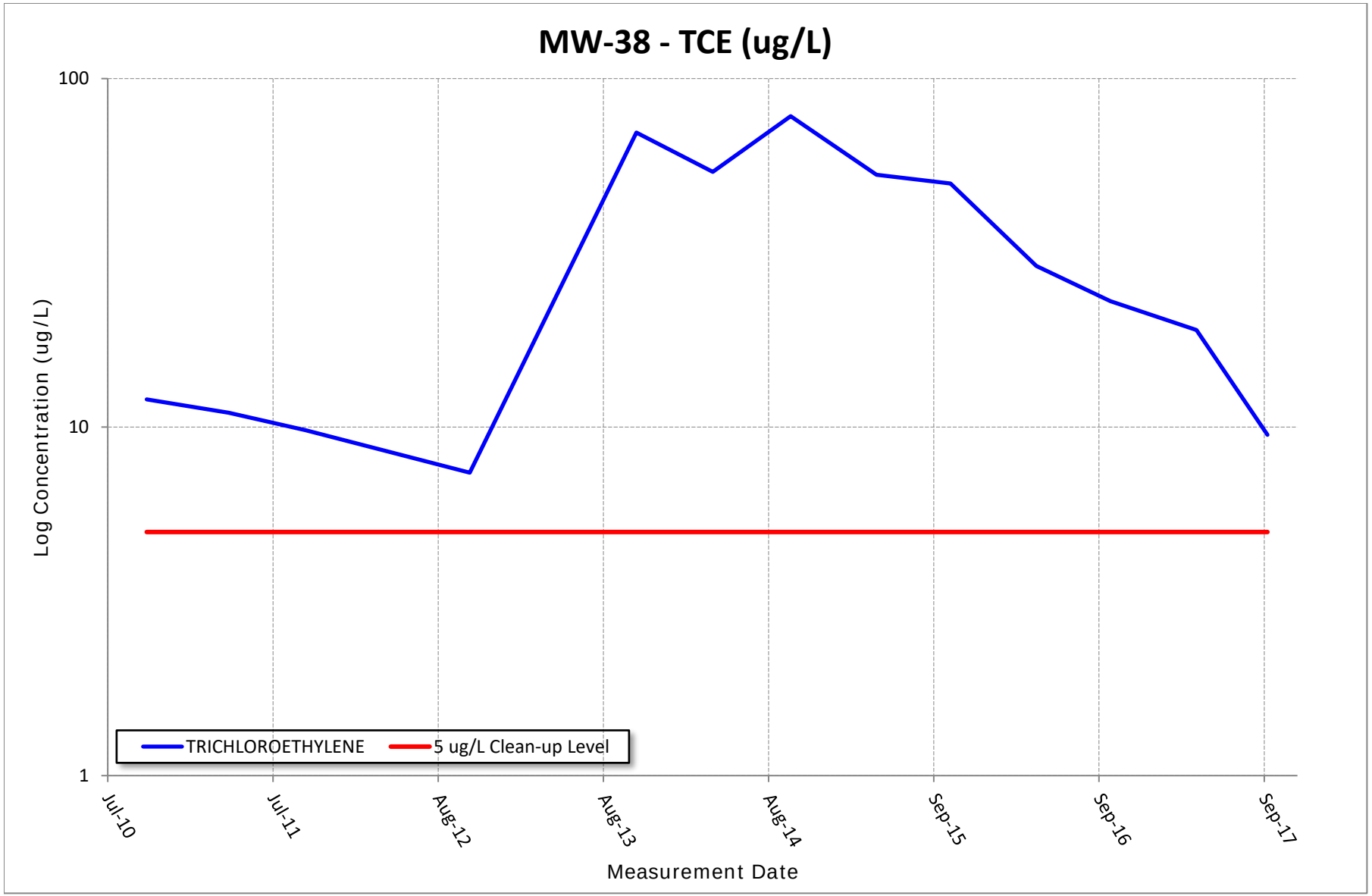

MW-21D - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
10000
1000
100
10
1
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

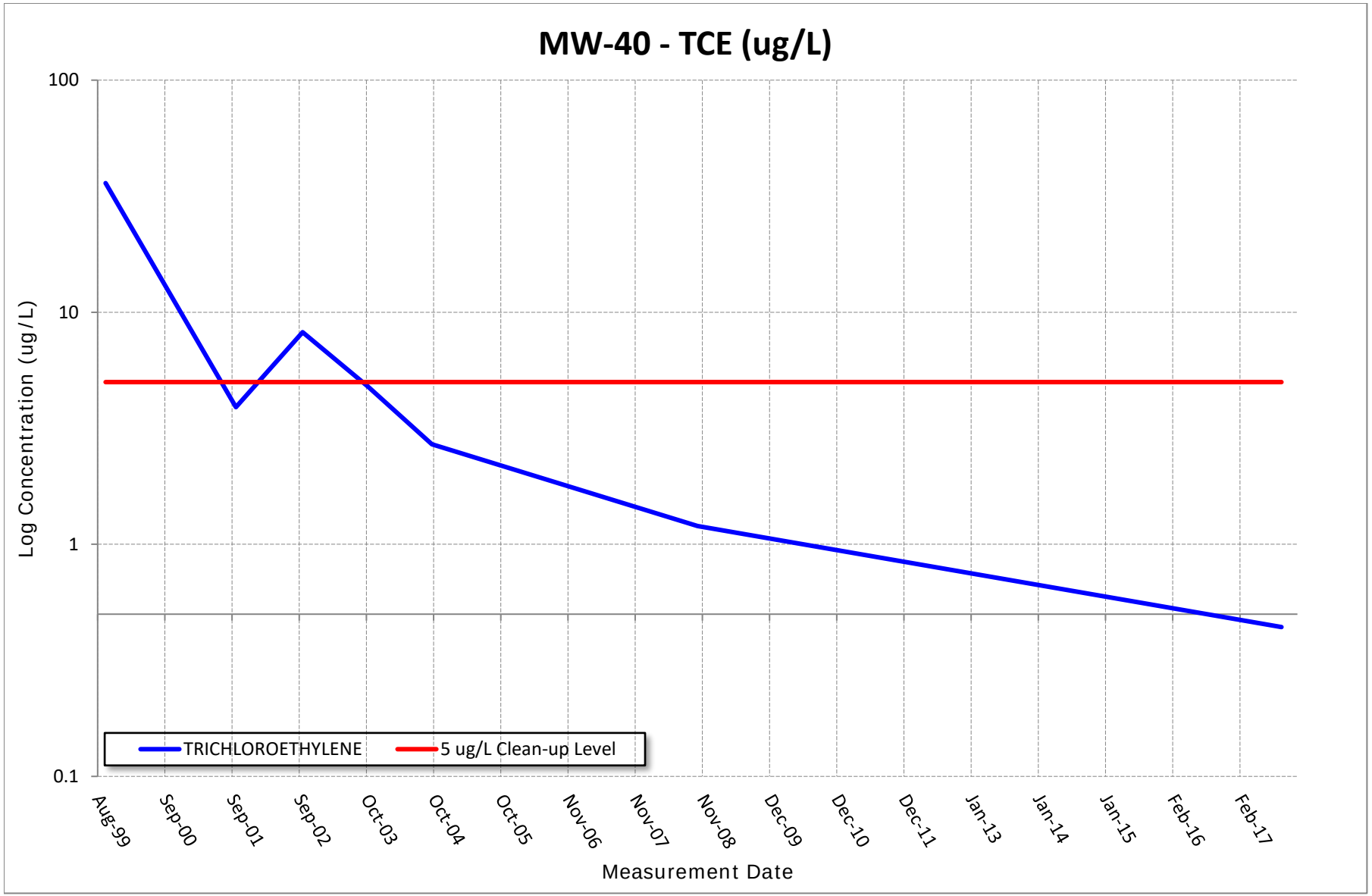

MW-22D - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
1000
100
10
1
20
18
16
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date

