MCP Phase III Remedial Action Plan
Former General Electric Facility
50 Fordham Road, Wilmington, MA
RTN 3-0518

Prepared for:

Lockheed Martin Corporation

Prepared by:

AECOM

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Prepared By: Tauhirah Abdul-Matin

Reviewed By: Daniel Folan, PhD, PG, LSP

Reviewed By: Art Taddeo

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°	degrees
'	minutes
"	seconds
AECOM	AECOM Technical Services, Inc.
amsl	above mean seal level
AUL	activity and use limitation
AST	above ground storage tank
bgs	below ground surface (depth below the ground surface)
BRT	Barbo Realty Trust
BTEX	benzene toluene ethyl benzene xylene
BWSC	Bureau of Waste Site Cleanup
C/I	Commercial/Industrial
CMR	Code of Massachusetts Regulations
COC	chemical(s) of concern
CSA	comprehensive site assessment
CSIA	compound-specific isotope analysis
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
CWA	Clean Water Act
DEQE	Department of Environmental Quality Engineering
DCE	dichloroethene
DFN	Discrete Fracture Network
DNAPL	dense non-aqueous phase liquid
DPS	down-gradient property status
E	east
EDR	Environmental Data Resources, Inc.
EIR	Environmental Impact Report
EISB	enhanced *in situ* bioremediation
ENF	Environmental Notification Form
EPH	extractable petroleum hydrocarbon

EPL	Eastern Parking Lot
ERM	Environment Resource Management
EZVI	emulsified zero valent iron
ft	feet
GE	General Electric Company
ISB	*In situ* biological
ISCO	*in situ* chemical oxidation
ITRC	The Interstate Technology & Regulatory Council
IWPA	Interim Wellhead Protection Area
LNAPL	light non-aqueous phase liquid
Lockheed Martin	Lockheed Martin Corporation
LSP	licensed site professional
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MNA	monitored natural attenuation
MTBE	methyl tertiary butyl ether
N	north
NAPL	non-aqueous phase liquid
NAS	National Academy of Sciences
NRC	National Research Council
OHM	oil and/or hazardous materials
OM&M	operations, maintenance, and monitoring
OOC	Order of Conditions
OU	Operating Unit
PCE	tetrachloroethene
PIP	Public Involvement Plan
PFM	passive flux meter
PRP	potentially responsible party
PWS	public water supply well
RAO	Response Action Outcome
RAM	Release Abatement Measure
RAP	Remedial Action Plan

RC	reportable concentration
RP	responsible party
RIP	Remedy Implementation Plan
ROS	remedy operation status
RSSB	regulated substances storage building
RTN	release tracking number
RW	recovery well
S	south
SOW	Scope of Work
sq ft	square feet
SSDS	sub-slab depressurization systems
Sterling	Former Sterling Supply Corporation
SVE	soil vapor extraction
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TRC	TRC Companies, Inc.
UCL	upper concentration limit
µg/l	microgram(s) per liter
UPS	United Parcel Service
UST	underground storage tank
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
W	west
WPA	wellhead protection area
WRT	Wilmington Realty Trust
WQC	Water Quality Certificate

Executive Summary

AECOM Technical Services, Inc. (AECOM) has prepared this Massachusetts Contingency Plan (MCP) Phase III Remedial Action Plan (Phase III) on behalf of Lockheed Martin Corporation in fulfillment of the requirements of the MCP for the former General Electric site (Release Tracking Number 3-0518) known as 50 Fordham Road in Wilmington, Massachusetts (site). The site is a joint Public Involvement Plan site with three other MCP sites (YRC Freight [YRC], MSM Industries, Inc. [MSM], and Sterling Supply Corporation [Sterling]), all located to the east along Concord Street in North Reading, Massachusetts. This Phase III includes a summary of the site history, provides a Conceptual Site Model, documents the development, evaluation, and selection of remedial alternatives, provides a feasibility evaluation, and projects time periods for achieving any Permanent or Temporary Solution.

The nature and extent of contamination has been adequately characterized for indoor air, surface water, soil, sediment, wetland soil, and groundwater. Groundwater plumes have been delineated laterally for chlorinated volatile organic compounds, petroleum hydrocarbons, 1,4-dioxane, and arsenic. Vertical delineation of the contaminant plumes has been defined to a significant and risk-relevant depth of from 250 to 320 feet below ground surface. A risk characterization has determined that a level of No Significant Risk exists for current human health and environmental receptors, but that a level of No Significant Risk does not exist for future ingestion of groundwater at the site.

No active sources remain at the site. Facility operations have been terminated, storage tanks removed, contaminated soil and sediment excavated and removed from the site, and additional remedial activities have been performed, including groundwater extraction and treatment, light non-aqueous phase liquid (LNAPL) recovery, bioventing/sparge and venting, and soil vapor extraction. Two areas, the former Tank K Area and the wetland outfalls 001 and 002, have been closed under partial Response Action Outcomes. The volume of LNAPL in subsurface soil has been significantly reduced to the extent practical. Residual LNAPL has been shown to be stable with micro-scale mobility. Dense non-aqueous phase liquid has not been encountered at the site;

however, presumptive DNAPL conditions have been observed based on the CVOC concentrations detected in the bedrock aquifer. Groundwater plumes have been determined to be stable or shrinking.

This Phase III has been completed in accordance with the requirements of the MCP (310 CMR 40) and meets the Remedial Action Performance Standards and Phase III Performance Standards as defined in 310 CMR 40.0853. Remedial action alternatives that are reasonably likely to achieve a condition of No Significant Risk have been evaluated. The recommended remedial action alternatives are not anticipated to achieve a Permanent Solution, but rather a Temporary Solution, and may reduce the concentrations of oil and hazardous materials to levels that support a condition of No Significant Risk. Reducing concentrations to levels that achieve or approach background have been determined to be infeasible based on the persistent nature of the chlorinated volatile organic compounds (CVOCs), 1,4-dioxane, and arsenic present as well as the subsurface bedrock conditions at the site. A set of comprehensive remedial action alternatives have been selected based on the information and evaluation documented in this Phase III and will include the following:

- Monitored Natural Attenuation (MNA) of CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic in groundwater
- Continued evaluation of stability and micro-scale mobility for residual LNAPL, with recovery/removal if warranted

Section 1
Introduction

AECOM Technical Services, Inc. (AECOM) has prepared this Phase III Remedial Action Plan (Phase III) on behalf of Lockheed Martin Corporation (Lockheed Martin) in fulfillment of the requirements of the Massachusetts Contingency Plan (MCP) 310 Code of Massachusetts Regulations (CMR) 40.0850, relative to the Former General Electric Company (GE) Facility located at 50 Fordham Road, Wilmington, Massachusetts (site). A portion of the property formerly occupied by the GE facility and numbered 50 Fordham Road, has since been re-numbered as 40 Fordham Road. Number 50 Fordham Road was reassigned to the Building 2 area on the northern portion of the same property that is currently occupied by Ametek, Inc. Aerospace & Defense. The site is designated as 50 Fordham Road under the MCP and therefore this address has been used in this document to denote the MCP site. In this report, "property" pertains to the address (40 and 50 Fordham Road, unless otherwise specified) and "site" refers to the MCP disposal site boundary.

This report is being submitted electronically via eDEP to the Massachusetts Department of Environmental Protection (MassDEP) with the appropriate transmittal form (MassDEP Bureau of Waste Site Cleanup [BWSC]-108), providing additional responsible party (RP) and Licensed Site Professional (LSP) certifications.

The purpose of this Phase III is to identify, through the screening and evaluation process, remedial options for the site that achieve either a Permanent or Temporary Solution.

This MCP Phase III is organized as follows:

- **Section 2 – Site Description and History** summarizes the physical property, site location, facility history and operations, utilities, release history, regulatory status, public involvement, and the relationship of the disposal site to other nearby disposal sites
- **Section 3 - Conceptual Site Model (CSM), Basis of Design and Remedial Goals** describes the conceptual site model of the occurrence and migration of the contamination

at the site, the basis of the requirements for any remedial design necessary, and the remedial goals applicable to the site

- **Section 4 – Development of Remedial Alternatives** identifies those remedial technologies applicable to the media and contaminants of concern and performs an initial screening of those alternatives

- **Section 5 – Detailed Evaluation of Alternatives** focuses on those remedial alternatives retained during the initial screening and identifies those which can reach a Permanent Solution or, if a Permanent Solution is not feasible, then a Temporary Solution.

- **Section 6 – Selection of Remedial Alternatives** identifies those alternatives appropriate for each contaminant condition requiring treatment that will reach either a Permanent or Temporary Solution

- **Section 7 – Feasibility Evaluation** evaluates the feasibility of the selected remedial action alternative(s) to reach a Permanent or Temporary Solution, background concentrations and other regulatory thresholds, as well as the ability to control source materials

- **Section 8 – Proposed Schedule** provides the projected periods for achieving any Permanent or Temporary Solution and implementation of the remedial action alternative(s), if necessary

- **Section 9 – Phase III Completion Statement and Licensed Site Professional (LSP)** provides the required regulatory forms and Licensed Site Professional Opinion

- **Section 10 – Public Notification** summarizes the MCP public involvement requirements for the site

- **Section 11 – References**

Section 2
Site Description and History

This section presents an overview of the property and site characteristics, site history and regulatory status, significant permitting and filings, the relationship of the disposal site to surrounding properties, and current and ongoing remedies at the site.

2.1 PROPERTY DESCRIPTION, SITE BOUNDARIES, AND SITE MAP

More detailed site information is provided by AECOM in the Phase II Comprehensive Site Assessment (AECOM, 2017). The former GE property is located at what was formerly known as 50 Fordham Road in Wilmington, Massachusetts, as shown on Figure 2-1, the Site Location Map. The property consists of a 13-acre parcel east of Fordham Road and north of Concord Street, in an industrial park. The 13-acre parcel is located both in the towns of Wilmington and North Reading, in Middlesex County, Massachusetts. The property is at 42 degrees (°) 33 minutes (') 39.14 seconds (") North (N) latitude and 71° 8' 9.88"West (W) longitude; the Universal Transverse Mercator coordinates in meters are 324,654 East (E) and 4,714,264 N in Zone 19T. The property is identified as Map 91, Parcel 131A on the Wilmington, Massachusetts Assessor's Maps.

A portion of the property formerly occupied by the GE facility and numbered 50 Fordham Road has since been re-numbered as 40 Fordham Road. Number 50 Fordham Road was reassigned to the Building 2 area on the northern portion of the same property that is currently occupied by Ametek, Inc. Aerospace & Defense. The site is designated as 50 Fordham Road under the MCP and therefore this address has been used in this document to denote the MCP site.

The site is located in a mixed commercial, industrial, and residential area. The site is bounded by woodland and wetland to the north beyond which are residential properties and commercial/industrial properties to the south along Concord Street. Fordham Road is located along the western property boundary with commercial/industrial parcels further west and north along Fordham Road. The eastern boundary is defined by Concord Street and the wetland associated with the Ipswich River.

The former GE property contains a number of former industrial buildings, paved parking areas, and an active sewage and wastewater treatment plant for the facility. The buildings are identified as Building 1 and 1A, which are attached, and Building 2. The only ancillary structure still present is a Treatment Building/Shed that houses an inactive groundwater treatment system. Building 3, the Oil House (formerly referred to by GE as the regulated substances storage building [RSSB]), the concrete ramp to the former Oil House, the Guard Shack, the former Pump House/Vault, the former Tank Farm, and the original Tank Farm area groundwater treatment building have been removed. The current site plan is depicted in Figure 2-2.

The site is located in an Interim Wellhead Protection Area (IWPA) for the inactive North Reading Stickney public water supply (PWS) well and a Zone II Wellhead Protection Area (WPA) for five Town of Reading emergency backup wells (3246000-07G through -11G) located between 3,500 feet (ft) to 4,300 ft south and southeast of the center of the former GE property. Specifically, these include the Town Forest Well, Well #82-20, Well #66-8, Well #13, and Well#15, all screened in the Ipswich River valley sand and gravel overburden. The Town of Reading has discontinued use of the Town Forest Wells and dismantled the water treatment facility there, but the wells are still listed as backup water supplies. Wetland and surface water bodies mapped by MassDEP are co-located in the eastern portion of the property.

2.2 PROPERTY AND FACILITY HISTORY & OPERATIONS

This section summarizes the history of the property and the former facility operations including use of oil and hazardous materials.

2.2.1 Property and Facility History

The Wilmington Realty Trust (WRT), formerly the Barbo Realty Trust (BRT), has owned the property at least since it was developed in the late 1960s. The Town of Wilmington

Assessor's property card shows the owner of record as Rosemarie Stanieich, with Frank Dardeno, Esq. as co-owner (Trustee).

Before 1968, the 50 Fordham Road property was reportedly used for gravel mining. The property was developed from 1968 through 1970. GE Aerospace used the facility (Buildings 1, 1A, 2, 3, the Oil House, and the Pump House) for manufacturing and supporting research and development from the time of development through August 1989. Former facility operations are discussed below. A portion of Building 2 was subleased to Converse, a sports shoe manufacturer, from 1973 to 1986, and a portion of Building 1 was subleased to Hamilton Standard, a manufacturer of hydrogen generators, from 1983 to 1985. In August 1989, the GE operations at the facility were sold to Ametek, Inc.; however, GE retained environmental liability. According to their website, Ametek Aerospace & Defense is a manufacturer of engine sensor suites, aircraft data management systems, cooling and ventilating systems, environmental control systems, and a variety of sub-assemblies for military and aerospace customers, and site operations are described as a global manufacturing operation.

GE Aerospace was acquired by Martin Marietta on April 2, 1993, which was subsequently merged with Lockheed Corporation to form Lockheed Martin on March 15, 1995 (MassDEP, 2000a). Ametek occupied the entire property until 1997 when General Scanning moved into Building 2. General Scanning's Laser Systems Division product development, manufacturing and worldwide support headquarters occupied Building 2 for 11 years until 2008. An early 1998 press release regarding the General Scanning Laser Systems move to Wilmington describes their operations as product development, manufacturing and worldwide support headquarters, with the move consolidating in Building 2 operations such as design centers, manufacturing and test areas, and a customer care center. Operations are described as follows: "General Scanning's Laser Systems Division creates and provides systems and services to improve yield, throughput and end product performance across a wide spectrum of manufacturing applications including linear and mixed signal electronics, semiconductor memory devices, passive SMT components, aerospace structures, and flat panel displays on large substrates." In 2008, Ametek moved from Buildings 1, 1A, and 3 to Building 2, their current location. Buildings 1 and 1A were vacant from 2008 through May 2013. Building 3 was demolished in July 2011.

The WRT leased portions of Building 1 to Got Books, a book scanning and warehouse business, which occupied approximately 95% of the first floor and approximately 20% of the second floor of Building 1 beginning approximately June 1, 2013. Got Books ceased operations in December 2013 and vacated the Building by May 2014.

The WRT conducted significant renovations in Building 1 and 1A in preparation for new tenants, in 2014 and 2015. Colonial Systems, an office cubicle assembly company, leased a portion of Building 1A and then moved their operations into the first floor of Building 1 from early 2015 through early 2016. The WRT divided Building 1A into two separate spaces, Suite 2, a 30,000 square foot (sf) space in the southern portion; and Suite 1, a 75,000 sf space in the northern portion that was built out for K1 Speed, a go-cart racing facility, in 2015. K1 Speed opened to the public in December 2015 and is currently in operation. Suite 2 is leased to a company titled CranBarry, a field hockey sports distributor. It is believed that CranBarry has occupied Suite 2 for approximately 8 to 12 months since late 2015 or early 2016.

In November 2016, WRT leased the Eastern Parking Lot (EPL) to United Parcel Service (UPS) for temporary operations in the parking lot during the holiday period. WRT subsequently leased Building 1 to UPS in 2017 to serve as a package distribution center.

2.2.2 Oil and/or Hazardous Materials Use and Storage History

The following information was obtained primarily from the Public Involvement Plan (PIP) generated by the MassDEP dated November 17, 2000, as confirmed and augmented with details obtained from copies of other historical reports and site plans (MassDEP, 2000a).

Manufacturing operations have been present on-property from approximately 1968 to 1970 through the present. Site operations are summarized by Building below:

Building	Aerospace manufacturing	Other Manufacturing	Warehousing/Assembly/ Other
Building 1	1968/1970 – 2008	1983-1985 (generators)	2013-2014 (books) 2015-2016 (office cubicles assembly) 2016 (UPS)
Building 1A	1968/1970 – 2008	None	2015 (office cubicles assembly) 2015-present (sports apparel distributor) 2015-present (go cart racing)
Building 2	1968/1970 – 1997 and 2008 to 2016	1973-1986 (shoe) 1997-2008 (electronics)	---
Building 3	1968/1970 – 2008	None	---

Two 5,000-gallon capacity aboveground storage tanks (ASTs), A and B, were located in the former Oil House (Figure 2-2). Tank A reportedly contained jet fuel and Tank B reportedly contained waste oil (TRC, 2001).

Tank C is described as a small concrete pit located in the former Pump House, also referred to as the Vault, and reportedly received waste through concrete chase troughs from Buildings 1 and 3 before transfer to the waste oil Tank (Tank B) in the Oil House. This Pump House/Vault and associated pipe chases were removed in February 2017.

From 1969 through June 1987, four underground storage tanks (USTs) D, G, H, and I, collectively referred to as the former Tank Farm, were located between Buildings 1 and 3 (Figure 2-2). Shallow bedrock had to be removed to install the tanks.

Details of the four USTs are as follows:

- Tank D was a 10,000-gallon capacity UST that received waste fuel and oil, thinners, and solvents from the facility.
- Tank G was a 10,000-gallon UST that stored jet fuel and oil (Stoddard Solvent).
- Tank H was a 1,000-gallon UST that stored JP-4 jet fuel.
- Tank I was a 500-gallon methanol storage tank.

According to GE personnel, Tank D did not receive any waste fluids after 1979, although it was available as a contingency to accept liquid if any overflow occurred from ASTs A and B in the Oil House. Tanks G and H were drained in 1979 and were reportedly never used again. Tanks D, G, H, and I were reportedly removed in June 1987.

Liquid acid and caustic wastes from a former metal finishing room in Building 1 drained via floor drains into Tank F, a 3,500-gallon UST, located outside the southwestern corner of Building 1. Tank F replaced an older butyl rubber-lined open top steel tank, which was taken out of service in 1981 and removed from the property in June 1987. No identification number of this open top steel Tank is provided, and it appears to be described by multiple names (acid Tank and inorganic waste) and varying capacities (ranging from 3,000 to 3,800 gallons). Tank F was reported to have been taken out of service before the summer of 1988 and removed in February 1990.

AECOM reviewed a series of historical GE site plans provided by the current property owner. A trichloroethene (TCE) AST (estimated to be approximately 275 gallons in size) that was formerly present in the metals finishing room as part of the GE operations (southwest corner of Building 1) was identified in the review. The Tank was also noted in a site inspection report prepared by the Massachusetts Department of Environmental Quality Engineering (DEQE) in 1976.

Chemical liquid wastes generated by Hamilton Standard's "Direct Energy Conversion Operation" discharged into a 5,000-gallon UST (Tank J) located east of Building 1A. This Tank was reported to have been taken out of service in 1981 and removed in 1987.

Chemical wastes from sinks in the Liquid Crystal Division Laboratory, Materials Destruction Laboratory, and Liquid Crystal Division clean room flowed into Tank E, an underground butyl rubber-lined, open-top steel tank. Tank E was installed in 1981 and was located east of Building 1A, below the ground surface in a concrete secondary containment vault. Tank E was removed in December 1992. Tank E reportedly replaced Tank J.

Converse, a former sub-lessee of GE, installed a 5,000-gallon gasoline UST (Tank K) east of Building 2 and a blow-down UST associated with the steam curing of rubber (Tank L) north of Building 2. Converse removed both tanks in 1986 before vacating the property. Converse also reportedly generated waste naphtha, methyl ethyl ketone, and rubber compounds, which were removed from the property.

In addition to drains and pipes that connected Buildings 1/1A, 3, and the Pump House to the various USTs and ASTs formerly on-site, floor drain networks were also present in Buildings 1/1A and 3. Drain lines throughout GE operations in Building 1/1A discharged either to manholes in Fordham Road or to Outfalls 001 and 002. Discharges to the storm-water system (001 and 002) reportedly only consisted of non-contact cooling water (Environment Resource Management New England [ERM], 1987). Drains to the on-site wastewater treatment facility mainly consisted of sanitary drains, but also included various sinks, eye wash stands, water coolers, floor drains and cleanouts, etc. These features may or may not have been used to discharge process wastes from the GE operations. Drains from Buildings 1 and 3 were connected to Outfall 001 and drains from Building 1A were connected to Outfall 002. Roof drains also conveyed storm water to these same drain lines. Historical building plans indicated Building 2 sewer drains connected to the wastewater treatment plant and one drain line to Fordham Road.

There are no USTs currently on-site according to Environmental Data Resources, Inc. (EDR) database reports obtained by CDM Smith, Inc. (CDM Smith) in 2009, and by AECOM in 2012 (EDR, 2012).

2.3 SITE HISTORY AND REGULATORY STATUS

Contamination of the Stickney Well, a currently inactive public supply well for the town of North Reading, was discovered in the late 1970s. Subsequent investigations of multiple surrounding properties, including the GE property, began in the early 1980s. Remedial investigations and cleanup have been ongoing at the 50 Fordham Road site since 1986. A timeline summary of the regulatory history of the site is provided in Table 2-1.

On October 9, 1987, the MassDEP classified the former GE facility as a Priority Disposal Site, before the adoption of the MCP in 1988. In 1994, the MassDEP classified the former GE facility as a Tier 1A Transition Site and provided Release Tracking Number (RTN)

3-0518 and Permit Number (No.) 83052 to authorize comprehensive remedial response actions to meet the requirements of the MCP. Due to recent changes to the MCP, the site is now categorized as a Tier 1 Classified site because the former Tier Permitting process has been eliminated and has been replaced by the Tier Classification process.

2.3.1 Release Tracking Number 3-0518

Manufacturing processes by a number of firms at the facility have contributed to releases of fuels, oils, solvents, and metals to the environment. RTN 3-0518 incorporates these four separate Operable Units (OU):

- OU-1 – Former Tank Farm source area (includes Pump House/Vault and Oil House) and adjacent Eastern Parking Lot (Stoddard Solvent and other petroleum products)
- OU-2 – Former Tank Farm source area and downgradient groundwater plume both on-property and off-property (chlorinated solvents)
- OU-3 – Storm water/Wastewater Outfalls 001 and 002
- OU-4 – Former Tank K Source Area and immediately downgradient groundwater plume

Analytical data indicate that six primary types of organic and inorganic compounds are associated with RTN 3-0518. These include chlorinated volatile organic compounds (CVOCs); total petroleum hydrocarbons (TPH); benzene, toluene, ethyl benzene, and xylene (BTEX)-related compounds; methyl tertiary butyl ether (MTBE); several metals; and light non-aqueous phase liquid (LNAPL) identified as Stoddard Solvent.

OU-3 and OU-4 are closed, as discussed below. The remaining two areas, OU-1 and OU-2, make up RTN 3-0518. A detailed summary of the historical remedial response actions is provided in the Remedy Operation Status (ROS), ROS Termination, and Tier IA Permit Extension Report (AECOM, 2013).

2.3.1.1 OU-3 Closure

Areas in OU-3 have been resolved and closed under the MCP via a partial Response Action Outcome (RAO, Class A-2) submitted in December 2004 (TRC, 2004). On

November 30, 1995, MassDEP conditionally approved sediment remediation activities for the Outfall areas. The approval required sediment excavation of the Outfall 001 and 002 areas to proceed until all contaminants of concern reached or approached background levels, if feasible.

In 1996, Engineering Metal Constructing Company (EMCON) conducted a sediment evaluation to update and more accurately delineate the extent of sediments to be remediated in the vicinity of Outfalls 001 and 002. In 1998, EMCON, conducted a qualitative ecological risk characterization, which indicated that a condition of No Significant Risk already existed at the Outfall locations (EMCON, 1998a). Therefore, a recommendation of no further response action was submitted for MassDEP approval.

In December 1998, MassDEP issued a written response to the 1998 Report, requiring that Lockheed Martin either conduct a quantitative Stage II ecological risk characterization or proceed with the remediation of contaminated sediments. In February 1999, Lockheed Martin submitted a letter indicating their desire to pursue a Stage II ecological risk characterization. The scope of work for the Stage II Assessment was submitted to MassDEP on January 1, 2002. A final Stage II Ecological Risk Characterization Report and Phase IV Remedy Implementation Plan (RIP) was completed and submitted in January 2004. The remedial plan included excavation and disposal of contaminated sediments, with subsequent backfill and restoration.

Remediation activities were conducted in August and September 2004, and restoration activities were completed in October 2004. A summary of these activities is presented in the Phase IV As-Built Construction and Final Inspection Report and Partial Response Action Outcome Statement (Class A-2) submitted in December 2004 (TRC, 2004). In accordance with the MassDEP Water Quality Certification (WQC), a five-year post-restoration monitoring program was required in the wetland area through the fall of 2009. The work was completed and a final status report was submitted to MassDEP in December 2009. A Certificate of Compliance was not obtained from the North Reading Conservation Commission (ConCom) upon completion. On September 25, 2015, AECOM submitted a request to the ConCom to officially close out the Order of Conditions for the site. A

Certificate of Compliance was provided by the ConCom on November 12, 2015 (Town of North Reading Conservation Commission, 2015). No additional MCP actions were required at this Operable Unit.

2.3.1.2 OU-4 Closure

The OU-4 has been resolved and closed under the MCP via a partial RAO (Class A-2) dated November 9, 2010 (TRC, 2010). In February 1998, EMCON, on behalf of Lockheed Martin, conducted a Focused Feasibility Study to compare the remedial alternatives for the Tank K area with alternatives developed since the Phase III Remedial Action Plan (RAP) was prepared in October 1993 (EMCON, 1998b). The study recommended the implementation of chemical oxidation to treat the groundwater and smear-zone soils in the Tank K area.

The chemical oxidation pilot test was conducted in early 1999 and was unsuccessful as it failed to show that it could achieve cleanup standards and indicated that the cost would exceed prior estimates. The pilot test letter report dated May 1999 included a request for MassDEP approval to change the remedial action alternative for the Tank K area, based on a re-evaluation of other feasible technologies.

TRC submitted a work plan for a Biosparging/Soil Vapor Extraction (SVE) Pilot Test in October 1999. MassDEP approved the work plan in November 1999, and the pilot test was conducted from November 29 - December 2, 1999. The Phase III Addendum Report, submitted to MassDEP on January 24, 2000, summarized the pilot test results and concluded that a full-scale system should be implemented. MassDEP approved the RAP Addendum on June 9, 2000. The Phase IV RIP for the former Tank K system was submitted to MassDEP on July 25, 2000. A system modification that increased the depth of air injection from 5 to 10 ft below water table was submitted to MassDEP on September 19, 2000. The RIP was approved by MassDEP on October 31, 2000.

The biosparging/SVE system was installed in the Tank K Area during the winter 2000-2001 and startup operations began in February 2001. The Tank K Area Operations, Maintenance and Monitoring (OM&M) program was performed in accordance with the Tank K Area Phase IV As-Built Construction and Completion Report submitted on March 20, 2001 and approved by MassDEP June 11, 2001. System maintenance, system performance, and groundwater monitoring was conducted between 2001 and 2005.

TRC noted a trend of decreasing contaminant levels from late 2001 through March 2005. Groundwater monitoring showed a nutrient deficiency of nitrogen, phosphorous, and potassium. TRC injected nutrient supplements, in the form of soluble fertilizer, to selected wells between June and November 2007. Operation of the former Tank K remediation system resumed following the initial nutrient addition in July 2007. The system was then cycled from November 2007 through June 2008.

On June 30, 2008, the system was placed in shutdown mode to assess sustainable conditions per the MCP, 310 CMR 40.0893(6)(d). Post-remedial groundwater monitoring was performed through April 2010. Results showed all compounds below GW-1 Standards and it was determined that the Tank K system had achieved its goal.

2.3.2 Former Release Tracking Number 3-28282 (Arsenic)

As a result of an expanded groundwater sampling event in November 2007, arsenic was observed above MCP Reportable Concentrations (RCs) in groundwater. This finding was reported to MassDEP. During that period, TRC also observed that 1,4-dioxane was present above RCs but determined that this condition did not require a new notification to the MassDEP. The elevated arsenic condition was issued RTN 3-28282 on January 8, 2009. On January 8, 2010, CDM Smith, on behalf of Lockheed Martin, submitted to MassDEP: 1) the Numerical Ranking Score sheet identifying this RTN as a Tier 1C site; 2) the Tier 1C Permit Application (CDM Smith, 2010b); 3) the Phase I Initial Site Investigation Report and Completion Statement; and 4) the Phase II Scope of Work (SOW) (CDM Smith, 2010c). An MCP Phase II and Phase III were due for the new RTN in January 2012. An Interim Phase II was submitted in January 2012; however, no Phase III was submitted because CDM Smith concluded the elevated arsenic was related to reducing conditions resulting from the releases addressed by RTN 3-0518. Lockheed Martin completed linking of RTN 3-28282 to 3-0518 through a submittal on March 30, 2012.

2.3.3 Tier IA Permit

On July 13, 1999, a Tier I Minor Permit Modification was submitted to MassDEP by TRC, on behalf of Lockheed Martin, to document that Lockheed Martin, the current signatory to the Tier IA Permit, had entered into an outsource agreement with TRC for future environmental work at the former GE Facility and that there was a change in LSP-of-Record for the site (TRC, 1999a). On August 5, 1999, a Tier I Permit Extension application was submitted to the MassDEP by TRC, again on behalf of Lockheed Martin, in anticipation of a change in the party conducting response actions (TRC, 1999b). On October 22, 1999, Lockheed Martin contractually assigned direct responsibility for the MCP actions to TRC. On December 13, 1999, TRC submitted a Tier I Permit Transfer application to transfer the Waste Site Cleanup Permit from Lockheed Martin to TRC (TRC, 1999c). The Permit Extension and Permit Transfer applications were approved simultaneously by MassDEP on December 28, 1999.

With an effective date of January 18, 2000, the Tier IA permit was extended to January 18, 2004. Because additional bioremediation studies were needed before installation of the proposed groundwater source control remedy, a second extension to the Tier 1A permit was submitted in December 2003 (TRC, 2003) and was subsequently approved (the approval date is unknown) for two additional years. A ROS Opinion was filed on April 20, 2006, which effectively suspended Tier IA Permit requirements.

Although work in each of the four OUs proceeded on separate MCP response action courses from 2000 to 2006, an ROS Report was submitted for the entirety of RTN 3-0518 in April 2006. Subsequently, semi-annual ROS Reports were submitted to MassDEP covering the period through December 1, 2012 (submitted March 27, 2013).

Lockheed Martin resumed MCP responsibility for the remaining response actions for OU-1 and OU-2 through the submittal of a Tier 1 Major Permit Modification to MassDEP dated January 6, 2012 (TRC, 2012). On May 30, 2012, a Tier 1 Minor Permit Modification (BWSC-109) was filed to replace the CDM Smith LSP-of-Record with AECOM's LSP, Elissa Brown (LSP #5371). AECOM completed a subsequent Tier 1 Minor Permit

Modification (BWSC 109) and uploaded it to MassDEP's eDEP system on March 13, 2013, to replace Elissa Brown with Daniel Folan, LSP #1736, as the current LSP-of-Record for the site.

On February 28, 2013, AECOM completed and submitted to Lockheed Martin a comprehensive data evaluation and trend analysis for the monitoring well network to determine the effect of the 2007 emulsified zero valent iron (EZVI) injection and the subsequent 2008 groundwater pump and treatment system shutdown. Based upon this evaluation, AECOM and Lockheed Martin determined that groundwater data trends did not indicate significant reductions in contaminant concentrations on-site, and that additional actions may be necessary to achieve a permanent solution. Lockheed Martin and AECOM determined on February 28, 2013, that the requirements to maintain ROS were no longer being met, and they submitted the required ROS Termination Notice on March 27, 2013.

Since additional response actions (exclusive of preliminary response actions) cannot be conducted at the site in the absence of a Tier 1 permit, a Tier I Permit Extension Application was also submitted on March 27, 2013. This extension was presumptively approved on May 3, 2013, which extended the Tier 1 Permit until May 3, 2015. With the submittal of the ROS Termination and the Tier IA Permit Extension application, the site has now returned to Phase II/Phase III status of the MCP. Semi-annual status reports are not required while in these phases of the MCP.

On November 1, 2013, a Supplemental Phase II Scope of Work was submitted to MassDEP to outline the additional investigation activities to be conducted from 2013 through 2015. A subsequent PIP meeting (December 2013) was held followed by a 20 day comment period before the start of the supplemental investigation activities in January 2014.

On October 10, 2014, Lockheed Martin submitted a Tier Classification Extension that was approved by MassDEP on November 11, 2014. On November 20, 2014, the MassDEP notified Lockheed Martin that the Tier Classification deadline was extended to May 3, 2017.

On August 28, 2015, Lockheed Martin electronically submitted to MassDEP a Final Work Plan Addendum which described additional bedrock investigation work at the site. A public meeting was held on September 3, 2015, followed by comment period through September 23, 2015, before the start of work in late September 2015.

2.3.4 Wetland Permitting

In preparation for drilling activities in the wetland located east of the site in North Reading, MA, AECOM prepared and submitted permit applications in March 2014. These included a Joint Application for MassDEP 401 WQC and United States Army Corps of Engineers (USACE) Massachusetts General Permit (Cat. II) Authorization under Clean Water Act (CWA) 404, and a Notice of Intent to the ConCom.

Order of Conditions (OOC) #245-1468 was issued by North Reading on March 25, 2014, and the OOC was recorded on April 22, 2014. On April 4, 2014, the USACE issued Permit #NAE-2014-515 to authorize the planned work as a Category 2 activity under the federal permit known as the Massachusetts General Permit. On July 18, 2014, the MassDEP issued letter X259587 with a WQC approval for the Permit #NAE-2014-515.

All of the planned work in the wetland was conducted between August and December 2014. Subsequent wetland restoration work was conducted in 2015 in accordance with the OOC. On August 14, 2015, AECOM submitted a memorandum to the ConCom summarizing the wetland restoration activities completed. AECOM will submit a request for Certificate of Compliance to the ConCom, and the Compliance Certification Form to the USACE and MassDEP, once the work is officially complete.

In November 2013, AECOM submitted an Environmental Notification Form (ENF) to the Massachusetts Historical Commission. The Commonwealth replied on December 20, 2013 with a determination that the planned project work did not require the preparation of an Environmental Impact Report (EIR).

Additionally, a Request for Determination of Applicability was submitted to the ConCom for the 2014-2015 work to be conducted outside of the wetland in the buffer zone on the property at 50 Fordham Road. A negative determination was issued by the ConCom on November 13, 2013, for this portion of the 2014-2015 work.

2.3.5 Activity and Use Limitation

An Activity and Use Limitation (AUL) was placed on the southwestern portion of the site, encompassing Buildings 1, 1A and 2 on July 13, 2015 by WRT (Appendix A). This AUL was established to prevent uses of the former GE property which would be inconsistent with maintaining a condition of No Substantial Hazard under the MCP. These prohibited uses include the following:

- Residential, school, playground, park or daycare use
- Activities that would result in exposure to or the disturbance of potentially contaminated soils, bedrock, groundwater, and indoor air, unless appropriate precautions to prevent human exposure are taken, as described in the AUL

In addition, the AUL imposes certain obligations and conditions to maintain a condition of No Substantial Hazard, including maintenance of concrete floors, management of any excavated soil and/or bedrock under Soil Management Procedures in 310 CMR 40.0030, and appropriate management of any groundwater removed during dewatering activities. Lastly, any activities which could result in exposure to or disturbance of soil, bedrock or groundwater must be conducted in accordance with the performance standards for release abatement measures (RAMs) set forth by the MCP at 310 CMR 40.0440, the Soil Management Procedures pursuant to 310 CMR 40.0030, the Similar Soils Provisions Guidance (WSC#-13-500, MassDEP, 2014), Construction of Buildings in Contaminated Areas (Policy WSC#-00-425; MassDEP, 2000b), and applicable Health and Safety procedures outlined in 310 CMR 40.0018, as determined by an LSP.