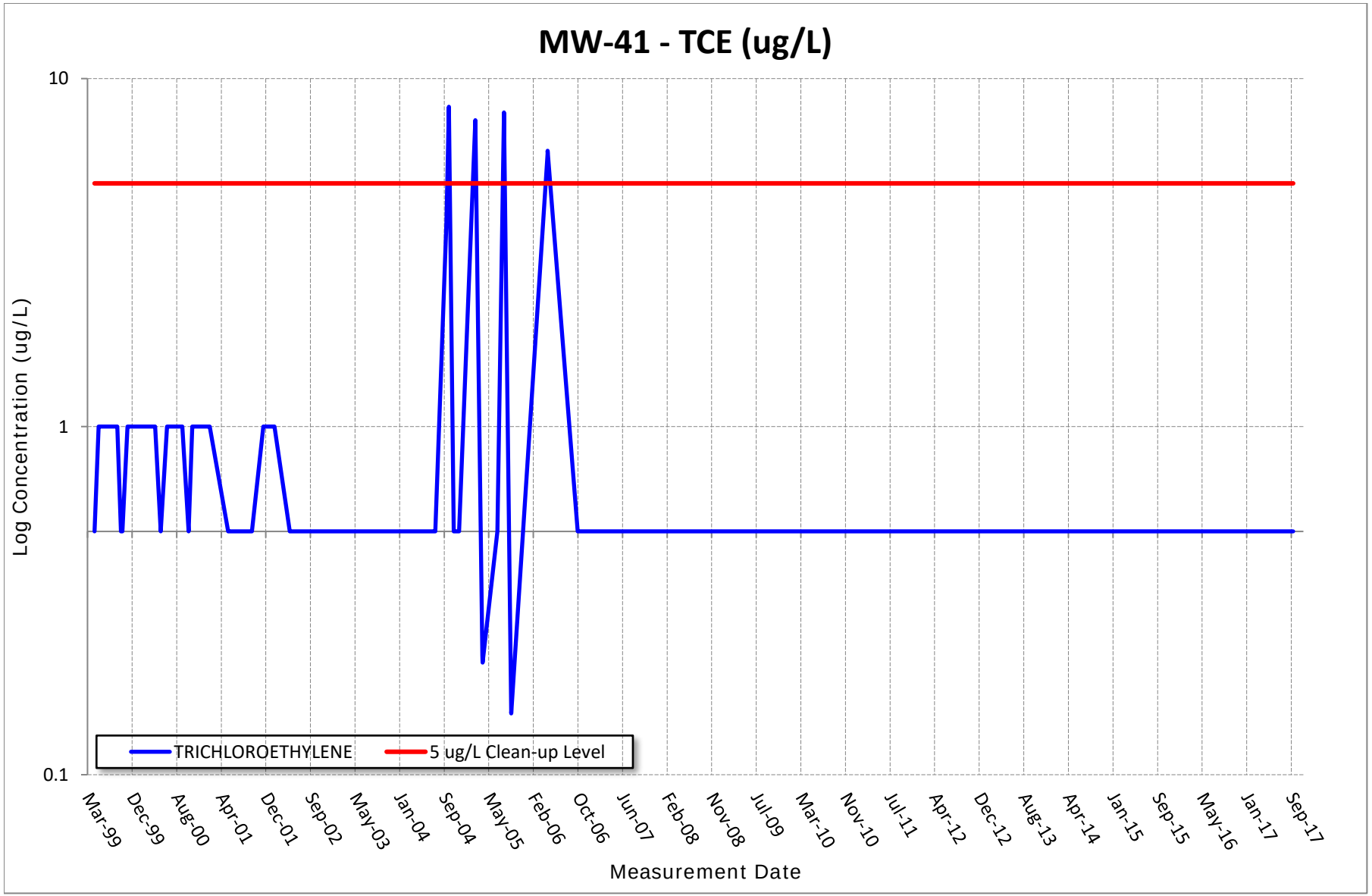

MW-23D - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Measurement Date

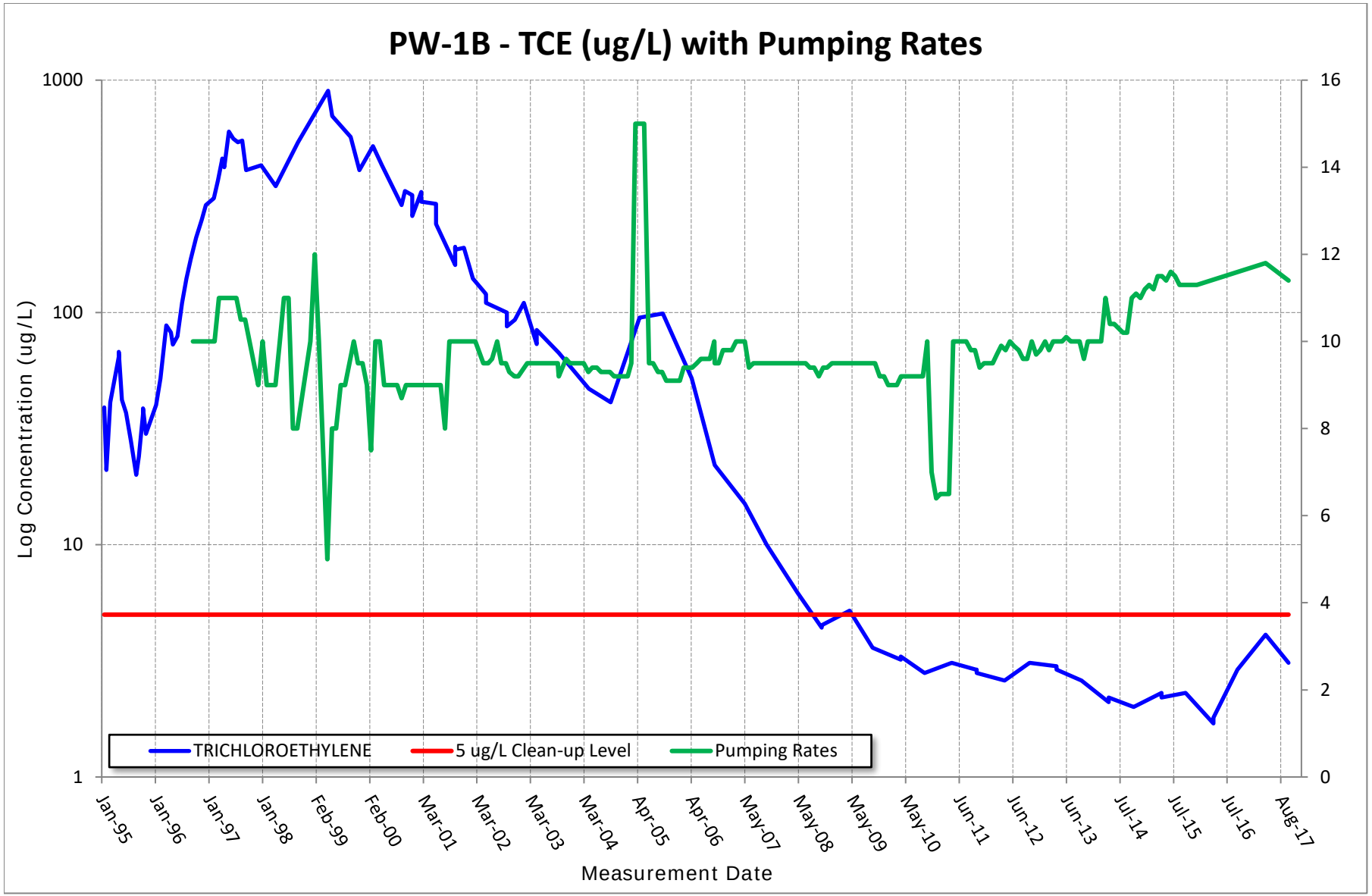

MW-33 - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Feb-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Apr-04
Apr-05
Apr-06
May-07
May-08
May-09
Jun-10
Jun-11
Jun-12
Jul-13
Jul-14
Jul-15
Aug-16
Aug-17
Measurement Date

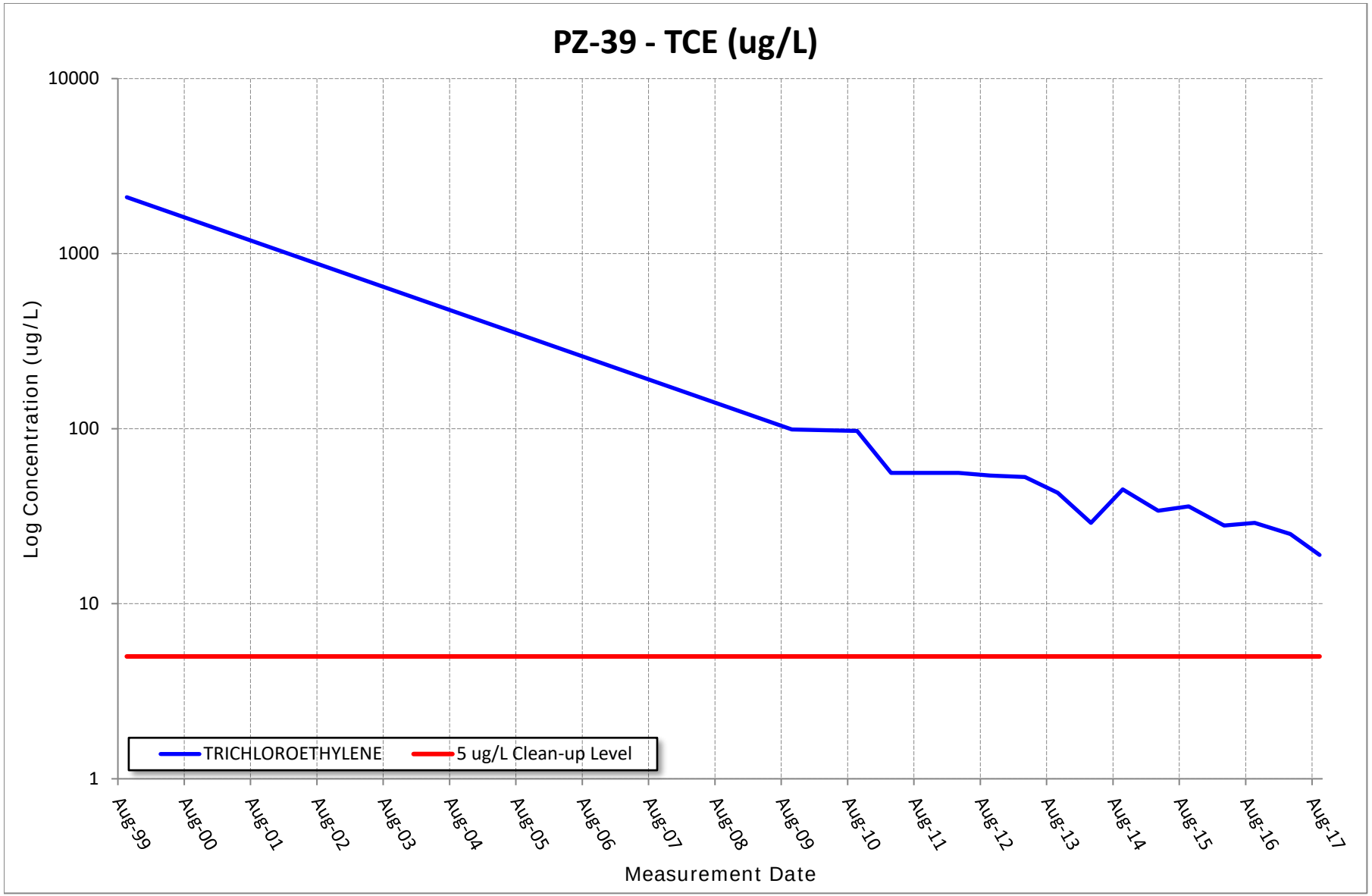

MW-35 - TCE (ug/L)
1000
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Feb-99
Feb-00
Feb-01
Feb-02
Feb-03
Feb-04
Feb-05
Feb-06
Feb-07
Feb-08
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
Feb-14
Feb-15
Feb-16
Feb-17
Measurement Date


MW-38 - TCE (ug/L)
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Jul-10
Jul-11
Aug-12
Aug-13
Aug-14
Sep-15
Sep-16
Sep-17
Measurement Date


MW-40 - TCE (ug/L)
100
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Aug-99
Sep-00
Sep-01
Sep-02
Oct-03
Oct-04
Oct-05
Nov-06
Nov-07
Nov-08
Dec-09
Dec-10
Dec-11
Jan-13
Jan-14
Jan-15
Feb-16
Feb-17
Measurement Date


MW-41 - TCE (ug/L)
10
1
0.1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Mar-99
Dec-99
Aug-00
Apr-01
Dec-01
Sep-02
May-03
Jan-04
Sep-04
May-05
Feb-06
Oct-06
Jun-07
Feb-08
Nov-08
Jul-09
Mar-10
Nov-10
Jul-11
Apr-12
Dec-12
Aug-13
Apr-14
Jan-15
Sep-15
May-16
Jan-17
Sep-17
Measurement Date


PW-1B - TCE (ug/L) with Pumping Rates
Log Concentration (ug/L)
1000
100
10
1
16
14
12
10
8
6
4
2
0
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Pumping Rates
Jan-95
Jan-96
Jan-97
Jan-98
Feb-99
Feb-00
Mar-01
Mar-02
Mar-03
Mar-04
Apr-05
Apr-06
May-07
May-08
May-09
May-10
Jun-11
Jun-12
Jun-13
Jul-14
Jul-15
Jul-16
Aug-17
Measurement Date