2.4 PUBLIC INVOLVEMENT PLAN

The site is one of four MCP Tier 1A sites in the Fordham Road and Concord Street portion of the towns of Wilmington and North Reading, Massachusetts. These four sites are part of a single PIP, prepared by MassDEP on November 17, 2000. The three other sites are Roadway Express (currently YRC Freight [YRC]), MSM Industries, Inc. (MSM), and Sterling Supply Corporation (Sterling). On February 22, 2011, TRC (the previous environmental consultant/LSP) notified the Public Involvement mailing list participants that the PIP was no longer considered active. However, no formal modification or termination notice was submitted to MassDEP regarding the PIP. Lockheed Martin and its contractors have continued public communications as site activities continue and to implement public involvement activities in accordance with the 2000 PIP.

2.5 RELATIONSHIP OF DISPOSAL SITE TO SURROUNDING DISPOSAL SITES

AECOM performed a search of MassDEP records to determine if any releases in the area of the site are attributed to the former GE disposal site by their filing of a Downgradient Property Status (DPS) submittal. A summary of this search is presented in Table 2-2. Properties are depicted on Figure 2-2. Of the four DPS filings within one-half mile of the site, two properties cite the former GE disposal site as the potential source:

- Howland Development/Former Bard Medsystems/Baxter (RTN 3-10722) – 87 Concord Street
- International Family Church/Former Converse (RTN 3-20467) – 99 Concord Street/ 1 Fordham Drive

The third DPS, for St. Johnsbury Trucking/New England Motor Freight DPS (RTN 3-18024) at 90 Concord St cites the Roadway Express/YRC disposal site (RTN 3-2363), located immediately upgradient at 95 Concord Street, as the most likely source of tetrachloroethene (PCE). The fourth DPS, for the Service Pumping & Drain, Inc. /CHF Products disposal site at 5 Hallberg Park (RTN), cites the Sterling property at 70 Concord Street as the likely source.

2.6 CURRENT AND ONGOING REMEDIES UNDER PHASE II

There are several remedial OM&M activities currently being performed at the site, which have continued since the site Remedy Operation Status (ROS) was terminated in March 2013. These are ongoing monitoring and evaluation activities under Phase II and consist of the following:

- Quarterly light non-aqueous phase liquid (LNAPL) monitoring and free product recovery (if present) in the Eastern Parking Lot
- Continued evaluation of groundwater plume trends due to any site activities or natural attenuation
- Continued evaluation of vapor-intrusion potential in Building 1

A discussion of future OM&M activities warranted and their schedule, based on this Phase III feasibility evaluation, is presented in Section 8 of this report.

Section 3
Conceptual Site Model, Delineation of Areas of Concern, Risk Characterization Summary, Remedial Goals, and Basis of Design

This section presents the Conceptual Site Model (CSM) for the site, delineation of areas of contamination, a summary of the risk characterization completed, remedial goals, and the basis of design.

3.1 CONCEPTUAL SITE MODEL

This section summarizes and describes the CSM for the former GE facility site that is the culmination and output of the Phase II Comprehensive Site Assessment. A generalized cross-sectional schematic of the CSM is presented in Figure 3-1 and a summary of receptor risk CSM is presented in Figure 3-2. Details and supporting data for the information summarized below are presented in the Phase II Comprehensive Site Assessment (CSA; AECOM, 2017).

3.1.1 Contaminant Release Sources

The Phase II Comprehensive Site Assessment (AECOM, 2017) has identified the current highest groundwater concentrations of CVOC in shallow bedrock beneath Building 1. Other historic possible source contributions are from former tanks in Building 1, the former Tank Farm, vault, and Oil House areas of the site. PCE and TCE were released to the subsurface, migrating through the overburden soils and into the fractured bedrock aquifer at these locations. The plume migrated east/southeast. Contaminated groundwater then migrated off-property east/southeasterly beneath the woodland and wetland area toward Concord Street in the direction of the Ipswich River. Additionally, wastes from Building 1 operations, transported via floor drains into the storm water system, were discharged to Outfall 001 and

Outfall 002, contaminating the localized wetland area immediately adjacent to these outfall structures with metals. Finally, a release from a gasoline UST, immediately east of Building 2, contaminated soils and shallow groundwater in that area with hydrocarbons. Naturally occurring arsenic in native soils has dissolved into groundwater in localized areas due to reducing conditions in groundwater caused by other contaminants. Possibly related to this condition, sporadic iron flocculant presence has been reported in wetland areas as well.

All USTs and ASTs have been removed from the facility. The contamination to the wetland from the outfalls and the contamination from Tank K were remediated and closed under partial RAOs. No continuing sources of product, wastes, or contamination exist at the site.

3.1.2 Site Geology

The bedrock formations in the region of the site are primarily igneous in nature and have been fractured and folded, and at places faulted. Structural features in the region include many northeast-trending, generally steeply dipping, longitudinal faults. Evidence of high angle joints/faults at various orientations have been observed from visual inspection of outcrops, rock cores collected at the site, and borehole geophysical logging results. Given the nature of these rocks, and the complex history of deformation, intrusions, and faulting, localized fractures and jointing in the rock will be highly variable.

The configuration of the bedrock surface is highly irregular in and around the site. Two main bedrock valleys are observed, one beneath the Ipswich River and one that lies north and east of the former GE facility and is a tributary to the Ipswich River valley. Beneath Building 1, the depth to rock is approximately 40 ft (bedrock elevation 45 ft above mean seal level [amsl]). Heading east into the former Tank Farm area, a bedrock knob is evident where overburden thickness approaches only 10 feet (bedrock elevation approximately 80 ft amsl). Moving east across the EPL toward the woodlands, the bedrock slopes sharply downward to a maximum depth of about 80 ft below ground surface (bgs) or approximately 5 ft below mean sea level. Continuing in an east-southeasterly direction from the woodland through the wetland, the overburden-thickness decreases from about 80 ft to approximately 40 ft at Concord Street (bedrock elevation 55-60 ft amsl). Moving further southeast toward the

Ipswich River valley, the overburden thickness increases once again. On the opposite side of the Ipswich River, bedrock surface starts to climb again forming the south side of the Ipswich River valley.

A northwest trending buried valley that appears to be a tributary of the pre-glacial Ipswich River is located to the northeast of the former GE facility property. This buried tributary valley extends along the long axis of the wetland area approximately 1,500 ft east-southeast of the property, and is expected to represent a preferential flow pathway for groundwater in the overburden aquifer east of the former GE facility. The main point of groundwater discharge to surface water is to another buried valley that is coincident with the current Ipswich River directly south of the site.

The site is underlain by fill, very fine to coarse sand and gravel, boulders, glacial till and organic deposits (peat). Except for outcrops and very shallow bedrock in certain places, till overlies the bedrock surface at most locations in and around the site. Recent wetland deposits consisting of peat are located in low-lying areas to the northwest, north, and east of the property and to the south along the Ipswich River. The peat deposits in and around the site range in thickness from less than 1 ft to 17 ft.

3.1.3 Groundwater Characteristics

Groundwater at the property is present in the overburden and through underlying fractured bedrock. The depth to groundwater beneath the site ranges from approximately less than 1 ft in the wetland to 12 ft bgs between Building 1 and Fordham Road. Shallow overburden groundwater flows generally to the east-southeast, toward the Ipswich River. As the shallow groundwater flows into and beneath the wetland, it is influenced by groundwater flow from the north, resulting in a southeastern groundwater flow pathway coincident with axis of the buried aquifer valley beneath the wetland. At the eastern end of the site near Concord Street, the groundwater flow direction bends to the south toward the Ipswich River.

Based on measured hydraulic heads in overburden and bedrock monitoring wells, vertical groundwater flow is not significant with an overall slightly downward hydraulic gradient across the site. A review of vertical hydraulic gradients from wells installed south of Concord

Street on the north bank of the Ipswich River show strong upward gradients from bedrock and deep overburden to the shallow wetland area as part of the Ipswich River bedrock valley. Groundwater potentiometric surface figures for overburden and bedrock intervals are presented as Figures 3-3 through 3-5.

A water mass balance was conducted for the catchment basin that includes the site, notably the wetland, the buried aquifer valley to the east of the former GE property, and the upper portion of fractured bedrock in the site. This analysis indicates that most flow that enters the basin passes through the buried aquifer valley as groundwater, and exits the basin to the Ipswich River valley under Concord Street near the far eastern end of the site. Groundwater from the former GE property also discharges to streams, such as the Ipswich River Tributary. There is very minor surface water flow that is channeled through a small culvert under Concord Street. Most flow occurs as groundwater in the surficial sand and gravel aquifer rather than the fractured bedrock aquifer, based on the analysis of flow through cross-sections utilized in the water balance calculations.

Within the study area, most infiltrating water is retained in the vadose zone as soil moisture during the spring and summer, and thus does not contribute to recharge. Although the lowland wetland areas are inundated, they generally have very low permeability, which may limit the volume of recharge that occurs through these areas. While the vertical hydraulic conductivity is low in the wetland, the peat deposits are highly absorbent and can store large volumes of water. Water is discharged from the wetland through both evaporation and transpiration.

Fractured bedrock groundwater flow directions will be influenced by a combination of hydraulic heads, the geologic framework created by the bedrock valleys in the area, and the bedrock fracture network, including the orientation of strike and dip of fractures.

A simplified groundwater model was constructed to provide information on contaminant plume trajectory in the aquifer and the potential influence of a groundwater pumping system located on an adjacent property to the south of the site on the plume. The model indicated that the capture zone of the pumping system extraction wells does not extend into the site.

Simulations suggest the plume trajectory is influenced somewhat to the south in the EPL and buried aquifer valley, but that no contaminant particles from the source areas are captured by the extraction wells. There are uncertainties associated with this simplified model; however, groundwater results from bedrock wells located directly between the site and the extraction wells do not contain any elevated CVOC concentrations. This observation supports the model's overall conclusion.

3.1.4 Bedrock Characteristics

Geophysical evaluations have confirmed high variability in the bedrock characteristics of the site, depending on location and depth. A low resistivity zone, potentially indicative of high transmissivity, was identified in a portion of the EPL where well TRC-201R was installed. Additional resistivity surveys in the EPL area identified a high density of fractures in a number of locations at Transect A. The strike of fractures measured in these boreholes trend either northeast-southwest or northwest-southeast and are consistent with the regional geologic fracture trends and fracture trace analysis results. Many boreholes along Transect A exhibit high angle fractures.

There is a wide variability of fracture aperture sizes observed in bedrock over the site, ranging from large to very small. All sizes of fractures contribute to groundwater flow as well as contaminant transport. While larger fractures contribute more flow, the smaller fractures can contribute to more contaminant transport in certain cases. Transect A, where the core of the CVOC plume is located, has a higher amount of larger fractures. ALS temperature logging provides strong evidence that considerably higher horizontal groundwater flux occurs in Transect A than Transect B. Total borehole transmissivities, as measured by the FLUTe transmissivity profiling method, are one to three orders of magnitude greater in the center of Transect A than in other locations around the site, presumably due to the high degree of fracturing here.

Large localized areas of fractures can contribute more surface area to groundwater flow either in their primary or secondary porosity, which can play a greater role in diffusion processes (see discussion below). Although highly fractured zones have been identified in localized areas at Transect A and the EPL, many of these fractures may be of limited extent (discontinuous) or infilled with minerals or other material, and may not transmit groundwater over any great distance. The very high variability in transmissivity values site-wide from the FLUTe testing suggests that only a low percentage of the fractures in the overall bedrock aquifer network are contributing a high percentage of the flow. The overall flow in these lower numbers of fractures is also slow due to the tortuous flow pathways through the highly heterogeneous fracture network. PFM data suggest that contaminant mass flux is controlled by both the high and low transmissivity zones (see discussion below).

Overburden aquifer hydraulic conductivity values ranged from 0.142 to 614 feet per day (ft/day.). The higher values were observed in the deep overburden deposits (outwash) in the wetland area. The range in estimated linear groundwater seepage velocities for overburden in the study area is calculated to be 0.09 to 0.35 ft/day. Bedrock aquifer hydraulic conductivity values in and around the site were much lower and ranged from 0.01 to 19.6 ft/day. The highest value in the bedrock was recorded in the EPL at a depth interval of 95-115 ft bgs. The estimated groundwater seepage velocities in fractured bedrock range from 57 ft/day to 84 ft/day. While these values represent averages, seepage velocities are typically higher in bedrock than in unconsolidated material, and so this is not uncommon. It is indicative that advective flow plays an important role in the transport of contaminants in the bedrock aquifer at the site.

Groundwater in the bedrock occurs chiefly in fractures and joints. These are interconnected narrow planar openings with variable apertures. They are variously spaced and dip at a variety of angles from horizontal to vertical. In general, joints intersect each other and may be interconnected over a considerable area. They occupy only a very small part of the total volume of the bedrock. As a result, the porosity and permeability of the bedrock, although differing greatly from place to place, are low compared to overburden.

Matrix porosity (primary) and other bedrock physical property values were obtained from rock samples from the former Tank Farm and Transect A in the EPL. Matrix porosity varied from 0.00 to 0.045 with an average of 0.023. In general, these values are high relative to typical values reported in the scientific literature for crystalline rocks which are usually less than 1% (0.01) and are attributed to intra-and inter-granular micro-cracks (Schild et al., 2001).

The primary porosity values were subsequently used to estimate matrix diffusion rates in bedrock underlying the site. Calculated matrix diffusion rate coefficients for PCE ranged from 8.2E-8 to 4.02E-6 with an average of 1.15E-6 square centimeters per second (cm^2/s). For TCE, matrix diffusion coefficients ranged from 9.1E-8 to 4.46E-6 with an average of 1.27E-6 cm^2/s. These rates of diffusion are consistent with a fractured crystalline rock matrix (Singhal and Gupta, 1999). The CRAFLUSH parallel plate model was used to evaluate the influence of matrix diffusion of contaminants into the primary porosity of the rock on contaminant (PCE) concentrations in groundwater moving through the model fracture. The results indicate that PCE concentrations (or mass discharge) could decrease by approximately 85% between Transect A and B as a result of diffusion into the matrix.

This simulation result is in reasonable agreement with field data along Transects A and B, which show approximately a 90% to 99% decrease in PCE groundwater concentrations as PCE migrates from Transect A to Transect B. The CRAFLUSH simulation likely underestimates the PCE attenuation because biodegradation, abiotic degradation, dilution, and dispersion processes are not considered in the model. Matrix diffusion into the rock matrix has a significant effect on contaminant distribution because it increases the overall attenuation rate thereby reducing downgradient migration (i.e., retardation).

Passive flux meter testing indicates that the contaminant mass flux is higher in bedrock than in the overburden of the EPL (Figure 3-6). Contaminant mass flux in the fractured bedrock was due predominantly to TCE and PCE, with lesser amounts of cis-1,2 dichloroethene (DCE). The highest TCE and PCE mass flux in the bedrock wells tested was observed in well IP-2R2 in the EPL, which is located immediately down-gradient of the former Tank Farm. The highest flux for cis-1,2-DCE was observed at well BRW-1R4, further downgradient in the EPL near Transect-A. The depth of the greatest mass flux in well IP-2R2 was the interval from 46 to 66 ft bgs. The depth of the highest mass flux in well BRW-1R4 was from 133 to 153 ft bgs. Therefore, it appears that the mass discharge is greater at depth at the downgradient edge of the EPL compared to the mass discharge upgradient.

The higher mass flux observed at BRW-1R4 is consistent with the results from the mass flux calculations conducted using the Mass Flux Toolkit. According to this model, the core of the plume along Transect A passes through AE-102RR at a depth interval ranging from 130 to 160 ft bgs, near well BRW-1R4. Well BRW-1R4 is located approximately 50 ft east-northeast of well AE-102RR and is open across the same interval, i.e., 133 to 153 ft bgs.

In terms of the relationship of contaminant mass flux to depth of boreholes, well TRC-202R was drilled to a depth of 320 ft bgs and mass flux was evaluated from 49 ft bgs to 320 ft bgs. The results indicated:

- 21% of the total mass flux was in the interval 41-96 ft bgs
- 76% of the total mass flux was in the interval 96-170 ft bgs
- 3% of the total mass flux was in the interval from 170 ft bgs to 320 ft bgs

Although this location was the only area where testing was performed below 250 ft bgs, these results indicate that mass flux decreases significantly below depths of 200 ft bgs at the site.

3.1.5 Fate and Transport Processes

The extent of the contamination described above can be affected by the attenuation of contaminants, which includes a number of physical, chemical, and biological processes. Certain fate and transport processes are present at the former GE site. These most likely include, to a lesser degree: volatilization, adsorption, abiotic transformation, and biodegradation. The key processes however, that control the fate and transport of contaminants in fractured rock networks as is present at this site are advection, dispersion, and diffusion.

For advection or transport of the CVOCs in groundwater, the groundwater seepage velocity at the site is higher in bedrock than in overburden. Flow in individual bedrock fractures, is controlled by the fracture network. As described above, only a low percentage of the fractures at the site are contributing to a high percentage of the advective flow observed. This focuses (limits) the extent of the plume migration in the bedrock aquifer. As indicated above, however, the passive flux meter (PFM) results suggest both high and low transmissivity zones contribute to mass flux.

Sorption is likely to play a more dominant role in the fate and transport of CVOCs and arsenic in the overburden than in the bedrock. It is possible that the organic carbon present in rock samples may have some effect on the uptake of CVOCs in the bedrock aquifer, though this is not anticipated to be significant. The same would be true for the volatilization process as well, i.e., important in overburden but not likely in bedrock. Dispersion and dilution are expected to be important in unconsolidated deposits as found in overburden; however these processes can also be important in fractured rock with high aperture variability, as is observed at the former GE site.

Diffusion into the rock matrix is probably one of the most important processes influencing CVOC attenuation in the bedrock aquifer at this site. Matrix porosity (primary porosity) of bedrock at the site has been measured to range from 0.015 to 0.045. These results are high for a crystalline rock, suggesting a relatively large storage reservoir in the bedrock. This would allow for moderate contaminant storage and attenuation. Under these circumstances, diffusive contaminant transport would occur between the rock matrix and the open fractures.

Following a release of chlorinated solvent product (dense non-aqueous phase liquid, DNAPL) into a fractured rock system, the DNAPL will dissolve into flowing groundwater giving rise to dissolved phase plumes. Following the release, dissolved PCE and TCE will diffuse into the primary porosity of the rock. This process is referred to as forward matrix diffusion with most of the dissolved phase mass stored in the micro-fractures and micro-cracks in the rock, and not the secondary open fractures. The rock matrix porosity acts as a reservoir that can sustain long-term release of contaminants back into fractures through reverse or back-diffusion. Unlike the forward matrix diffusion process, which is relatively rapid due to initially high concentration (presumptive DNAPL) gradients, the back-diffusion process will be much slower process normally occurring over decades.

The evaluation of contaminant matrix diffusion into fractured bedrock was conducted using the CORE-DFN (Discrete Fracture Network) approach at the former GE site. Rock core samples from a borehole in the former Tank Farm were analyzed for volatile organic compounds (VOCs) and the results were used to estimate the concentration in the pore water present in the rock matrix primary porosity, micro-fractures, and micro-cracks. PCE and TCE were the main compounds detected, with calculated pore water concentrations of up to 650 and 1,800 µg/l, respectively. This suggests that despite overall low hydraulic conductivity and relatively low porosity values in crystalline bedrock, matrix diffusion has occurred into the primary porosity, micro-cracks, and dead-end fractures in the granite, granite-pegmatite, and diorite rock and has contributed to attenuation of the dissolved CVOC plume in this fractured media.

Evidence of biodegradation has been noted in a few specific wells monitored over the entire plume network, based on decreases in PCE and TCE, with the resultant generation of daughter products (cis-1,2-DCE and ethene). Electron acceptor profiles indicate strongly reducing conditions and geochemical changes in certain wells indicative of reductive dechlorination. Microbiological tests indicate low to moderate presence of bacteria capable of mediating this reaction, though the prevalence is low and specific to select locations. Compound-specific isotope analysis (CSIA) results also show unique enrichment of cis-1,2-DCE and vinyl chloride (VC) in select locations, which could be indications of abiotic or biological transformation, although again this process appears to be quite limited in the bedrock aquifer from the available data.

Similarly, abiotic transformation reactions may also be occurring in the bedrock aquifer, based on the presence of iron minerals, high levels of sulfate, as well as anecdotal evidence of abiotic reaction products such as acetylene, propane, and ethane, although again this process appears to be quite limited in the bedrock aquifer from the available data.

3.2 DELINEATION OF AREAS OF CONCERN AND/OR OPERABLE UNITS

Figure 2-2 presents the plan view of the MCP site boundary. Manufacturing processes performed by several firms have contributed to releases of fuels, oils, solvents, and metals to the environment. Analytical data have shown that six primary types of organic and inorganic compounds are associated with release tracking number (RTN) 3-0518. These include CVOCs, TPH, benzene, toluene, ethylbenzene, and xylene (BTEX)-related compounds, MTBE, several metals including arsenic, and LNAPL identified as Stoddard Solvent (solvent).

RTN 3-0518 originally incorporated four separate operable units (OUs) as summarized below.

- OU-1 – Former Tank Farm source area and adjacent Eastern Parking Lot (petroleum)
- OU-2 – Former Tank Farm source area and downgradient groundwater plume both on-site and off-site (solvents)
- OU-3 – Storm water/Waste water Outfalls 001 and 002 (metals)
- OU-4 – Former Tank K Source Area and immediately downgradient groundwater plume (gasoline)

In November 2007, arsenic was observed greater than MCP RCs in groundwater. During that period, 1,4-dioxane, was also present above RCs. As described above, areas OU-3 and OU-4 have been resolved and closed under the MCP. The remaining two areas, OU-1 and OU-2, still require response actions in RTN 3-0518, as well as the arsenic and 1,4-dioxane concerns.

3.2.1 Soil Contamination

Soil analytical results from the former Tank Farm-Building 3 area (2 to 15 ft depth) confirmed contamination above applicable S-1 and S-3 standards for C9-C10 aromatic compounds in the VPH fraction. Arsenic was detected in each soil sample from EPL soil borings and was below the S-1/GW-1 standards. 1-4-Dioxane was not detected in any of the soil samples analyzed from the EPL area. One boring in the immediate vicinity of the former Tank Farm was installed. A soil sample analyzed from 9-10 ft indicated the presence of EPH and VPH hydrocarbon fractions above S-1 and S-3 standards.

Soil samples from the former Tank F area, outside of the southwestern corner of Building 1, showed low levels of metals and PCE, all below applicable standards. Soil samples from beneath Building 1 indicate the presence of low levels of PCE and TCE below standards. A lone detection of cis-1,2-DCE from 5-7 ft deep exceeded the S-1 standard. Low level metals (arsenic, chromium, copper, lead, nickel, and zinc) concentrations were also detected below

S-1 standards. Detections of naphthalene (11,400 μg/kg) from 38-39 ft and chromium (32 mg/kg) from 25-26 ft in Building 1 exceed the S-1 standard.

Elevated levels of iron were detected in sediment and wetland soil samples in the areas of Outfalls OU-1 and OU-2. Variable concentrations of arsenic were also observed in these samples; however, both were considered consistent with natural ambient or background levels for that area. All other metals and VOCs were at trace levels or did not pose risks to environmental receptors.

3.2.2 Groundwater Contamination – Overburden and Bedrock Groundwater

Operable Unit 2 (OU-2) consists of both overburden and bedrock groundwater contaminated by solvents, primarily chlorinated solvents. Figures 3-7 through 3-10 present total CVOC concentrations detected in the overburden and bedrock groundwater. The Phase II Comprehensive Site Assessment (AECOM, 2017) has identified the current highest groundwater concentrations of CVOC in shallow bedrock beneath Building 1. Other historic possible source contributions are from former tanks in Building 1, the former Tank Farm, vault, and Oil House areas of the site. Contamination to the groundwater has migrated into and through the bedrock downgradient through the EPL, and off the property into the downgradient wetland and woodland east of the facility. These contaminants are primarily from PCE and TCE with lesser amounts of other CVOCs, some of which may be degradation by-products.

A comprehensive groundwater evaluation of overburden and bedrock aquifer, together with surface water samples was performed. A number of upgradient and crossgradient wells in areas not affected by contaminant sources at the site have frequently indicated dissolved arsenic levels above the GW-1 standard, indicating potential naturally elevated levels of this metal in the region's groundwater.

CVOCs in the overburden (0-78 ft bgs when present) are at their highest concentrations in a small area near the southwestern corner of Building 1, upgradient of the former Tank Farm. Concentrations decrease over an order of magnitude in the former Tank Farm, and another order of magnitude by the time the eastern wetland is reached. CVOCs in overburden and upper bedrock are the determinants for the plume extent to the east. Areal extent in overburden is well defined by the site and off-site well network.

CVOCs in upper bedrock intervals (0-60 ft bgs) are higher in concentration than in overburden, with maximum concentrations centered by Building 1 and a larger area extending from Building 1 and the former Tank Farm through the EPL. TCE plume extent is limited to the western third of the area beneath the wetland, while total CVOC and to a lesser extent PCE, plumes extend to the eastern boundary of the site. Areal extent in upper bedrock is well defined to the south, southeast, and east, in the direction of groundwater flow and plume migration.

CVOC extent in middle and lower bedrock intervals (61-120 ft bgs and 121-232 ft bgs, respectively) are very similar. Both of these plumes show the largest areal extent of CVOC concentrations greater than 5,000 µg/l beneath Building 1 and the EPL, extending approximately 100 ft horizontally into the area beneath the wetland, east of the former GE property. The CVOC concentrations in lower bedrock are on the same order of magnitude or decreasing slightly from the concentrations present in the middle bedrock interval. Areal extent is considered defined, based on this data and off-site wells to the east, south and southeast of the plume.

The compound 1,4-dioxane is also co-located with parts of the CVOC plume, as this chemical has been shown to be a co-contaminant with TCE (Anderson, et al., 2012). With a GW-1 standard value of 0.3 µg/l, all but five of the 169 detected 1,4-dioxane concentrations at the site are above the GW-1 standard. There is a direct correlation between the highest detected concentrations of 1,4-dioxane and the wells with elevated CVOC concentrations. The lower bedrock plume shows the larger occurrence of elevated 1,4-dioxane concentrations as they coincide with the highest density of elevated CVOC concentrations from Building 1 to Transect A.

Historically, arsenic has been detected above MCP RCs in certain monitoring wells at the site. The presence of elevated arsenic is coincident with locations where reduced groundwater is observed and is considered a result of reductive dissolution of naturally-occurring arsenic minerals to the groundwater due to reducing conditions in the aquifer caused by biodegradation of hydrocarbons. Of the 120 detected arsenic samples, 75 of the concentrations are above the GW-1 value of 10 µg/l. Arsenic has been detected in a higher percentage of the overburden samples than in bedrock samples. The highest concentrations are located in the EPL. No arsenic has been detected in groundwater samples from upper or deeper bedrock intervals. This is consistent with the mechanism of arsenic dissolution that has been identified.

Certain areas of the groundwater CVOC plume also contain elevated dissolved arsenic levels compared to levels observed regionally in groundwater. This has been attributed to reductive dissolution of naturally occurring minerals due to contaminants from the OU-1 (petroleum) area and other releases, which result in depletion of oxygen and reducing geochemical groundwater conditions. The dissolution of redox-sensitive arsenic is considered transient, as arsenic readily oxidizes and precipitates when groundwater conditions return to an oxidized state.

The horizontal and vertical distribution of total CVOCs, 1,4-dioxane, and dissolved arsenic plumes are presented in Figures 3-7 to 3-18. These plumes indicate that groundwater exceeds Method 1 GW-1 standards in overburden and bedrock aquifers for several of the CVOCs, 1,4-dioxane, and arsenic. In addition, the upper concentration limit (UCL) for TCE is also exceeded in the bedrock aquifer.

A review of CVOC and petroleum hydrocarbon concentrations over time in several of the monitoring wells indicates that concentrations of several specific compounds have either remained at the same levels or decreased in select wells over the different areas of the site. Concentration trend plots for numerous wells were observed for various periods between 1989 and 2016 (Appendix B).

Areas/wells with notable CVOC concentration (PCE, TCE, cis-1,2-DCE, and VC) and petroleum (BTEX, MTBE, VPH, and naphthalene) trends exhibiting stable or decreasing conditions include:

- Former Tank F area: GZA-101R

- Transect A area: GZA-103S, EMW-10D
- EPL area: IP-01R2, TRC-101, TRC-102, TRC-104
- Transect B: PS-1S, GZA-14, GZA-14A
- Transect C area: STM-8D, STM-8R
- Downgradient wetland: PS-2D, PS-5S

A subset of these wells was evaluated using Mann-Kendall statistics for the most prevalent COCs, PCE, and TCE, to confirm their trends. This evaluation is presented in Appendix C. This evaluation indicates that the concentrations of the most prevalent VOCs, PCE and TCE, were stable or have decreased in multiple wells over different areas of the site.

3.2.3 Surface Water, Sediment, and Wetland Soil Contamination

Surface water samples obtained at Outfall locations OU-1 and OU-2, as well as in the downgradient wetland, and along the Ipswich River contained trace concentrations of VOCs and low concentrations of metals, including dissolved arsenic and iron. These levels were determined to be consistent with background or to not present risks to environmental receptors.

3.2.4 Vapor-Intrusion Pathway

Sub-slab soil gas samples were obtained from beneath the Building 1 footprint from 2009 to 2012. Approximately 20 different CVOCs were detected with PCE, TCE, and cis-1,2-DCE above the MassDEP Commercial/Industrial (C/I) screening values. Indoor air analytical results from Building 1 indicate that a number of solvent and petroleum-related VOCs of concern were detected, all at low concentrations below the available MassDEP C/I Threshold Values. Based on the results of these soil gas samples, AECOM concluded that the source of the CVOC and petroleum contaminants were from the Building 1 and former Tank Farm and pump house/vault areas.

Indoor air sample data indicate that certain CVOCs were detected at indoor air sampling locations, but at concentrations below the commercial/industrial threshold values. Based on the vapor-intrusion evaluation, the indoor air samples indicate that the Building 1 concrete slab significantly impedes CVOC vapor intrusion into the building. While sub-slab soil gas concentrations beneath the building are significant compared to MassDEP C/I screening values, sufficient attenuation is observed under current conditions, and the indoor air concentrations are consistent with a condition of No Significant Risk to current receptors in the building.

Currently, there is a voluntary Activity and Use Limitation (AUL) present on the property that restricts modifications to the foundations of the buildings by any construction activities (Wilmington Realty Trust [WRT], 2015). Therefore, no further mitigation of this issue is necessary, other than the continued monitoring to ensure a condition of No Significant Risk.

3.2.5 Source Area Non-aqueous Phase Liquid

Petroleum LNAPL has been identified in the area of the former Tank Farm and EPL. Source tanks have been removed. Free-product recovery was performed over several years and petroleum-contaminated soils were also excavated. The thickness of LNAPL in recovery and monitoring wells has decreased to a point where its presence is observed only when the groundwater table drops significantly. The lower groundwater table exposes more of the bedrock allowing residual LNAPL remaining to seep out into the saturated soils. The low volume of seepage is indicative of reduced LNAPL volume in bedrock as a result of the groundwater pump and treat and LNAPL recovery activities conducted. It is apparent that the LNAPL remaining at the site is small, stable (not expanding laterally or vertically) and has micro-scale mobility (not expanding but is visibly present), based on the behavior of the LNAPL in the wells. Petroleum hydrocarbons in groundwater remain limited to the area of the former Tank Farm and EPL, their extent has been defined, and their concentrations are decreasing since the source was removed.

The area of the former Tank Farm, former pump house/vault, and immediate area of the EPL are associated with historical contaminants from a petroleum release of a former Stoddard Solvent underground storage tank (OU-1). Several previous remedial actions have been performed in these areas to remove contaminated soils (primarily unsaturated soils), as well as active and passive free product collection. The Risk Characterization (Appendix B, 2017 Phase II CSA, AECOM, 2017) indicates that in these areas there are no conditions of significant risk from soil exposure to utility or construction workers.

LNAPL monitoring and recovery were performed before ROS termination (March 2013) and continue to the present. Depending on fluctuations in the groundwater table, LNAPL sporadically is observed in very small amounts in one to two collection wells (CW-1 and CW-2) in the former Tank Farm area. Related to the occasional presence of LNAPL, VOC, VPH, and EPH COC are sometimes observed to groundwater in the immediate area of the former Tank Farm. These COC are shown in Figure 3-19.

Response actions have been performed to adequately assess LNAPL mobility and meet the requirements of 310 CMR 40.1003(7)(b). Based on the extensive measurement and evaluation of the LNAPL present at the site, it is apparent that the LNAPL is not a non-stable non-aqueous phase liquid (NAPL), as defined at 30 CMR 40.0006, because the LNAPL footprint is not expanding, nor is LNAPL migrating through any subsurface strata, discharging to a surface water body, structure, or utility.

The extent of LNAPL has been well defined with its presence observed historically in wells CW-1, CW-2, DP-5, DP-6, GZA-105S, PZ-2S, RW-1, RW-2, TF-1, and TRC-101 as shown in Figure 3-20. Figure 3-21 presents the volume of LNAPL removed from monitoring wells and through EPL soil excavation between 1992 and 2016. From 1992-1994, 611 gallons of product were removed from three historical recovery wells (RW-1, RW-2, and TF-1). LNAPL was not observed in these wells after 1994. In 2000, TRC removed an estimated 2,653 gallons of LNAPL via excavation of contaminated soils in the western portion of the EPL. Subsequent manual and passive LNAPL removal measures were conducted from wells PZ-2S, CW-1, and CW-2 from 2000–2016 removing an additional 95 gallons between 2000-2010, and only 9 gallons between 2010 and 2016.

Currently, LNAPL is intermittently observed as sheen in wells CW-1 and CW-2. Periodically, at times when the water table is depressed sufficiently below the smear zone, LNAPL thickness can range up to 0.12 ft (1.44 inches) in wells CW-1 and CW-2. The extent of LNAPL is bounded by its absence over the past 3-14 years of measurements in monitoring wells AE-03, AE-04, GZA-102S, PZ-2S, and TRC-101, surrounding wells CW-1 and CW-2

Collectively, the LNAPL at the site can be defined as having micro-scale mobility (as per MassDEP Policy #WSC-16-450, February 2016), where LNAPL sheens with thickness less than ⅛-inch are periodically observed, meeting even the most conservative values for Stability Action Levels. In addition, due to the intermittent presence of LNAPL in monitoring wells in this area of the site, it has been determined that LNAPL has been recovered to the extent feasible, given the limited and declining recoverability of LNAPL (1.5 gallons recovered between November 2010 and September 2016). Therefore, in accordance with the MassDEP LNAPL guidance, it has been demonstrated that complete LNAPL recovery is no longer feasible, although, based on gauging data from September 2015 and 2016, LNAPL with micro-scale mobility remains in the area described above.

3.3 RISK CHARACTERIZATION SUMMARY

Potential receptors identified at the site include current and future commercial tenants, business customers, trespassers, and utility and construction workers. Potential ecological receptors are also present in the wetland and woodland off-property. The Risk Characterization (Appendix B, Phase II Site Assessment, AECOM, 2017) included a determination that a condition of No Significant Risk exists in OU-1 related to exposure to petroleum residuals in soils and groundwater. The LNAPL related to the historical Stoddard Solvent release continue to exist sporadically and represents a potential risk to soil, groundwater and/or soil gas contaminant from the specific chemical components of the LNAPL. Additionally, the presence of LNAPL as a separate phase may also trigger the assessment and closure requirements of the MassDEP Guidance on LNAPL and the MCP, Guidance for Site Assessment and Closure, Policy #WSC-16-450, 2016.

Receptors at the former GE site encounter indoor air, soil gas, upland soil, sediment, wetland soil, surface water, and groundwater. Given the possible receptor types, populations, frequency, and intensity of potential exposures, the applicable categories for the media present at this site include:

- Ecological criteria
- S-1, S-2, and S-3 soil criteria for wetland soils
- S-2 and S-3 soil criteria for upland soils in the commercial/industrial area of the site
- GW-3 criteria for surface water
- GW-1, GW-2, and GW-3 criteria for groundwater

As indicated in Figure 3-2, complete exposure pathways exist for direct contact, inhalation, and ingestion. A risk characterization was performed for human health and the environment. The results show that a condition of No Significant Risk does not exist for future resident ingestion of groundwater, and for public welfare due to the presence of TCE above its UCL in groundwater. A condition of no substantial hazard does exist.

3.4 REMEDIAL GOALS

Remedial action objectives consist of specific goals for protecting health, safety, public welfare, and the environment. These objectives will guide the development and evaluation of remedial action alternatives for the site. The performance standards for Phase III evaluation (310 CMR 40.0853) require that remedial action alternatives be identified and evaluated that are "reasonably likely to achieve a level of No Significant Risk," and that the recommended alternative be a Permanent Solution or a Temporary Solution. "No Significant Risk," as defined in the MCP (310 CMR 40.0006), is "a level of control of each identified substance of concern at a site or in the surrounding environment such that no such substance of concern shall present a significant risk of harm to health, safety, public welfare, or the environment during any foreseeable period of time." A Permanent Solution is any measure or combination of measures which will, when implemented, ensure attainment of a condition of No Significant Risk.

Permanent Solutions must also include measures that reduce the levels of oil and hazardous materials in the environment to as close to background as feasible. A Temporary Solution is any measure or combination of measures which will, when implemented, eliminate any Substantial Hazard which is presented by a disposal site until a Permanent Solution is achieved. A Temporary Solution can be selected if a Permanent Solution is not currently feasible or if response actions to achieve a Temporary Solution are feasible and shall be continued toward a Permanent Solution.

3.4.1 Groundwater

The Risk Characterization performed as part of the Phase II effort (see Appendix B of the Phase II Comprehensive Site Assessment Report, AECOM, 2017) has shown that the site presents a significant risk for certain specific concerns and therefore does not meet the condition of No Significant Risk. The specific concerns include the following:

- Risk to public welfare due to TCE in groundwater greater than the UCL
- Risk to human health due to ingestion of groundwater from several compounds, including the presence of LNAPL that may contribute to these potential risks, as well as trigger other MCP requirements

The regulatory drivers used to determine risks to ingestion of groundwater in the RC included the Massachusetts Drinking Water GW-1 Standards (MassDEP, 2016) which are the Massachusetts Maximum Contaminant Level, the Massachusetts Drinking Water Guideline, the Massachusetts Secondary Maximum Contaminant Level, and the United States Environmental Protection Agency (USEPA) Maximum Contaminant Level (USEPA, 2016).

These criteria will be used as remedial goals for the Phase III evaluation at the site. The COC for groundwater ingestion risks include PCE, TCE, DCE, 1,1-DCE, vinyl chloride, 1,1-dichloroethane, 1,4-dioxane, arsenic, C5-C8 aliphatics, C9-C12 aromatics, and toluene. There are also exceedances of secondary (aesthetic) contaminant levels for aluminum, iron, and manganese. The specific regulatory remedial goals for these compounds of concern are provided in Table 3-1. The basis of design for remedial actions are discussed and presented below in Section 3.5.

The remedial action goals for the overburden and bedrock groundwater at the site include the following:

- Reduce concentrations of TCE in bedrock groundwater where they exceed corresponding UCLs

- Eliminate or control, to the extent feasible, any migration of elevated levels of CVOCs in fractured bedrock that may be a source of contaminants to groundwater or that may be non-stable

- Establish a stable or contracting plume of CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic in overburden and bedrock groundwater

- Reduce concentrations of CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic in overburden and bedrock groundwater, to GW-1, GW-2, and GW-3 criteria, to the extent practicable

Various remedial approaches are evaluated for the contaminated groundwater in Section 4 (Initial Screening) and Section 5 (Detailed Evaluation).

3.4.2 LNAPL

Under the MCP Final Policy #WSC-16-450 (MassDEP, February 2016), the options for closure at a site contaminated by LNAPL depend on whether the product is stable and what degree of mobility the LNAPL residual has. The remedial goals for the LNAPL present are:

- To document the presence of stable or non-stable LNAPL with micro-scale mobility, and eliminate LNAPL to the extent feasible and demonstrate control. This would allow a Temporary Solution to be achieved.

- To meet GW-1 criteria related to petroleum constituents in the immediate area of the LNAPL. This would allow a Permanent Solution to be achieved with the implementation of an AUL, due to the presence of the LNAPL micro-scale mobility.

Additionally:

- Under the “Source Elimination and Control” provisions, a Permanent Solution cannot be achieved unless NAPL constituting a Source of oil and/or hazardous materials (OHM) Contamination is eliminated, or if not eliminated, eliminated to the extent feasible and controlled. For a Temporary Solution, NAPL that constitutes a Source of OHM Contamination must be eliminated or controlled to the extent feasible. Under the "Migration Control" provisions, a Permanent Solution cannot be achieved unless plumes of dissolved OHM in groundwater and vapor-phase OHM in the Vadose Zone are stable or contracting. For a Temporary Solution, such plumes must be stable or contracting or otherwise controlled or mitigated to the extent feasible.

Various remedial approaches are evaluated for the area contaminated by LNAPL in Section 4 (Initial Screening) and Section 5 (Detailed Evaluation).

3.5 BASIS OF DESIGN

The basis of design for the remedial alternatives evaluated in Sections 4 and 5 of this document to reach a Permanent Solution includes the following:

- Treat groundwater in the overburden aquifer containing CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic. The overburden aquifer thickness ranges from 4 to 78 feet deep, depending on the area of the site.
- Treat groundwater in the bedrock aquifer containing CVOCs, 1,4-dioxane, and petroleum hydrocarbons. The contamination is present in the bedrock aquifer over a large variation in depth from 4 feet to at least 232 feet deep below ground.
- Treatment alternatives would need to address presumptive DNAPL and LNAPL concentrations, as well as moderate to low levels of the COC.
- Treatment goals are GW-1, GW-2, and GW-3 criteria for groundwater COC, and a continued observation of stable and micro-scale conditions and/or a decreased presence or removal of all LNAPL.
- Treatment in the area of Building 1/1A would require a design compatible with active tenant businesses in those spaces, as well as a busy parking lot.
- Discharge of extracted groundwater after contaminant treatment (if necessary) could potentially use an on-site wastewater treatment facility or storm water drains to surface outfalls and wetland, with proper permitting, post-treatment, and discharge monitoring.
- *In situ* treatment in the bedrock aquifer would require a design compatible with a highly fractured matrix having an extremely wide variation in hydraulic conductivity.
- Remedial design and implementation will require MCP regulatory requirements and possibly other permitting (Phase IV Remedy Implementation Plan, Public Involvement Plan, Wetland permitting, etc.).
- For groundwater treatment, hydraulic control (pump and treat) assumes an area of 120,000 square feet (300 ft by 400 ft) and an extraction depth of 100 feet thick using 50 wells in the network for 30 years of operations.
- *In situ* bioremediation and ISCO are estimated to be similar to each other, using a treatment area of 181,000 square feet (sq ft) (area corresponds to TCE plume greater than 1000 µg/l contour in upper bedrock), with 800 drive injection points in the overburden (30 ft injection zone) and 32 bedrock wells (130 ft injection zone). Costs for each of these technologies were estimated using three injection events.

- MNA was estimated assuming 120 wells monitored annually for a total 30 years. The same groundwater monitoring approach and costs were incorporated into each of the other groundwater treatment alternatives for consistency.

- For LNAPL treatment, the areal extent used was 5,000 sq. ft (50 ft x 100 ft). The free product recovery approach would utilize a 50 ft long horizontal French drain recovery system. Operations for the LNAPL MNA or free product recovery alternatives would be quarterly for a 30 year period, and would include LNAPL monitoring and waste disposal.

Further details and assumptions on the basis of the design used to estimate costs are presented in Appendix D.

Section 4

Development of Remedial Alternatives-Initial Screening

The purpose of the initial screening phase is to determine which technologies are to be retained for further evaluation in accordance with the criteria in 310 CMR 40.0855(2)(a). The criteria require that technologies be screened and retained for those that are likely to achieve a level of No Significant Risk and achieve a Permanent Solution. The categories of remedial technologies/response actions were divided by site media, with further screening related to whether the medium is a source area versus part of the dissolved plume. A brief description of the categories of remedial technologies and remedial action alternatives are presented in the following sections and summarized in Table 4-1.

There are numerous site challenges that significantly limit the feasibility and performance of the various treatment technologies - especially for groundwater contamination, as indicated in the basis of design discussion. Contamination at this site extends into a deep fractured rock aquifer as well as over a large area. Due to the plume size and complexity (variety of different contaminant types), a multi-component remedy would be required, and the remedial periods would be very long. Access to critical areas of the site for remedial implementation, such as tenant operations and parking, will be challenging as well.

4.1 GROUNDWATER

As discussed in Section 3.2.2, groundwater is contaminated in both the overburden and bedrock aquifers, with CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic, above regulatory criteria. This section reviews potential remedial approaches and their feasibility of reaching a Permanent Solution.

4.1.1 Activity and Use Limitation

An AUL is a legal document recorded with the deed and tied to the property that specifies allowable uses, prohibited uses, and ongoing maintenance requirements associated with any engineered controls (caps, engineered barriers, vertical containment barriers, etc.). Use of an AUL requires agreement of the existing property owners. Given that ingestion of groundwater poses a condition of significant risk, prohibition of future wells would be required. Use of an AUL for this purpose is very limited by the MCP. An AUL can provide notice that existing wells are not suitable for drinking purposes, but cannot be used to limit future drinking water supplies. For this reason, this approach has not been retained for site groundwater.

4.1.2 Containment

Containment of groundwater functions to isolate contaminated groundwater and prevent migration of contaminants off-site. Technologies that were screened include engineered vertical barriers (slurry walls, sheet piles, etc.) and hydraulic containment using groundwater extraction with *ex situ* treatment. Vertical barriers are proven technologies with a low degree of difficulty to implement and are effective for contaminated overburden groundwater. Installation of such barriers into deep bedrock, however, would encounter significant challenges.

Hydraulic containment and *ex situ* treatment (pump and treat) includes extraction and treatment of groundwater to capture groundwater contaminants and prevent off-site migration. This technology is proven for containment applications, has a low degree of difficulty to implement in overburden, and is effective for both overburden and well connected bedrock groundwater. Installation of extraction wells into deep bedrock would require much more extensive efforts.

Despite the availability of vertical barrier and hydraulic containment technologies, it is not reasonably likely that they can achieve a Permanent Solution in conjunction with other technologies due to the challenging nature of site bedrock. While a barrier/containment approach will have a low chance of attaining the remedial goals described in Section 3, the containment approach may minimize further contaminant mass from moving downgradient of the Fordham Road property as a source control measure. Therefore, hydraulic containment has been retained for site groundwater.

4.1.3 Treatment

Groundwater treatment technologies include *in situ* biological treatment, *in situ* chemical treatment (oxidation and reduction), and *in situ* thermal treatment. Both biological and chemical treatment technologies rely heavily on obtaining a successful distribution of the amendments. Heterogeneous subsurface conditions could pose difficulties for obtaining the needed distribution. Both technologies have been proven successful at treating a wide range in CVOC concentrations, petroleum hydrocarbons, and to a lesser degree 1,4-dioxane; however they have not traditionally been used to address arsenic contamination. Implementation of thermal technology would pose significant technical challenges for treatment in bedrock, and would carry with it very high installation and energy costs. All three of these technologies are readily available and may achieve a Permanent Solution in overburden but would have difficulty achieving a level of No Significant Risk in the bedrock aquifer. *In situ* biological and chemical treatments have been retained for site groundwater as they may be able to meet some of the remedial goals and achieve a Temporary Solution.

4.1.4 Monitored Natural Attenuation

Monitored natural attenuation (MNA) is the use of natural attenuation processes, which includes physical, chemical, and biological processes, to achieve remedial objectives. This technology has a low degree of difficulty of implementation, yet requires a long period to achieve treatment goals. This approach can be applied to all the groundwater contaminants present at this site at the same time. It can also be applied to most, if not all areas and depths of the site. The Phase II CSA has indicated the ongoing occurrence of some of these processes, notably advection, diffusion, biological degradation, and abiotic transformation, in both the overburden and bedrock aquifers at the site. The conclusion of the Phase II CSA was that the overall plume has been observed to be stable or shrinking. Therefore, the aquifer attenuation capacity appears to be present to a certain degree. This technology is unlikely to achieve a Permanent Solution; however it may achieve levels of No Significant Risk, and therefore may achieve a Temporary Solution. MNA has been retained for site groundwater.

4.2 NON-AQUEOUS PHASE LIQUID

Light non-aqueous phase liquid (LNAPL) from a Stoddard Solvent release has been observed sporadically as a floating layer on the groundwater table in the former Tank Farm-EPL area of the site. In conjunction with this is a slightly larger area with dissolved concentrations of petroleum hydrocarbons. The presence of an LNAPL pool, if it is expanding and highly mobile, can create certain risks, particularly when directly exposed to it during subsurface work. The LNAPL plume at the former GE site has been documented to be stable and has micro-scale mobility, which if maintained would meet the remedial goal to achieve a Temporary Solution. Complete removal of all traces of the LNAPL and reduction in dissolved petroleum hydrocarbon concentrations to below their GW-1 criteria would allow for a Permanent Solution. Since bulk phase DNAPL has not been physically observed at the site, the evaluation below focuses on alternatives to address only LNAPL.

4.2.1 Activity and Use Limitation

An AUL is a legal document recorded with the deed and tied to the property that specifies allowable uses, prohibited uses, and ongoing maintenance requirements associated with any engineered controls. There is an existing AUL for the property that has been filed with the MassDEP and recorded with the deed that limits site activities and exposure to LNAPL. Use of an AUL will not in and of itself achieve a Permanent Solution, unless in conjunction with the successful implementation of one or more of the other technologies. Since the existence and maintenance of the executed AUL is an active part of the site management approach, it has been retained for site LNAPL.

4.2.2 Recovery

Per The Interstate Technology & Regulatory Council (ITRC) Guidance (ITRC, 2009), NAPL mass-recovery technologies are those technologies that physically remove NAPL from the subsurface. Technologies include excavation and various pump and treat technologies, such as skimming, dual pump recovery, surfactant-enhanced and multi-phase extraction. As a less energy-intensive polishing step, mass recovery can also be accomplished to collect free product down to a sheen through the use of passive skimmers, installation of sump drains, or other means. Previous remedial actions at the former GE site include active and passive extraction which has removed most of the mobile LNAPL. Therefore, aggressive mass-recovery technologies are no longer appropriate for the site. Passive free product recovery using skimmers have been utilized recently at the site, with some success. There is a low degree of difficulty to implement this technology, which is readily available and likely to achieve a Permanent Solution, in association with an AUL. Installation of passive free product recovery has been retained for further evaluation.

4.2.3 Treatment

Treatment of LNAPL areas often involves phase-change technologies that convert some components of the LNAPL to another form. They are designed to increase the rates of volatilization, degradation, and/or dissolution of the LNAPL constituents, thereby accelerating the weathering process (ITRC, 2009). The contaminants are then degraded *in situ* or are captured in the vapor phase and treated aboveground. Examples of these technologies include air sparging, soil-vapor extraction, *in situ* chemical oxidation (ISCO), *in situ* biological treatment (ISB).

There would be substantial difficulty in designing and implementing an *in situ* injection and extraction system for air sparge and soil-vapor extraction (sparge and vent) technology in the interface of the bedrock and overburden where the LNAPL has come to be located at the former GE site. This would result in inefficient LNAPL removal and may be ineffective for heavier weight chemicals in the LNAPL mixture as well.

In situ biological treatment and ISCO are phase change technologies that can be effective but challenging for sites containing LNAPL, and generally require relatively long treatment periods because treatment rates are limited by the rate of LNAPL dissolution into groundwater where it can then undergo biotic and/or chemical reaction. These *in situ* treatment technologies rely heavily on obtaining a successful distribution of the remedial amendments in and around the LNAPL mass, which can be difficult in heterogeneous subsurface environments, as is present at the former GE site.

In situ approaches requiring injection (enhanced bioremediation and/or ISCO) may accelerate LNAPL removal toward a Permanent Solution, but would be difficult to implement and may not substantially reduce the remedial period for the already-stable LNAPL. ISCO and ISB have not been retained for further evaluation.

4.2.4 Monitored Natural Attenuation

Monitored natural attenuation, in this case, would involve the frequent evaluation (gauging) and confirmation of an immobile, declining LNAPL mass in the groundwater capillary fringe zone (utilizing MassDEP guidance on LNAPL assessment), as well as continued monitoring of associated dissolved petroleum hydrocarbons in the groundwater. If LNAPL is observed, adsorbent socks would be installed to remove the small and temporarily present material. This remedial alternative has a low degree of difficulty of implementation, yet often requires a long period to achieve treatment goals.

This remedial approach will not achieve a Permanent Solution; however, with an AUL, it can achieve a Temporary Solution, particularly if it is supplemented with passive free product recovery. MNA has been retained for further evaluation.

Section 5
Detailed Evaluation of Alternatives

The purpose of this section is to present the detailed comparative evaluation of the Remedial Action Alternatives of each OU or area/condition that were identified and developed in Section 4 against the criteria specified in 310 CMR 40.0858. The detailed evaluation provides the basis for selection of an alternative for each site media and includes consideration of each alternative's effectiveness, reliability, implementability, cost, risks, benefits, timeliness, non-pecuniary interests, and sustainability.

Tables 5-1 and 5-2 provide a detailed comparative evaluation of the ability of each of the alternatives for groundwater and LNAPL, respectively, to meet the detailed evaluation criteria (and the subcategories for each criterion as identified in the MCP). For all criteria, the alternatives are given a qualitative rating such as poor, fair, good, or very good, relative to each other. Additionally, for all criteria, the alternatives are given a score of 1 to 4 for poor to very good ratings, respectively. The scores are used to illustrate, when summed, the overall favorability in the selection of the remedial action alternative. All criteria were weighed equally in calculating the overall alternative score.

Conceptual-level cost estimates developed for each of the alternatives are included in Appendix D. The estimates include labor and capital costs related to materials, laboratory analysis, engineering design and reporting, oversight, operations, maintenance, monitoring, and documentation, as appropriate. The cost estimates have been developed at a +50/-30% level of accuracy, consistent with standard conceptual design/feasibility study level cost estimates. Annual operation, maintenance, and monitoring costs have been considered over a period of 30 years. Cost estimates over the 30 years do not include any 5-year review evaluations required for a Temporary Solution by the MCP.

The following discussion is a summary of the evaluation presented in Tables 5-1 and 5.2. As such, the focus of this discussion is to present the key criteria that cause the alternatives to be ranked differently, as opposed to a detailed discussion of each criteria/sub-criterion.

The effectiveness of the Remedial Action Alternatives is evaluated in terms of:

- Achieving a Permanent or Temporary Solution
- Reusing, recycling, destroying, detoxifying, reducing mobility, or treating oil and hazardous material
- Achieving or approaching background concentrations

The reliability of the Remedial Action Alternatives is evaluated in terms of:

- Certainty of Success
- Effectiveness of measures to manage residues or control emissions/discharges

The implementability of the Remedial Action Alternatives is evaluated in terms of:

- Technical complexity
- Integration with facility operations
- Monitoring, O&M or site access requirements/limitations
- Availability of services, materials, equipment or specialists
- Availability, capacity and location of off-site treatment, storage and disposal facilities
- Permits

The cost of the Remedial Action Alternatives is evaluated in terms of:

- Cost of implementation (not including cost of environmental restoration)
- Cost of environmental restoration and potential damages to natural resources
- Cost of energy consumption

The risk of the Remedial Action Alternatives is evaluated in terms of:

- Risk during implementation
- Risk during operations
- Risk associated with remaining oil and hazardous materials

The benefits of the Remedial Action Alternatives are evaluated in terms of:

- Restores natural resources
- Achieves productive reuse of the site
- Avoids lost value of the site

The timeliness of the Remedial Action Alternatives is evaluated in terms of:

- Time to eliminate uncontrolled sources and achieve a level of No Significant Risk

The non-pecuniary considerations of the Remedial Action Alternatives are evaluated in terms of:

- Aesthetics
- Community acceptance

The sustainability of the Remedial Action Alternatives is evaluated in terms of the alternative's ability to:

- Eliminate or reduce to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts, though energy efficiency, renewable energy use, materials management, water reduction, land management, and ecosystem protection.

5.1 REMEDIAL ALTERNATIVES FOR CONTAMINATED GROUNDWATER

The detailed evaluation of remedial alternatives for site groundwater is presented in Table 5-1 and discussed below. Four alternatives are considered for a detailed evaluation: hydraulic containment, ISB treatment, ISCO treatment, and MNA.

5.1.1 Effectiveness

Contaminated groundwater will contain both presumptive DNAPL concentrations of CVOCs, and lower concentration dissolved CVOC plumes requiring treatment. The overburden and bedrock aquifers will need to be addressed. Finally, 1,4-dioxane, petroleum hydrocarbons, and arsenic will also require treatment. Realistically, no single technology could be implemented to treat all these compounds, in all these situations. In fact, it is highly unlikely that combined multiple treatments would be effective either.

Hydraulic containment using pump and treat has a poor effectiveness rating because it will not achieve a Permanent Solution as it does not mitigate the risk to human health via the ingestion of drinking water. An ISB treatment alternative (specifically reductive dechlorination), an *in situ* chemical treatment alternative, and MNA are also unlikely to achieve a Permanent Solution for the treatment of CVOCs, 1,4-dioxane, and arsenic. Furthermore, given the likelihood that contaminant mass is sequestered in bedrock fractures and matrices, at great depths in the bedrock aquifer, achieving or approaching background concentrations in groundwater is technically impracticable for the all of these methods.

5.1.2 Reliability

Overall, the reliability of all of the technologies being evaluated drops significantly from treatment of COC in the overburden to the bedrock due to its heterogeneity, complexity, and the depth of contamination.

In general, the *in situ* approaches associated with ISB and ISCO treatment are typically considered successful for CVOCs in overburden aquifer applications; however, the level of reliability decreases significantly in bedrock as distribution of reagents becomes extremely challenging. These technologies are also not well suited for the treatment of arsenic in groundwater. Of these two methods, only ISCO has the capability to treat 1,4-dioxane.

Hydraulic containment using pump and treat is a reliable and well understood technology. Its use in fractured bedrock environments is less reliable unless the nature and extent of groundwater flow is well understood. Due to the nature of the large amount of fracturing at the site, this method may have some challenges in containing appreciable amounts of the contaminant mass where it is highest in the plume, i.e., in the EPL. Once contaminated groundwater is recovered, several types of post-recovery treatment processes will be necessary for the various types of compounds present before discharge. Some of these may not be extremely reliable, such as for 1,4-dioxane, particularly due to its very low discharge standard.

Monitored natural attenuation is generally successful and reliable for the compounds of concern. Anecdotal evidence supports the potential for 1,4-dioxane to undergo MNA (Chiang, 2013); however this pathway is not very reliable. Both of the *in situ* alternatives have the potential to generate residuals requiring management, whereas MNA does not. Phase II assessments indicate that the site has some capacity for MNA processes, which have been occurring for quite some time. For these reasons, it was rated as having good reliability.

5.1.3 Implementability

In general, any system implemented on-site that will actively inject or withdraw fluids to the deep bedrock will be severely constrained by logistics, permitting hurdles, accessibility, competing site operations, as well as the intricacies of designing and installing the system appropriately to address the applicable COC in the aquifer zone intended.

Natural attenuation has a very good implementability rating compared to the other methods evaluated due to the low technical complexity of groundwater monitoring and subsequent evaluation. The well monitoring network is already in place at the site for this alternative.

Implementation of hydraulic containment will be complicated by a) the need to coordinate installation and operations with site tenant's operations, b) the design and construction of a bedrock pumping system, and c) the design of a water treatment system able to handle CVOCs, 1,4-dioxane, arsenic, and iron.

The *in situ* biological and chemical treatment alternatives will also both pose accessibility issues and challenges coordinating with site operations to install and operate an effective system. ISB and ISCO were both rated with a fair implementability score for high technical complexity associated with delivering amendments and ensuring distribution in bedrock. They require the same long term monitoring and maintenance, and require the same services, materials, readily-available equipment, and permits.

5.1.4 Cost

Costs are estimated for each technology alternative screened. The cost build-up and assumptions are presented in Appendix D. Details can be found in the individual costing sheets.

Hydraulic control costs are estimated to be very expensive given the need for a detailed design, new well installations, and a comprehensive treatment works to handle and discharge the wastewater under a new permit. Operation of such a system would also involve real costs to include power, equipment servicing, maintenance, a full-time licensed operator, monitoring, and reporting. The *in situ* chemical treatment and biological alternatives also have moderately high costs associated with implementation (multiple injection events) and post-injection monitoring of the majority of the CVOC groundwater plume. Monitored natural attenuation has a much lower cost rating owing to its lack of equipment and infrastructure, having costs associated with long term monitoring and data evaluation.

5.1.5 Risk

The ISCO treatment alternative was graded as fair because it did not mitigate overall risks related to ingestion of drinking water for quite some time after treatment and with only a low to moderate probability at that, and also had risks associated with installation and operation due to the chemicals used. Although the ISB remedial approach has a longer period to mitigate ingestion exposure, it did not have the same risk to workers during operations and monitoring, and so was graded as fair as well.

Hydraulic containment was also graded as fair for overall risks for the same reasons as *in situ* biological treatment. Monitored natural attenuation has a fair risk rating because, although it has low short term risk during implementation and monitoring activities, the period to reach the mitigation of risk associated with OHM is considerably long.

5.1.6 Benefits

The developed portion of the site is being utilized productively as a commercial/industrial property. The undeveloped portion of the site is stable ecologically, serving as wetland and woodland habitat. Each of the alternatives would result in continued productive use of the site and would not result in lost value. All remedial methods, if successful, would potentially increase the value of the property, but this would occur over a long period, therefore all were rated with fair benefits.

5.1.7 Timeliness

The remedial alternatives are evaluated not only on whether they can reach either a Permanent or Temporary Solution, but also on achieving remedial goals for the overburden and bedrock groundwater in a timely period. These include reduction in TCE to below its UCL, control of high source level concentrations in bedrock fractures, creation of a stable or contracting plume, and reduction of COC in the bedrock aquifer.

The hydraulic control and MNA alternatives have poor timeliness ratings. Hydraulic control will never reach a level of No Significant Risk as it is a containment approach, simply limiting further migration of contaminant mass further downgradient. Monitored natural attenuation will contribute to a reduction in contaminant mass and groundwater concentrations, albeit on a very slow timescale. The remaining alternatives were rated as fair primarily because contaminants would likely not reach a condition of No Significant Risk in a timely manner. Despite the length of time these alternatives may require, the current groundwater evaluation supports that the plume is currently stable or shrinking.

5.1.8 Non-pecuniary Considerations

The only alternative that requires permanent structures be left in place is the hydraulic control approach. A significantly sized treatment shed would be necessary to house all of the equipment needed for treatment and discharge of the groundwater, and therefore may affect the aesthetic quality of the facility. This alternative has been rated as fair. As each remaining alternative creates no permanent negative effects on the aesthetics of the site, they are rated based on the temporary aesthetics affected during episodic treatment, and of community acceptance for each alternative. The *in situ* biological and chemical treatment alternatives were rated as good because despite short term transport of chemical amendments associated with treatment implementation, each alternative makes an effort at mitigating risk with good community acceptance. Monitored natural attenuation requires no permanent visible changes to the site; however, the fact that this approach is not an active treatment process may be viewed less favorably by the community. For this reason, MNA was rated as fair.

5.1.9 Sustainability

The MNA alternative has a sustainability rating of very good due to the minimal use of resources. The ISB and ISCO treatment alternatives have good sustainability ratings due to the use of drilling equipment, water and reagents are required for the implementation of these alternatives. Hydraulic control has a poor rating due to the large amounts of equipment and power necessary to operate the system for a long period of time.

5.1.10 Summary

Groundwater MNA has the highest overall numerical score of 23 compared to the other remedial action alternatives. As with any rating system, there are uncertainties in the scoring as many of the criteria ratings were qualitatively assessed.

5.2 REMEDIAL ALTERNATIVES FOR LIGHT NON-AQUEOUS PHASE LIQUID

The detailed evaluation of remedial alternatives for LNAPL is presented in Table 5-2 and discussed below. Two alternatives are considered for a detailed evaluation: free product recovery/disposal, and MNA. Although an AUL was retained during the screening process in Section 4, it has not been evaluated here, as it is already in place and will support any alternative chosen or implemented.

Monitored natural attenuation in this case is simply the gauging of LNAPL and monitoring of petroleum hydrocarbon and other related attenuation parameters in the groundwater from the area surrounding the LNAPL observations. The remedial goals for these alternatives are to continue to document stable and micro-scale mobility of the LNAPL to support the Temporary Solution, and to reduce petroleum hydrocarbon concentrations in groundwater in the area around the LNAPL zone to achieve a Permanent Solution paired with the existing AUL.

5.2.1 Effectiveness

The status of the LNAPL is that a Temporary Solution can be achieved under the current conditions. Both alternatives could reduce the presence of LNAPL to such low levels that dissolved phase constituents may begin to approach MassDEP GW-1 standards, however this is anticipated to take a very long time with low to only moderate likelihood of success. Free product recovery and MNA alternatives are not likely to achieve background concentrations of LNAPL and dissolved petroleum hydrocarbons in a reasonable period. Both of these alternatives have been rated as fair for effectiveness.

5.2.2 Reliability

Free product recovery has a fair reliability rating as it is moderately effective at mitigating the LNAPL source and is typically a highly reliable treatment technology, however the amount of residual LNAPL may be too low to remove enough to reach GW-1 standards for the dissolved petroleum hydrocarbons and achieve a Permanent Solution. MNA could be successful at mitigating the extent of LNAPL in conjunction with attenuation of dissolved constituents, but similarly does not have a high likelihood of reaching a Permanent Solution. Both of these alternatives were rated as fair.

5.2.3 Implementability

The free product recovery alternative and MNA both have very good implementability ratings as both are relatively simple technically (assuming a passive recovery program) with only minor effects to the existing facility requiring access discussions with the property owner. All other issues are either easily available or not required.

5.2.4 Cost

The free product recovery alternative has a good cost rating for moderate to low costs associated with system installation and O&M. Monitored natural attenuation, primarily monitoring with sporadic passive adsorption, if needed, has a lower cost estimate than the free product recovery alternative, and is rated as very good.

5.2.5 Risk

Treatment via a free product recovery system has a good risk rating due to the low chance of incidents during passive recovery to facility operations or field workers, as well as the risk mitigation the recovery approach provides for remaining OHM. Monitored natural attenuation has a very good risk rating since this approach primarily consists only of monitoring/gauging of wells for LNAPL with the possible passive use of adsorbent material if present.

5.2.6 Benefits

Each of the alternatives would result in continued productive use of the site and would not result in lost value. Free product recovery and MNA both have little capacity to increase the value of the site and natural resources, and so both alternatives have a fair rating.

5.2.7 Timeliness

The free product recovery alternative was rated as poor, as it only has a low to moderate likelihood to achieve a level of No Significant Risk if continued removal of product can reduce the mobility (as determined by the MassDEP LNAPL assessment procedures), and affect adjacent groundwater concentrations of petroleum hydrocarbons. Monitored natural attenuation is not anticipated to reach this goal alone, or for quite a long time, and was also rated as poor.

5.2.8 Non-pecuniary Considerations

Each alternative has a good rating related to community acceptance, based on an understanding of the community concerns and past discussion points during public meetings. No negative impacts to the aesthetics of the site would be expected from either alternative. Free product recovery and MNA were therefore both rated as fair.

5.2.9 Sustainability

Monitored natural attenuation has a sustainability rating of good due to use of minimal resources for implementation, related only to site visits and sample collection/monitoring.

Free product recovery was rated as fair, since it will require equipment and labor resources and waste disposal efforts.

5.2.10 Summary

Monitored natural attenuation for LNAPL had a higher score of 24 as compared to a score of 21 for the free product recovery alternative.

Section 6
Selection of Remedial Alternatives

As required by 310 CMR 40.0859, the following considerations, and requirements apply to selection of the Remedial Action Alternatives

- With limited exception, the remedial action alternatives must be selected based on the results of the detailed evaluation criteria.
- A remedial action alternative that results in a Permanent Solution must be selected if identified and found to have a more cost-effective and timely solution than that for the implementation of a Temporary Solution. If a Permanent Solution is not feasible, a Temporary Solution that eliminates substantial hazards must be selected and implemented, and a plan for the identification and development of a Permanent Solution must be prepared.
- A selected Permanent Solution must reduce the concentrations of OHM in the environment to levels that achieve or approach background, to the extent feasible.
- An engineered barrier, cap, or other remedial action alternative that relies upon on-site disposal, isolation, or containment of OHM shall not be selected until a Phase III evaluation demonstrates that a feasible alternative does not exist.

Based on the results of the comparative analysis conducted for each of the remedial action alternatives described in Section 5 and summarized in Tables 5-1 and 5-2, the following sections provide the recommended remedial alternatives for the two media identified (groundwater and LNAPL). While evaluated independently, the selected alternatives are compatible and complimentary and are intended to create a complete Permanent Solution, where possible, or if not possible, a Temporary Solution.

6.1 CONTAMINATED GROUNDWATER – MONITORED NATURAL ATTENUATION

The remediation action alternative identified for groundwater, which is monitored natural attenuation, has the highest numerical score (23) of the four evaluated alternatives. As can be seen from the detailed evaluation, none of the alternatives have the likelihood of achieving a condition of No Significant Risk or a Permanent Solution in any reasonable period.

As discussed in Section 3, the COC in groundwater requiring treatment consist of several quite different classes of compounds (CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic), each with different characteristics to address. The CVOC contamination includes presumptive DNAPL concentrations of PCE and TCE. The groundwater contamination has been shown to extend deep into the bedrock aquifer which is very complex with its highly fractured nature. Based on the size and complexity of these plumes, treatment will require a very long time for groundwater conditions to reach a Permanent Solution. Implementation of an active treatment approach, over MNA, will not significantly improve the period to achieve a Permanent Solution at this site.

The implementation of MNA as an integral part of a Temporary Solution for the site is supported by the Phase III evaluation. MNA has the highest level of reliability, implementability, cost-effectiveness, and sustainability compared to the other alternatives reviewed for groundwater. This approach is also supported by an existing voluntary AUL in place that maintains a condition of no substantial hazard. No active treatment component is necessary to achieve the Temporary Solution as the plume is stable or shrinking, the natural attenuation capacity of the aquifer has been shown to be significant, there are no substantial hazards present, all active sources have been removed, and there are no current risks to human health or environmental receptors.

6.2 LNAPL-FREE PRODUCT RECOVERY

The remediation action alternative identified for LNAPL, which is MNA (continued gauging with sporadic collection as necessary), has the highest numerical score (24) of the two evaluated alternatives. The primary drivers for the selection of this remedial action alternative are cost, lower risks, and sustainability.

In accordance with the MassDEP LNAPL Guidance (MassDEP, 2016), LNAPL at the former GE site has been documented as stable, having micro-scale mobility. This status indicates it has achieved a level of a Temporary Solution. The existence of an AUL for the property that limits access to the LNAPL would allow a Permanent Solution to be achieved, with the exception that dissolved petroleum hydrocarbons associated with this LNAPL plume have migrated into the groundwater and exceed GW-1 criteria.

The remedial alternatives evaluated for LNAPL are not anticipated to achieve or reduce the COC to background concentrations; however the chosen alternative (MNA) may continue to support the reduction of LNAPL residual volumes to a point in which the dissolved phase constituents decrease to levels consistent with achieving a Permanent Solution.

Section 7
Feasibility Evaluation

Under certain conditions, the MCP (310 CMR 40.0860) requires an evaluation of the feasibility of these five outcomes:

1. Implementing a Permanent Solution;
2. Reducing the concentrations of oil and hazardous material in the environment to levels that achieve or approach background;
3. Reducing the concentrations of oil and hazardous material in soil at a disposal site to levels at or below applicable soil UCL;
4. Eliminating, preventing or mitigating critical exposure pathway(s); and,
5. Eliminating or controlling each Source of OHM Contamination, controlling migration of OHM, and removing NAPL at a disposal site in support of a Permanent or Temporary Solution pursuant to 310 CMR 40.1003(5) through (7).