PZ-39 - TCE (ug/L)
10000
1000
100
10
1
Log Concentration (ug/L)
TRICHLOROETHYLENE
5 ug/L Clean-up Level
Aug-99
Aug-00
Aug-01
Aug-02
Aug-03
Aug-04
Aug-05
Aug-06
Aug-07
Aug-08
Aug-09
Aug-10
Aug-11
Aug-12
Aug-13
Aug-14
Aug-15
Aug-16
Aug-17
Measurement Date

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APPENDIX C

DATA FOR CLOSURE MONITORING

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APPENDIX C-1

WELLS EXCLUDED FROM CLOSURE MONITORING

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Appendix C-1. Wells Excluded from the Closure Monitoring Program

Well Name	Justification	Well ID	Justification
RAMW-2C	COC never detected above CUL	IWS-1	Remediation Well
AMW-5A	COC never detected above CUL	IWS-1PZ	Remediation Well
AMW-6A*	COC never detected above CUL	IWS-2	Remediation Well
AMW-7A*	COC never detected above CUL	IWS-2PZ	Remediation Well
AMW-9A	COC never detected above CUL	IWS-3	Remediation Well
AMW-10A*	COC never detected above CUL	IWS-3PZ	Remediation Well
AMW-11A*	COC never detected above CUL	IWS-4	Remediation Well
AMW-14	Abandoned	IWS-4PZ	Remediation Well
AMW-15	Abandoned	IWS-5	Remediation Well
AMW-16	Impacted by Northern Plume	IWS-5PZ	Remediation Well
AMW-17	Impacted by Northern Plume	IWS-6	Remediation Well
AMW-18	Impacted by Northern Plume	IWS-6PZ	Remediation Well
AMW-19B	COC never detected above CUL	IWS-7	Remediation Well
AMW-20	COC never detected above CUL	IWS-7PZ	Remediation Well
AMW-21	COC never detected above CUL	IWS-8	Remediation Well
AMW-22	Abandoned	IWS-8PZ	Remediation Well
AMW-23	COC never detected above CUL	IWS-9	Remediation Well
AMW-25	COC never detected above CUL	IWS-9PZ	Remediation Well
AMW-43	COC never detected above CUL	LAVALLEY	Never in monitoring program
AMW-44	COC never detected above CUL	LV	Never in monitoring program
AMW-45	COC never detected above CUL	MILLER	Never in monitoring program
AMW-50	COC never detected above CUL	MW-1	Never in monitoring program (Clark County well)
AMW-51	COC never detected above CUL	MW-2	Never in monitoring program (Clark County well)
AMW-52C	COC never detected above CUL	MW-3	Never in monitoring program (Clark County well)
AMW-53B	COC never detected above CUL	MW-4	Never in monitoring program (Clark County well)
AMW-53C	COC never detected above CUL	MW-5	Never in monitoring program (Clark County well)
AMW-54C	COC never detected above CUL	MW-5A	Abandoned
AMW-55C	COC never detected above CUL	MW-5B	Abandoned
AMW-56C	COC never detected above CUL	MW-11A	Abandoned
AMW-57	COC never detected above CUL	MW-11B	Abandoned
AMW-62	COC never detected above CUL	MW-17E	COC never detected above CUL
AMW-63	COC never detected above CUL	MW-23D	Impacted by Northern Plume
AMW-64	Impacted by Northern Plume	MW-24D	Abandoned
COLF	Never in monitoring program	MW-28	Abandoned
COLUMBIA VE	Never in monitoring program	MW-29	Abandoned
CPU-1D	Abandoned	MW-30	COC never detected above CUL
CPU-1S	Abandoned	MW-31	Abandoned
CPU-2	COC never detected above CUL	MW-32	Abandoned
CPU-3D	COC never detected above CUL	MW-34	COC never detected above CUL
CPU-3S	COC never detected above CUL	MW-35	Abandoned
CPU-4D	Water levels only, never sampled	MW-36	Abandoned
CPU-4S	Water levels only, COC never detected above CUL	MW-37	Abandoned
CPU-10	COC never detected above CUL	MW-39	Never in monitoring program; pilot study well
CPU-15	COC never detected above CUL	MW-46	COC never detected above CUL
CPU-16	Abandoned	MW-47	COC never detected above CUL
CROCKFORD	Never in monitoring program	PERMALUME	Never in monitoring program/abandoned
EC-1	COC never detected above CUL	PZ-1	Water levels only, COC never detected above CUL
FERGUSON	Never in monitoring program	PZ-2	Water levels only, COC never detected above CUL
FITZGERALD	Never in monitoring program	PZ-40	Water levels only, COC never detected above CUL
GARRISON	Never in monitoring program	SW-1	Abandoned
GRIMM	Never in monitoring program	WELCH	Never in monitoring program
GWSW-1	Production well, COC never detected above CUL	WILLIAMS	Never in monitoring program
GWSW-2	Production well, COC never detected above CUL	WOODAEGE	Never in monitoring program
HASTAY	Never in monitoring program	ZENT	Never in monitoring program
HORN	Never in monitoring program		

Notes:
COC = Contaminant of Concern identified for the Site.
CUL = Cleanup level identified in the Site Record of Decision.
* = Well sampled as part of the Linde infiltration gallery monitoring.

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APPENDIX C-2

REMEDIATION MONITORING ANALYSIS

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Appendix C-2.1 - Remediation Monitoring Analysis
CHLORODIBROMOMETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	36	10/2013	10/2017	U	U	U	4	YES
TCE Source Wells									
AMW-1A	M	56	04/2016	10/2017	0.13	1.3	0.13	2	NO
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES
AMW-2A	M	59	04/2016	10/2017	U	U	U	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	45	10/2013	10/2017	U	2.1	U	2	NO
AMW-4A	M	13	10/2004	10/2017	U	0.16	U	4	YES
AMW-12A	M	58	04/2016	10/2017	U	U	U	4	YES
AMW-13A	M	44	10/2012	10/2015	U	U	U	4	YES
AMW-19A	M	43	10/2013	10/2017	U	U	U	4	YES
AMW-26	M	29	10/2010	10/2017	U	U	U	4	YES
AMW-52A	M	28	10/2012	10/2015	U	0.29	U	4	YES
AMW-53A	M	43	04/2016	10/2017	U	0.53	U	4	YES
AMW-54A	M	30	10/2013	10/2017	U	U	U	4	YES
AMW-55A	M	23	10/2012	10/2015	U	U	U	4	YES
AMW-56A	M	29	10/2013	10/2017	U	U	U	4	YES
MW-1A	M	57	04/2016	10/2017	U	U	U	4	YES
MW-1B	M	25	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	U	U	4	YES
MW-2A	M	26	10/2011	10/2016	U	0.32	0.32	4	YES
MW-2B	M	14	10/2003	10/2017	U	U	U	4	YES
MW-2C	M	8	10/2002	10/2009	U	U	U	4	YES
MW-3A	M	18	05/2004	10/2008	U	U	U	4	YES
MW-3B	M	15	10/2010	10/2016	U	U	U	4	YES
MW-3C	M	8	10/2002	10/2017	U	U	U	4	YES
MW-4A	M	19	05/2004	10/2017	U	U	U	4	YES
MW-4B	M	16	10/2011	10/2016	U	U	U	4	YES
MW-4BSHED	M	15	10/2003	10/2017	U	U	U	4	YES
MW-4C	M	9	05/2004	10/2017	U	U	U	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	49	04/2016	10/2017	U	0.14	0.13	4	YES
MW-6C	M	11	10/2003	10/2017	U	U	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	U	U	4	YES
MW-7B	M	8	10/2004	10/2017	U	0.22	0.22	4	YES
MW-7C	M	6	05/1995	10/2009	U	U	U	4	YES
MW-8B	M	15	10/2010	10/2017	U	0.19	0.19	4	YES

Appendix C-2.1 - Remediation Monitoring Analysis
CHLORODIBROMOMETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed? [a]
MW-9B	M	18	10/2012	10/2017	U	U	U	4	YES
MW-9C	M	10	05/1998	10/2017	U	U	U	4	YES
MW-10B	E	49	04/2016	10/2017	U	U	U	4	YES
MW-10C	E	51	04/2016	10/2017	U	0.12	0.12	4	YES
MW-12C	M	27	10/2012	10/2017	U	U	U	4	YES
MW-13C	M	29	10/2012	10/2017	U	0.039	0.039	4	YES
PW-1B	E	59	04/2016	10/2017	U	U	U	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	U	U	U	4	YES
AMW-60	M	5	11/2004	10/2017	U	U	U	4	YES
CPU-14	M	35	04/2015	10/2017	U	U	U	4	YES
MW-14C	E	56	04/2016	10/2017	U	U	U	4	YES
MW-14E	E	58	04/2016	10/2017	U	U	U	4	YES
MW-15E	M	29	10/2014	10/2017	U	U	U	4	YES
MW-18D	E	56	04/2016	10/2017	U	U	U	4	YES
MW-18E	M	34	10/2014	10/2017	U	U	U	4	YES
MW-19D	E	55	04/2016	10/2017	U	U	U	4	YES
MW-20D	E	56	04/2016	10/2017	U	U	U	4	YES
MW-38	M	13	04/2016	10/2017	U	U	U	4	YES
MW-40	M	7	10/1999	10/2017	U	U	U	4	YES
PZ-39	PZ	17	04/2016	10/2017	U	U	U	4	YES
Church of God Wells									
AMW-27	M	51	04/2015	10/2016	U	U	U	4	YES
AMW-61	M	14	10/2015	10/2017	U	U	U	4	YES
CPU-12	M	34	04/2015	10/2017	U	U	U	4	YES
CPU-13	E	52	04/2013	10/2014	U	U	U	4	YES
MW-21D	E	58	04/2016	10/2017	U	U	U	4	YES
MW-22D	E	54	04/2016	10/2017	U	U	U	4	YES
MW-25D	E	52	10/2012	10/2014	U	U	U	4	YES
MW-26D	E	51	10/2012	10/2014	U	U	U	4	YES
MW-27D	M	43	10/2011	10/2014	U	U	U	4	YES
MW-49	E/M	30	10/2012	10/2014	U	U	U	4	YES
Toe Wells									
AMW-42	M	38	10/2009	10/2014	U	U	U	4	YES
MW-31	M	25	10/2008	10/2012	U	U	U	4	YES
MW-35	M	42	10/2015	04/2017	U	U	U	4	YES
MW-41	M	44	10/2010	10/2017	U	U	U	4	YES
MW-48	M	30	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	27	10/2014	10/2017	U	U	U	4	YES
MW-33	M/D	27	10/2014	10/2017	U	U	U	4	YES
BENNETT	M	24	04/2016	10/2017	U	U	U	4	YES