7.1 FEASIBILITY TO IMPLEMENT A PERMANENT SOLUTION

The selected remedial action alternatives are not anticipated to achieve a Permanent Solution. As discussed previously, releases of CVOCs at the site have entered fractures in the bedrock and have dissolved and migrated to become distributed over a wide area, horizontally and vertically, into the bedrock aquifer. DNAPL is suspected to have been released at the site due to the relatively high concentrations of PCE and TCE in well AE-23R beneath Building 1. This has resulted in contaminants that are quite deep (greater than 250 ft bgs), present in the bedrock aquifer fracture network, as well as diffused into the bedrock matrix and micro-fractures.

Studies have shown that these CVOCs will slowly back-diffuse out of the matrix and micro-fractures over a long period on the order of several hundred years (Reynolds and Kueper, 2002). Treatment of the bedrock aquifer contamination is extremely difficult, complex, costly, and of low reliability, regardless of the technical approach, as identified in Table 5-1 and discussed in Section 6. Effective treatment of a substantial amount of this contamination, let alone the treatment needed to reach the remedial goals necessary for a Permanent Solution are infeasible at this time.

It has been recognized since the early 1990s that chlorinated solvent fractured bedrock sites contaminated with DNAPL are the most challenging types of sites to remediate, particularly those environments characterized with matrix porosity. The United States National Research Council (NRC) published a volume in 1994 entitled “Alternatives for Ground Water Cleanup” (NRC, 1994). Table 7-1 summarizes the relative ease of cleanup and identifies DNAPL in fractured rock as the most difficult environment for remediation. NRC discussed the fact that because DNAPL moves through discrete fractures, locating all of the DNAPL is very difficult using available investigation techniques such as drilling.

In 2003 the USEPA published a report titled *The DNAPL Remediation Challenge: Is There a Case for Source Depletion?* (USEPA, 2003). With respect to DNAPL source-zone depletion technologies, the report identified a variety of knowledge gaps including “effectiveness of any of the technologies in fractured clay, fractured bedrock, and karst saturated zones.”

In 2013 the NRC published a volume titled *Alternatives for managing the nation’s complex contaminated groundwater sites.* That study stated “It is widely agreed that long-term management will be needed at many sites for the foreseeable future, particularly for the more complex sites that have recalcitrant contaminants, large amounts of contamination, and/or subsurface conditions known to be difficult to remediate (e.g., low-permeability strata, fractured media, deep contamination).” The study further stated “The most problematic sites are those with potentially persistent contaminants including chlorinated solvents recalcitrant to biodegradation, and with hydrogeologic conditions characterized by large spatial heterogeneity or the presence of fractures.”

In 2015 the National Academy of Sciences (NAS) published a volume titled *Characterization, Modeling, Monitoring, and Remediation of Fractured Rock* (NAS, 2015). This study stated “Perhaps the greatest impediment to remediation in fractured rock settings is the lack of common framework, understanding, or expectations related to assessment and realistic remediation end-points.” The study indicated that remediation approaches such as

ISCO and enhanced *in situ* bioremediation (EISB) will have limited effectiveness because of the difficulty to achieve a uniform distribution in the fracture system, and that because much of the contaminant is stored in the matrix, contact between amendments and contaminants relies on diffusion of the amendment into the matrix, which is a rate-limiting step in the remediation process.

The above studies make it clear that fractured rock sites contaminated with CVOCs are extremely difficult to remediate because of the difficulty in locating DNAPL, the non-uniform and preferential nature of groundwater flow in fractured media, the difficulty in accessing contaminants in the matrix, and the time limiting influence of the back diffusion process. Current industry practice recognizes that long term management will be required at these sites, and that monitored natural attenuation in combination with institutional controls are the most effective strategies at fractured rock sites such as the Wilmington site. For these reasons, a Temporary Solution is recommended for the former GE site.

7.2 FEASIBILITY OF ACHIEVING OR APPROACHING BACKGROUND

MassDEP Policy #WSC-04-160, *Conducting Feasibility Evaluations under the MCP* (Feasibility Guidance), provides guidance on a process for evaluating the feasibility of approaching or achieving background which leads to "presumptive certainty" with respect to the conclusions of the feasibility evaluation. The policy includes four situations where it can be considered to be categorically infeasible to reach or approach background. The four situations identified for categorical infeasibility are the following:

- Excavations under permanent structures
- Remedial actions that will substantially interrupt public service or threaten public safety
- Remediation of degradable (non-persistent) contaminants
- Remediation of persistent contaminants located in S-2 and S-3 soils

If the situation for a given site is other than those identified under categorically infeasible, a site-specific feasibility evaluation must be completed. The site-specific evaluation considers whether it is technically feasible to achieve or approach background, and whether there is sufficient benefit compared to the additional cost required to expand the remediation beyond that which is needed to reach a condition of No Significant Risk to reach background. Relative to the benefit-cost analysis, the Feasibility Guidance provides that "it shall be considered feasible to conduct remedial actions to approach background conditions if the additional costs to remediate beyond No Significant Risk are equal to or less than 20% of the cost to remediate to No Significant Risk."

The COC for the site, and in particular those COC that are the primary contributors to the potential for significant risk, e.g., TCE, are included in Table 9-2 of the Feasibility Guidance (MassDEP, 2004), and are considered Persistent Contaminants.

7.2.1 Groundwater

Of the four remedial action alternatives evaluated for groundwater, the active treatment alternatives and the MNA alternative do not have a high likelihood of reducing COC concentrations to levels that achieve background in a timely manner. Given that contaminant mass has diffused into bedrock micro-fractures and matrix porosity, achieving or approaching background concentrations in groundwater is technically impracticable. Even with significant resources, a variety of technical approaches, major interruption of public and private properties, and very long treatment durations, background concentrations would most likely not be easily achieved in groundwater.

7.2.2 Non-Aqueous Phase Liquid

A remedial alternative evaluation was performed (Table 5-2) related to residual petroleum contaminants at the aquifer capillary fringe in the former Tank Farm and EPL areas, where free product has been observed. Monitored natural attenuation was selected as the alternative for LNAPL present in these areas. These areas have been shown to have petroleum hydrocarbon constituents in groundwater, above standards, in addition to free phase LNAPL.

The selected remedial alternative of natural processes, combined with passive use of adsorbents if transient presence of LNAPL occurs, is likely to continue to support conditions in which LNAPL would be reduced to below levels observable in collection wells, as well as other monitoring wells in the area. This reduction should contribute to the decrease of petroleum hydrocarbon constituent concentrations in the surrounding groundwater; however it is unlikely that these levels will be reduced to background levels in the near future.

7.3 FEASIBILITY OF REDUCING CONCENTRATIONS OF OIL AND/OR HAZARDOUS MATERIALS IN SOIL TO LEVELS BELOW UPPER CONCENTRATION LIMITS

OHM has successfully been removed from soil during previous site remedial activities and thus no soils exceed their UCLs at the site, as identified in the Risk Characterization Report (Appendix B, Phase II CSA, AECOM, 2017).

7.4 FEASIBILITY OF ELIMINATING, PREVENTING OR MITIGATING CRITICAL EXPOSURE PATHWAYS

Since there are no pre-schools, daycares, schools, or occupied residential dwellings located within the site boundary, there are no Critical Exposure Pathways at the site. Based on the Phase II CSA, the plume has been shown to be stable or shrinking and is not likely to be transported to any human receptors by vapor intrusion or drinking water routes, particularly to pre-schools, daycares, schools, or occupied residential dwellings.

7.5 SOURCE ELIMINATION AND CONTROL

This section presents a discussion as to how the proposed Temporary Solution meets the general provisions requirements found under section 40.1003 of the MCP.

7.5.1 Source Elimination or Control

According to section 40.1003(5)(a) of the MCP, a Temporary Solution shall not be achieved until all unpermitted releases of OHM to the environment are eliminated. There are no unpermitted releases of OHM to the environment at the site.

According to section 40.1003(5)(c) of the MCP, a Temporary Solution shall not be achieved until all sources of OHM contamination are eliminated or controlled to the extent feasible. Although the current source of CVOCs to groundwater, i.e., presumptive DNAPL concentrations of PCE and TCE in the bedrock aquifer, have not been eliminated, the natural attenuation processes, particularly diffusion into the bedrock matrix, is controlling the plume.

The concentrations of CVOC in Transect A have naturally attenuated from levels greater than 20,000 µg/L to approximately 200 µg/L as the plume intersects Transect B. Diffusion into the bedrock micro-fractures and micro-cracks has been indicated as the major controlling mechanism for plume attenuation.

7.5.2 Migration Control

According to section 40.1003(6)(b) of the MCP, a Temporary Solution shall not be achieved until response actions are taken that ensure plumes of dissolved OHM in groundwater and vapor phase OHM in the vadose zone are stable or contracting or otherwise controlled or mitigated to the extent feasible. The existing site data indicates that the groundwater plume is stable and/or decreasing. Soil gas concentrations beneath Building 1 are elevated; however, there are no risks to indoor air as the OHM concentrations in these vadose zone soils are controlled by the concrete slab foundation of the building. In addition, the existing AUL requires ongoing maintenance and protection of the concrete slab to control potential future vapor intrusion. OHM soil gas concentrations in the vadose zone in areas outside of the Building 1 footprint are low and controlled naturally.

7.5.3 NAPL Removal or Control

According to section 40.1003(7)(b) of the MCP, a Temporary Solution shall not be achieved until all Non-Stable NAPL and NAPL with Micro-scale Mobility is removed and/or controlled if and to the extent feasible. The existing dataset indicates that Non-Stable NAPL does not exist at the site. A monitored natural attenuation with sporadic passive recovery remedy has been selected to allow further removal, to the extent feasible, of NAPL containing Micro-scale Mobility from the site, if detected during monitoring activities.

Section 8
Schedule

As described in the previous sections, a Temporary Solution is the recommended outcome for this site. This section presents the projected plan and implementation schedule for Post-Temporary Solution activities to maintain a Temporary Solution and work towards reaching a Permanent Solution.

8.1 PLAN FOR ACHIEVING A PERMANENT SOLUTION

Section 310 CMR 40.1056 (2)(j) and 310 CMR 40.0861 require that for all Temporary Solutions, a plan and schedule be developed for definitive and enterprising steps to identify and develop an alternative that is likely a Permanent Solution.

AECOM will implement an active remedial monitoring plan according to the details and schedule outlined below.

- Annual indoor air monitoring of pertinent on-site buildings will continue to be conducted according to the current scope performed from 2014 to 2016. Once each heating season (typically in February), indoor air samples will be collected from several locations of Building 1. Samples will be collected following procedures contained in the MassDEP Vapor Intrusion Guidance Policy #WSC-16-435 dated October 14, 2016. Samples will be analyzed for VOCs via TO-15 SIM.

- Quarterly LNAPL gauging of seven (7) monitoring wells (AE-03, AE-04, CW-1, CW-2, GZA-102S, PZ-2S, and TRC-101) located in the western portion of the EPL to monitor the presence/absence of LNAPL in this area. In the event that LNAPL thickness of greater than 0.05 ft is detected in a well, an absorbent sock will be deployed to soak up the LNAPL for disposal. In accordance with the MassDEP Guidance Policy (#WSC-16-450) Assessment and Closure of LNAPL, an evaluation of the mobility of LNAPL in porous media (soils) at the site will be performed to demonstrate compliance with the MCP LNAPL Performance Standards, and determine whether a Permanent Solution can be achieved for this condition.

- Annual groundwater sampling of selected monitoring wells to document temporal concentrations of site compounds of concern (CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic) in overburden and bedrock groundwater, and to verify that the contaminant plume is stable and not migrating. Each groundwater sampling event will include a site wide synoptic water level measurement round and groundwater potentiometric maps will be produced for the overburden and bedrock zones. Monitoring wells will be purged and sampled. The dedicated multiport FLUTe liners will be purged and sampled. The final list of wells to be used for groundwater monitoring will be determined before implementation, but an example well and analyte list from the comprehensive June 2016 sampling event is provided as close approximation of the monitoring scope in Table 8-1. This well list includes horizontal and vertical coverage of the overburden and bedrock plumes both on-site and on downgradient properties. The analyte list includes the site COC (VOCs, 1,4-dioxane, EPH/VPH, total, and dissolved arsenic) and relevant MNA parameters that will be useful in documenting attenuation of the detected compounds of concern in groundwater.

Consistent with the MCP requirements, site conditions will be re-evaluated every five years at which time new technologies or an alternative strategic approach will be evaluated to overcome limiting factors at the site to achieve a Permanent Solution.

8.2 PROJECTED PERIOD TO ACHIEVE A PERMANENT SOLUTION

A key aspect to the CSM at the former GE site is the premise that significant CVOC contaminant mass has entered the bedrock matrix via diffusion, rendering the COC unavailable for plume migration. For this same reason as well as the potential presence of DNAPL, active remediation is infeasible and unable to achieve a Permanent Solution. Studies have shown that CVOCs that have diffused into the bedrock matrix will slowly back diffuse over a long period on the order of decades to several hundred years (Reynolds and Kueper, 2002). Therefore, it is unlikely that a Permanent Solution will be achieved at this site for all of the COC for quite some time.

8.3 PROJECTED SCHEDULE FOR IMPLEMENTATION OF POST-TEMPORARY SOLUTION ACTIVITIES

As part of a Temporary Solution Statement submittal, a Post-Temporary Solution OM&M plan will be provided. This Post-Temporary Solution OM&M Plan will present details of the remedial monitoring response action. The components of the plan described above will be performed at the frequencies indicated, starting immediately upon submittal of the final MCP documents. Documentation of the OM&M Plan results will be presented in Post-Temporary Solution Status Reports, as described in 310 CMR 40.0898(2), that shall be submitted every six months following the original plan submittal. Should site conditions change, or if monitoring data becomes unnecessary or redundant, a revised plan will be prepared and presented to the MassDEP.

Section 9

Phase III Completion Statement and LSP Opinion

This Phase III has been completed in accordance with the requirements of the MCP (310 CMR 40) and meets the Remedial Action Performance Standards and Phase III Performance Standards as defined in 310 CMR 40.0853. Remedial action alternatives have been evaluated that are reasonably likely to achieve a condition of No Significant Risk. The recommended remedial action alternatives are not anticipated to achieve a Permanent Solution, but rather a Temporary Solution, and may reduce the concentrations of oil and hazardous materials to levels that support a condition of No Significant Risk. A condition of no substantial hazards does exist for the site. Reducing concentrations to levels that achieve or approach background have been determined to be infeasible based on the persistent nature of the CVOCs, 1,4-dioxane, and arsenic and the subsurface bedrock conditions at the site. A set of comprehensive remedial action alternatives have been selected as part of the Temporary Solution recommended, based on the information and evaluation documented in this Phase III and will include the following:

- MNA of CVOCs, 1,4-dioxane, petroleum hydrocarbons, and arsenic in groundwater
- Continued evaluation of stability and micro-scale mobility for residual LNAPL, with recovery/removal if warranted

Section 10
Public Notification

The MCP (310 CMR 40.1403(3)(e)) requires written notice be made upon the completion of a Phase III Remedial Action Plan. This written notice is to be provided to the Chief Municipal Officer and Board of Health in the community where the site is located. A letter sent to public officials is provided in Appendix E, and has been sent to the Towns of North Reading and Wilmington, Massachusetts, as well as interested public citizens, concurrent with submittal of this Phase III.

The former GE site is part of a joint PIP that was prepared in 2000 by the MassDEP including other potentially responsible parties (PRPs). Being a PIP site, there are additional regulatory requirements above and beyond the minimum requirements. These include public notifications including local newspapers (see legal advertisement in Appendix E), public meetings, draft document public comment periods, and responding to public comments on final documents.

1) For the following draft documents: Phase II Report, Phase III Report, and Temporary Solution Statement, the November 17, 2000 PIP Plan requirements (MassDEP, 2000a) that specifically apply to the former GE facility will include the following documents or activities:

    a. Provide a copy of the draft document to the designated information repository established in the PIP (Town of North Reading library;

    b. A written Notice of Availability of the draft document will be sent to parties on the updated PIP site mailing list;

    c. A Notice of Public Meeting to present the draft document will be sent to parties on the PIP site mailing list 14 days in advance of the meeting;

    d. Hold public meeting(s) to discuss the draft document;

    e. After the public meeting, allow a 20-day public comment period on the draft document. MassDEP will determine if the comment period should be extended based on site complexity. Public comments are to be sent to MassDEP

(Northeast Regional Office), AECOM (Chelmsford, MA), and Lockheed Martin concurrently;

f. Within 60 days of the close of the comment period, AECOM, on the behalf of Lockheed Martin, will prepare a Response Summary that will include a summary of all comments received on the draft document available for public comment, and the responses to these comments prepared by AECOM and Lockheed Martin. In addition, those comments that are incorporated into the revised document will be identified and an explanation will be provided for each comment that is not incorporated into the revised document;

g. A copy of the Response Summary will be sent to all those who submitted comments and will be placed in the information repository; and

h. A Notice of Availability of the Response Summary will be sent to the PIP mailing list.

Section 11
References

1. AECOM Technical Services, Inc. (AECOM), 2013. ROS Status, ROS Termination, and Tier IA Permit Extension Report. March 2013.

2. AECOM, 2017. Draft Phase II Comprehensive Site Assessment, Former General Electric Site, 50 Fordham Road, Wilmington, MA, RTN 3-0518. May 2017.

3. Anderson, R.H., Anderson, J.K., Bower, P.A, 2012. "Co-occurrence of 1,4-Dioxane with TCE in chlorinated Solvent Groundwater Plumes at U.S. Air force Installations: Fact or Fiction", Integrated Environmental Assessment Management, Vol. 4, pg. 731, October 8, 2012.

4. Chiang, D.,R. Mora, M. Zenker, S. Mahendra, and P. Dombrowski, 2013. 29th Annual International Conference on Soils, Sediments, Water, and Energy, UMass Amherst. October 23, 2013.

5. Engineering Metal Constructing Company (EMCON), 1998a. Correspondence, RE: Wilmington Sediment Evaluation. January 8, 1998.

6. EMCON, 1998b. Correspondence, RE: Proposed Changes to the Phase III Remedial Action Plan. February 27, 1998.

7. Environmental Data Resources, Inc. (EDR), 2012. EDR Radius Map, Former General Electric Facility, 50 Fordham Road, Wilmington, MA. June 2012.

8. Environment Resource Management New England (ERM), 1987. Interim Phase II Site Investigation, General Electric Company, Wilmington, Massachusetts. June 1987.

9. The Interstate Technology & Regulatory Council (ITRC), 2010. Use and Measurement of Mass Flux and Mass Discharge. August 2010.

10. Massachusetts Department of Environmental Protection (MassDEP), 2000a. Public Involvement Plan, MSM Industries, Former Sterling Supply Corporation Disposal Site, Roadway Express Disposal Site, Former General Electric Disposal Site, Wilmington and North Reading, Massachusetts. November 2000.

11. MassDEP, 2000b. Construction of Buildings in Contaminated Areas. Policy #WSC-00-425. January 2000.

12. MassDEP, 2004. WSC #04-160: Conducting Feasibility Evaluations Under the MCP. July 16, 2004.

13. MassDEP, 2009. 310 CMR 40.0000 Massachusetts Contingency Plan. June 2009.

14. MassDEP, 2014. Similar Soils Provision Guidance - Guidance for Identifying When Soil Concentrations at a Receiving Location Are "Not Significantly Lower Than" Managed Soil Concentrations Pursuant to 310 CMR 40.0032(3). September 4, 2014 (Originally published October 2, 2013 and revised April 25, 2014). WSC#-13-500.

15. MassDEP, 2016. WSC #16-450: Light Non-Aqueous Phase Liquids (LNAPL) and the MCP: Guidance for Site Assessment and Closure. February 2016.

16. National Academy of Sciences (NAS), 2015. Characterization, Modeling, Monitoring, and Remediation of Fractured Rock.

17. National Research Council (NRC), 1994. *Alternatives for Groundwater Cleanup,* The National Academic Press, Washington, District of Columbia.

18. NRC, 2013. *Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites,* The National Academic Press, Washington, District of Columbia

19. Reynolds, D.A. and B.H. Kueper, 2002. Numerical examination of the factors controlling DNAPL migration through a single fracture. Ground Water 40(4): 368–377.

20. TRC Companies, Inc. (TRC), 1999a. Tier I Minor Permit Modification submitted to MassDEP. July 13, 1999.

21. TRC, 1999b. Tier I Permit Extension submitted to the MassDEP. August 5, 1999.

22. TRC, 1999c. Tier I Permit Modification, Transferring the Waste Site Cleanup Permit from Lockheed Martin to TRC. December 13, 1999.

23. TRC, 2001. Phase IV As-Built Construction and Final Inspection Report, Eastern Parking Lot Area, Former GE Facility, RTN#3-0518, Wilmington, Massachusetts. January 2001.

24. TRC, 2003. Tier 1A Permit Extension. December 2003.

25. TRC, 2004. Partial Class A-2 RAO for OU-3. December 2004.

26. TRC, 2010. Partial Class A-2 RAO for the Tank K Area. November 2010.

27. TRC. 2012. Tier I Permit Modification, Transferring the Waste Site Cleanup Permit from TRC to Lockheed Martin. January 6, 2012.

28. United States Environmental Protection Agency (USEPA), 2003. The DNAPL Remediation Challenge: Is There a Case for Source Depletion?

29. USEPA, 2016. Drinking Water Regulations and Contaminants.

30. Wilmington Realty Trust (WRT), 2015. Activity and Use Limitation.

FIGURES

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

SITE LOCATION MAP

DATE: 01/25/2017

PROJECT: 60478638

FIGURE: 2-1

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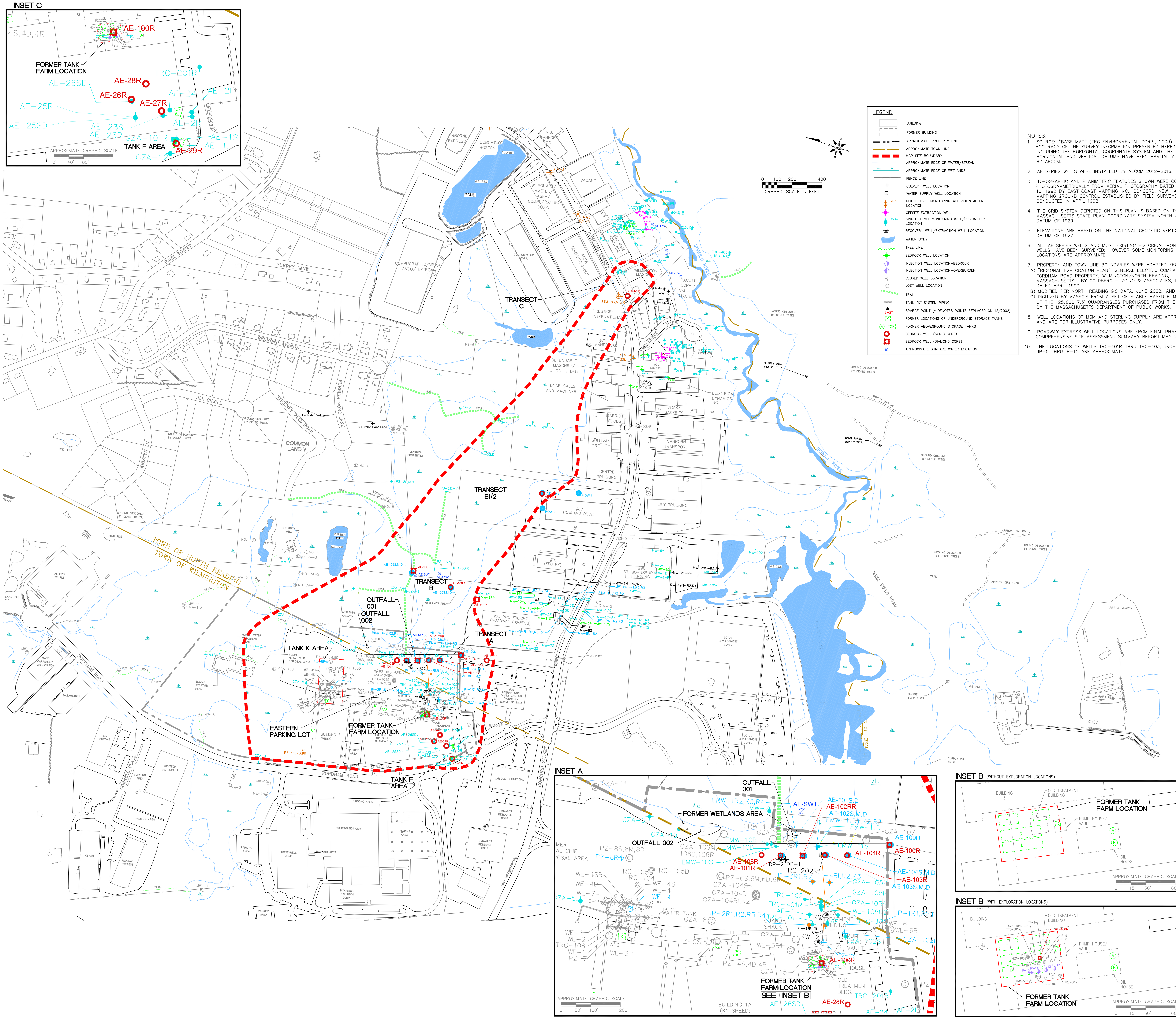


NOTES:

1. SOURCE: "BASE MAP" (TRC ENVIRONMENTAL CORP., 2003). THE ACCURACY OF THE SURVEY INFORMATION PRESENTED HEREIN, INCLUDING THE HORIZONTAL COORDINATE SYSTEM AND THE HORIZONTAL AND VERTICAL DATUMS HAVE BEEN PARTIALLY VERIFIED BY AECOM.
2. AE SERIES WELLS WERE INSTALLED BY AECOM 2012–2016.
3. TOPOGRAPHIC AND PLANIMETRIC FEATURES SHOWN WERE COMPILED PHOTOGRAMMETRICALLY FROM AERIAL PHOTOGRAPHY DATED APRIL 16, 1992 BY EAST COAST MAPPING INC., CONCORD, NEW HAMPSHIRE. MAPPING GROUND CONTROL ESTABLISHED BY FIELD SURVEYS CONDUCTED IN APRIL 1992.
4. THE GRID SYSTEM DEPICTED ON THIS PLAN IS BASED ON THE MASSACHUSETTS STATE PLAN COORDINATE SYSTEM NORTH AMERICAN DATUM OF 1929.
5. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1927.
6. ALL AE SERIES WELLS AND MOST EXISTING HISTORICAL MONITORING WELLS HAVE BEEN SURVEYED; HOWEVER SOME MONITORING WELL LOCATIONS ARE APPROXIMATE.
7. PROPERTY AND TOWN LINE BOUNDARIES WERE ADAPTED FROM:
   A) "REGIONAL EXPLORATION PLAN", GENERAL ELECTRIC COMPANY, 50 FORDHAM ROAD PROPERTY, WILMINGTON/NORTH READING, MASSACHUSETTS, BY GOLDBERG – ZOINO & ASSOCIATES, INC., DATED APRIL 1990;
   B) MODIFIED PER NORTH READING GIS DATA, JUNE 2002; AND
   C) DIGITIZED BY MASSGIS FROM A SET OF STABLE BASED FILM PRINTS OF THE 125:000 7.5' QUADRANGLES PURCHASED FROM THE USGS BY THE MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS.
8. WELL LOCATIONS OF MSM AND STERLING SUPPLY ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.
9. ROADWAY EXPRESS WELL LOCATIONS ARE FROM FINAL PHASE 2 COMPREHENSIVE SITE ASSESSMENT SUMMARY REPORT MAY 28, 2002.
10. THE LOCATIONS OF WELLS TRC–401R THRU TRC–403, TRC–505 AND IP–5 THRU IP–15 ARE APPROXIMATE.

FIGURE: 2-2

SITE PLAN

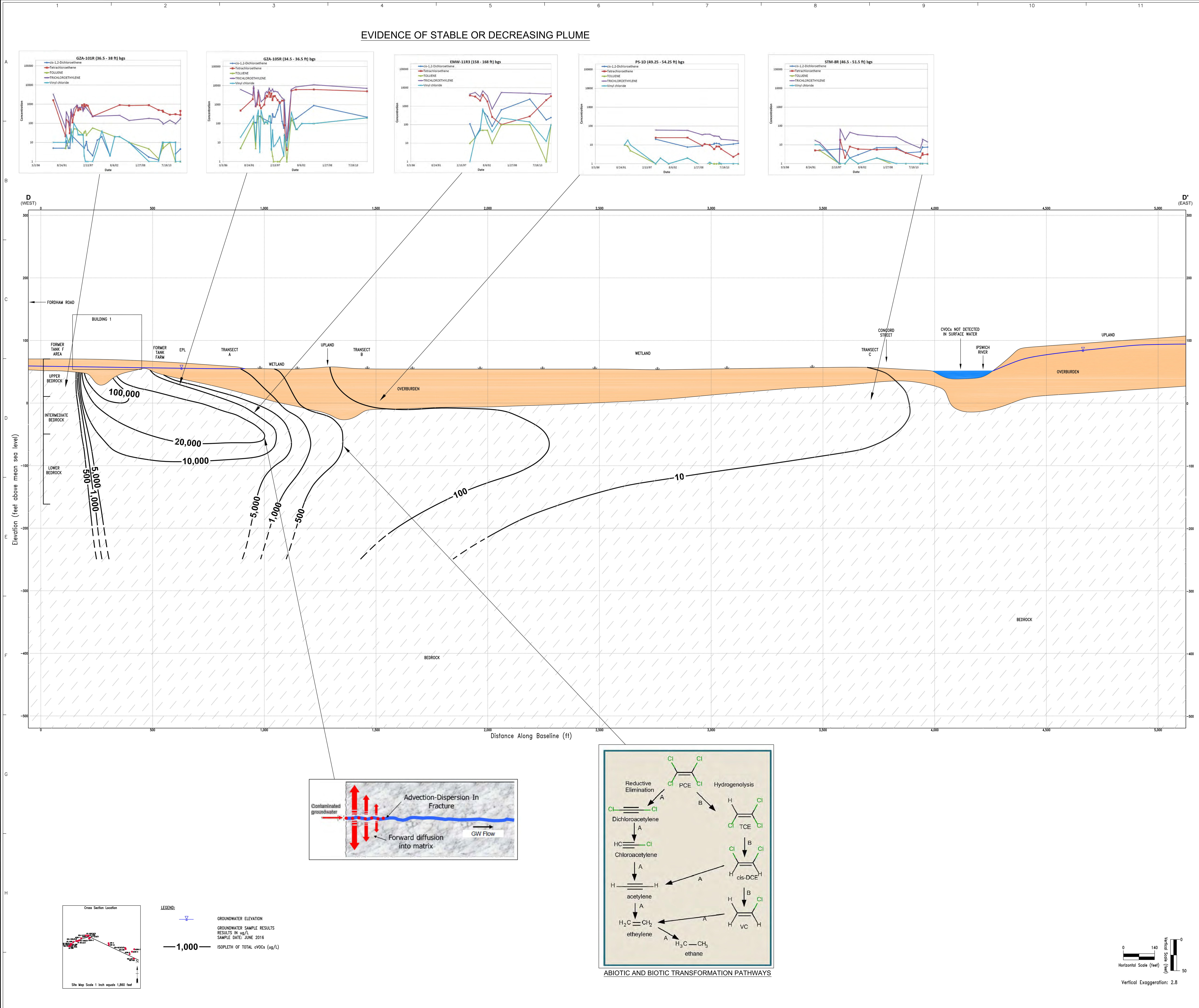
Former GE Facility - 50 Fordham Rd, Wilmington, MA
Lockheed Martin Corporation

60478638

Date: 2016-11-09

Filename: P:\JOBS\REM_ENG\PROJECT FILES\LOCKHEED MARTIN\WILMINGTON, MA 2016-2017 WORK 60478638\CAD\PHASE III RAP REPORT - CAD\FIG 2-2 SITE PLAN.DWG Last saved by: BARRYK Last Plotted: 2017-03-01

Project Management Initials: K.P.B. Designer: K.P.B. Checked: S.O. Approved: A.T. ARCH C 18" x 24"



NO	DRWN DATE	CHKD DATE	APPVD DATE	REVISION
0				
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2				
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4				
5				
6				
7				

AECOM

AECOM Environment
250 Apollo Drive
Chelmsford, MA 01824
www.aecom.com

LOCKHEED MARTIN CORP.
50 FORDHAM ROAD, WILMINGTON, MA

PROJ. NO.: 60478638

DATE: 02/17

CONCEPTUAL SITE MODEL CROSS SECTION

50 FORDHAM ROAD, WILMINGTON, MA

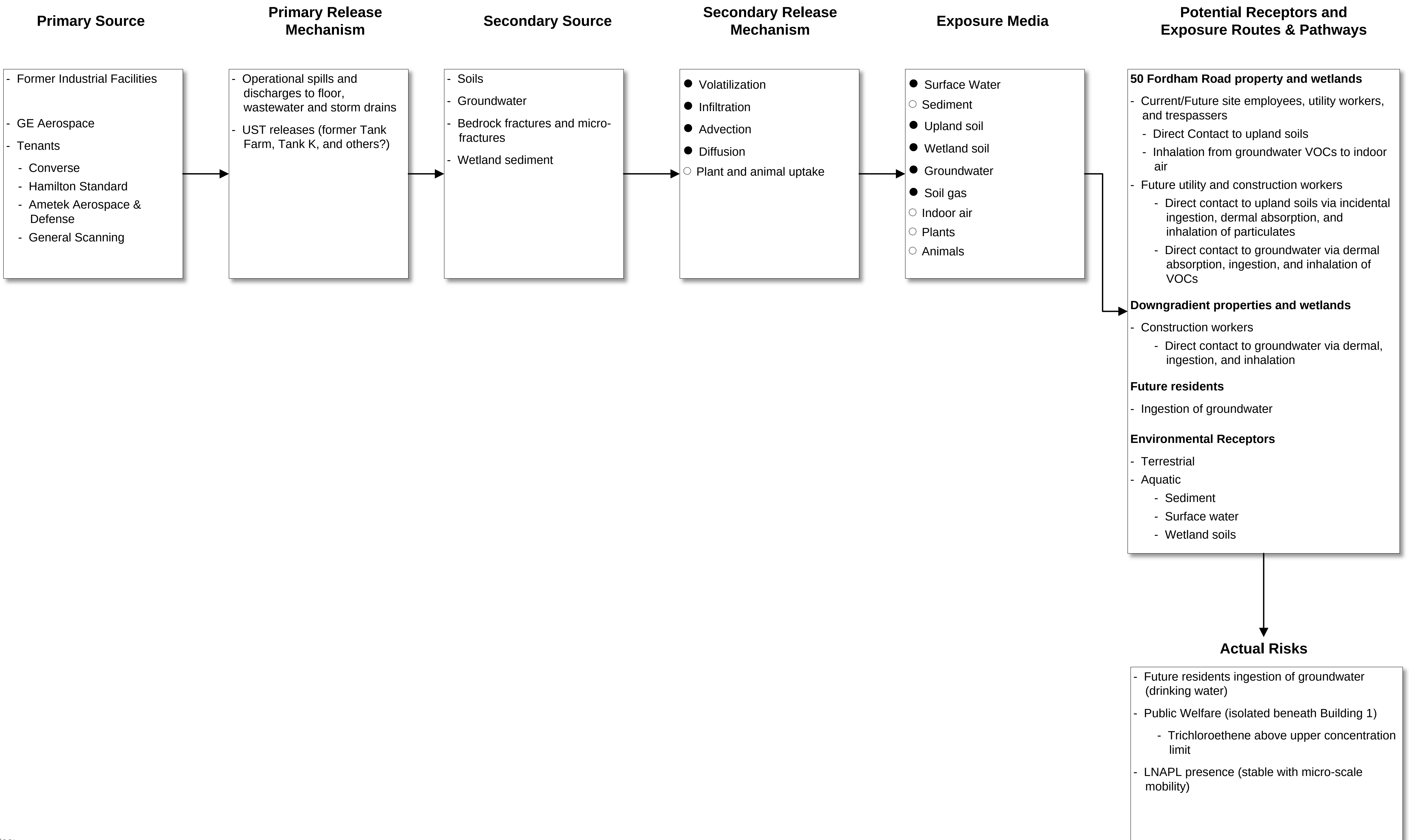
FIGURE 3-1

SHEET NUMBER: 1 OF 1

REVISION 0

FIGURE 3-2

CONCEPTUAL SITE MODEL RECEPTOR RISKS



Notes:
GE = General Electric Company
LNAPL = light notn-aqueous phase liquid
VOCs = volatile organic compounds
○ = Possible
● = Confirmed above applicable criteria and background levels

Former GE Facility, 50 Fordham Road
Wilmington, MA
Lockheed Martin
60478638

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FORMER GE FACILITY
50 FORDHAM RD, WILMINGTON, MA
Project No.: 60478638.2.73

GROUNDWATER CONTOUR MAP 0-60 FEET, JUNE 10, 2016

AECOM

FIGURE 3-3

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FORMER GE FACILITY
50 FORDHAM RD, WILMINGTON, MA
Project No.: 60478638.2.73

GROUNDWATER CONTOUR MAP 61-120 FEET, JUNE 10, 2016

AECOM

FIGURE 3-4

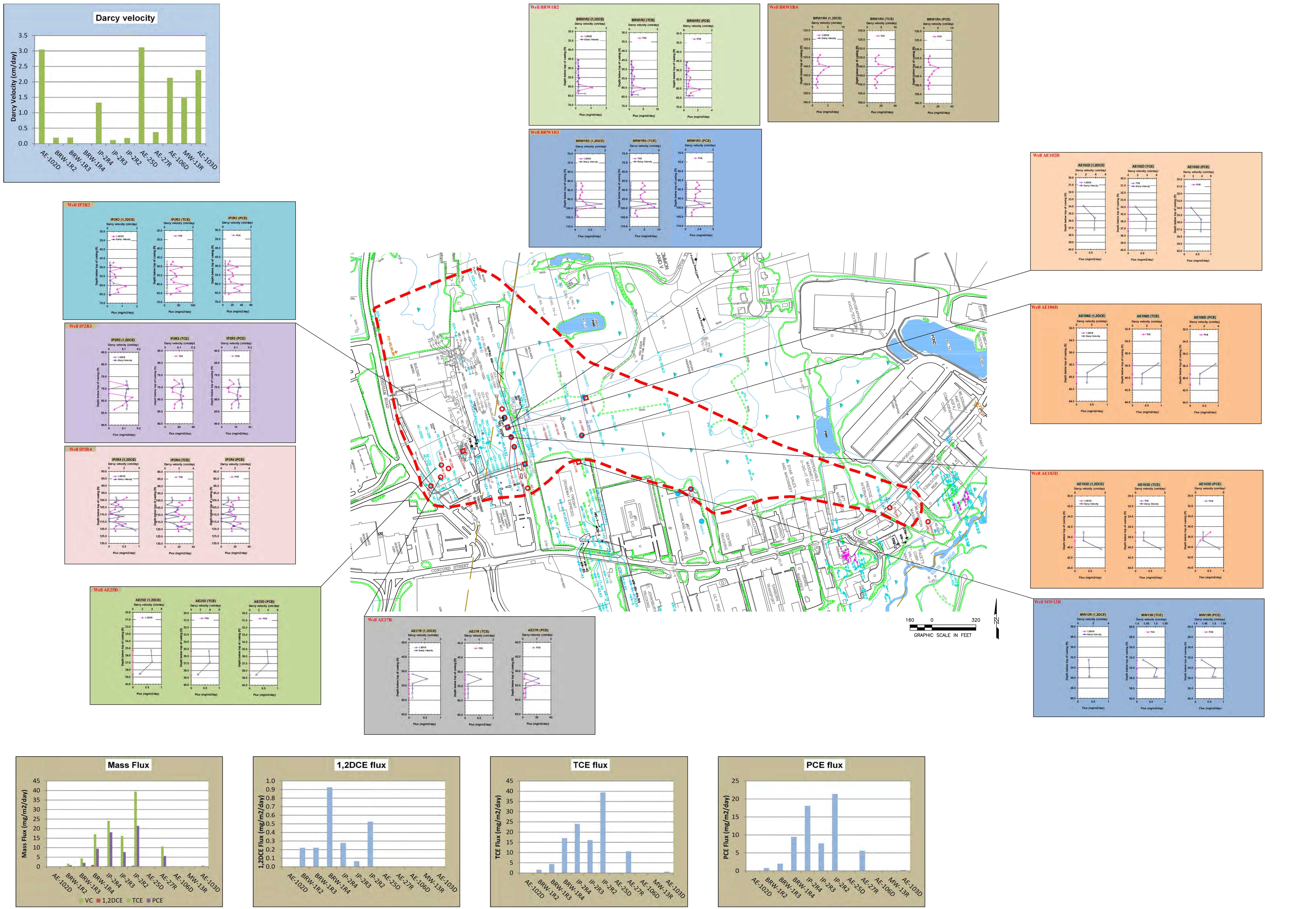
Document Path: P:\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Field Work\GW sampling\June 2016\Synoptic WLs_Gradients\MXD\Fig_4_10_2016_GW_Contours_121_232.mxd

FORMER GE FACILITY
50 FORDHAM RD, WILMINGTON, MA
Project No.: 60478638.2.73

GROUNDWATER CONTOUR MAP 121-250 FEET, JUNE 10, 2016

AECOM

FIGURE 3-5



AECOM

FIGURE: 3-6

PASSIVE FLUX METER RESULTS

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Lockheed Martin Corporation

Date: 2016-11-22

60478638

ANSI D 22" x 34"
Approved: A.T.
Checked: D.F.
Designer: K.P.B.
Project Management Initials:

Last saved by: BARRYK(2017-01-30) Last Plotted: 2017-01-30
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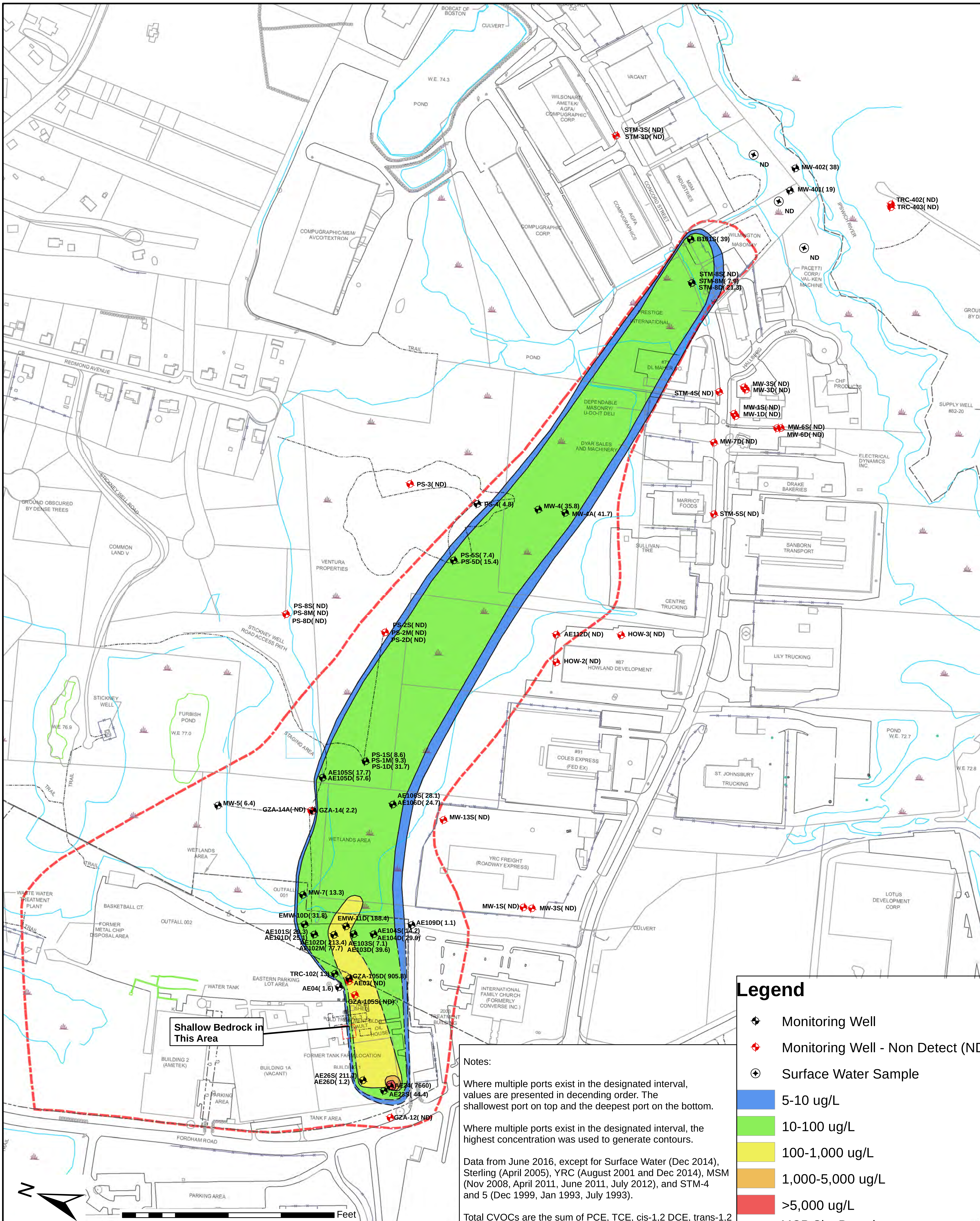

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

Total CVOCs in Groundwater Overburden (0-78 ft bgs)

FIGURE: 3-7

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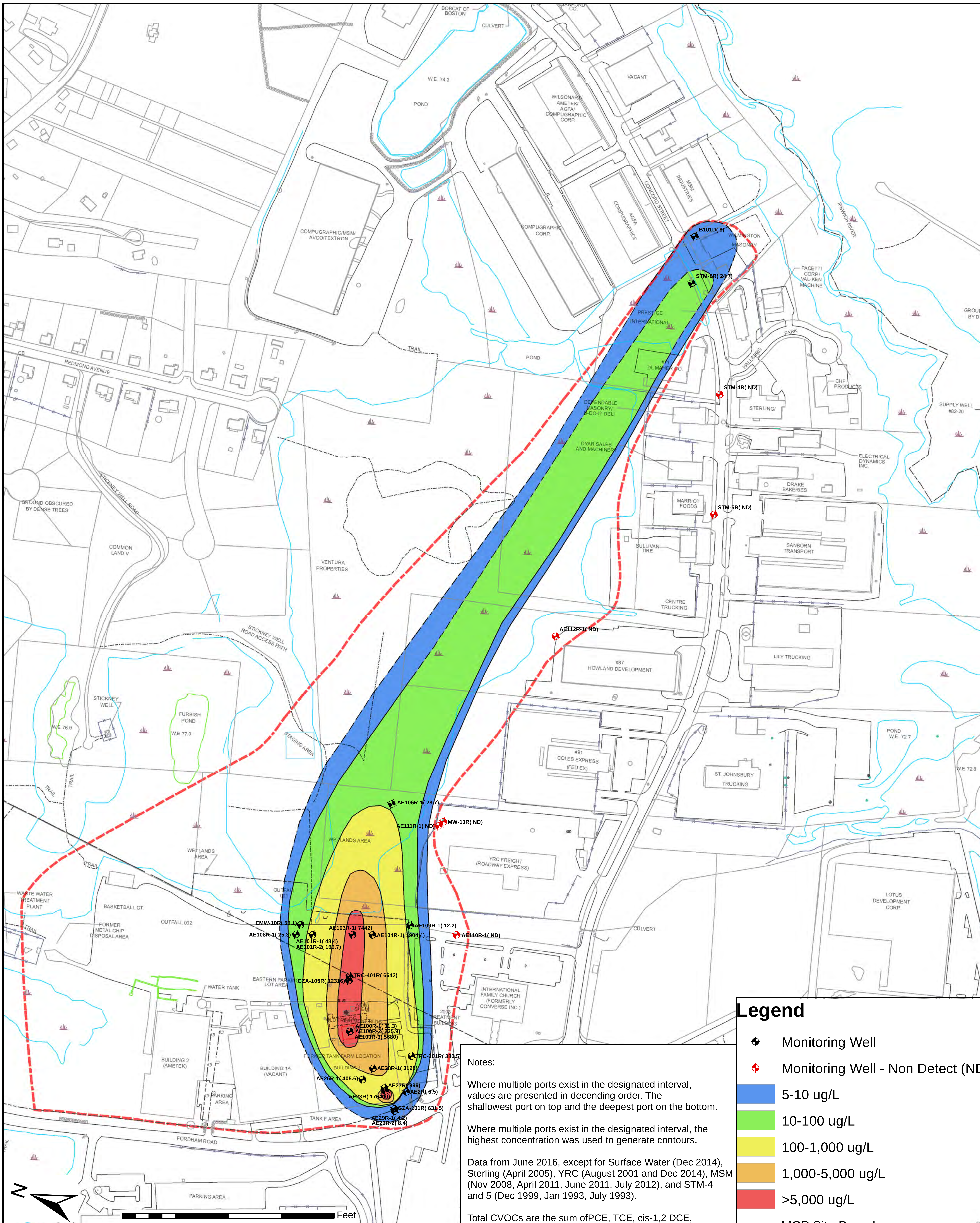

Legend

- Monitoring Well
- Monitoring Well - Non Detect (ND)
- 5-10 ug/L
- 10-100 ug/L
- 100-1,000 ug/L
- 1,000-5,000 ug/L
- >5,000 ug/L
- MCP Site Boundary

Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

Total CVOCs are the sum ofPCE, TCE, cis-1,2 DCE, trans-1,2 DCE,1,1 DCE, 1,1DCA, and 1,2 DCA

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

Total CVOCs in Groundwater
Upper Bedrock (0-60 ft bgs)

FIGURE: 3-8

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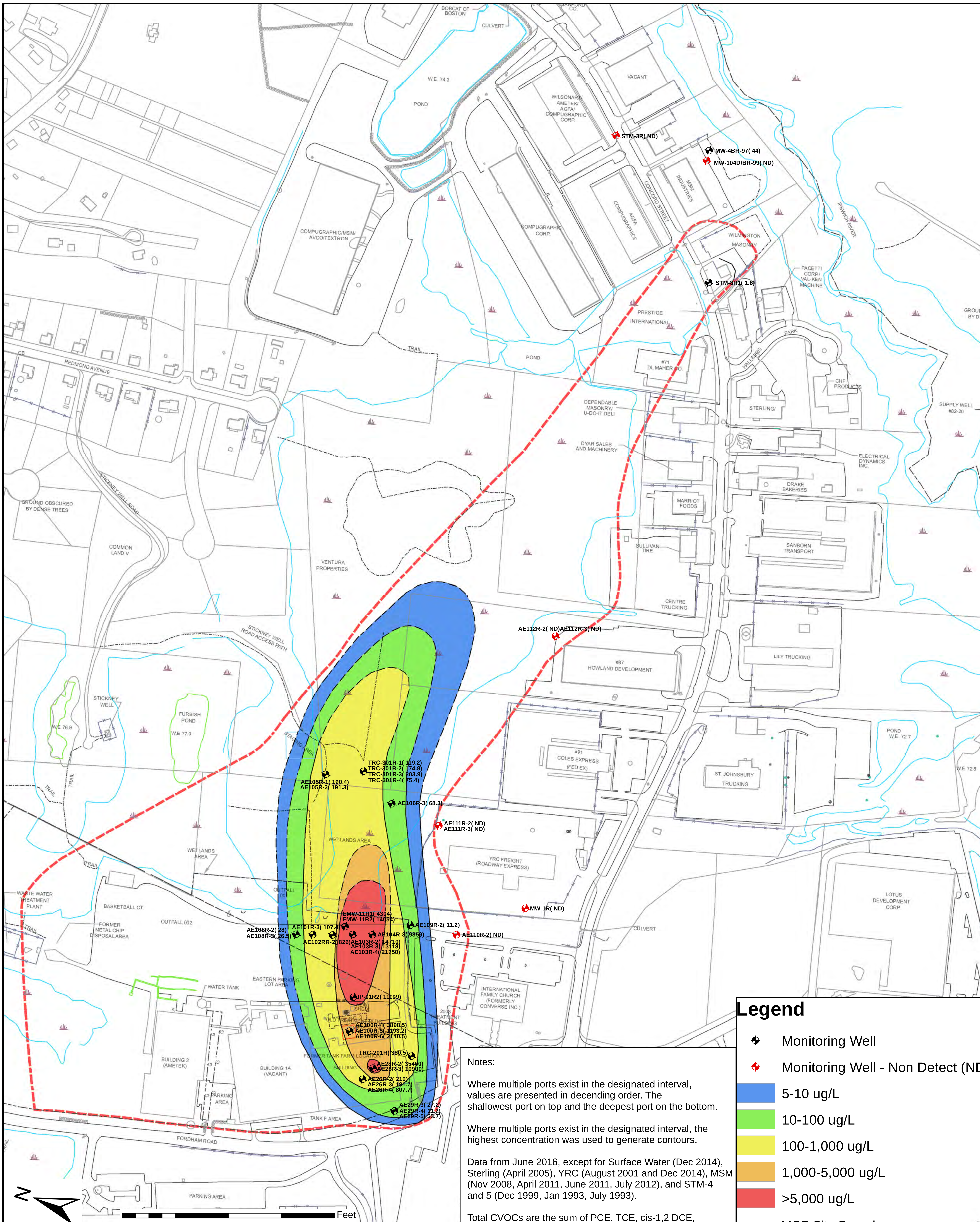


Legend

- Monitoring Well
- Monitoring Well - Non Detect (ND)
- 5-10 ug/L
- 10-100 ug/L
- 100-1,000 ug/L
- 1,000-5,000 ug/L
- >5,000 ug/L
- MCP Site Boundary

Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

Total CVOCs are the sum of PCE, TCE, cis-1,2 DCE, trans-1,2 DCE, 1,1 DCE, 1,1DCA, and 1,2 DCA

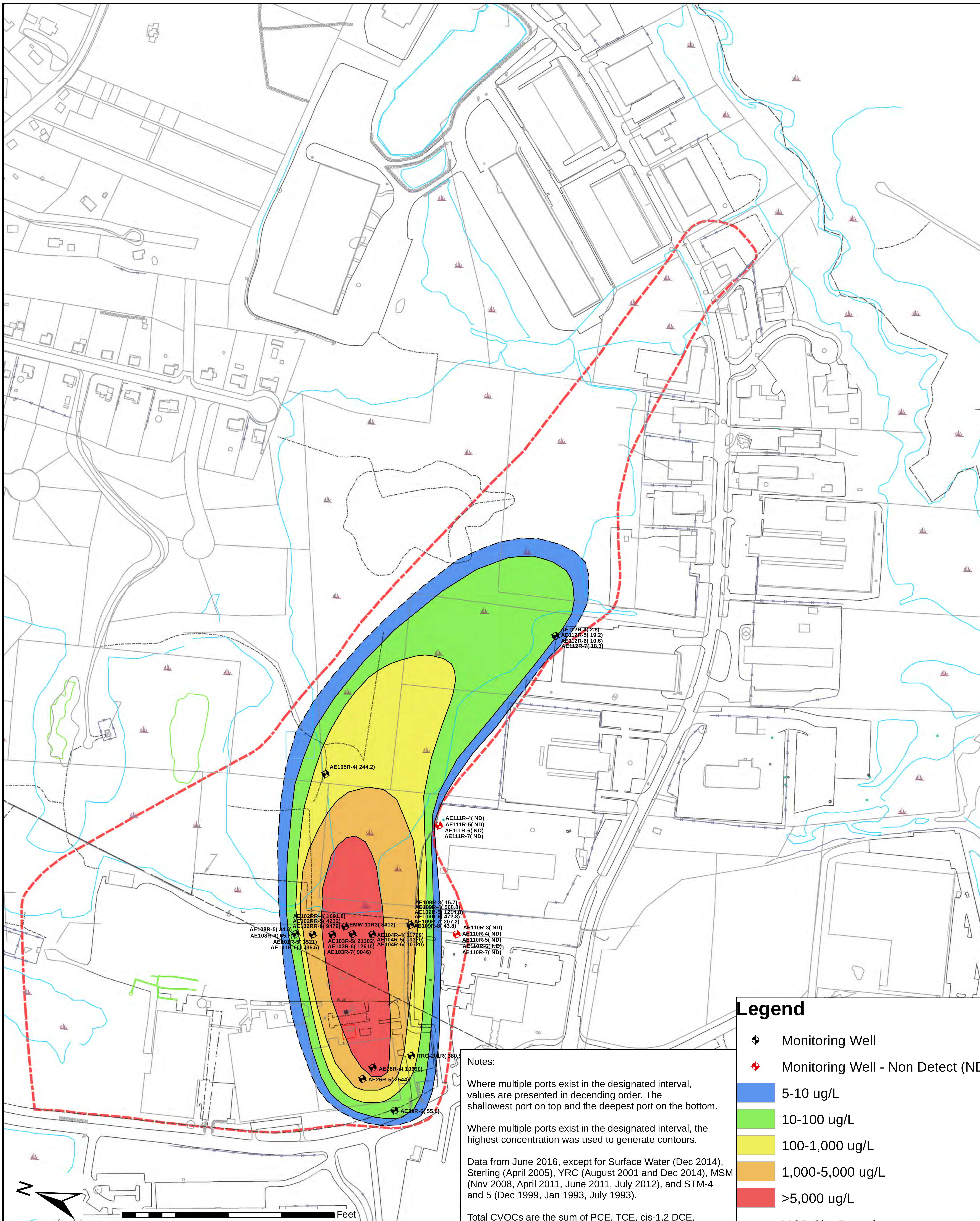
AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

Total CVOCs in Groundwater
Middle Bedrock (61-120 ft bgs)

FIGURE: 3-9

Path: \\USCHL1FP001\Data\Projects\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Prelim Draft Phase II CSA\Report Figures\2016 Plume Figures\MXD\tcvocs_middle BR_2016.mxd



Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

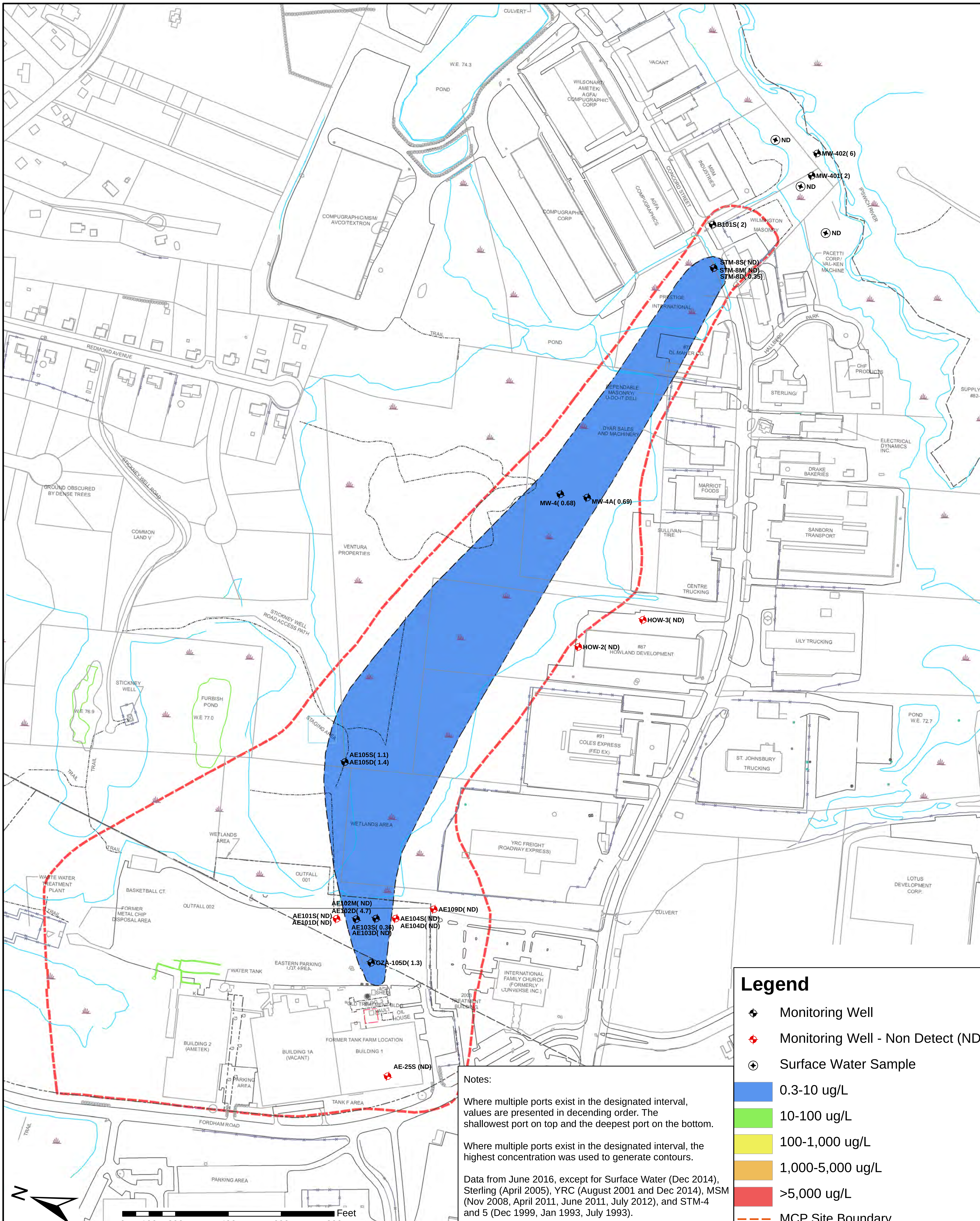
Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

Total CVOCs are the sum of PCE, TCE, cis-1,2 DCE, trans-1,2 DCE, 1,1 DCE, 1,1DCA, and 1,2 DCA

AECOM	Former GE Facility 50 Fordham Road, Wilmington, MA	**Total CVOCs in Groundwater Lower Bedrock (121 - 232 ft bgs)** **FIGURE: 3-10**

Path: P:\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Prelim Draft Phase II CSA\Report Figures\2016 Plume Figures\MXD\tcvocs_lower BR_2016.mxd



Legend

- Monitoring Well
- Monitoring Well - Non Detect (ND)
- Surface Water Sample
- 0.3-10 ug/L
- 10-100 ug/L
- 100-1,000 ug/L
- 1,000-5,000 ug/L
- >5,000 ug/L
- MCP Site Boundary

Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

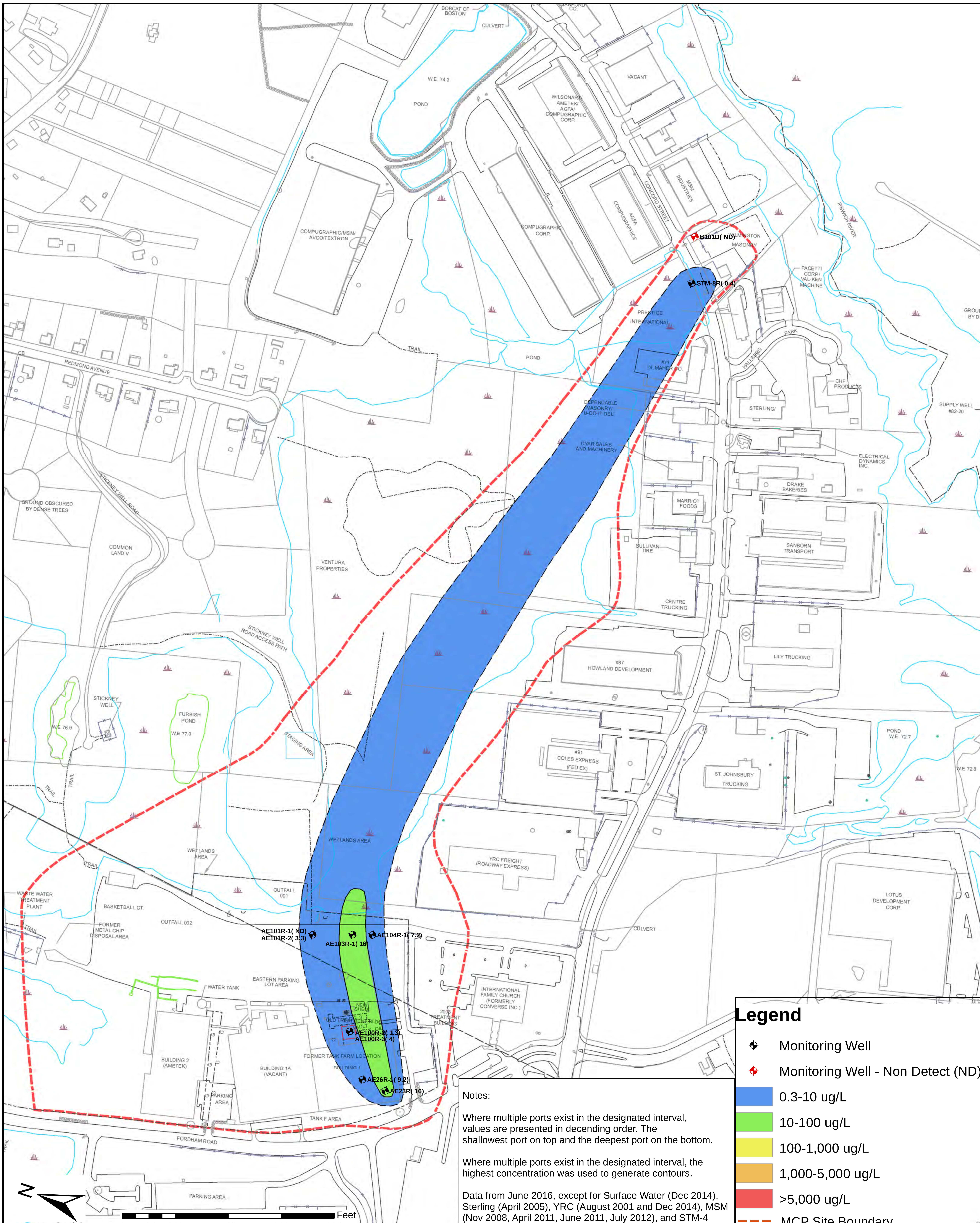
AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

1,4-Dioxane in Groundwater Overburden (0-78 ft bgs)

FIGURE: 3-11

Path: \\USCHL1FP001\Data\Projects\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Prelim Draft Phase II CSA\Report Figures\2016 Plume Figures\MXD\diox_OB_2016.mxd



Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

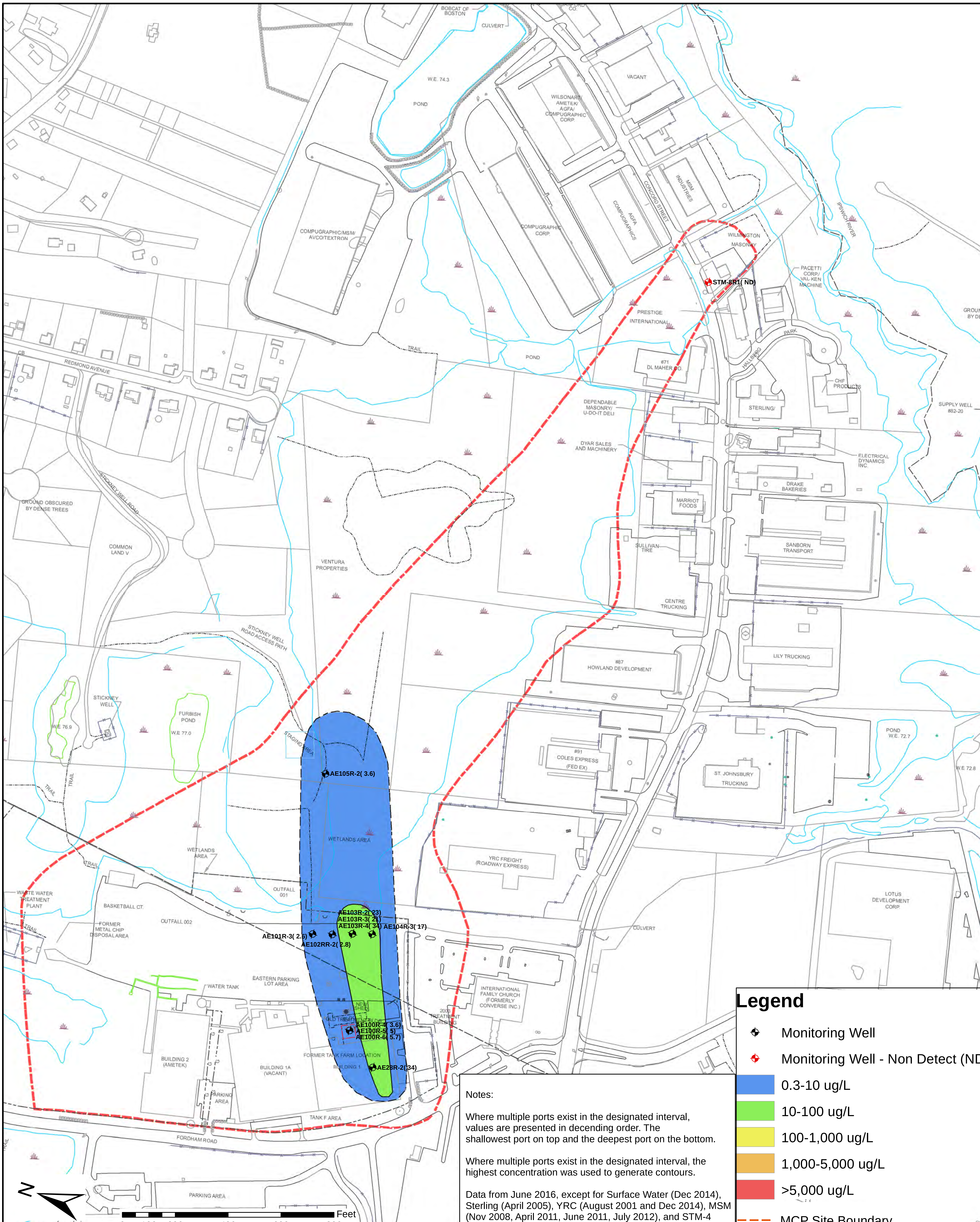
AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

1,4-Dioxane in Groundwater
Upper Bedrock (0-60 ft bgs)

FIGURE 3-12

Path: \\USCHL1FP001\Data\Projects\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Prelim Draft Phase II CSA\Report Figures\2016 Plume Figures\MXD\diox_upper BR



AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

1,4-Dioxane in Groundwater
Middle Bedrock (61-120 ft bgs)