Appendix C-2.1 - Remediation Monitoring Analysis
CHLORODIBROMOMETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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Appendix C-2.2 - Remediation Monitoring Analysis
1,1-DICHLOROETHENE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	37	10/2013	10/2017	U	U	U	4	YES
TCE Source Wells									
AMW-1A	M	57	04/2016	10/2017	U	0.94	0.94	4	YES
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES
AMW-2A	M	60	04/2016	10/2017	0.37	0.98	0.91	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	46	10/2013	10/2017	U	U	U	4	YES
AMW-4A	M	13	10/2004	10/2017	U	U	U	4	YES
AMW-12A	M	58	04/2016	10/2017	0.2	0.28	0.28	4	YES
AMW-13A	M	45	10/2012	10/2015	U	U	U	4	YES
AMW-19A	M	43	10/2013	10/2017	U	U	U	4	YES
AMW-26	M	29	10/2010	10/2017	U	0.2	0.2	4	YES
AMW-52A	M	28	10/2012	10/2015	U	U	U	4	YES
AMW-53A	M	43	04/2016	10/2017	U	0.23	0.23	4	YES
AMW-54A	M	30	10/2013	10/2017	U	U	U	4	YES
AMW-55A	M	23	10/2012	10/2015	U	U	U	4	YES
AMW-56A	M	29	10/2013	10/2017	U	0.037	0.037	4	YES
MW-1A	M	58	04/2016	10/2017	U	0.73	0.73	4	YES
MW-1B	M	26	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	0.22	U	4	YES
MW-2A	M	27	10/2011	10/2016	U	U	U	4	YES
MW-2B	M	15	10/2003	10/2017	U	U	U	4	YES
MW-2C	M	8	10/2002	10/2009	U	U	U	4	YES
MW-3A	M	19	05/2004	10/2008	U	U	U	4	YES
MW-3B	M	15	10/2010	10/2016	U	U	U	4	YES
MW-3C	M	8	10/2002	10/2017	U	U	U	4	YES
MW-4A	M	20	05/2004	10/2017	U	U	U	4	YES
MW-4B	M	16	10/2011	10/2016	U	U	U	4	YES
MW-4BSHED	M	15	10/2003	10/2017	U	0.22	U	4	YES
MW-4C	M	9	05/2004	10/2017	U	0.4	U	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	50	04/2016	10/2017	U	U	U	4	YES
MW-6C	M	11	10/2003	10/2017	U	0.54	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	0.75	U	4	YES
MW-7B	M	8	10/2004	10/2017	U	6	0.1	3	NO
MW-7C	M	6	05/1995	10/2009	U	U	U	4	YES

Appendix C-2.2 - Remediation Monitoring Analysis
1,1-DICHLOROETHENE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]
MW-8B	M	15	10/2010	10/2017	U	0.079	0.079	4	YES
MW-9B	M	18	10/2012	10/2017	U	0.11	0.066	4	YES
MW-9C	M	10	05/1998	10/2017	U	0.43	U	4	YES
MW-10B	E	50	04/2016	10/2017	0.079	0.09	0.079	4	YES
MW-10C	E	52	04/2016	10/2017	U	U	U	4	YES
MW-12C	M	28	10/2012	10/2017	U	U	U	4	YES
MW-13C	M	30	10/2012	10/2017	U	U	U	4	YES
PW-1B	E	60	04/2016	10/2017	U	U	U	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	4.3	11	4.3	None	NO
AMW-60	M	5	11/2004	10/2017	0.33	16	1.4	None	NO
CPU-14	M	36	04/2015	10/2017	0.1	0.19	0.1	4	YES
MW-14C	E	57	04/2016	10/2017	U	0.035	0.035	4	YES
MW-14E	E	59	04/2016	10/2017	1.5	2.7	1.5	None	NO
MW-15E	M	29	10/2014	10/2017	U	0.043	0.043	4	YES
MW-18D	E	56	04/2016	10/2017	0.34	0.44	0.34	4	YES
MW-18E	M	35	10/2014	10/2017	5.8	8.3	8	None	NO
MW-19D	E	55	04/2016	10/2017	0.82	0.91	0.82	4	YES
MW-20D	E	56	04/2016	10/2017	1.3	1.6	1.4	None	NO
MW-38	M	13	04/2016	10/2017	0.13	0.19	0.13	4	YES
MW-40	M	7	10/1999	10/2017	U	0.65	U	4	YES
PZ-39	PZ	17	04/2016	10/2017	1.4	1.9	1.4	None	NO
Church of God Wells									
AMW-27	M	52	04/2015	10/2016	0.08	0.13	0.11	4	YES
AMW-61	M	14	10/2015	10/2017	0.24	0.39	0.33	4	YES
CPU-12	M	35	04/2015	10/2017	U	0.029	0.029	4	YES
CPU-13	E	53	04/2013	10/2014	U	U	U	4	YES
MW-21D	E	59	04/2016	10/2017	0.36	0.45	0.42	4	YES
MW-22D	E	55	04/2016	10/2017	U	0.11	0.058	4	YES
MW-25D	E	53	10/2012	10/2014	0.15	0.33	0.15	4	YES
MW-26D	E	52	10/2012	10/2014	U	U	U	4	YES
MW-27D	M	44	10/2011	10/2014	U	U	U	4	YES
MW-49	E/M	30	10/2012	10/2014	U	0.08	U	4	YES
Toe Wells									
AMW-42	M	39	10/2009	10/2014	U	U	U	4	YES
MW-31	M	26	10/2008	10/2012	U	U	U	4	YES
MW-35	M	43	10/2015	04/2017	U	0.09	0.09	4	YES
MW-41	M	45	10/2010	10/2017	U	U	U	4	YES
MW-48	M	31	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	28	10/2014	10/2017	0.98	1.3	0.98	1	NO
MW-33	M/D	28	10/2014	10/2017	0.65	1.4	0.65	3	NO
BENNETT	M	24	04/2016	10/2017	0.24	0.31	0.25	4	YES

Appendix C-2.2 - Remediation Monitoring Analysis
1,1-DICHLOROETHENE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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Appendix C-2.3 - Remediation Monitoring Analysis
1,2-DICHLOROETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (5 ug/L)	Remediation Monitoring Phase is Completed ? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	37	10/2013	10/2017	U	U	U	4	YES
TCE Source Wells									
AMW-1A	M	57	04/2016	10/2017	U	6.6	6.6	4	YES
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES
AMW-2A	M	60	04/2016	10/2017	2.3	5.8	5	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	46	10/2013	10/2017	U	U	U	4	YES
AMW-4A	M	13	10/2004	10/2017	U	U	U	4	YES
AMW-12A	M	58	04/2016	10/2017	0.19	0.39	0.27	4	YES
AMW-13A	M	45	10/2012	10/2015	U	0.11	U	4	YES
AMW-19A	M	43	10/2013	10/2017	U	U	U	4	YES
AMW-26	M	29	10/2010	10/2017	U	1.3	1.3	4	YES
AMW-52A	M	28	10/2012	10/2015	U	U	U	4	YES
AMW-53A	M	43	04/2016	10/2017	U	1.2	1.2	4	YES
AMW-54A	M	30	10/2013	10/2017	U	0.19	0.19	4	YES
AMW-55A	M	23	10/2012	10/2015	U	U	U	4	YES
AMW-56A	M	29	10/2013	10/2017	U	0.23	0.23	4	YES
MW-1A	M	58	04/2016	10/2017	U	3.6	3.6	4	YES
MW-1B	M	26	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	U	U	4	YES
MW-2A	M	27	10/2011	10/2016	U	U	U	4	YES
MW-2B	M	15	10/2003	10/2017	U	0.21	U	4	YES
MW-2C	M	8	10/2002	10/2009	U	0.25	U	4	YES
MW-3A	M	19	05/2004	10/2008	U	U	U	4	YES
MW-3B	M	15	10/2010	10/2016	U	U	U	4	YES
MW-3C	M	8	10/2002	10/2017	U	0.18	0.03	4	YES
MW-4A	M	20	05/2004	10/2017	0.07	0.21	0.07	4	YES
MW-4B	M	16	10/2011	10/2016	U	0.09	0.09	4	YES
MW-4BSHED	M	15	10/2003	10/2017	U	0.21	0.039	4	YES
MW-4C	M	9	05/2004	10/2017	U	0.62	U	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	50	04/2016	10/2017	U	0.31	0.15	4	YES
MW-6C	M	11	10/2003	10/2017	U	1.7	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	0.4	U	4	YES
MW-7B	M	8	10/2004	10/2017	U	8.8	0.27	4	YES
MW-7C	M	6	05/1995	10/2009	U	0.8	U	4	YES
MW-8B	M	15	10/2010	10/2017	U	0.3	0.3	4	YES

Appendix C-2.3 - Remediation Monitoring Analysis
1,2-DICHLOROETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (5 ug/L)	Remediation Monitoring Phase is Completed ? [a]
MW-9B	M	18	10/2012	10/2017	U	U	U	4	YES
MW-9C	M	10	05/1998	10/2017	U	U	U	4	YES
MW-10B	E	50	04/2016	10/2017	U	U	U	4	YES
MW-10C	E	52	04/2016	10/2017	U	U	U	4	YES
MW-12C	M	28	10/2012	10/2017	U	U	U	4	YES
MW-13C	M	30	10/2012	10/2017	U	U	U	4	YES
PW-1B	E	60	04/2016	10/2017	U	U	U	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	U	U	U	4	YES
AMW-60	M	5	11/2004	10/2017	U	0.19	0.19	4	YES
CPU-14	M	36	04/2015	10/2017	U	U	U	4	YES
MW-14C	E	57	04/2016	10/2017	U	U	U	4	YES
MW-14E	E	59	04/2016	10/2017	U	U	U	4	YES
MW-15E	M	29	10/2014	10/2017	U	U	U	4	YES
MW-18D	E	56	04/2016	10/2017	U	U	U	4	YES
MW-18E	M	35	10/2014	10/2017	U	U	U	4	YES
MW-19D	E	55	04/2016	10/2017	U	U	U	4	YES
MW-20D	E	56	04/2016	10/2017	U	0.039	0.039	4	YES
MW-38	M	13	04/2016	10/2017	U	U	U	4	YES
MW-40	M	7	10/1999	10/2017	U	U	U	4	YES
PZ-39	PZ	17	04/2016	10/2017	U	U	U	4	YES
Church of God Wells									
AMW-27	M	52	04/2015	10/2016	U	U	U	4	YES
AMW-61	M	14	10/2015	10/2017	U	0.08	0.057	4	YES
CPU-12	M	35	04/2015	10/2017	U	U	U	4	YES
CPU-13	E	53	04/2013	10/2014	U	U	U	4	YES
MW-21D	E	59	04/2016	10/2017	U	0.025	0.025	4	YES
MW-22D	E	55	04/2016	10/2017	U	U	U	4	YES
MW-25D	E	53	10/2012	10/2014	U	U	U	4	YES
MW-26D	E	52	10/2012	10/2014	U	U	U	4	YES
MW-27D	M	44	10/2011	10/2014	U	0.09	U	4	YES
MW-49	E/M	30	10/2012	10/2014	U	U	U	4	YES
Toe Wells									
AMW-42	M	39	10/2009	10/2014	U	U	U	4	YES
MW-31	M	26	10/2008	10/2012	U	U	U	4	YES
MW-35	M	43	10/2015	04/2017	U	0.08	U	4	YES
MW-41	M	45	10/2010	10/2017	U	U	U	4	YES
MW-48	M	31	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	28	10/2014	10/2017	U	0.023	0.023	4	YES
MW-33	M/D	28	10/2014	10/2017	U	0.032	0.032	4	YES
BENNETT	M	24	04/2016	10/2017	U	U	U	4	YES