FIGURE: 3-13

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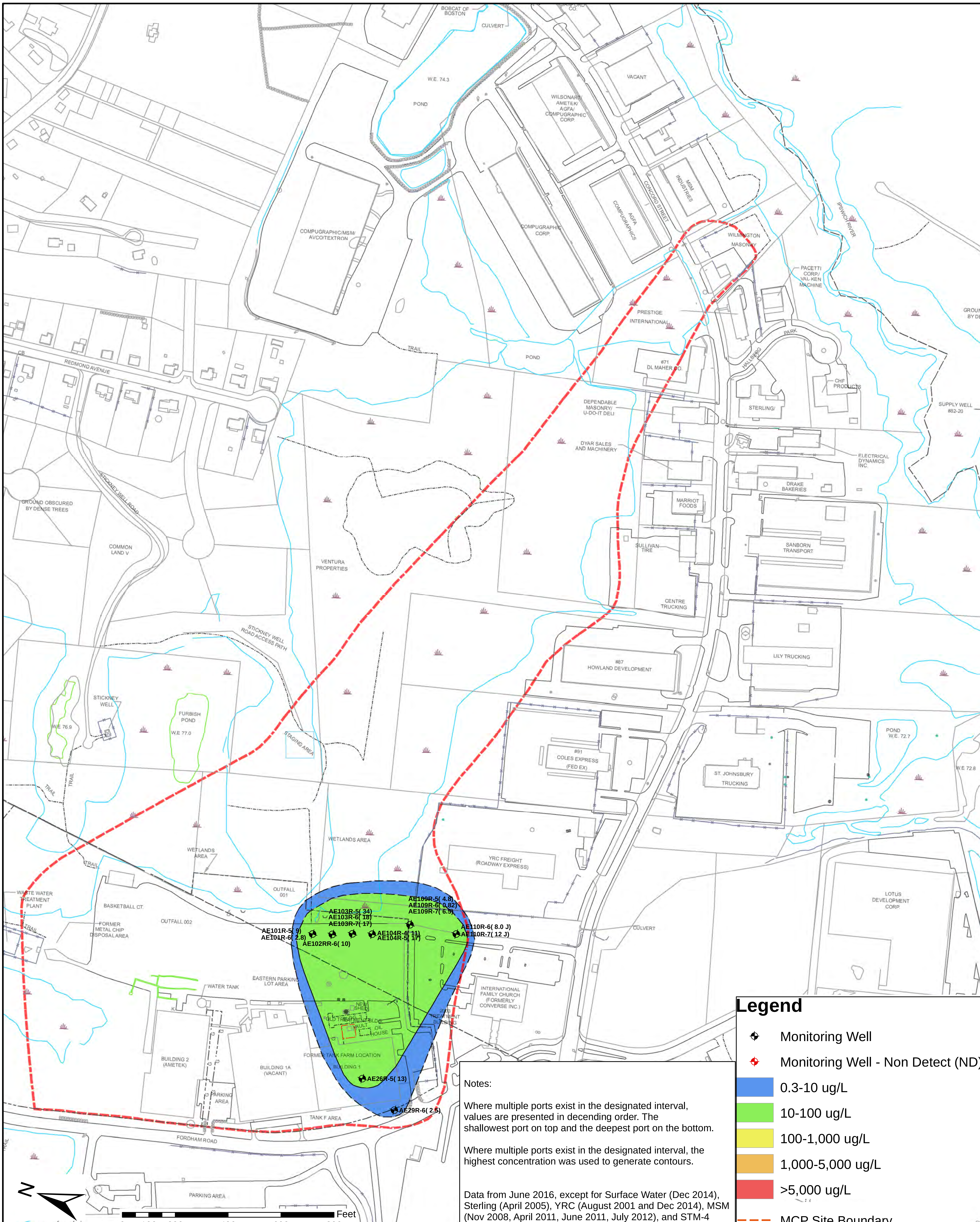

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

1,4-Dioxane in Groundwater
Lower Bedrock (121-232 ft bgs)

FIGURE: 3-14

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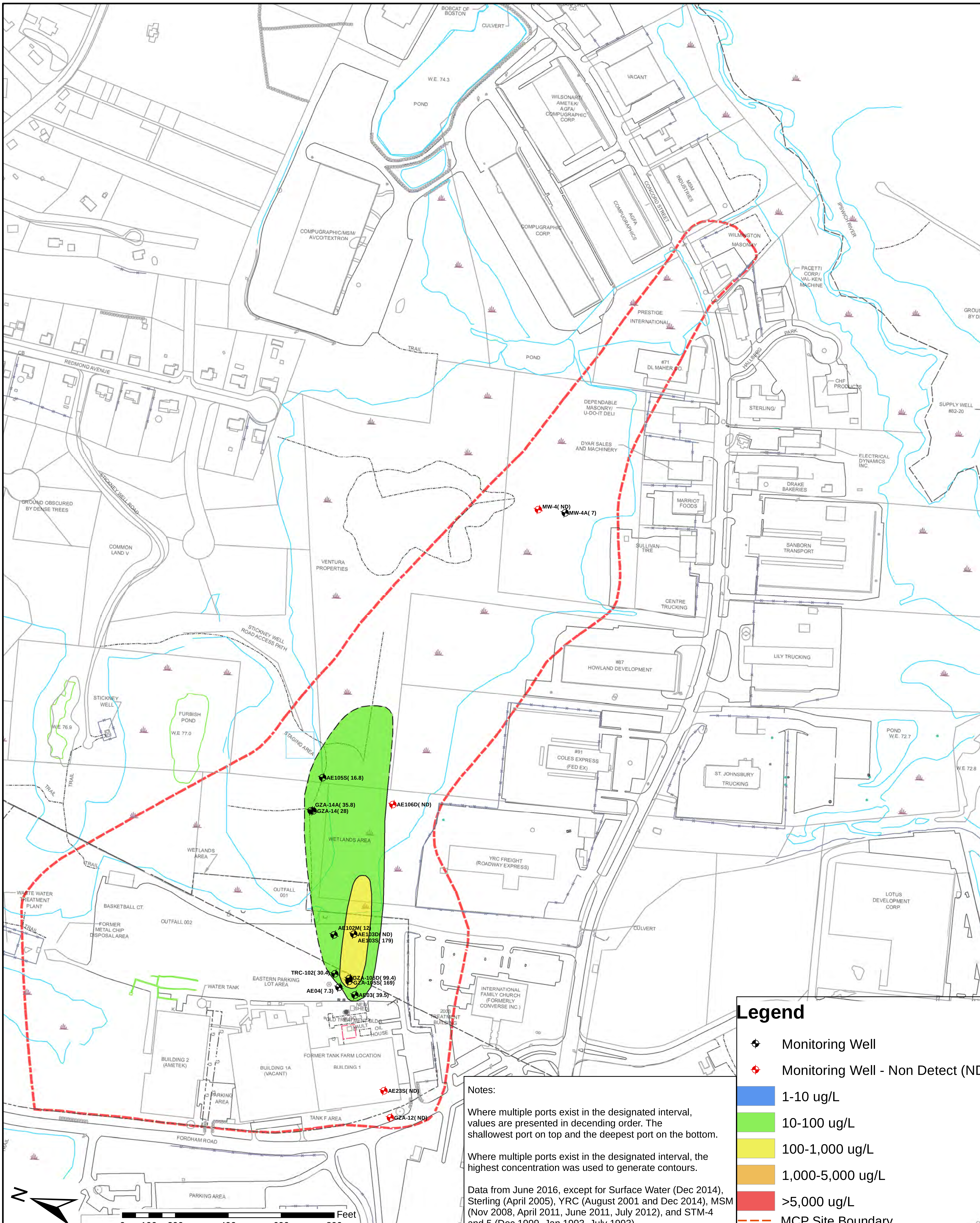

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

Dissolved Arsenic in Groundwater
Overburden (0-78 ft bgs)

FIGURE 3-15

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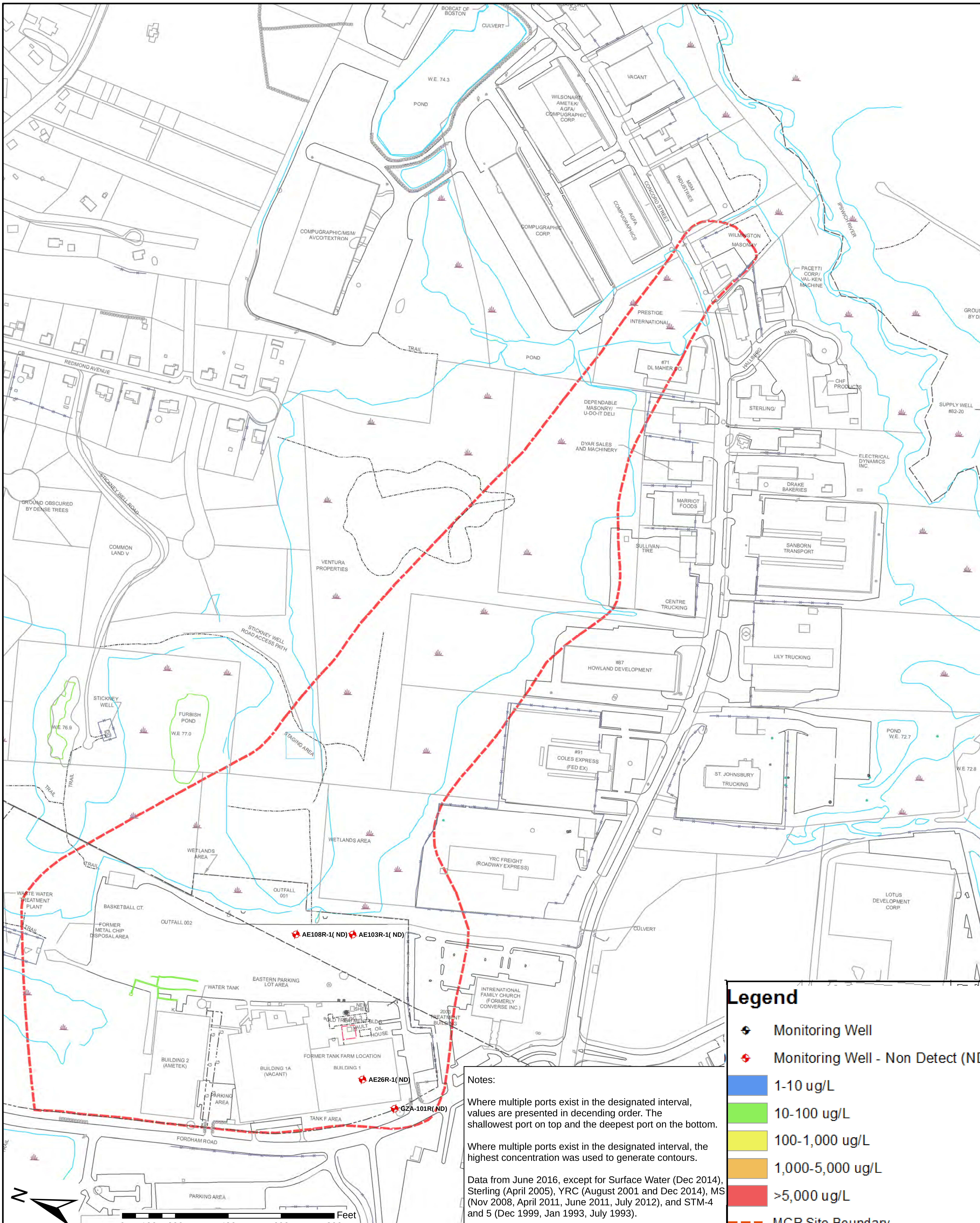


Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

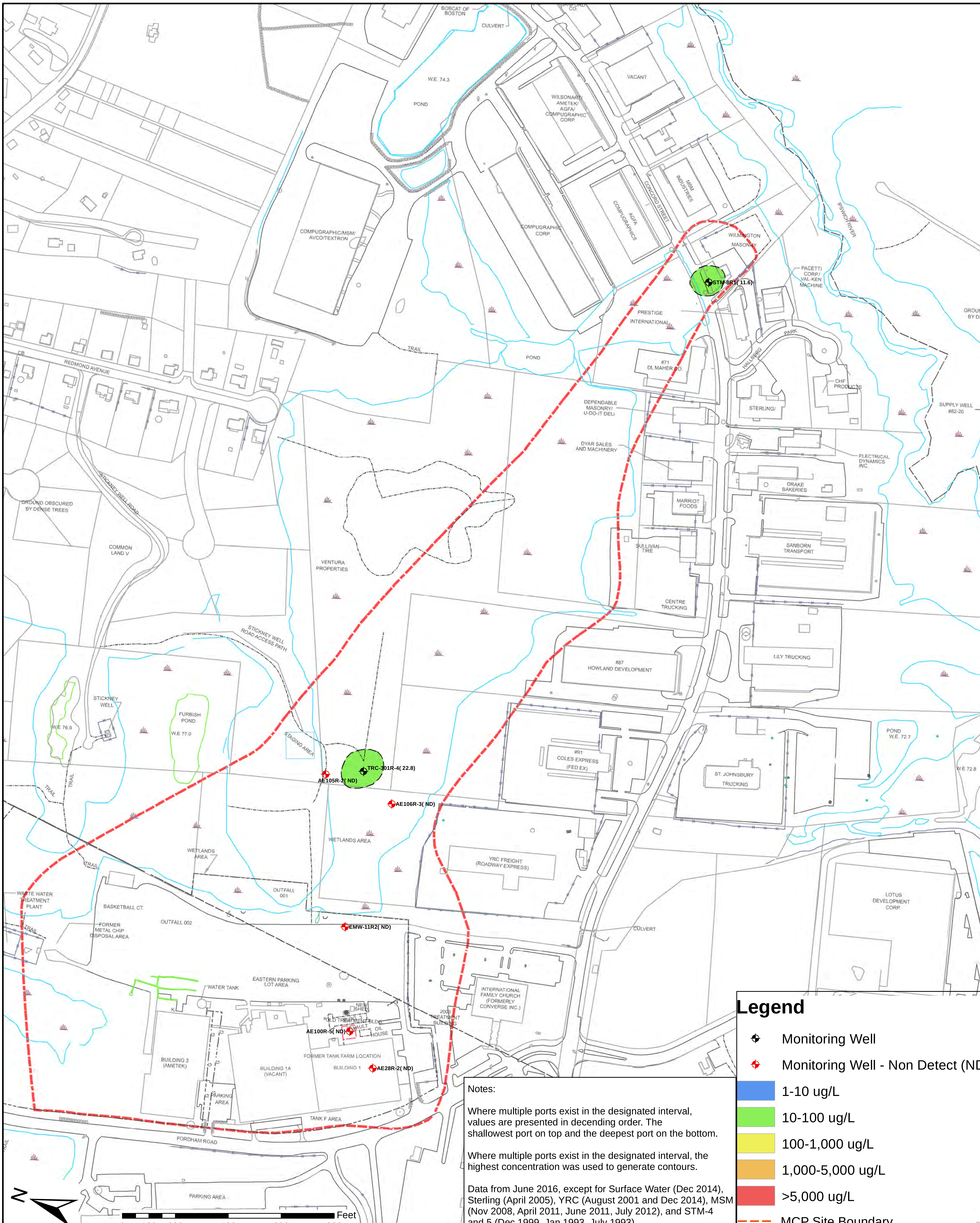
Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MS (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

Legend

- Monitoring Well
- Monitoring Well - Non Detect (ND)
- 1-10 ug/L
- 10-100 ug/L
- 100-1,000 ug/L
- 1,000-5,000 ug/L
- >5,000 ug/L
- MCP Site Boundary

AECOM	Former GE Facility 50 Fordham Road, Wilmington, MA	**Dissolved Arsenic in Groundwater** **Upper Bedrock (0-60 ft bgs)** **FIGURE: 3-16**

Path: \\USCHL1FP001\Data\Projects\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Report Figures\2016 Plume Figures\MXD\As_upper BR_2016.mxd



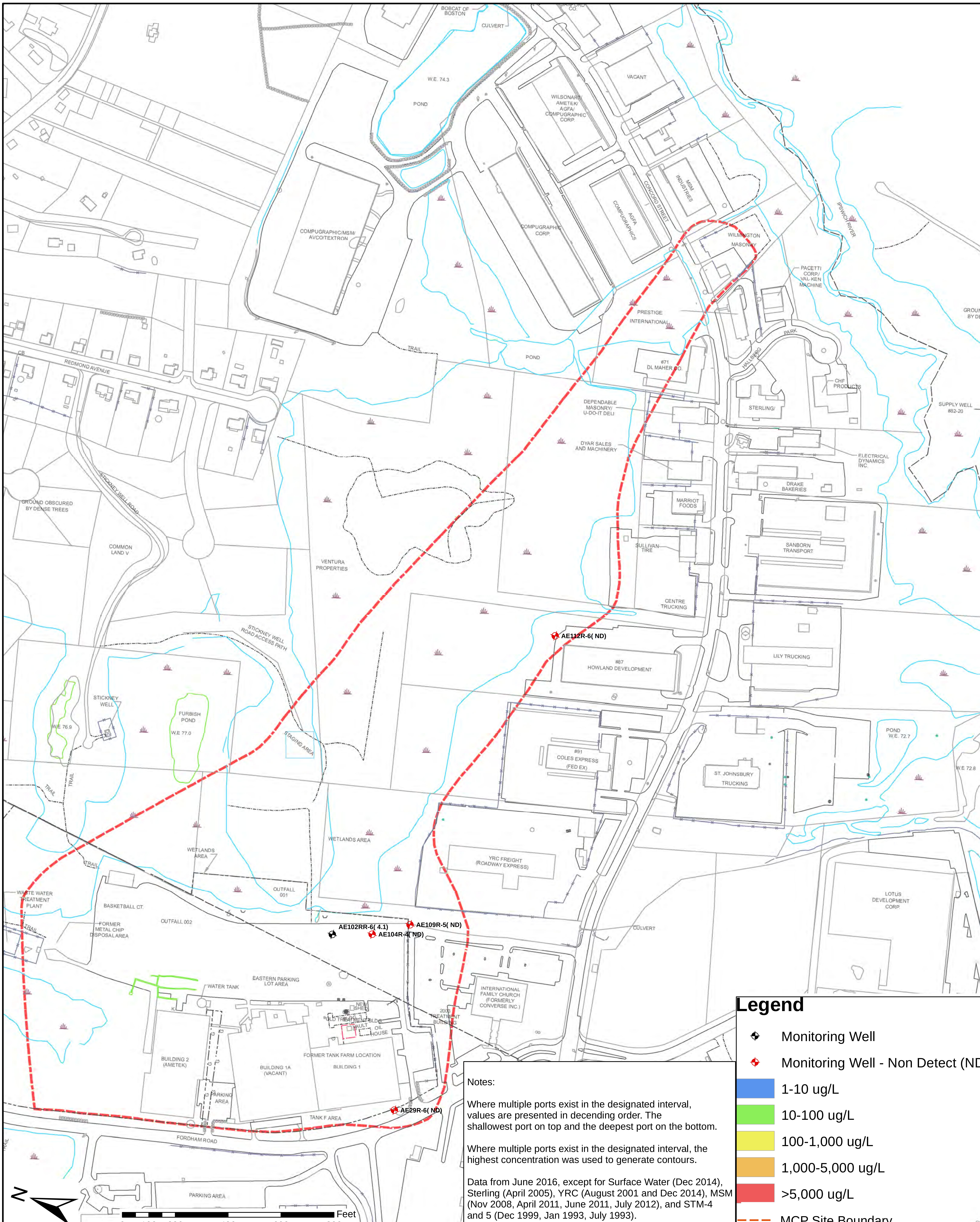
AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

Dissolved Arsenic in Middle Bedrock (61 - 120 ft bgs)

Figure 3-17

Path: P:\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Prelim Draft Phase II CSA\Report Figures\2016 Plume Figures\MXD\As_middle BR_2016.mxd



Legend

- Monitoring Well
- Monitoring Well - Non Detect (ND)
- 1-10 ug/L
- 10-100 ug/L
- 100-1,000 ug/L
- 1,000-5,000 ug/L
- >5,000 ug/L
- MCP Site Boundary

Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

Dissolved Arsenic in Groundwater
Lower Bedrock (121 - 232 ft bgs)

FIGURE: 3-18

Path: \\USCHL1FP001\Data\Projects\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Prelim Draft Phase II CSA\Report Figures\2016 Plume Figures\MXD\As_lower BR_2016.mxd

ANSI D 22" x 34"
Approved: A.T.
Checked: S.O.
Designer: K.P.B.
Project Management Initials:
Filename: P:\JOBS\REM_ENG\PROJECT FILES\LOCKHEED MARTIN\WILMINGTON, MA 2016-2017 WORK 60478638\CAD\PHASE III RAP REPORT - CAD\FIG 3-15 EASTERN PARKING LOT AREA GW EPH-VPH CONCS.DWG
Last saved by: BARRYK(2017-03-01) Last Plotted: 2017-03-01

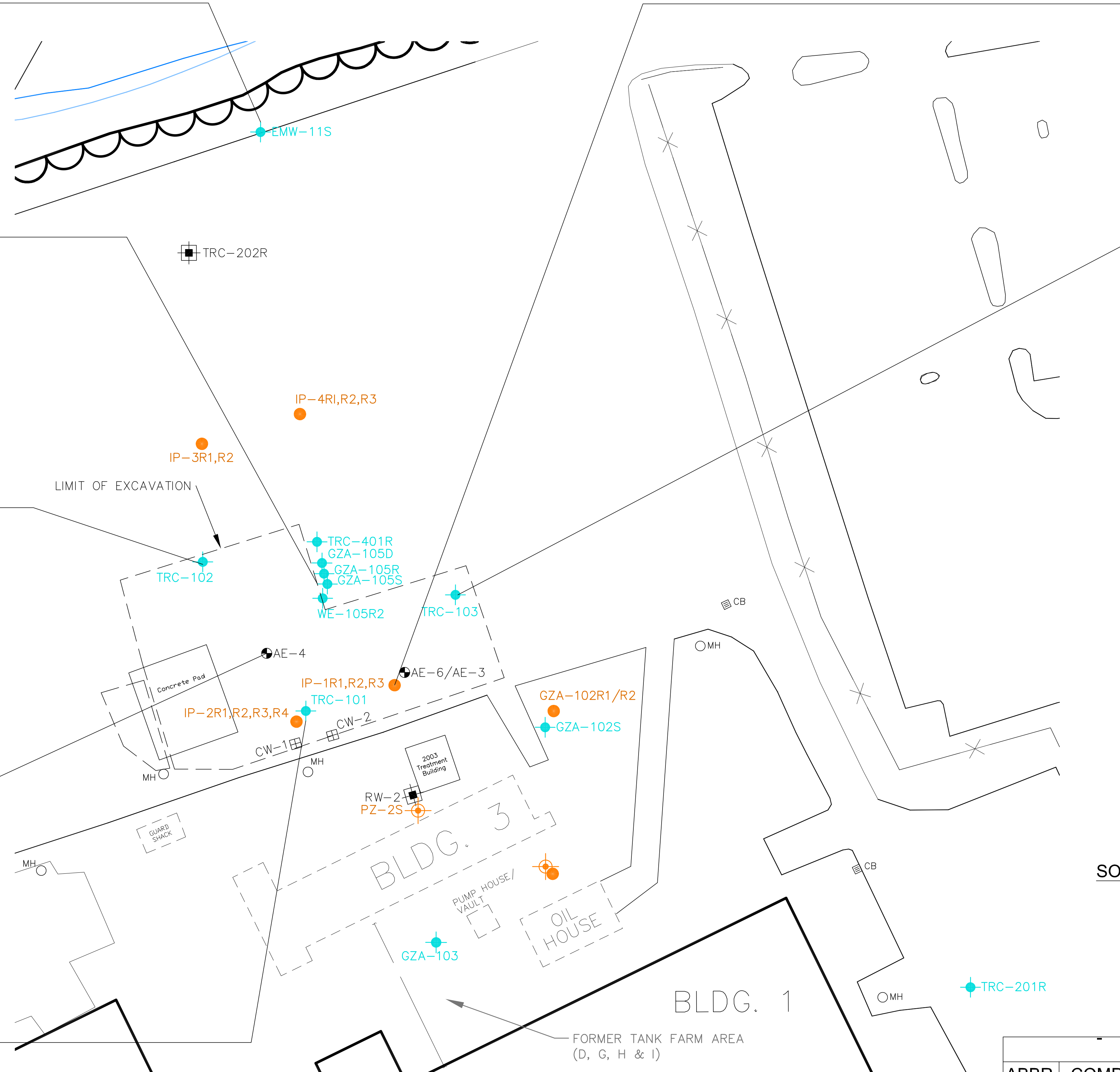
EMW-11S	Si 1-11	
UNITS mg/L	12/2000	09/2002
E1	<30	50
E2	<40	<40
E3	<85	<86
V1	<240	<240
V2	<70	<70
V3	<100	<100

GZA-105S	Si 4-14		
UNITS mg/L	09/2001	09/2005	11/2011
E1	98	61	138
E2	49	<44	<100
E3	<87	<93	<100
V1	<240	<200	<50
V2	310	170	162
V3	170	150	306

TRC-102	Si 2.25-12.25		
UNITS mg/L	09/2001	09/2004	11/2011
E1	66	37	ND
E2	66	37	<100
E3	<40	<40	<100
V1	<240	<200	<50
V2	230	<100	<50
V3	260	<100	102

AE-04	Si 3-13	
UNITS mg/L	09/2012	11/2012
E1	118	181
E2	ND	ND
E3	ND	ND
V1	ND	81.1
V2	137	156
V3	179	162

TRC-101	Si 1.5-10.5		
UNITS mg/L	12/2000	09/2002	09/2004
E1	<31	90	93
E2	<42	<42	<41
E3	<88	<89	<87
V1	<240	<240	<200
V2	1,900	3,200	2,000
V3	<100	2,000	<100



AE-03	Si 3-13	
UNITS mg/L	09/2012	11/2012
E1	165	206
E2	ND	ND
E3	ND	ND
V1	105	140
V2	376	359
V3	432	338

TRC-103	Si 1.25-11.25	
UNITS mg/L	12/2000	09/2003
E1	<31	44
E2	<42	<40
E3	<88	<86
V1	<240	<240
V2	98	74
V3	240	140

30 0 60
GRAPHIC SCALE IN FEET

NOTE:
ALL RESULTS SHOWN ARE IN ug/L(PPB)
VALUES SHADED IN YELLOW EXCEED GW-1 STANDARDS
All values below GW-2 and GW-3 standards

LEGEND

MONITORING WELL LOCATIONS
Si = SCREENED INTERVAL (FEET BELOW GRADE)
ND = NOT DETECTED

SOURCE:
1. TRC-101, TRC-102, TRC-103, GZA-105S, EMW-11S Groundwater Data from TRC Monitoring Program (2000 - 2011)
2. AE-3 and AE-4 Groundwater Data from Field Activity Summary Memorandum (AECOM, 2012)

		MCP GW STANDARDS		
ABBR.	COMPOUND	GW-1	GW-2	GW-3
E1	C9-C18 Aliphatics	700	5,000	50,000
E2	C19-C36 Aliphatics	14,000	NA	50,000
E3	C11-C22 Aromatics	200	50,000	5,000
V1	C5-C8 Aliphatics	300	3,000	50,000
V2	C9-C10 Aromatics	200	7,000	50,000
V3	C9-C18 Aliphatics	700	5,000	50,000

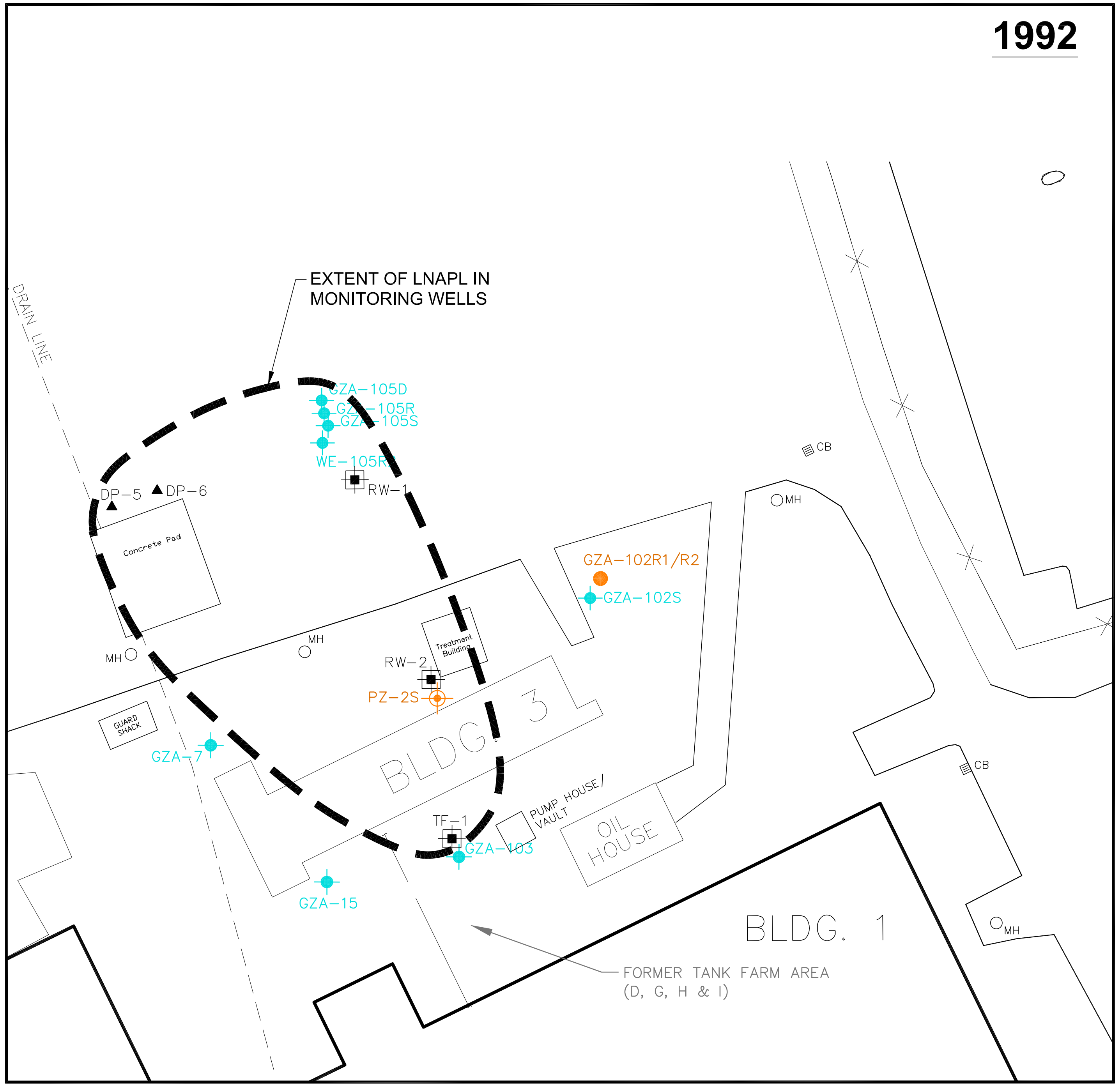
AECOM
FIGURE 3-19

EASTERN PARKING LOT AREA
GROUNDWATER EPH/VPH CONCENTRATIONS

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Lockheed Martin Corporation
60478638
2017-02

SOURCE:

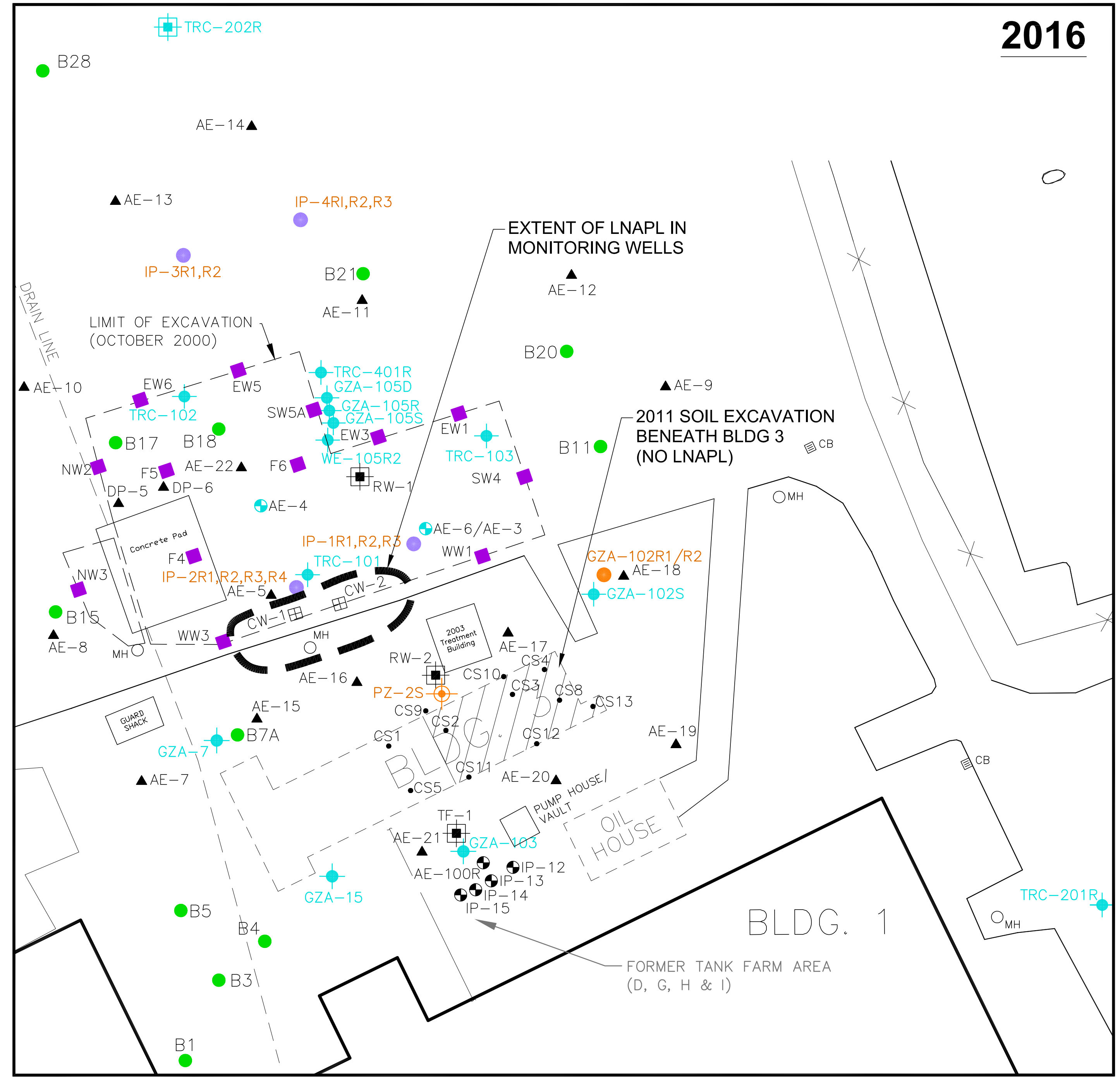
1. EPL Soil Borings (B1, B4, B11, B15, B17, B18, B21, B28) from Phase III RAP Addendum Report (TRC, March 2000)
2. Post Excavation Soil Samples (floor and side walls) and Confirmatory Soil Boring Samples (B7A, B20) from Phase IV As-Built Construction and Final Inspection Report (TRC, January 2001)
3. Building 3 Post Excavation Soil Samples (CS-1 through CS-5, CS-8 through CS-12) from RAM Completion Report (TetraTech, March 2012)
4. Eastern Parking Lot Soil Borings (AE-4 through AE-22, excluding AE-12, -13, -14) from Phase II Comprehensive Site Assesment (AECOM, 2017)



LEGEND

MONITORING WELL LOCATIONS

APPROXIMATE EXTENT OF LNAPL (TF-1, RW-1, RW-2, PZ-2S, GZA-105S, DP-5, DP-6) [APPROX. 19,574.3 SQ. FT.]



LEGEND

MONITORING WELL LOCATIONS

2012 SOIL BORING LOCATION

1999-2000 SOIL BORING LOCATION (APPROXIMATE)

2011 BUILDING 3 POST EXCAVATION SOIL SAMPLE LOCATION (APPROXIMATE)

2000 EPL POST EXCAVATION SOIL SAMPLE LOCATION (APPROXIMATE)

APPROXIMATE EXTENT OF LNAPL (CW-1, CW-2) [APPROX. 1,792.8 SQ. FT.]