Appendix C-2.3 - Remediation Monitoring Analysis
1,2-DICHLOROETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (5 ug/L)	Remediation Monitoring Phase is Completed ? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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Appendix C-2.4 - Remediation Monitoring Analysis
1,1,1-TRICHLOROETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (200 ug/L)	Remediation Monitoring Phase is Completed ? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	37	10/2013	10/2017	U	U	U	4	YES
TCE Source Wells									
AMW-1A	M	57	04/2016	10/2017	U	6.6	6.6	4	YES
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES
AMW-2A	M	60	04/2016	10/2017	2.3	5.8	5	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	46	10/2013	10/2017	U	U	U	4	YES
AMW-4A	M	13	10/2004	10/2017	U	U	U	4	YES
AMW-12A	M	58	04/2016	10/2017	0.19	0.39	0.27	4	YES
AMW-13A	M	45	10/2012	10/2015	U	0.11	U	4	YES
AMW-19A	M	43	10/2013	10/2017	U	U	U	4	YES
AMW-26	M	29	10/2010	10/2017	U	1.3	1.3	4	YES
AMW-52A	M	28	10/2012	10/2015	U	U	U	4	YES
AMW-53A	M	43	04/2016	10/2017	U	1.2	1.2	4	YES
AMW-54A	M	30	10/2013	10/2017	U	0.19	0.19	4	YES
AMW-55A	M	23	10/2012	10/2015	U	U	U	4	YES
AMW-56A	M	29	10/2013	10/2017	U	0.23	0.23	4	YES
MW-1A	M	58	04/2016	10/2017	U	3.6	3.6	4	YES
MW-1B	M	26	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	U	U	4	YES
MW-2A	M	27	10/2011	10/2016	U	U	U	4	YES
MW-2B	M	15	10/2003	10/2017	U	0.21	U	4	YES
MW-2C	M	8	10/2002	10/2009	U	0.25	U	4	YES
MW-3A	M	19	05/2004	10/2008	U	U	U	4	YES
MW-3B	M	15	10/2010	10/2016	U	U	U	4	YES
MW-3C	M	8	10/2002	10/2017	U	0.18	0.03	4	YES
MW-4A	M	20	05/2004	10/2017	0.07	0.21	0.07	4	YES
MW-4B	M	16	10/2011	10/2016	U	0.09	0.09	4	YES
MW-4BSHED	M	15	10/2003	10/2017	U	0.21	0.039	4	YES
MW-4C	M	9	05/2004	10/2017	U	0.62	U	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	50	04/2016	10/2017	U	0.31	0.15	4	YES
MW-6C	M	11	10/2003	10/2017	U	1.7	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	0.4	U	4	YES
MW-7B	M	8	10/2004	10/2017	U	8.8	0.27	4	YES
MW-7C	M	6	05/1995	10/2009	U	0.8	U	4	YES

Appendix C-2.4 - Remediation Monitoring Analysis
1,1,1-TRICHLOROETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (200 ug/L)	Remediation Monitoring Phase is Completed ? [a]
MW-8B	M	15	10/2010	10/2017	U	0.3	0.3	4	YES
MW-9B	M	18	10/2012	10/2017	0.19	0.29	0.22	4	YES
MW-9C	M	10	05/1998	10/2017	U	1.7	U	4	YES
MW-10B	E	50	04/2016	10/2017	U	0.1	0.055	4	YES
MW-10C	E	52	04/2016	10/2017	U	0.11	0.076	4	YES
MW-12C	M	28	10/2012	10/2017	U	U	U	4	YES
MW-13C	M	30	10/2012	10/2017	U	0.13	U	4	YES
PW-1B	E	60	04/2016	10/2017	U	0.17	0.16	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	U	U	U	4	YES
AMW-60	M	5	11/2004	10/2017	U	U	U	4	YES
CPU-14	M	36	04/2015	10/2017	0.21	0.26	0.26	4	YES
MW-14C	E	57	04/2016	10/2017	U	0.09	0.049	4	YES
MW-14E	E	59	04/2016	10/2017	U	0.11	U	4	YES
MW-15E	M	29	10/2014	10/2017	0.12	0.41	0.12	4	YES
MW-18D	E	56	04/2016	10/2017	U	0.11	U	4	YES
MW-18E	M	35	10/2014	10/2017	U	U	U	4	YES
MW-19D	E	55	04/2016	10/2017	U	0.09	U	4	YES
MW-20D	E	56	04/2016	10/2017	U	0.14	0.12	4	YES
MW-38	M	13	04/2016	10/2017	0.24	0.33	0.24	4	YES
MW-40	M	7	10/1999	10/2017	0.051	0.92	0.051	4	YES
PZ-39	PZ	17	04/2016	10/2017	0.27	0.5	0.49	4	YES
Church of God Wells									
AMW-27	M	52	04/2015	10/2016	U	0.16	0.16	4	YES
AMW-61	M	14	10/2015	10/2017	U	0.15	0.093	4	YES
CPU-12	M	35	04/2015	10/2017	U	0.12	0.086	4	YES
CPU-13	E	53	04/2013	10/2014	U	U	U	4	YES
MW-21D	E	59	04/2016	10/2017	0.09	0.18	0.17	4	YES
MW-22D	E	55	04/2016	10/2017	U	U	U	4	YES
MW-25D	E	53	10/2012	10/2014	0.11	0.17	0.11	4	YES
MW-26D	E	52	10/2012	10/2014	U	U	U	4	YES
MW-27D	M	44	10/2011	10/2014	U	0.1	U	4	YES
MW-49	E/M	30	10/2012	10/2014	U	0.09	U	4	YES
Toe Wells									
AMW-42	M	39	10/2009	10/2014	U	0.14	U	4	YES
MW-31	M	26	10/2008	10/2012	U	0.26	U	4	YES
MW-35	M	43	10/2015	04/2017	U	0.12	0.12	4	YES
MW-41	M	45	10/2010	10/2017	U	U	U	4	YES
MW-48	M	31	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	28	10/2014	10/2017	0.12	0.22	0.12	4	YES
MW-33	M/D	28	10/2014	10/2017	0.08	0.12	0.082	4	YES
BENNETT	M	24	04/2016	10/2017	U	0.09	0.056	4	YES

Appendix C-2.4 - Remediation Monitoring Analysis
1,1,1-TRICHLOROETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (200 ug/L)	Remediation Monitoring Phase is Completed ? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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Appendix C-2.5 - Remediation Monitoring Analysis
CARBON TETRACHLORIDE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	37	10/2013	10/2017	U	U	U	4	YES
TCE Source Wells									
AMW-1A	M	57	04/2016	10/2017	U	U	U	4	YES
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES
AMW-2A	M	60	04/2016	10/2017	U	U	U	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	46	10/2013	10/2017	U	U	U	4	YES
AMW-4A	M	13	10/2004	10/2017	U	U	U	4	YES
AMW-12A	M	58	04/2016	10/2017	U	U	U	4	YES
AMW-13A	M	45	10/2012	10/2015	U	U	U	4	YES
AMW-19A	M	43	10/2013	10/2017	U	U	U	4	YES
AMW-26	M	29	10/2010	10/2017	U	U	U	4	YES
AMW-52A	M	28	10/2012	10/2015	U	U	U	4	YES
AMW-53A	M	43	04/2016	10/2017	U	U	U	4	YES
AMW-54A	M	30	10/2013	10/2017	U	U	U	4	YES
AMW-55A	M	23	10/2012	10/2015	U	U	U	4	YES
AMW-56A	M	29	10/2013	10/2017	U	U	U	4	YES
MW-1A	M	58	04/2016	10/2017	U	U	U	4	YES
MW-1B	M	26	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	U	U	4	YES
MW-2A	M	27	10/2011	10/2016	U	U	U	4	YES
MW-2B	M	15	10/2003	10/2017	U	U	U	4	YES
MW-2C	M	8	10/2002	10/2009	U	U	U	4	YES
MW-3A	M	19	05/2004	10/2008	U	U	U	4	YES
MW-3B	M	15	10/2010	10/2016	U	U	U	4	YES
MW-3C	M	8	10/2002	10/2017	U	U	U	4	YES
MW-4A	M	20	05/2004	10/2017	U	U	U	4	YES
MW-4B	M	16	10/2011	10/2016	U	U	U	4	YES
MW-4BSHED	M	15	10/2003	10/2017	U	U	U	4	YES
MW-4C	M	9	05/2004	10/2017	U	U	U	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	50	04/2016	10/2017	U	U	U	4	YES
MW-6C	M	11	10/2003	10/2017	U	U	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	U	U	4	YES
MW-7B	M	8	10/2004	10/2017	U	U	U	4	YES
MW-7C	M	6	05/1995	10/2009	U	U	U	4	YES
MW-8B	M	15	10/2010	10/2017	U	U	U	4	YES

Appendix C-2.5 - Remediation Monitoring Analysis
CARBON TETRACHLORIDE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]
MW-9B	M	18	10/2012	10/2017	U	U	U	4	YES
MW-9C	M	10	05/1998	10/2017	U	U	U	4	YES
MW-10B	E	50	04/2016	10/2017	U	U	U	4	YES
MW-10C	E	52	04/2016	10/2017	U	U	U	4	YES
MW-12C	M	28	10/2012	10/2017	U	U	U	4	YES
MW-13C	M	30	10/2012	10/2017	U	U	U	4	YES
PW-1B	E	60	04/2016	10/2017	U	U	U	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	U	U	U	4	YES
AMW-60	M	5	11/2004	10/2017	U	U	U	4	YES
CPU-14	M	36	04/2015	10/2017	U	U	U	4	YES
MW-14C	E	57	04/2016	10/2017	U	U	U	4	YES
MW-14E	E	59	04/2016	10/2017	U	U	U	4	YES
MW-15E	M	29	10/2014	10/2017	U	U	U	4	YES
MW-18D	E	56	04/2016	10/2017	U	U	U	4	YES
MW-18E	M	35	10/2014	10/2017	U	U	U	4	YES
MW-19D	E	55	04/2016	10/2017	U	U	U	4	YES
MW-20D	E	56	04/2016	10/2017	U	U	U	4	YES
MW-38	M	13	04/2016	10/2017	U	U	U	4	YES
MW-40	M	7	10/1999	10/2017	U	U	U	4	YES
PZ-39	PZ	17	04/2016	10/2017	U	U	U	4	YES
Church of God Wells									
AMW-27	M	52	04/2015	10/2016	U	U	U	4	YES
AMW-61	M	14	10/2015	10/2017	U	U	U	4	YES
CPU-12	M	35	04/2015	10/2017	U	U	U	4	YES
CPU-13	E	53	04/2013	10/2014	U	U	U	4	YES
MW-21D	E	59	04/2016	10/2017	U	U	U	4	YES
MW-22D	E	55	04/2016	10/2017	U	U	U	4	YES
MW-25D	E	53	10/2012	10/2014	U	U	U	4	YES
MW-26D	E	52	10/2012	10/2014	U	U	U	4	YES
MW-27D	M	44	10/2011	10/2014	U	U	U	4	YES
MW-49	E/M	30	10/2012	10/2014	U	U	U	4	YES
Toe Wells									
AMW-42	M	39	10/2009	10/2014	U	U	U	4	YES
MW-31	M	26	10/2008	10/2012	U	U	U	4	YES
MW-35	M	43	10/2015	04/2017	U	U	U	4	YES
MW-41	M	45	10/2010	10/2017	U	U	U	4	YES
MW-48	M	31	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	28	10/2014	10/2017	U	U	U	4	YES
MW-33	M/D	28	10/2014	10/2017	U	U	U	4	YES
BENNETT	M	24	04/2016	10/2017	U	U	U	4	YES

Appendix C-2.5 - Remediation Monitoring Analysis
CARBON TETRACHLORIDE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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Appendix C-2.6 - Remediation Monitoring Analysis
BROMODICHLOROMETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	36	10/2013	10/2017	U	U	U	4	YES
TCE Source Wells									
AMW-1A	M	56	04/2016	10/2017	0.55	2.4	0.55	2	NO
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	0.25	U	4	YES
AMW-2A	M	59	04/2016	10/2017	U	0.1	U	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	45	10/2013	10/2017	U	3.2	0.18	2	NO
AMW-4A	M	13	10/2004	10/2017	U	1.6	0.084	1	NO
AMW-12A	M	58	04/2016	10/2017	U	0.078	0.078	4	YES
AMW-13A	M	44	10/2012	10/2015	0.17	0.28	0.23	4	YES
AMW-19A	M	43	10/2013	10/2017	U	0.12	0.037	4	YES
AMW-26	M	29	10/2010	10/2017	U	0.16	0.16	4	YES
AMW-52A	M	28	10/2012	10/2015	U	0.71	U	4	YES
AMW-53A	M	43	04/2016	10/2017	0.12	2.6	0.56	2	NO
AMW-54A	M	30	10/2013	10/2017	U	U	U	4	YES
AMW-55A	M	23	10/2012	10/2015	U	U	U	4	YES
AMW-56A	M	29	10/2013	10/2017	U	0.24	0.24	4	YES
MW-1A	M	57	04/2016	10/2017	U	U	U	4	YES
MW-1B	M	25	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	U	U	4	YES
MW-2A	M	26	10/2011	10/2016	U	0.65	0.65	4	YES
MW-2B	M	14	10/2003	10/2017	U	0.035	0.035	4	YES
MW-2C	M	8	10/2002	10/2009	U	U	U	4	YES
MW-3A	M	18	05/2004	10/2008	U	U	U	4	YES
MW-3B	M	15	10/2010	10/2016	U	U	U	4	YES
MW-3C	M	8	10/2002	10/2017	U	0.09	U	4	YES
MW-4A	M	19	05/2004	10/2017	U	U	U	4	YES
MW-4B	M	16	10/2011	10/2016	U	0.1	0.1	4	YES
MW-4BSHED	M	15	10/2003	10/2017	U	0.048	0.048	4	YES
MW-4C	M	9	05/2004	10/2017	U	U	U	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	49	04/2016	10/2017	U	0.43	0.43	4	YES
MW-6C	M	11	10/2003	10/2017	U	0.13	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	U	U	4	YES
MW-7B	M	8	10/2004	10/2017	U	0.46	0.46	4	YES
MW-7C	M	6	05/1995	10/2009	U	U	U	4	YES
MW-8B	M	15	10/2010	10/2017	U	0.56	0.56	4	YES

Appendix C-2.6 - Remediation Monitoring Analysis
BROMODICHLOROMETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]
MW-9B	M	18	10/2012	10/2017	U	0.1	0.047	4	YES
MW-9C	M	10	05/1998	10/2017	U	U	U	4	YES
MW-10B	E	49	04/2016	10/2017	U	0.11	0.087	4	YES
MW-10C	E	51	04/2016	10/2017	0.14	0.49	0.3	4	YES
MW-12C	M	27	10/2012	10/2017	U	U	U	4	YES
MW-13C	M	29	10/2012	10/2017	U	0.68	0.68	4	YES
PW-1B	E	59	04/2016	10/2017	U	0.1	0.054	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	U	U	U	4	YES
AMW-60	M	5	11/2004	10/2017	U	U	U	4	YES
CPU-14	M	35	04/2015	10/2017	U	0.07	0.07	4	YES
MW-14C	E	56	04/2016	10/2017	U	0.17	0.13	4	YES
MW-14E	E	58	04/2016	10/2017	U	U	U	4	YES
MW-15E	M	29	10/2014	10/2017	U	0.042	0.042	4	YES
MW-18D	E	56	04/2016	10/2017	U	0.12	0.099	4	YES
MW-18E	M	34	10/2014	10/2017	U	U	U	4	YES
MW-19D	E	55	04/2016	10/2017	U	0.31	0.28	4	YES
MW-20D	E	56	04/2016	10/2017	U	U	U	4	YES
MW-38	M	13	04/2016	10/2017	U	U	U	4	YES
MW-40	M	7	10/1999	10/2017	U	0.15	0.041	4	YES
PZ-39	PZ	17	04/2016	10/2017	U	U	U	4	YES
Church of God Wells									
AMW-27	M	51	04/2015	10/2016	U	U	U	4	YES
AMW-61	M	14	10/2015	10/2017	U	U	U	4	YES
CPU-12	M	34	04/2015	10/2017	U	0.03	0.03	4	YES
CPU-13	E	52	04/2013	10/2014	U	0.1	U	4	YES
MW-21D	E	58	04/2016	10/2017	U	U	U	4	YES
MW-22D	E	54	04/2016	10/2017	U	U	U	4	YES
MW-25D	E	52	10/2012	10/2014	U	U	U	4	YES
MW-26D	E	51	10/2012	10/2014	U	U	U	4	YES
MW-27D	M	43	10/2011	10/2014	U	U	U	4	YES
MW-49	E/M	30	10/2012	10/2014	U	U	U	4	YES
Toe Wells									
AMW-42	M	38	10/2009	10/2014	U	U	U	4	YES
MW-31	M	25	10/2008	10/2012	U	U	U	4	YES
MW-35	M	42	10/2015	04/2017	U	U	U	4	YES
MW-41	M	44	10/2010	10/2017	U	U	U	4	YES
MW-48	M	30	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	27	10/2014	10/2017	U	U	U	4	YES
MW-33	M/D	27	10/2014	10/2017	U	U	U	4	YES
BENNETT	M	24	04/2016	10/2017	U	U	U	4	YES

Appendix C-2.6 - Remediation Monitoring Analysis
BROMODICHLOROMETHANE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (1 ug/L)	Remediation Monitoring Phase is Completed ? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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Appendix C-2.7 - Remediation Monitoring Analysis
TETRACHLOROETHENE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (5 ug/L)	Remediation Monitoring Phase is Completed ? [a]
Closure Monitoring Program Wells									
Upgradient Wells									
AMW-8A	M	37	10/2013	10/2017	U	0.025	0.025	4	YES
TCE Source Wells									
AMW-1A	M	57	04/2016	10/2017	U	0.51	0.51	4	YES
AMW-1B	M	31	01/2009	10/2010	U	U	U	4	YES
AMW-1C	M	24	10/2007	10/2009	U	U	U	4	YES
AMW-2A	M	60	04/2016	10/2017	0.85	1.6	1.6	4	YES
AMW-2B	M	36	10/2012	10/2015	U	U	U	4	YES
AMW-3A	M	46	10/2013	10/2017	0.27	0.51	0.51	4	YES
AMW-4A	M	13	10/2004	10/2017	U	U	U	4	YES
AMW-12A	M	58	04/2016	10/2017	0.45	0.58	0.58	4	YES
AMW-13A	M	45	10/2012	10/2015	U	0.11	0.11	4	YES
AMW-19A	M	43	10/2013	10/2017	0.29	0.33	0.29	4	YES
AMW-26	M	29	10/2010	10/2017	U	0.42	0.42	4	YES
AMW-52A	M	28	10/2012	10/2015	U	0.12	0.1	4	YES
AMW-53A	M	43	04/2016	10/2017	U	0.4	0.4	4	YES
AMW-54A	M	30	10/2013	10/2017	0.14	0.4	0.16	4	YES
AMW-55A	M	23	10/2012	10/2015	0.21	0.34	0.34	4	YES
AMW-56A	M	29	10/2013	10/2017	0.43	0.61	0.43	4	YES
MW-1A	M	58	04/2016	10/2017	0.22	1.2	1.2	4	YES
MW-1B	M	26	10/2006	10/2009	U	U	U	4	YES
MW-1C	M	20	10/2006	10/2009	U	U	U	4	YES
Proximal Wells									
AMW-58	M	9	10/2006	10/2012	U	U	U	4	YES
MW-2A	M	27	10/2011	10/2016	0.75	1.1	1.1	4	YES
MW-2B	M	15	10/2003	10/2017	0.36	2.4	0.36	4	YES
MW-2C	M	8	10/2002	10/2009	0.29	1.5	0.29	4	YES
MW-3A	M	19	05/2004	10/2008	0.21	0.4	0.21	4	YES
MW-3B	M	15	10/2010	10/2016	0.54	0.89	0.67	4	YES
MW-3C	M	8	10/2002	10/2017	0.35	3.5	0.35	4	YES
MW-4A	M	20	05/2004	10/2017	0.57	1.1	0.57	4	YES
MW-4B	M	16	10/2011	10/2016	0.5	0.64	0.62	4	YES
MW-4BSHED	M	15	10/2003	10/2017	0.54	2.7	0.54	4	YES
MW-4C	M	9	05/2004	10/2017	0.35	2.8	0.35	4	YES
MW-6A	M	5	05/1995	10/2017	U	U	U	4	YES
MW-6B	E	56	04/2016	10/2017	0.38	0.55	0.38	4	YES
MW-6C	M	11	10/2003	10/2017	U	2	U	4	YES
MW-6D	M	9	10/1999	10/2017	U	0.11	U	4	YES
MW-7B	M	8	10/2004	10/2017	0.52	4.3	0.57	4	YES
MW-7C	M	6	05/1995	10/2009	0.12	0.5	0.12	4	YES
MW-8B	M	15	10/2010	10/2017	0.77	1.6	0.77	4	YES