30 0 60

GRAPHIC SCALE IN FEET

AECOM

FIGURE 3-20

TANK FARM - EPL
EXTENT OF LNAPL IMPACTS

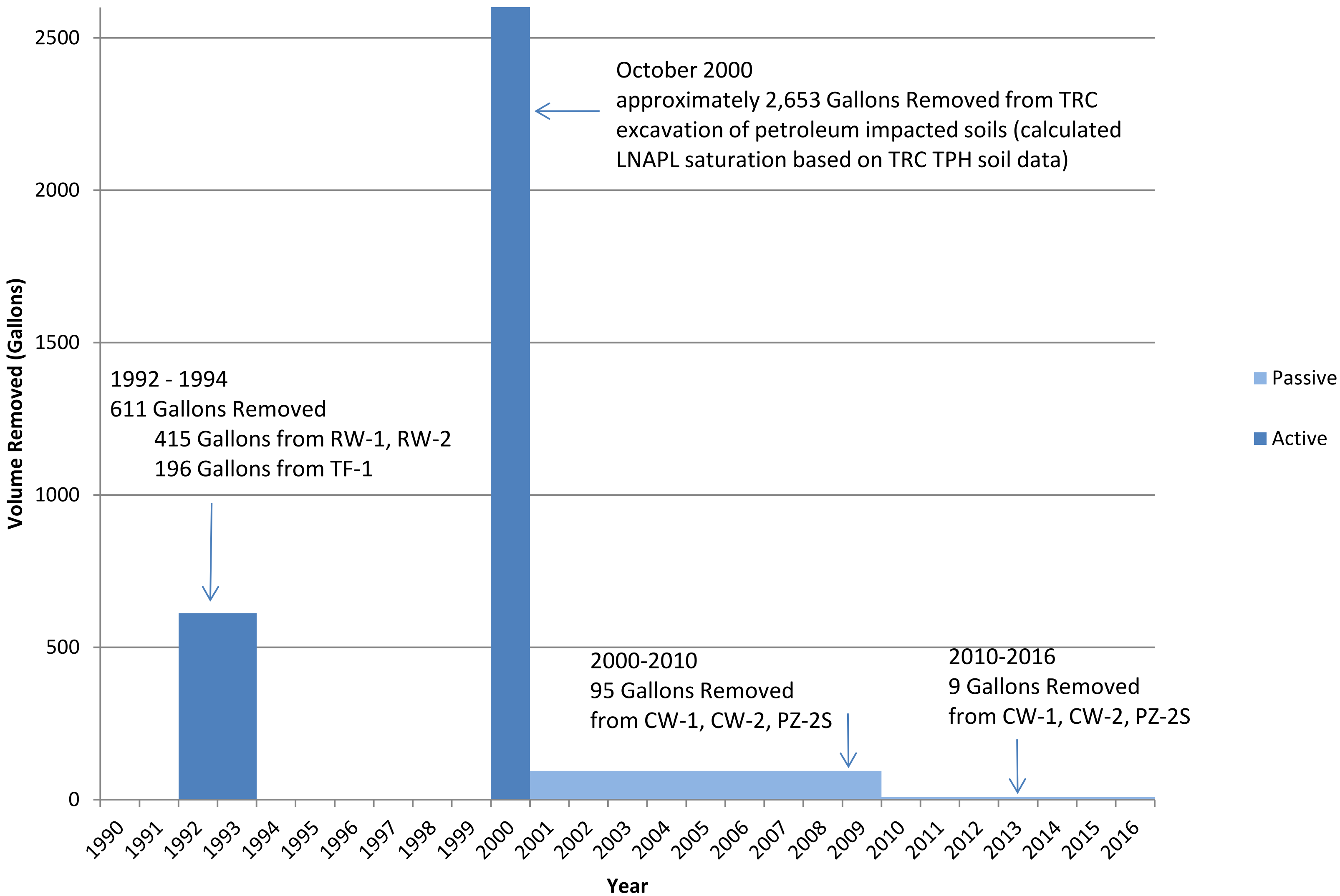
Former GE Facility - 50 Fordham Rd, Wilmington, MA
Lockheed Martin Corporation

2016-12-19

60478638

Last saved by: BARRYK(2017-03-02) Last Plotted: 2017-03-02
Filename: P:\JOBS\REM_ENG\PROJECT FILES\LOCKHEED MARTIN\WILMINGTON, MA 2016-2017 WORK 60478638\CAD\PHASE III RAP REPORT - CAD\FIG 3-16 TANK FARM - EPL EXTENT OF LNAPL IMPACTS.DWG

Project Management Initials: Designer:K.P.B. Checked:S.O. Approved:A.T. ANSI D 22" x 34"



AECOM

FIGURE: 3-21

LNAPL VOLUME REMOVED
FROM TANK FARM - EPL AREA

Former GE Facility, 50 Fordham Rd, Wilmington, MA
Lockheed Martin

60478638

TABLES

Table 2-1
Site Characterization History and Regulatory Timeline
Former GE Facility, 50 Fordham Road, Wilmington, MA

1968 - 70	Development of 50 Fordham Road property
1970	General Electric Company's (GE) Aerospace Instruments Control Systems enters facility
Dec-78	Town of North Reading tests the Stickney Well; Well is shut down
1986	Tank K removed
Jun-86	Massachusetts Department of Environmental Protection (MassDEP) (formerly Department of Environmental Quality Engineering) issues GE a Notice of Responsibility (NOR)
Sep-86	Phase I study
Jun-87	Tanks D, G, H, I, J, and a small tank adjacent to Tank F are removed.
Jun-87	Interim Phase II Site Investigation Report
Oct-87	MassDEP (Department of Environmental Quality Engineering) classifies the GE site as a Priority Disposal Site
Feb-90	Tank F removed
Apr-90	Phase II Investigation Report
Oct-91	MassDEP approves Tank Farm Area Interim Measure
Oct-91	Tank Farm Pump-and-Treat System Installed (TF-1) (operated ~1993-2002)
Nov-91	Phase II Supplemental Investigation Report
Dec-91	MassDEP approves Eastern Parking Lot Interim Measure
Dec-91	Public Health and Ecological Risk Characterization Report
1992	Interim Measure Remediation System Installed at the Tank Farm and Eastern Parking Lot - Groundwater treatment and product recovery (RW-1 and RW-2) (operated ~1992 - 1994)
Dec-92	Second Phase II Supplemental Investigation Report
Apr-93	Martin Marietta acquires GE Aerospace
Oct-93	Phase III Remedial Action Plan (RAP)
1994	Completion of product recovery operations in Eastern Parking Lot (no product in wells RW-1 & RW-2)
Oct. 28,1994	MassDEP classifies the site as Transition Tier IA site - Issues Permit #83052
Mar-95	Lockheed and Martin Marietta merge to form Lockheed Martin Corporation
Nov-95	MassDEP conditionally approves RAP soil and sediment remediation activities
Oct-96	MassDEP conditionally approves on-site groundwater remediation activities
Mar-97	MassDEP approves RAP modification to eliminate soil vapor extraction (SVE) and treatment in Tank Farm Area
Jul-97	Conditional approval from MassDEP to proceed with a modified long-term groundwater monitoring program
Jan-98	Wilmington Sediment Evaluation letter report
Feb-98	Letter Report presenting proposed change to the Phase III RAP
Mar-98	Request to change Tank K selected remedy from soil-vapor extraction to *in situ* chemical oxidation
Apr-98	Phase IV Remedy Implementation Plan (RIP) - Eastern Parking Lot and Tank K areas
Jun-98	MassDEP approves request for temporary solution based on technical impracticability and natural attenuation study
Aug-98	MassDEP approves change in selected remedy for Tank K Area pending pilot test results
Sep-98	Eastern Parking Lot Supplemental Investigation Report - Additional groundwater data for RIP
Feb-99	Groundwater Sampling Summary and Evaluation of Natural Attenuation Report
May-99	Tank K Chemical Oxidation Pilot Test letter report - Technology not able to achieve cleanup standards
Aug-99	Tier I Permit Extension Application Submittal 8/6/1999
Oct-99	Lockheed Martin Corporation contractually assigns environmental liability and Massachusetts Contingency Plan (MCP) response action responsibility to TRC Companies, Inc. (TRC)
Nov-99	MassDEP approves Supplemental Biosparging/SVE Pilot Test for Tank K Area
Nov-99	MassDEP approves Supplemental Soil Sampling in Eastern Parking Lot
Nov-99	MassDEP receives a petition to designate the site as a Public Involvement Plan (PIP) site
Jan-00	MassDEP grants the Tier I permit Extension and Transfer Application
Jan-00	Tank K Phase III Addendum Report - Biosparging/SVE Pilot Test Results
Feb-00	MassDEP comment letter regarding 1998-1999 reports on groundwater remediation
Jan. 24, 2000	Phase III RAP Addendum for Tank K Area
Mar. 16, 2000	Phase III RAP Addendum for Eastern Parking Lot
Jun. 9, 2000	Conditional approval from MassDEP of Phase III RAP for Eastern Parking Lot
Jun. 9, 2000	Conditional approval from MassDEP of Phase III RAP for Tank K Area
Jul. 7, 2000	Phase IV RIP for Eastern Parking Lot/Drum Storage Area
Jul. 25, 2000	Phase IV RIP for Tank K Area
Aug. 31, 2000	Conditional approval from MassDEP of Phase IV RIP for Eastern Parking Lot Area
Oct. 31, 2000	Conditional approval from MassDEP of Phase IV RIP for Tank K Area
Nov. 7, 2000	Complete Eastern Parking Lot area soil excavation and disposal
Nov. 17, 2000	Public Involvement Plan issued by MassDEP
Jan. 19, 2001	Phase IV As-Built and Final Inspection Report for Eastern Parking Lot/Drum Storage Area
Jan. 22, 2001	Eastern Parking Lot Interim Measure Completion Report
Feb. 2001	Tank K Biosparge/SVE System Startup
Mar. 20, 2001	Phase IV As-Built and Final Inspection Report for Tank K
Mar. 29, 2001	Conditional approval from MassDEP of Phase IV As-Built Final Inspection Report for Eastern Parking Lot
Mar. 29, 2001	Conditional approval from MassDEP of proposed work plan addendum for groundwater investigation
Mar.-Aug. 2001	Supplemental Groundwater Investigation
Jun. 11, 2001	Conditional approval from MassDEP of Phase IV As-Built Final Inspection Report for Tank K Area
Oct. 30, 2001	MassDEP approval of Comprehensive Review of Groundwater Data Report
Jan-02	Scope of Work—Stage II Environmental Risk Characterization for Outfalls 001 and 002
Feb. 2002	Tank Farm Pump-and-Treat System Decommissioned
Mar. 22, 2002	Phase III Remedial Action Plan Addendum for Groundwater

Table 2-1
Site Characterization History and Regulatory Timeline
Former GE Facility, 50 Fordham Road, Wilmington, MA

Jul-02	Tank Farm Interim Measure Completion Report
Jul. 12, 2002	Conditional approval from MassDEP of Phase III RAP Addendum for Groundwater
Aug. 16, 2002	Conditional approval from MassDEP of Stage II Environmental Risk Characterization Scope of Work
Nov-02	Phase IV Remedy Implementation Plan for Groundwater
Nov-02	Eastern Parking Lot Area Phase V Operations and Maintenance Report
Nov-02	Tank Farm Phase V Operations and Maintenance Report
Mar. 12, 2003	Conditional approval from MassDEP of Phase IV RIP for Groundwater
Mar. - Aug. 2003	Groundwater Pump-and-Treat System Installed—Start up in August 2003
Aug. 11, 2003	Revisions to the MCP; direct oversight no longer provided by MassDEP
Sept. 11, 2003	Phase IV As-Built and Final Inspection Report for Groundwater
Jan. 21, 2004	Part I—Stage II Environmental Risk Characterization and Part II—Phase IV RIP, Outfalls 001 and 002
Aug - Oct 2004	Remediation of Wetlands (Outfalls 001 and 002) August-September and Restoration in October 2004
Dec. 13, 2004	Phase IV As-Built Construction, Final Inspection Report & Partial (A-2) RAO for Outfalls 001 and 002
5-May-05	Release Abatement Measure (RAM) Plan—New Sewer Line System
Mar. 6, 2005	RAM Completion Report—New Sewer Line System
Apr. 20, 2006	Remedy Operation Status Opinion
Sep. & Nov. 2006	Emulsified zero valent iron injected into Open Boreholes at Tank Farm Area
Sep-07	Phase III RAP Addendum II for Groundwater
Sep-07	Modified Phase IV RIP for Groundwater
Sep-07	Phase IV As-Built Construction and Final Inspection Report for Groundwater
Oct-07	TRC Work Plan Evaluation of Emerging Chemicals and TICs in Groundwater
May-08	Work Plan—Vapor Intrusion Study
Jun-08	Groundwater Pump-and-Treat System Shutdown
Jun. 30, 2008	Tank K biosparge/SVE System Shutdown
Sep-08	TRC Work Plan Evaluation of Emerging Chemicals and TICs in Groundwater Addendum A
Jan.8, 2009	Notification to MassDEP of 120-day Reporting Condition for arsenic in groundwater above RCGW-1
Feb. 26, 2009	MassDEP issued Notice of Responsibility to Lockheed Martin and issued RTN 3-28282
Jul-09	Work Plan—Vapor Intrusion Study Addendum A
Oct. 28, 2009	Vapor Intrusion Sampling Report
12/1/2009	Final Status Report for Outfalls 001 and 002 Water Quality Certification (5-Year Post-Restoration Monitoring)
Jan. 8, 2010	Phase I Site Assessment Report, Completion Statement & Tier 1C Permit Application Release Tracking Number (RTN) 3-28282
Jul. 29, 2010	Vapor Intrusion Sampling Report
Nov. 9, 2010	Partial (A-2) RAO for the Tank K Area
6/1/2011	RAM Plan for Building 3 and Oil House Demolition and B3 Soil Excavation/Disposal
8/1/2011	RAM Plan Addendum Building 3 and Oil House Demolition and B3 Soil Excavation/Disposal
10/1/2011	RAM Status Report Building 3 and Oil House Demolition and B3 Soil Excavation/Disposal
Jan. 6, 2012	Tier 1 Permit Modification Transferring Environmental Liability from TRC to Lockheed Martin
Jan. 7, 2012	Interim Phase II Comprehensive Site Assessment for RTN 3-28282
Mar-12	RAM Completion Report Building 3 and Oil House Demolition and B3 Soil Excavation/Disposal
Mar. 30, 2012	RTN 3-28282 Linked to RTN 3-0518
Sep-12	Remedy Operation Status (ROS) Report
Mar. 13, 2013	Tier 1 Minor Permit Modification—Change Licensed Site Professional of Record
Mar. 27, 2013	ROS Termination and Tier 1 Permit Extension Application
Nov. 1, 2013	Supplemental Phase II Scope of Work with PIP Meeting and Comment Period
Mar-14	Joint Application for MassDEP 401 Water Quality Certification and United States Army Corps of Engineers (USACE) Massachusetts General Permit (Cat. II) Authorization under Clean Water Act (CWA) 404, and Notice of Intent to the North Reading Conservation Commission
March 25, 2014	Order of Conditions (OOC) #245 1468 issued by North Reading ConCom
April 22,2014	Order of Conditions #245 1468 recorded on April 22, 2014
Oct. 10, 2014	Tier Classification Extension Submittal to MassDEP
Nov. 20, 2014	Tier Classification Extension Approval from MassDEP
July 2015	Voluntary Activity and Use Limitation (AUL) entered into between Wilmington Realty Trust and Lockheed Martin
Aug. 26, 2015	Addendum to the November 1, 2013 Supplemental Phase II Scope of Work with PIP Meeting and Comment Period
September 25, 2015	Request to North Reading Conservation Commission for Certificate of Compliance to close out TRC wetland sediment remediation work under OOC 245-1029 conducted 2004-2009
November 12, 2015	Certificate of Compliance received from North Reading Conservation Commission for TRC wetland sediment work under OOC 245-1029 conducted between 2004 and 2009
July 20, 2016	Submittal of Groundwater Flow Study Work Plan (Plan for the application of remedial additives as part of ongoing Supplemental Phase II activities) to MassDEP with Bureau of Waste Site Cleanup form BWSC-108 transmittal (30 day presumptive approval)

Source:
Information listed 1968 through February 2000 taken from the Public Involvement Plan (PIP) (MassDEP 11/17/00).
Subsequent information compiled from site historical files provided by CDM, TRC, and the MassDEP website.
While this project timeline summary is detailed, it is not considered to be comprehensive.

Table 2-2
Summary of RTNs and Downgradient Property Status Filings Near 50 Fordham Road
Former GE Facility, 50 Fordham Rd, Wilmington, MA

Property	Address	City	Related RTNs	DPS Filed?	DPS File Date	Comments
23 Concord Realty Trust						
NO LOCATION AID	23 CONCORD ST	North Reading, MA	3-0016752	No	N/A	RAM Completion/Class A2 RAO (1999)
Taylor Oil Northeast / Hutt Trucking Company, Inc.						
EXIT 39 OFF I 93	35 CONCORD ST	North Reading, MA	3-0018713	No	N/A	Class A1 RAO (1999)
NO LOCATION AID	35 CONCORD ST	North Reading, MA	3-0022324	No	N/A	IRA Completion/Class A1 RAO (2003)
MSM Industries Site			RTN 3-0692			
MSM INDUSTRIES	60 CONCORD ST	North Reading, MA	3-0000692	No	N/A	Class C1 RAO (2013) (surface spills of TCA and TCE)
Wilmington Masonry						
NO LISTING	62 CONCORD ST	North Reading, MA	---	---	---	---
M&K Engineering, Inc.						
NO LOCATION AID	66 CONCORD ST	North Reading, MA	3-0015477	No	N/A	Class B1 RAO (2010) (TCE) "Paragon contacted Ms. Amy Vaija of DEP to discuss the current status of several properties near the Site. Ms. Vaija told Paragon that Sterling Supply Co. at 70 Concord St, across Hallberg Park from the Site, is a Tier IA site & currently is undergoing GW remediation for the presence of chlorinated compounds. Additionally, Ms. Valja told us that CHF Products at 5 Hallberg Park, ~150 feet south of the Site, is also a Tier IA site. Ms. Valja said that contamination from the former General Electric plant in Wilmington, ~0.4 miles NW of the Site, has been detected in monitoring wells on Concord St.
Sterling Site			RTN 3-2584			
STERLING SUPPLY CORP FMR	70 CONCORD ST	North Reading, MA	3-0002584	No	N/A	Pipe release CVOCs (1996); annual sampling by MassDEP (2015)
DL Maher						
D L MAHER CO	71 CONCORD ST	North Reading, MA	3-0000647	No	N/A	Class A-1 RAO (1995)
Yellow Freight / UPS Freight / Sanborn APA Terminal						
SANBORN APA TERMINAL	80 CONCORD ST	North Reading, MA	3-0001046	No	N/A	Waiver of Completion Transition Site (1988) (Diesel)
YELLOW FREIGHT SYSTEM INC.	80 CONCORD ST	North Reading, MA	3-0017390	No	N/A	Class A2 RAO (2009) (Diesel; naphthalene)
YELLOW FREIGHT SYSTEMS	80 CONCORD ST	North Reading, MA	3-0021535	No	N/A	RTN Closed and linked to 3-17390 (2002) (petroleum)
NO LOCATION AID	80 CONCORD ST	North Reading, MA	3-0022112	No	N/A	Class A1 RAO (2002) (Pyridine; drum release)
YELLOW FREIGHT SYSTEM	80 CONCORD ST	North Reading, MA	3-0023012	No	N/A	RTN Closed and linked to 3-17390 (2004) (diesel; vehicle release)
NO LOCATION AID	80 CONCORD ST	North Reading, MA	3-0023502	No	N/A	Class A-1 RAO (2004) (diesel fuel; pipe release)
UPS FREIGHT TERMINAL	80 CONCORD ST	North Reading, MA	3-0033103	No	N/A	Permanent Solution (2015) (diesel fuel)
Sullivan Tire, Centre Trucking (multiple entities sharing a property)						
NO LISTING	81 CONCORD ST	North Reading, MA	---	---	---	---
Lily Truck Leasing Corp						
LILY TRUCK LEASING CORP	84 CONCORD ST	North Reading, MA	3-0002276	No	N/A	Class A2 RAO (2002) (Petroleum NOS; dry wells/UST)
NO LOCATION AID	84 CONCORD ST	North Reading, MA	3-0028941			Class B1 RAO (2010) (diesel fuel; unknown oil; UST)
Howland Development			RTN 3-10722			
FORMERLY BARD MEDSYSTEMS NOW BAXTER	87 CONCORD ST	North Reading, MA	3-0010722	Yes	10/25/1995	Tetrachloroethene Release; DPS submittal (1995) "Both of the reports from the former GE site identify an upgradient source of contaminants that were also found on the 87 Concord St. property...it is the LSP's opinion that the low level of PCE detected at 87 Concord Street is due to the upgradient source of PCE found at the former GE site at 50 Fordham Road."
St. Johnsbury Trucking						
ST JOHNSBURY TRUCKING	90 CONCORD ST	North Reading, MA	3-0002277	No	N/A	Class A-2 RAO (1999)
NEW ENGLAND MOTOR FREIGHT	90 CONCORD ST	North Reading, MA	3-0018024	Yes	4/13/1999	Tetrachloroethene, offsite source of PCE; the Roadway disposal site boundary includes the NEMF property; MassDEP DPS approval states "TRC/Adler also concluded that the PCE contamination is most likely attributable to the Roadway Express site, located immediately upgradient at 95 Concord Street."
NEW ENGLAND MOTOR FREIGHT	90 CONCORD ST	North Reading, MA	3-0027006	No	N/A	Formaldehyde, Class A-1 RAO (2007)
NEW ENGLAND MOTOR FREIGHT	90 CONCORD ST	North Reading, MA	3-0028088	No	N/A	Styrene Resin, Class A-2 RAO (2008)
NEW ENGLAND MOTOR FREIGHT	90 CONCORD ST	North Reading, MA	3-0028858	No	N/A	Styrene, Class A-1 RAO (2009)
Central Transport (Federal Express; formerly Coles Express)						
NO LISTING	91 CONCORD ST	North Reading, MA	---	---	---	---
YRC Freight			RTN 3-2363			
YRC FREIGHT	95 CONCORD ROAD	North Reading, MA	3-0030907	No	N/A	Diesel Release - Class A-1 RAO (2012)
YRC INC. FORMERLY ROADWAY EXPRESS	95 CONCORD ST	North Reading, MA	3-0002363	No	N/A	ROS - GW recovery (2016)
NEAR LOADING DOCK	95 CONCORD ST	North Reading, MA	3-0012907	No	N/A	Polylite Laminating Resin Release - Class A-2 RAO (1996)
ROADWAY EXPRESS LOADING DOCK	95 CONCORD ST	North Reading, MA	3-0020647	No	N/A	Potassium Hydroxide Release - Class A-1 RAO (2001)
YRC FREIGHT	95 CONCORD ST	North Reading, MA	3-0030985	No	N/A	Diesel Release - Class A-1 RAO (2012)
YRC FREIGHT	95 CONCORD ST	North Reading, MA	3-0031080	No	N/A	Ammonia Release - Class A-1 RAO (2012)
YRC FREIGHT TRUCKING TERMINAL	95 CONCORD ST	North Reading, MA	3-0033079	No	N/A	Petroleum Naphtha Release - RAO - Permanent Solution (2015)
International Family Church (formerly Converse)			RTN 3-20467			
NO LOCATION AID	99 CONCORD ST (Listed on DEP as 1 Fordham Dr.)	North Reading, MA	3-0020467	Yes	2/8/2001	Tetrachloroethene, trichloroethene. MassDEP DPS approved DPS for the International Church Property. The DPS is based on the CVOC plume from the former GE Facility extending onto the wooded/wetland portion of the 99 Concord St property. The results of a limited Phase II investigation performed by ENSR International in 2001 near the Church building showed no indication that the plume from the former GE Facility has extended to this portion of hte property.
Melanson (private ownership, undeveloped land)						
NO LISTING	0 Furbish Pond Lane	North Reading, MA	---	---	---	---
Service Pumping & Drain, Inc.						
CHF PRODUCTS INC.	5 HALLBERG PARK	North Reading, MA	3-0002804	No	N/A	Perm. Solution (2014) (#2 fuel; UST)
NO LOCATION AID	5 HALLBERG PARK	North Reading, MA	3-0026178	Yes	8/2/2016	PCE (DPS in 8/2016); DPS - source: Sterling Supply Corporation release at 70 Concord Street (RTN 3-2584)
Fransen Corp.						
AT RIVER PARK DRIVE	CONCORD ST @ RT 93	North Reading, MA	3-0010393	No	N/A	RAO-D RAO - MassDEP Lead (1994) (Hydraulic Fluid/Oil; vehicle)
Lot 1, Riverpark 93						
NO LOCATION AID	RIVER PARK DR AND CONCORD ST	North Reading, MA	3-0016790	No	N/A	RAM Completion/Class A2 RAO (1998)
Riverpark/93, Spaulding & Slye						
ADJACENT PROPERTY	RIVERPARK OFF CONCORD ST	North Reading, MA	3-0002077	No	N/A	Class A2 RAO (1995) (PCBs)
Lotus Corporation						
LOTUS CORPORATION	400 RIVER PARK RD	North Reading, MA	3-0023553	No	N/A	Class A2 RAO (2004) (Hydraulic Fluid/Oil; pipe)

Notes:
CVOCs - chlorinated volatile organic compounds
DPS - Downgradient Property Status
GE - General Electric Company
GW - groundwater
IRA - interim remedial action
LSP - Licensed Site Professional
PCE - tetrachloroethene
MassDEP - Massachusetts Department of Environmental Protection
RAM - remedial action measures
RAO - remedial action outcome
ROS - Remedy Operation Status
RTN - Release Tracking Number
TCA - trichloroethane
TCE - trichloroethene
UST - underground storage tank

Table 3-1
Groundwater State & Federal Drinking Water Standards for Chemicals of Concern
Former GE Facility, 50 Fordham Rd, Wilmington, MA

Compound [(a)]	Fraction	Units	Massachusetts Drinking Water Standards [(b)]		National Primary Drinking Water Standards [(c)]		Groundwater EPC [(j)]
Metals							
Aluminum	T	µg/l	200	(g)	200	(g)	703
Arsenic	T	µg/l	10	(d)	10	(f)	287
Iron	T	µg/l	300	(g)	300	(g)	46,000
Manganese	T	µg/l	300	(e)	50	(g)	13,400
Semivolatile organic compounds							
1,4-Dioxane	T	µg/l	0.3	(e)	NA		34
Volatile organic compounds							
1,1-Dichloroethane	T	µg/l	70	(e)	NA		161
1,1-Dichloroethene	T	µg/l	7	(d)	7	(f)	32
cis-1,2-Dichloroethene	T	µg/l	70	(d)	70	(f)	1,380
Tetrachloroethene	T	µg/l	5	(d)	5	(f)	37,300
Trichloroethene	T	µg/l	5	(d)	5	(f)	110,000
Vinyl Chloride	T	µg/l	2	(d)	2	(f)	268
Volatile petroleum hydrocarbons							
C5-C8 Aliphatic Hydrocarbons	T	µg/l	300	(e)	NA		107,000
C9-C10 Aromatic Hydrocarbons	T	µg/l	200	(e)	NA		342
Toluene	T	µg/l	1,000	(d)	1,000	(f)	3,320

Notes:

µg/l = micrograms per liter.

NA = Not Available.

USEPA = United States Environmental Protection Agency.

EPC = Exposure Point Concentration.

T = Total.

(a) Only compounds identified as chemicals of concern (COC) in sitewide groundwater (all depths) are shown.

(b) MassDEP. Spring 2016 Standards and Guidelines for Contaminants in Massachusetts Drinking Waters. 2016. (http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/standards-and-guidelines-for-drinking-water-contaminants.html).
Bold values exceed the Massachusetts Drinking Water Standard.

(c) USEPA Maximum Contaminant Level. Accessed October 2016. (http://water.epa.gov/drink/contaminants/index.cfm).
Highlighted values exceed the National Primary Drinking Water Standards.

(d) Massachusetts Maximum Contaminant Level (MMCL).

(e) Massachusetts Drinking Water Guideline (ORSG).

(f) USEPA Maximum Contaminant Level (MCL).

(g) Secondary Maximum Contaminant Level (SMCL).

(h) Action Level.

(i) Where total xylenes were not reported by the laboratory, total xylenes concentrations were calculated per sample prior to calculating exposure point concentrations (EPCs) by summing only the detected individual xylene (i.e., o-xylene and m,p-xylene) concentrations. For samples without any detection of individual xylenes, the maximum reporting detection limit within the sample was used as a non-detect value.

(j) For chemicals identified as COC via multiple method groups (i.e., 1,4-dioxane, benzene, ethylbenzene, methyl tert-butyl ether, naphthalene, toluene, and total xylenes), the maximum of the EPCs per method analyte group was selected for quantitative evaluation in the Human Health Risk Assessment.

(k) Value for benzo(a)pyrene used.

(l) USEPA Maximum Contaminant Level Goal (MCLG).

Table 4-1
Initial Screening of Remedial Technologies
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Media	Technology Category	Description	Advantages	Disadvantages	Feasibility (Ability to achieve Permanent Solution or No Significant Risk)	Status for Alternative Development
Groundwater Description: - Groundwater to the east of the Building 1 and Tank Farm Area, in both source area and downgradient plume - CVOCs and 1,4-dioxane detected in overburden and bedrock groundwater; arsenic detected primarily in overburden aquifer - Groundwater contributes to impacts detected in soil gas under Building 1 area and groundwater contamination extends beneath wetland downgradient	**Containment**	**Engineered Vertical Barrier—** Geotechnical method to isolate source areas and prevent migration of contaminants. Methods include sheet pile walls and bentonite slurry walls.	- Proven technology - Effective in over burden	- Neither effective nor practical in bedrock - Does not reduce mass, volume, or toxicity	Technology is available but would not achieve a permanent solution.	Not Retained
		Hydraulic Containment with *Ex Situ* Treatment—Impacted groundwater is pumped from the subsurface to confine the movement of contaminated groundwater. Extracted groundwater is treated above ground.	- Proven technology - Effective in overburden and in some bedrock environments; partial hydraulic containment would be achieved - Generally a low degree of difficulty to implement	- Would not be effective at removing source material and restoring aquifer to GW-1 standards - Implementation of this technology would be challenging given knowledge of site bedrock conductivity and pumping yield - High long term O&M costs - Generates multiple waste streams requiring treatment (groundwater, air emissions).	Technology is available but would be unlikely to achieve a permanent solution.	Retained
	Treatment	***In Situ* Biological Treatment—**Technology that reduces contaminant mass by microbial degradation via enhancement of natural bacteria or supplementation of microbes by direct application to the subsurface	- Enhances existing processes - Effective for CVOCs	- The area over which the groundwater impacts are observed is extensive; it would be impractical to treat all known source material - Limited treatment capabilities with 1,4-dioxane and arsenic - Arsenic potentially mobilized further under reducing conditions - Delivery/injection system is highly critical for complete distribution of amendments -Relatively long timeframe to achieve mass reduction in COC	Technology is available; unlikely to achieve a permanent solution; may reach a level of no significant risk in conjunction with another technology.	Retained
		***In Situ* Chemical Treatment—**Technology that enhances contaminant treatment via direct application of chemicals to the subsurface	- Enhances existing processes - Effective for CVOCs and 1,4-dioxane	- The area over which the groundwater impacts are observed is extensive; it would be impractical to treat all known source material - Limited capabilities with arsenic; Arsenic potentially mobilized further under reducing conditions - Requires direct contact between reagents and contaminant; delivery/injection system is highly critical for complete distribution of reagents - Sufficient distribution within bedrock has a low chance of success.	Technology is available; unlikely to achieve a permanent solution; may reach a level of no significant risk in conjunction with another technology.	Retained
		In Situ* Thermal Treatment—in situ* thermal remediation generates heat *in situ* or applies heat directly to the subsurface, raising the temperature to above the boiling point of the target VOC contaminant and evaporating VOCs from the soil. Vapors are collected from the subsurface through soil vapor extraction wells for above ground treatment	- Demonstrated in specific fractured rock environment, albeit sedimentary rather than crystalline - Short implementation and treatment timeframe	- High energy cost - Would face implementation challenges within site bedrock; generally, limited successful implementation in bedrock - The area over which the groundwater impacts are observed is extensive; it would be impractical to treat all known source material	Technology is available but would not reasonably achieve a permanent solution; achieving and maintaining required temperatures in bedrock would be impractical	Not Retained
	Activity and Use Limitation	Non-physical means of controlling risk factors associated with site specific migration and exposure pathways. Goal of AUL is to control activities for which human and/or ecological risks are greater than CMR.	This alternative is already in place to address existing LNAPL.	An AUL cannot be used to restrict groundwater use in Massachusetts. Does not reduce mass, volume, or toxicity	Will not achieve a permanent solution with or without another technology.	Not Retained
	Monitored Natural Attenuation	MNA relies on natural processes, including advection, dispersion, diffusion, biodegradation, and abiotic transformation to attenuate contaminant concentrations	- Proven technology - Low degree of difficulty to implement '- Low to moderate annual costs associated with OMM	- Long timeframe required to reach treatment goals - May require initial stimulation of microbial community.	Technology is available and may achieve a temporary solution in conjunction with another technology, but not a permanent solution.	Retained

Table 4-1
Initial Screening of Remedial Technologies
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Media	Technology Category	Description	Advantages	Disadvantages	Feasibility (Ability to achieve Permanent Solution or No Significant Risk)	Status for Alternative Development
LNAPL	**Recovery**	**Free Product Recovery and Disposal—**Use of a passive system to extract LNAPL from the oil/water interface over time.	- Low degree of difficulty to implement - Proven technology	- Only removes NAPL that is mobile and flows through recovery wells - Will not address residual NAPL - Potentially long term O&M - Moderate OMM costs	Potentially likely to achieve a permanent solution in conjunction with another technology or AUL	Retained (passive system)
Description: - LNAPL detected in the area between Buildings 1 and 3; - LNAPL in overburden soils and shallow groundwater; potentially located within shallow soil/upper bedrock fractures	**Activity and Use Limitation**	Non-physical means of controlling risk factors associated with site specific migration and exposure pathways. Goal of AUL is to control activities for which human and/or ecological risks are greater than CMR.	This alternative is already in place to address existing LNAPL; may be required in addition to remediation depending on future site use and selected remedy.	Does not reduce mass, volume, or toxicity	Reasonably likely to achieve a permanent solution in conjunction with another technology but not alone.	Retained
	Treatment	***In Situ* Chemical Treatment**—Technology that destroys the contaminant via direct application to the subsurface of a strong oxidant ***In Situ* Biological Treatmen**t - Technology that uses microbes (native or exogenous) and other nutrient amendments to degrade contaminants of concern *in situ*	- Enhances existing processes - Effective for CVOCs and petroleum hydrocarbons	- Neither approach very effective on NAPL - Delivery/injection system is highly critical for complete distribution of amendments -Relatively long timeframe to achieve mass reduction in COC - Moderate to high OMM costs	Technology is available and may achieve a permanent solution.	Not Retained
		Air Sparge/Soil-Vapor Extraction—Strips VOCs from groundwater through the addition of air below the treatment zone and can enhance aerobic biodegradation by injecting air and providing an oxygen source	- Enhances existing processes - Effective for CVOCs and petroleum hydrocarbons - Effective for residual concentrations	- Potential increase in risk of indoor air exposure due to proximity to building - Moderate OMM costs - May be challenging if NAPL impacts extend into bedrock	Technology is available but would not reasonably achieve a permanent solution.	Not Retained
	Monitored Natural Attenuation	MNA relies of natural processes, including dissolution, biodegradation, and dispersion to attenuate LNAPL and contaminant concentrations	- Proven technology - Low degree of difficulty to implement	- Long timeframe required to reach treatment goals - Low annual costs associated with OMM	Technology is available and may achieve a permanent solution in conjunction with another technology.	Retained

Notes;
AUL=Activity and Use Limitation
CMR=Code of Massachusetts Regulations
COC=chemicals of concern
CVOCs=chlorinated volatile organic compounds
MassDEP=Massachusetts Department of Environmental Protection
MNA=monitored natural attenuation
NAPL=nonaqueous phase liquid
O&M=operations and maintenance
OMM=operations, monitoring and maintenance
VOCs=volatile organic compounds

Table 5-1
Detailed Evaluation of Remedial Action Alternatives - Site Groundwater
Former GE Facility, 50 Fordham Rd, Wilmington, MA