Appendix C-2.7 - Remediation Monitoring Analysis
TETRACHLOROETHENE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (5 ug/L)	Remediation Monitoring Phase is Completed ? [a]
MW-9B	M	18	10/2012	10/2017	0.95	2	0.95	4	YES
MW-9C	M	10	05/1998	10/2017	0.25	2.1	0.25	4	YES
MW-10B	E	56	04/2016	10/2017	0.66	0.97	0.66	4	YES
MW-10C	E	58	04/2016	10/2017	0.5	0.69	0.5	4	YES
MW-12C	M	28	10/2012	10/2017	0.3	0.55	0.3	4	YES
MW-13C	M	30	10/2012	10/2017	0.67	1	1	4	YES
PW-1B	E	84	04/2016	10/2017	0.38	0.53	0.38	4	YES
Intermediate Wells									
AMW-59	M	14	10/2012	10/2017	U	U	U	4	YES
AMW-60	M	5	11/2004	10/2017	U	0.09	U	4	YES
CPU-14	M	36	04/2015	10/2017	U	0.12	0.1	4	YES
MW-14C	E	68	04/2016	10/2017	0.5	0.79	0.5	4	YES
MW-14E	E	66	04/2016	10/2017	1.8	3	1.8	4	YES
MW-15E	M	29	10/2014	10/2017	0.36	0.42	0.42	4	YES
MW-18D	E	77	04/2016	10/2017	0.86	1.4	0.86	4	YES
MW-18E	M	35	10/2014	10/2017	U	U	U	4	YES
MW-19D	E	76	04/2016	10/2017	0.91	1.3	0.91	4	YES
MW-20D	E	80	04/2016	10/2017	0.72	0.94	0.72	4	YES
MW-38	M	13	04/2016	10/2017	0.75	1	0.78	4	YES
MW-40	M	7	10/1999	10/2017	U	0.18	U	4	YES
PZ-39	PZ	17	04/2016	10/2017	0.83	0.94	0.89	4	YES
Church of God Wells									
AMW-27	M	52	04/2015	10/2016	0.92	1	1	4	YES
AMW-61	M	14	10/2015	10/2017	0.89	2	0.89	4	YES
CPU-12	M	35	04/2015	10/2017	U	U	U	4	YES
CPU-13	E	59	04/2013	10/2014	0.68	0.87	0.87	4	YES
MW-21D	E	83	04/2016	10/2017	U	0.11	0.11	4	YES
MW-22D	E	78	04/2016	10/2017	0.64	1	0.64	4	YES
MW-25D	E	77	10/2012	10/2014	U	U	U	4	YES
MW-26D	E	76	10/2012	10/2014	0.2	0.86	0.2	4	YES
MW-27D	M	50	10/2011	10/2014	U	U	U	4	YES
MW-49	E/M	35	10/2012	10/2014	0.27	0.49	0.49	4	YES
Toe Wells									
AMW-42	M	52	10/2009	10/2014	U	U	U	4	YES
MW-31	M	40	10/2008	10/2012	U	0.19	0.12	4	YES
MW-35	M	70	10/2015	04/2017	0.41	0.51	0.41	4	YES
MW-41	M	58	10/2010	10/2017	U	U	U	4	YES
MW-48	M	38	10/2006	10/2009	U	U	U	4	YES
Troutdale Wells									
AMW-24	M/D	29	10/2014	10/2017	0.12	0.16	0.12	4	YES
MW-33	M/D	29	10/2014	10/2017	0.12	0.2	0.15	4	YES
BENNETT	M	24	04/2016	10/2017	U	0.058	0.058	4	YES

Appendix C-2.7 - Remediation Monitoring Analysis
TETRACHLOROETHENE (Last 4 Samples)

Well Name	Well Type	Total Number of Datapoints	Date of First of the Most Recent Four Samples	Most Recent Sample Date	Min. Conc. (ug/L)	Max. Conc. (ug/L)	Most Recent Conc. (ug/L)	Number of Conc. < Cleanup Goal (5 ug/L)	Remediation Monitoring Phase is Completed ? [a]

NOTES:

[a] The "Remediation Monitoring Phase is Completed" determinations are per EPA Guidance (EPA 2013) based on the most recent four sample data points for each COC. The remediation monitoring phase is completed when the last four sample concentrations are lower than the cleanup level.

COC = Contaminant of Concern.
E = Extraction well.
E/M = Extraction well with pump pulled; now sampled as a monitoring well.
EPA = U.S. Environmental Protection Agency.
M = Monitoring well.
M/D = Monitoring well with dedicated pump installed.
U = Analyte not detected above the specified reporting limit.
µg/L = Micrograms per liter.

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APPENDIX D

PLUME CAPTURE EVALUATION

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Appendix D
Summary of 2017 Plume Capture Evaluation

As recommended in the 2015 and 2016 Annual Status Reports for the Site, pumping rates and plume capture were evaluated to determine if pumping should be reduced or discontinued in the following active extraction wells where VOCs and chromium remediation monitoring is complete: MW-6B, MW-10C, PW-1B, MW-21D, and MW-22D. These extraction wells, where TCE and chromium concentrations have remained consistently below cleanup levels for at least the last four sampling events, fall into two well groups: 1) wells PW-1B, MW-6B, and MW-10C in the Proximal well group, and 2) wells MW-21D and MW-22D in the downgradient Church of God well group, and are the farthest downgradient of the extraction wells that are currently active. Concentrations below cleanup levels in these extraction wells indicate relatively low contaminant mass in the groundwater in these areas; therefore, it may be appropriate to reduce pumping rates from these wells, if good plume capture can be maintained.

The existing Site groundwater flow and transport model (EA 2004a[1]), in Groundwater Modeling System (GMS) Program Version 10.2.5, was used to evaluate contaminant capture under current conditions and how capture would be affected if pumping were decreased or shut off in the extraction wells identified above (PW-1B, MW-6B, MW-10C, MW-21D and MW-22D).

Groundwater quality results from the Fall 2017 semiannual sampling event were used to determine the approximate extent of the TCE and chromium impacts above the cleanup levels (5 µg/L TCE and the 80 µg/L chromium) for use in the plume capture evaluation. The Northern Plume was not included in the capture zone analysis. The vicinity of silt well AMW-61 also was excluded from the plume extent, although this well had a slight exceedance of the cleanup standard for TCE in Fall 2016, because it is downgradient of the remaining extraction wells and the relatively low concentrations will attenuate naturally over time, it is not considered as part of the remaining plume.

Forward particle tracking using MODPATH was used to simulate and illustrate the effective capture zones of extraction wells, and to identify areas within the target capture zone where contaminant capture is successful and areas where contaminant capture is not occurring. Figures D-1, D-2, and D-3 illustrate the results of the particle tracking associated with the groundwater flow model.

For the pumping rate and plume capture evaluation, the groundwater model was first run using September 2017 pumping rates (Table 1 of the 2017 Closure Report). The model indicated good capture of contaminated groundwater from the upper alluvial aquifer (Layer 1) within the target capture zone under current conditions, consistent with previous evaluations.
The pumping rates in the wells identified for evaluation (PW-1B, MW-6B, MW-10C, MW-21D and MW-22D) were then decreased iteratively in subsequent model runs. The conclusions of the evaluation of decreased pumping rates are summarized below:

- Shutting off pumping from extraction wells PW-1B, MW-6B, and MW-10C has only minor effects

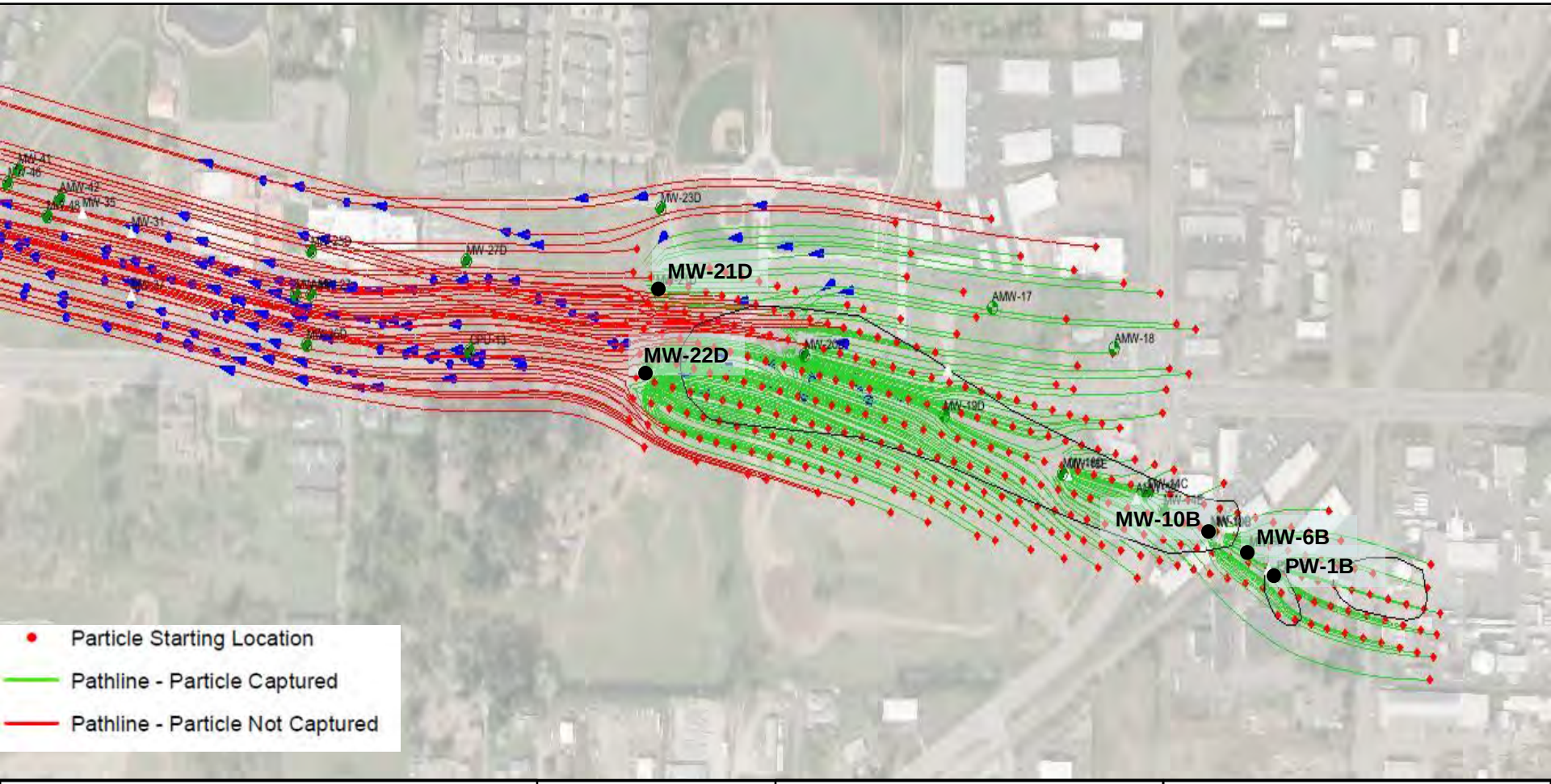
1 EA Engineering, Science, and Technology, Inc. (EA) 2004a. Groundwater Modeling Summary Report for the Boomsnub/Airco Superfund Site. Revision 1. January.

on the overall effective capture zone, and does not affect the degree to which groundwater within the target capture zone is captured, relative to capture under the current pumping regime.

- Shutting off pumping from extraction well MW-21D also does not affect the degree to which groundwater within the target (OU-3) capture zone is captured, but decreases the capture of the Northern Plume.

- Pumping from extraction well MW-22D is critical for maintaining capture of the downgradient portion of the plume. Therefore, any substantial decrease (e.g., 20 percent or more) in pumping rate from this well is expected to decrease the overall capture of the OU-3 plume.

Particle tracking results for Layer 1 from the model with no pumping from wells PW-1B, MW-6B, MW-10C, and MW-21D are illustrated in Figure D-3. Based on these results, it is possible to shut off pumping from these four wells and maintain the current level of OU-3 plume capture.



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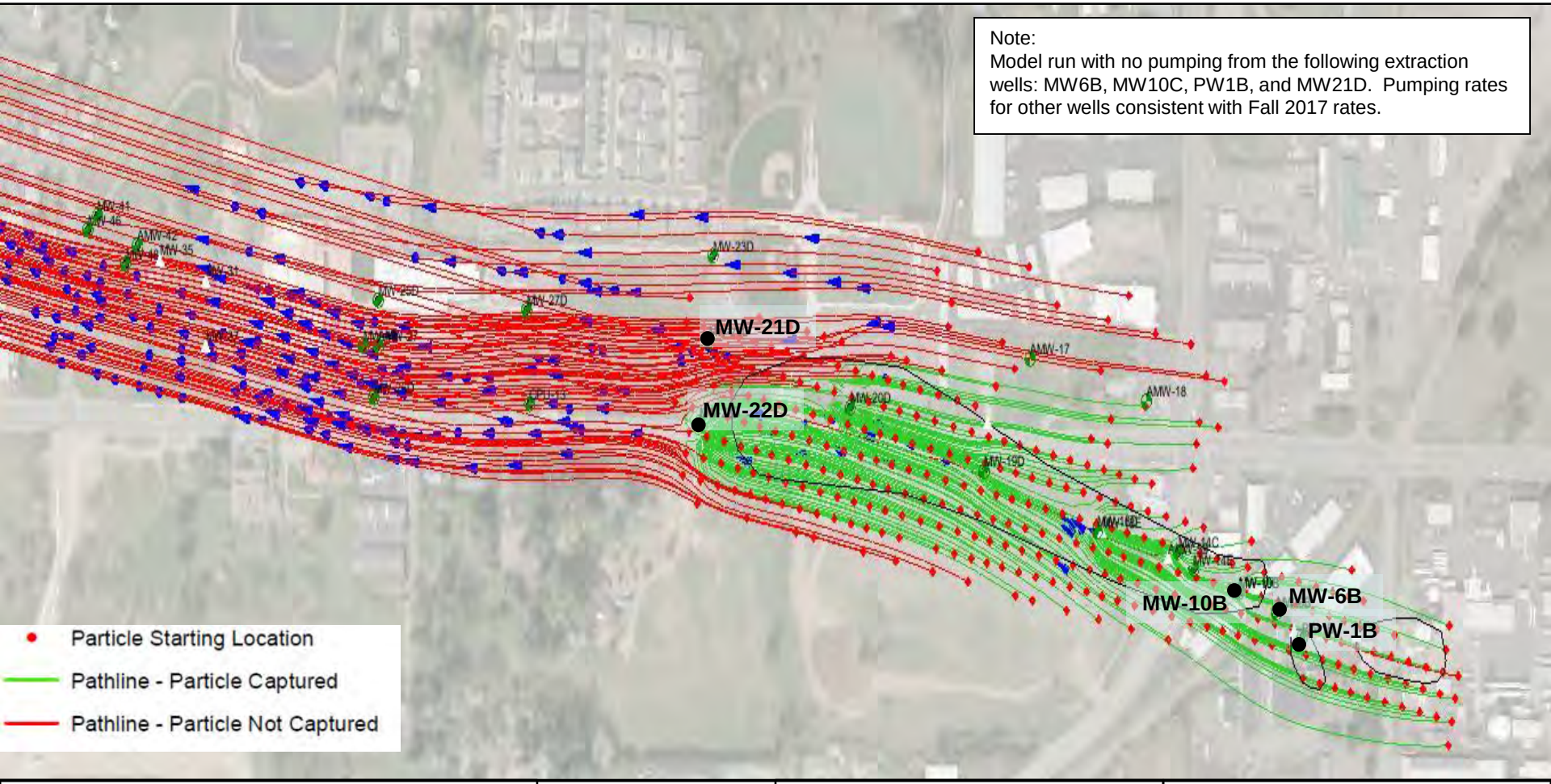
File Name: Fig_D1

Figure D1
Particle Tracking in the Upper Alluvial Aquifer (Layer 1) with Fall 2017 Pumping Rates



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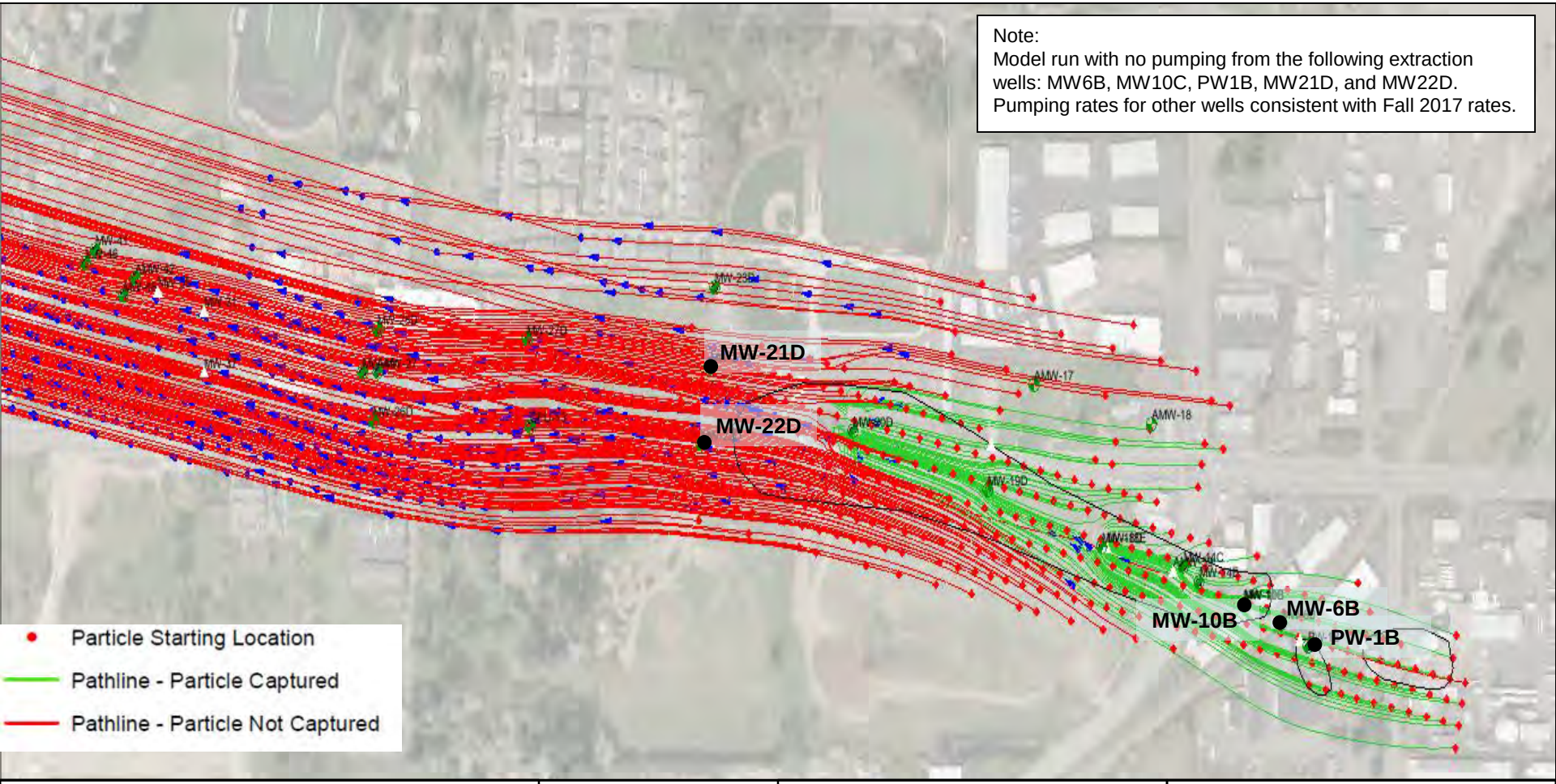
File Name: Fig_D3

Figure D2
Particle Tracking in the Upper Alluvial Aquifer (Layer 1) with Four Extraction Wells Shut off, Relative to Fall 2017



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File Name: Fig_D4

Figure D3
Particle Tracking in the Upper Alluvial Aquifer (Layer 1) with Five Extraction Wells Shut off, Relative to Fall 2017

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