		Remedial Action Alternatives - Site Groundwater			
		Hydraulic Containment	**Treatment: *In Situ* Biological Treatment**	**Treatment: *In Situ* Chemical Treatment**	**Monitored Natural Attenuation**
1	**Effectiveness**				
a)	Achieving a Permanent or Temporary Solution	- Low likelihood of achieving a Permanent Solution; could assist in a Temporary Solution	- Low likelihood of achieving a Permanent Solution; could assist in a Temporary Solution	- Low likelihood of achieving a Permanent Solution; could assist in a Temporary Solution	- Low likelihood of achieving a Permanent Solution; could assist in a Temporary Solution
b)	Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	- Alternative will not significantly contribute to the destruction of residual OHM as containment merely minimizes transport	- Alternative may contribute to the destruction of residual OHM if applied within source area	- Alternative may contribute to the destruction of residual OHM if applied within source area	- Alternative does not actively treat COC; solution relies on natural attenuation processes to decrease COC concentrations over time
c)	Achieving or Approaching Background Concentrations	- Low likelihood of achieving background concentrations within bedrock, however can be effective in reduction in mass	- Low likelihood of achieving background concentrations within bedrock, however can be effective in reduction in mass	- Low likelihood of achieving background concentrations within bedrock, however can be effective in reduction in mass	- Low likelihood of achieving background concentrations within bedrock, however can be effective in reduction in mass
	Effectiveness Rating	**Poor**	**Fair**	**Fair**	**Fair**
	Effectiveness Score	**1**	**2**	**2**	**2**
2	**Reliability**				
a)	Certainty of Success	- Reasonably high probability of success for containment of groundwater near source area; low probability of success with downgradient plume of CVOCs, 1,4-dioxane and arsenic	- Moderate probability of success for treatment of CVOCs in general; low probability of success with 1,4-dioxane and arsenic due to reducing conditions needed for CVOC treatment; challenges with heterogeneous bedrock fracture distribution	- Moderate probability of success for treatment of CVOCs and 1,4-dioxane in general, though rebound would be expected; some probability of success with arsenic; challenges with heterogeneous bedrock fracture distribution	- Phase II assessment indicates some capacity of site for biological and abiotic MNA; physical MNA processes (advection, dispersion, and diffusion) well in place
b)	Effectiveness of Measures to Manage Residuals or Control Emissions/Discharges	- Significant discharges and emissions generated from this alternative; Low probability of effectiveness of discharge control due to 1,4 dioxane and arsenic presence, as well as likely high levels of iron requiring treatment for discharge	- *In situ* treatment so no water discharge or air emissions are generated from this alternative; residuals of incomplete treatment may include more toxic vinyl chloride	- *In situ* treatment so no water discharge or air emissions are generated from this alternative; residuals of treatment by ISCO may include mobilization of dissolved metals, e.g., chromium	- No air emissions or residuals generated from this process that would require management
	Reliability Rating	**Poor**	**Fair**	**Fair**	**Good**
	Reliability Score	**1**	**2**	**2**	**3**
3	**Implementability**				
a)	Technical Complexity	- Moderate complexity in terms of design testing and installation/construction of the pump and treat system	- High technical complexity associated with delivery and contact of amendments with groundwater in bedrock	- High technical complexity associated with delivery and contact of amendments with groundwater in bedrock	- Low; Includes installation of monitoring points and performance of long-term monitoring testing and data interpretation with possibility of continued updates of site modeling
b)	Integration with Facility Operations	- High; interruption of facility operations during installation; system works and discharge will need to be interfaced with tenant operations	- High; interruption of facility operations during installation, amendment application, and monitoring	- High; interruption of facility operations during installation, amendment application, and monitoring	- Low; Very minor interruptions of facility operations during annual sampling and installation of any additional monitoring points
c)	Monitoring, O&M or Site Access Requirements/Limitations	- Monitoring of groundwater will be required, as will continuous operation of the containment system. Access available but constraints will likely be imposed such as any access to wetland areas; Access required for periodic monitoring; most already in place but will require renewals	- Multiple rounds of injections may be required to achieve goals; Access required for periodic monitoring; most already in place but will require renewals	- Multiple rounds of injections may be required to achieve goals; Access required for periodic monitoring; most already in place but will require renewals	- Access required for periodic monitoring; most already in place but will require renewals
d)	Availability of Services, Materials, Equipment, or Specialists	- Readily available though discharge treatment equipment for arsenic and 1,4-dioxane may require special procurement	- Readily Available	- Readily Available	- Readily Available

Table 5-1
Detailed Evaluation of Remedial Action Alternatives - Site Groundwater
Former GE Facility, 50 Fordham Rd, Wilmington, MA

		Remedial Action Alternatives - Site Groundwater			
		Hydraulic Containment	Treatment: *In Situ* Biological Treatment	Treatment: *In Situ* Chemical Treatment	Monitored Natural Attenuation
3	**Implementability (continued)**				
e)	Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	- System discharges will potentially require disposal of wastes; facilities available	- Minimally needed for wastes during monitoring	- Minimally needed for wastes during monitoring	- Minimally needed for wastes during monitoring
f)	Permits	High need for construction and discharge of treated water	- Remedial additive injection permit required	-Remedial additive injection permit required	- No permits required
	Implementability Rating	**Poor**	**Fair**	**Fair**	**Very Good**
	Implementability Score	**1**	**2**	**2**	**4**
4	**Cost**				
a)	Cost of Implementation	- High	- Moderate for EPL area; if downgradient plume is added then High	- Moderate for EPL area; if downgradient plume is added then High	- Low
b)	Cost of Environmental Restoration and Potential Damages to Natural Resources	- None anticipated for EPL area	- None anticipated for EPL area	- None anticipated for EPL area	- None anticipated
c)	Cost of Energy Consumption	- Moderate	- Low	- Low	- Low
d)	Estimated Cost	$26.1MM	$10.5MM	$11.2MM	$5.4MM
	Cost Rating	**Poor**	**Fair**	**Fair**	**Good**
	Cost Score	**1**	**2**	**2**	**3**
5	**Risk**				
a)	Risk during Implementation	- Moderate short-term risk to workers during installation of extraction wells and treatment works	- Moderate medium-term risk to workers during installation of injection and extraction wells and during injections	- Moderate medium-term risk to workers during installation of injection and extraction wells and during injections	- Low short-term to workers during groundwater monitoring
b)	Risk during Operations	- Low potential risk to workers to operate treatment system and monitor groundwater	- Low potential risk to workers to perform treatment injections and monitor groundwater	- Moderate risk to workers during handling and injections of chemicals and transport of chemicals to site; Low potential risk to workers to monitor groundwater	- Low risk during monitoring
c)	Risk associated with Remaining Oil and Hazardous Materials	- Risks to human health from ingestion of drinking water will still exist following implementation of this approach	- No significant risk to safety, public welfare, or the environment once concentrations are below UCLs; risk to ingestion of drinking water will likely remain until reduction below MCLs	- No significant risk to safety, public welfare, or the environment once concentrations are below UCLs; risk to ingestion of drinking water will likely remain until reduction below MCLs	- No significant risk to safety, public welfare, or the environment once concentrations are below UCLs; risk to ingestion of drinking water will likely remain until reduction below MCLs
	Risk Rating	**Fair**	**Fair**	**Fair**	**Fair**
	Risk Score	**2**	**2**	**2**	**2**
6	**Benefits**				
a)	Restores Natural Resources	- No Impact on natural resources	- No Impact on natural resources	- No Impact on natural resources	- No Impact on natural resources
b)	Achieves Productive Reuse of Site	- Continued commercial/industrial use of site	- Continued commercial/industrial use of site	- Continued commercial/industrial use of site	- Continued commercial/industrial use of site
c)	Avoids Lost Value of Site	- Could potentially increase the value of the site if effective in bedrock - Generally no lost value	- Could potentially increase the value of the site if effective in bedrock - Generally no lost value	- Could potentially increase the value of the site if effective in bedrock - Generally no lost value	- Could potentially increase the value of the site if effective in bedrock - Generally no lost value
	Benefits Rating	**Fair**	**Fair**	**Fair**	**Fair**
	Benefits Score	**2**	**2**	**2**	**2**

Table 5-1
Detailed Evaluation of Remedial Action Alternatives - Site Groundwater
Former GE Facility, 50 Fordham Rd, Wilmington, MA

		Remedial Action Alternatives - Site Groundwater			
		Hydraulic Containment	Treatment: *In Situ* Biological Treatment	Treatment: *In Situ* Chemical Treatment	Monitored Natural Attenuation
7	**Timeliness**				
a)	Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	- Will never achieve a level of No Significant Risk alone	- Could reduce EPL area concentrations below UCLs in approximately 2 to 4 years - Will not achieve a level of No Significant Risk in reasonable timeframe within bedrock	- Could reduce EPL area concentrations below UCLs in approximately 2 to 4 years - Will not achieve a level of No Significant Risk in reasonable timeframe within bedrock	- Will not achieve a level of No Significant Risk in reasonable timeframe within bedrock
	Timeliness Rating	**Poor**	**Fair**	**Fair**	**Poor**
	Timeliness Score	**1**	**2**	**2**	**1**
8	**Non-Pecuniary**				
a)	Aesthetics	- Some changes to Site, including expanded treatment shed to house treatment works	- Some change to site as treatment would be episodic with no long-term structures remaining	- Some change to Site as treatment would be episodic with no long-term structures remaining	- No change to site
b)	Community Acceptance	- Good	- Good	- Good	- Possible view of "do nothing" may be negative
	Non-Pecuniary Rating	**Fair**	**Good**	**Good**	**Fair**
	Non-Pecuniary Score	**2**	**3**	**3**	**2**
9	**Sustainability**				
a)	Eliminates or reduces to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials, consumption, and ecosystem impacts through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection	- Alternative involves significant equipment production, delivery, installation, labor and resources such as power, etc.	- Alternative requires only episodic delivery of resources and materials, some of which require energy and resources for production	- Alternative requires only episodic delivery of resources and materials, some of which require energy and resources for production	- Highly sustainable, utilizes minimal resources
	Sustainability Rating	**Fair**	**Good**	**Good**	**Very Good**
	Sustainability Score	**2**	**3**	**3**	**4**
	Overall Score	**13**	**20**	**20**	**23**

Notes;
AUL=Activity and Use Limitation
COC=chemicals of concern
CVOCs=chlorinated volatile organic compounds
EPL=Eastern Parking Lot
ISCO=*in situ* chemical oxidation
MCLs=maximum concentration limits
MNA=monitored natural attenuation
O&M=operations and maintenance
OHM=oil and/or hazardous materials
UCLs=upper concentration limits

Table 5-2
Detailed Evaluation of Remedial Action Alternatives - LNAPL
Former GE Facility, 50 Fordham Rd, Wilmington, MA

		Recovery: Passive Free Product Recovery and Disposal	Monitored Natural Attenuation (adsorbent socks if needed)
1	**Effectiveness**		
a)	Achieving a Permanent or Temporary Solution	- Current condition has achieved Temporary Solution; Low to moderate likelihood of achieving a Permanent Solution	- Current condition has achieved Temporary Solution; Low to moderate likelihood of achieving a Permanent Solution
b)	Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	- Low to moderate likelihood of removal of all OHM via this method	- Low to moderate likelihood as alternative relies on natural attenuation processes for slow reduction in LNAPL and dissolved hydrocarbon levels
c)	Achieving or Approaching Background Concentrations	- Low likelihood of achieving background concentrations	- Low to moderate likelihood of achieving background concentrations
	Effectiveness Rating	**Fair**	**Fair**
	Effectiveness Score	**2**	**2**
2	**Reliability**		
a)	Certainty of Success	- Low to moderate likelihood of success in removing LNAPL presence but only a low likelihood that this removal would be enough to reach GW-1 criteria of petroleum constituents	- Low to moderate likelihood of success alone, unless paired with another technology
b)	Effectiveness of Measures to Manage Residuals or Control Emissions/Discharges	- High as recovered product would be transported off-site for recycling or destruction	- High as any residuals created would be transported off-site for recycling or destruction
	Reliability Rating	**Fair**	**Fair**
	Reliability Score	**2**	**2**
3	**Implementability**		
a)	Technical Complexity	- Low complexity system installation	- Low complexity as primarily involves monitoring
b)	Integration with Facility Operations	- Low level efforts to integrate with property owner's tenant operations	- Low; Minor interruptions of facility operations during sampling of monitoring points
c)	Monitoring, O&M or Site Access Requirements/Limitations	- Minor limitations for access during O&M	- Minor limitations for access during O&M
d)	Availability of Services, Materials, Equipment, or Specialists	- Readily Available	- Readily Available
e)	Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	- Disposal facilities readily available to handle wastes generated	- Disposal facilities readily available to handle wastes generated
f)	Permits	- No permits required	- No permits required
	Implementability Rating	**Very Good**	**Very Good**
	Implementability Score	**4**	**4**
4	**Cost**		
a)	Cost of Implementation	- Low to moderate	- Low
b)	Cost of Environmental Restoration and Potential Damages to Natural Resources	- No cost for environmental restoration or damages to resources	- No cost for environmental restoration or damages to resources
c)	Cost of Energy Consumption	- Low to Moderate	- Low
d)	Cost Estimate	$700,000	$300,000
	Cost Rating	**Good**	**Very Good**
	Cost Score	**3**	**4**
5	**Risk**		
a)	Risk during Implementation	- Low to moderate short-term risks to workers and facility operations during installation	- Low short-term risk to workers and facility since efforts are solely monitoring
b)	Risk during Operations	- Low risks to workers or facility during operations	- Low risk during monitoring
c)	Risk associated with Remaining OHM following treatment	- Low risk related to residual LNAPL levels since already qualifies for Temporary Solution	- Low risk related to residual LNAPL levels since already qualifies for Temporary Solution
	Risk Rating	**Good**	**Very Good**
	Risk Score	**3**	**4**
6	**Benefits**		
a)	Restores Natural Resources	-None restored	- None restored
b)	Achieves Productive Reuse of Site	- Continued commercial/industrial use of site	- Continued commercial/industrial use of site
c)	Avoids Lost Value of Site	- Value not likely to change unless mobility is decreased	- Value not likely to change
	Benefits Rating	**Fair**	**Fair**
	Benefits Score	**2**	**2**
7	**Timeliness**		
a)	Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	- Low likelihood of achieving No Significant Risk and reaching GW-1 criteria if MassDEP LNAPL mobility assessment results are favorable	- Low likelihood of achieving No Significant Risk (GW-1) from MNA alone, unless a long time period or another method is paired with it
	Timeliness Rating	**Poor**	**Poor**
	Timeliness Score	**1**	**1**
8	**Non-Pecuniary**		
a)	Aesthetics	- Some changes to site but minimal	- No change to site anticipated
b)	Community Acceptance	- Good	- Good
	Non-Pecuniary Rating	**Fair**	**Fair**
	Non-Pecuniary Score	**2**	**2**

Table 5-2
Detailed Evaluation of Remedial Action Alternatives - LNAPL
Former GE Facility, 50 Fordham Rd, Wilmington, MA

		Recovery: Passive Free Product Recovery and Disposal	Monitored Natural Attenuation (adsorbent socks if needed)
9	**Sustainability**		
a)	Eliminates or reduces to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials, consumption, and ecosystem impacts through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection	- Alternative involves some minimal equipment production, delivery, installation, labor and resources, waste disposal, etc.	- Highly sustainable, utilizes minimal resources
	Sustainability Rating	**Fair**	**Good**
	Sustainability Score	**2**	**3**
	Overall Score	**21**	**24**

Note that an AUL was not evaluated although it was retained during screening as it already exists and will support either alternative
AUL=Activity and Use Limitation
COC=chemicals of concern
ISCO=*in situ* chemical oxidation
LNAPL=light nonaqueous phase liquid
MassDEP=Massachusetts Department of Environmental Protection
MNA=monitored natural attenuation
O&M=operations and maintenance
OHM=oil and/or hazardous materials
UCLs=upper concentration limits

Table 7-1
Relative Ease of Cleaning up of Contaminated Aquifers as a Function of Contaminant Chemistry and Hydrogeology (NRC, 1994)
Former GE Facility, 50 Fordham Rd, Wilmington, MA

Hydrogeology	Contaminant Chemistry					
	Mobile, dissolved (degrades/ volatilizes)	Mobile, dissolved	Strongly sorbed, dissolved (degrades/ volatilizes)	Strongly sorbed, dissolved	Separate Phase LNAPL	Separate Phase DNAPL
Homogeneous, single layer	1 [a]	1-2	2	2-3	2-3	3
Homogeneous, multiple layers	1	1-2	2	2-3	2-3	3
Heterogeneous, single layer	2	2	3	3	3	4
Heterogeneous, multiple layers	2	2	3	3	3	4
Fractured	3	3	3	3	4	4

Notes:
[a] Relative ease of cleanup, where 1 is easiest and 4 is most difficult.
LNAPL=light nonaqueous phase liquid
DNAPL=dense nonaqueous phase liquid

Table 8-1
Proposed Annual Groundwater Monitoring to Support Temporary Solution
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Area	Location	FLUTe Port	Strata	Well Dia. (inch)	Screen Interval (ft bgs)	Synoptic Water Level Reading *	VOCs (SW846-USEPA Method 8260C)	1,4-dioxane (SW846-USEPA Method 8270D SIM) to get DL <0.3 µg/l)	Field Parameters: pH, temperature, conductivity, ORP, DO, and turbidity	CSIA: 13C/12C ratio for PCE, TCE, cis-1,2-DCE, VC	Isotopic Analysis: O16/O18, H1/H2 and S34/S36	VPH (MassDEP VPH-04-1.1 Revision 1)	EPH and Polycyclic Aromatic Hydrocarbons (MassDEP EPH-04-1.1 Revision 1) (on site wells only)	Total As, Fe, Mn (SW846 - USEPA Method 6010C)	Dissolved As, Fe, Mn (field filtered) (SW846 - USEPA Method 6010C)	Chloride (USEPA 300.0)	Nitrite	Nitrate (USEPA 300.0)	Sulfate (USEPA 300.0)	Sulfide	Total Organic Carbon (SW 846-9060A)	Methane, Ethane, Ethene, Acetylene and Propane (Pace-Microseeps AM20Gax)	Dissolved Hydrogen (Pace - Microseeps)	Ferrous Iron and Manganese field test kits	Microbial Analysis: Quantaray (Microbial Insights)
	-																								
Building 1, inside	AE-26R	R1	Bedrock	FLUTE	50 - 56	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Building 1, inside	AE-26R	R2	Bedrock	FLUTE	72 - 78	1	1		1																
Building 1, inside	AE-26R	R3	Bedrock	FLUTE	81 - 88	1	1		1																
Building 1, inside	AE-26R	R4	Bedrock	FLUTE	104 - 114	1	1		1																
Building 1, inside	AE-26R	R5	Bedrock	FLUTE	123 - 132	1	1	1	1																
Building 1, inside	AE-27R	--	Bedrock	2	50 - 60	1	1		1																
Building 1, inside	AE-28R	R1	Bedrock	FLUTE	45 - 51	1	1		1																
Building 1, inside	AE-28R	R2	Bedrock	FLUTE	75 - 85	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Building 1, inside	AE-28R	R3	Bedrock	FLUTE	98 - 108	1	1		1																
Building 1, inside	AE 28R	R4	Bedrock	FLUTE	132 - 142	1	1		1																
Building 1, inside	AE-26S	--	Overburden	2	25 - 30	1	1		1																
Building 1, inside	AE-26D	--	Overburden	2	35 - 40	1	1		1																
Building 1, inside	AE-23R	--	Bedrock	1.5	44.75 - 54.75	1	1	1	1			1	1												
Building 1, inside	AE-23S	--	Overburden	2	10 - 20	1	1		1					1	1										
Building 1, inside	AE-24	--	Overburden	2	7.25 - 17.2.5	1	1		1																
Tank F	AE-29R	R1	Bedrock	FLUTE	37 - 44	1	1		1																
Tank F	AE-29R	R2	Bedrock	FLUTE	47 - 54	1	1		1																
Tank F	AE-29R	R3	Bedrock	FLUTE	70 -76	1	1		1																
Tank F	AE-29R	R4	Bedrock	FLUTE	90 - 96	1	1		1																
Tank F	AE 29R	R5	Bedrock	FLUTE	113 - 119	1	1		1																
Tank F	AE-29R	R6	Bedrock	FLUTE	140 -146	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tank F - south of Building 1	AE-2R	--	Bedrock	open rock 5"	22 - 36	1	1		1																
Tank F	GZA-101R	--	Bedrock	PVC	36 - 38	1	1		1	1				1	1	1	1	1	1	1		1	1		
Former Tank Farm	AE-100R	R1	Bedrock	FLUTE	18 - 24	1	1	1	1																
Former Tank Farm	AE-100R	R2	Bedrock	FLUTE	43 - 48	1	1	1	1																
Former Tank Farm	AE-100R	R3	Bedrock	FLUTE	50 - 56	1	1	1	1																
Former Tank Farm	AE 100R	R4	Bedrock	FLUTE	63 - 68	1	1	1	1																
Former Tank Farm	AE-100R	R5	Bedrock	FLUTE	88 - 93	1	1	1	1	1				1	1	1	1	1	1	1		1	1	1	1

Table 8-1
Proposed Annual Groundwater Monitoring to Support Temporary Solution
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Area	Location	FLUTe Port	Strata	Well Dia. (inch)	Screen Interval (ft bgs)	Synoptic Water Level Reading *	VOCs (SW846 -USEPA Method 8260C)	1,4-dioxane (SW846/USEPA Method 8270D SIM) to get DL <0.3 µg/l)	Field Parameters: pH, temperature, conductivity, ORP, DO, and turbidity	CSIA: 13C/12C ratio for PCE, TCE, cis-1,2-DCE, VC	Isotopic Analysis: O16/O18, H1/H2 and S34/S36	VPH (MassDEP VPH-04-1.1 Revision 1)	EPH and Polycyclic Aromatic Hydrocarbons (MassDEP EPH-04-1.1 Revision 1) (on site-wells only)	Total As, Fe, Mn (SW846 - USEPA Method 6010C)	Dissolved As, Fe, Mn (field filtered) (SW846 - USEPA Method 6010C)	Chloride (USEPA 300.0)	Nitrite	Nitrate (USEPA 300.0)	Sulfate (USEPA 300.0)	Sulfide	Total Organic Carbon (SW 846-9060A)	Methane, Ethane, Ethene, Acetylene and Propane (Pace-Microseeps AM20Gax)	Dissolved Hydrogen (Pace - Microseeps)	Ferrous Iron and Manganese field test kits	Microbial Analysis: Quantaray (Microbial Insights)
Former Tank Farm	AE-100R	R6	Bedrock	FLUTE	108.5 - 113.5	1	1	1	1																
Transect A	AE-101D	--	Overburden	2	20 - 25	1	1	1	1																
Transect A	AE 101R	R1	Bedrock	CMT	30.5 - 35.5	1	1	1	1																
Transect A	AE-101R	R2	Bedrock	CMT	55-60	1	1	1	1																
Transect A	AE-101R	R3	Bedrock	CMT	80 - 85	1	1	1	1																
Transect A	AE 101R	R5	Bedrock	CMT	175 - 180	1	1	1	1																
Transect A	AE-101R	R6	Bedrock	CMT	227-232	1	1	1	1																
Transect A	AE-101S	--	Overburden	2	10 - 15	1	1	1	1																
Transect A	AE-102D	--	Overburden	2	33 - 38	1	1	1	1																
Transect A	AE-102M	--	Overburden	2	23 - 28	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transect A	AE-102RR	R2	Bedrock	FLUTE	75 - 80	1	1	1	1																
Transect A	AE 102RR	R4	Bedrock	FLUTE	125 - 130	1	1	1	1																
Transect A	AE-102RR	R5	Bedrock	FLUTE	141-146	1	1	1	1																
Transect A	AE-102RR	R6	Bedrock	FLUTE	153-158	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	
Transect A	AE-103D	--	Overburden	2	35 - 40	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	
Transect A	AE-103R	R1	Bedrock	FLUTE	48 - 53	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	
Transect A	AE-103R	R2	Bedrock	FLUTE	62-67	1	1	1	1																
Transect A	AE-103R	R3	Bedrock	FLUTE	70 -76	1	1	1	1																
Transect A	AE-103R	R4	Bedrock	FLUTE	98-105	1	1	1	1																
Transect A	AE-103R	R5	Bedrock	FLUTE	122 - 128	1	1	1	1																
Transect A	AE-103R	R6	Bedrock	FLUTE	138-144	1	1	1	1																
Transect A	AE-103R	R7	Bedrock	FLUTE	162.5-168	1	1	1	1																
Transect A	AE-103S	--	Overburden	2	15 - 20	1	1	1	1					1	1										
Transect A	AE-104D	--	Overburden	2	35 - 40	1	1	1	1																
Transect A	AE 104R	R1	Bedrock	FLUTE	48 - 54	1	1	1	1																
Transect A	AE-104R	R3	Bedrock	FLUTE	62-68	1	1	1	1																
Transect A	AE-104R	R4	Bedrock	FLUTE	128-133	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transect A	AE 104R	R5	Bedrock	FLUTE	156 - 162	1	1	1	1																

Table 8-1
Proposed Annual Groundwater Monitoring to Support Temporary Solution
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Area	Location	FLUTe Port	Strata	Well Dia. (inch)	Screen Interval (ft bgs)	Synoptic Water Level Reading *	VOCs (SW846 -USEPA Method 8260C)	1,4-dioxane (SW846/USEPA Method 8270D SIM) to get DL <0.3 µg/l)	Field Parameters: pH, temperature, conductivity, ORP, DO, and turbidity	CSIA: 13C/12C ratio for PCE, TCE, cis-1,2-DCE, VC	Isotopic Analysis: O16/O18, H1/H2 and S34/S36	VPH (MassDEP VPH-04-1.1 Revision 1)	EPH and Polycyclic Aromatic Hydrocarbons (MassDEP EPH-04-1.1 R evision 1) (on site-wells only)	Total As, Fe, Mn (SW846 - USEPA Method 6010C)	Dissolved As, Fe, Mn (field filtered) (SW846 - USEPA Method 6010C)	Chloride (USEPA 300.0)	Nitrite	Nitrate (USEPA 300.0)	Sulfate (USEPA 300.0)	Sulfide	Total Organic Carbon (SW 846-9060A)	Methane, Ethane, Ethene, Acetylene and Propane (Pace-Microseeps AM20Gax)	Dissolved Hydrogen (Pace - Microseeps)	Ferrous Iron and Manganese field test kits	Microbial Analysis: Quantaray (Microbial Insights)
Transect A	AE-104R	R6	Bedrock	FLUTE	168-174	1	1	1	1																
Transect A	AE 104S	--	Overburden	2	15 - 20	1	1	1	1																
Transect A	AE-108R	R1	Bedrock	FLUTE	36.5 - 43.5	1	1		1	1				1	1	1	1	1	1	1	1	1	1	1	1
Transect A	AE-108R	R2	Bedrock	FLUTE	68 - 73	1	1		1																
Transect A	AE-108R	R3	Bedrock	FLUTE	84 - 89	1	1		1																
Transect A	AE-108R	R4	Bedrock	FLUTE	145 - 150	1	1		1																
Transect A	AE-108R	R5	Bedrock	FLUTE	163 - 168	1	1		1																
Transect A	AE-109R	R1	Bedrock	FLUTE	38 - 43	1	1		1																
Transect A	AE-109R	R2	Bedrock	FLUTE	66 - 76	1	1		1																
Transect A	AE-109R	R3	Bedrock	FLUTE	126 - 136	1	1		1																
Transect A	AE-109R	R4	Bedrock	FLUTE	174 - 180.5	1	1		1																
Transect A	AE-109R	R5	Bedrock	FLUTE	183 - 189	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	
Transect A	AE-109R	R6	Bedrock	FLUTE	156 - 161	1	1	1	1																
Transect A	AE-109R	R7	Bedrock	FLUTE	204 - 214	1	1	1	1																
Transect A	AE-109R	R8	Bedrock	FLUTE	245 - 250	1	1		1																
Transect A	AE-109D	--	Overburden	2	18 - 23	1	1	1	1																
Transect A	AE-110R	R1	Bedrock	FLUTE	34 - 44	1	1		1																
Transect A	AE-110R	R2	Bedrock	FLUTE	70 - 80	1	1		1																
Transect A	AE-110R	R3	Bedrock	FLUTE	128 - 138	1	1		1																
Transect A	AE-110R	R4	Bedrock	FLUTE	158 - 168	1	1		1																
Transect A	AE-110R	R5	Bedrock	FLUTE	171 - 182	1	1		1																
Transect A	AE-110R	R6	Bedrock	FLUTE	190 - 200	1	1	1	1																
Transect A	AE-110R	R7	Bedrock	FLUTE	224 -234	1	1	1	1																
Transect B	AE-105D	--	Overburden	2	73 - 78	1	1	1	1																
Transect B	AE-105R	R1	Bedrock	FLUTE	90.5 - 95.5	1	1		1																
Transect B	AE-105R	R2	Bedrock	FLUTE	98 - 103	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transect B	AE-105R	R4	Bedrock	FLUTE	125 - 130	1	1		1																
Transect B	AE 105S	--	Overburden	2	35 - 40	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 8-1
Proposed Annual Groundwater Monitoring to Support Temporary Solution
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Area	Location	FLUTe Port	Strata	Well Dia. (inch)	Screen Interval (ft bgs)	Synoptic Water Level Reading *	VOCs (SW846 -USEPA Method 8260C)	1,4-dioxane (SW846/USEPA Method 8270D SIM) to get DL <0.3 µg/l)	Field Parameters: pH, temperature, conductivity, ORP, DO, and turbidity	CSIA: 13C/12C ratio for PCE, TCE, cis-1,2-DCE, VC	Isotopic Analysis: O16/O18, H1/H2 and S34/S36	VPH (MassDEP VPH-04-1.1 Revision 1)	EPH and Polycyclic Aromatic Hydrocarbons (MassDEP EPH-04-1.1 Revision 1) (on site-wells only)	Total As, Fe, Mn (SW846 - USEPA Method 6010C)	Dissolved As, Fe, Mn (field filtered) (SW846 - USEPA Method 6010C)	Chloride (USEPA 300.0)	Nitrite	Nitrate (USEPA 300.0)	Sulfate (USEPA 300.0)	Sulfide	Total Organic Carbon (SW 846-9060A)	Methane, Ethane, Ethene, Acetylene and Propane (Pace-Microseeps AM20Gax)	Dissolved Hydrogen (Pace - Microseeps)	Ferrous Iron and Manganese field test kits	Microbial Analysis: Quantaray (Microbial Insights)
Transect B	AE-106D	--	Overburden	2	34 - 39	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transect B	AE-106R	R1	Bedrock	FLUTE	47 - 53	1	1		1																
Transect B	AE-106R	R3	Bedrock	FLUTE	84 - 88	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transect B	AE 106S	--	Overburden	2	12 - 17	1	1		1																
Transect B	TRC-301R	R1	Bedrock	CMT	96.5 - 100.5	1	1		1																
Transect B	TRC-301R	R2	Bedrock	CMT	81.5 - 85.5	1	1		1																
Transect B	TRC-301R	R3	Bedrock	CMT	75.5 - 79.5	1	1		1					1	1										
Transect B	TRC-301R	R4	Bedrock	CMT	65.5 - 69.5	1	1		1	1				1	1	1	1	1	1	1	1	1	1	1	1
Transect B	AE-111R	R1	Bedrock	FLUTE	44 - 54	1	1		1																
Transect B	AE-111R	R2	Bedrock	FLUTE	66 - 74	1	1		1																
Transect B	AE-111R	R3	Bedrock	FLUTE	95 - 103	1	1		1																
Transect B	AE-111R	R4	Bedrock	FLUTE	140 - 150	1	1		1																
Transect B	AE-111R	R5	Bedrock	FLUTE	155 - 165	1	1		1																
Transect B	AE-111R	R6	Bedrock	FLUTE	168 -173	1	1		1																
Transect B	AE-111R	R7	Bedrock	FLUTE	181 - 191	1	1		1																
Transect B 1/2	AE-112R	R1	Bedrock	FLUTE	41 - 51	1	1		1																
Transect B 1/2	AE-112R	R2	Bedrock	FLUTE	62 - 72	1	1		1																
Transect B 1/2	AE-112R	R3	Bedrock	FLUTE	91 - 101	1	1		1																
Transect B 1/2	AE-112R	R4	Bedrock	FLUTE	113 - 123	1	1		1																
Transect B 1/2	AE-112R	R5	Bedrock	FLUTE	136 - 146	1	1		1																
Transect B 1/2	AE-112R	R6	Bedrock	FLUTE	153 - 163	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transect B 1/2	AE-112R	R7	Bedrock	FLUTE	168 - 175	1	1		1																
Transect B 1/2	AE 112D	--	Overburden	2	24.5 - 29.5	1	1		1																
Transect C - Concord Street	STM-8S	--	Overburden	0.75	1 - 11	1	1	1	1																
Transect C - Concord Street	STM-8D	--	Overburden	0.75	34.7 - 39.7	1	1	1	1	1															
Transect C - Concord Street	STM-8M	--	Overburden	0.75	19.5 - 24.5	1	1	1	1																
Transect C - Concord Street	STM-8R	--	Bedrock	0.75	46.5 - 51.5	1	1	1	1																
Transect C - Concord Street	STM 8R1	--	Bedrock	2	85 - 90	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	

Table 8-1
Proposed Annual Groundwater Monitoring to Support Temporary Solution
Former GE Facility - 50 Fordham Rd, Wilmington, MA

Area	Location	FLUTe Port	Strata	Well Dia. (inch)	Screen Interval (ft bgs)	Synoptic Water Level Reading *	VOCs (SW846 -USEPA Method 8260C)	1,4-dioxane (SW846/USEPA Method 8270D SIM) to get DL <0.3 µg/l)	Field Parameters: pH, temperature, conductivity, ORP, DO, and turbidity	CSIA: 13C/12C ratio for PCE, TCE, cis-1,2-DCE, VC	Isotopic Analysis: O16/O18, H1/H2 and S34/S36	VPH (MassDEP VPH-04-1.1 Revision 1)	EPH and Polycyclic Aromatic Hydrocarbons (MassDEP EPH-04-1.1 R evision 1) (on site-wells only)	Total As, Fe, Mn (SW846 - USEPA Method 6010C)	Dissolved As, Fe, Mn (field filtered) (SW846 - USEPA Method 6010C)	Chloride (USEPA 300.0)	Nitrite	Nitrate (USEPA 300.0)	Sulfate (USEPA 300.0)	Sulfide	Total Organic Carbon (SW 846-9060A)	Methane, Ethane, Ethene, Acetylene and Propane (Pace-Microseeps AM20Gax)	Dissolved Hydrogen (Pace - Microseeps)	Ferrous Iron and Manganese field test kits	Microbial Analysis: Quantaray (Microbial Insights)
Transect C - Concord Street	STM-3S	--	Overburden	0.75	5 -15	1	1		1																
Transect C - Concord Street	STM-3D	--	Overburden	0.75	49.8 - 54.8	1	1		1																
Transect C - Concord Street	STM-3R	--	Bedrock	0.75	66.9 - 71.9	1	1		1																
Upgradient	GZA-12	--	Overburden	1.5	9.5 - 24.5	1	1		1					1	1	1	1	1	1	1	1	1	1	1	
EPL Area	AE-03	--	Overburden	2	3 - 13	1	1		1			1	1	1	1	1	1	1	1	1	1	1	1	1	1
EPL Area	AE 04	--	Overburden	2	3 - 13	1	1		1			1	1	1	1										
EPL Area	GZA 105D	--	Overburden	1.5	16 - 26	1	1	1	1			1	1	1	1										
EPL Area	GZA-105R	--	Bedrock	0.5	34.5 - 36.5	1	1		1																
EPL Area	GZA-105S	--	Overburden	1.5	4 - 14	1	1		1			1	1	1	1	1	1	1	1	1	1	1	1	1	1
EPL Area	TRC 102	--	Overburden	1.25	2.25 - 12.25	1	1		1			1	1	1	1										
LTGMP	EMW-10D	--	Overburden	2	19 - 29	1	1		1																
LTGMP	EMW-10R	--	Bedrock	2	42 - 52	1	1		1																
LTGMP	EMW-11D	--	Overburden	2	22 - 32	1	1		1																
LTGMP	EMW-11R1	--	Bedrock	0.75	79 - 89	1	1		1																
LTGMP	EMW-11R2	--	Bedrock	0.75	104 - 114	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
LTGMP	EMW 11R3	--	Bedrock	0.75	158 - 168	1	1		1																
LTGMP	TRC-402	--	Overburden	2	53.3 - 63.3	1	1		1																
LTGMP	TRC-403	--	Overburden	2	37.5 - 47.5	1	1		1																
Source Control - Downgradient	GZA-14	--	Overburden	1.5	39 - 49	1	1		1			1	1	1	1										
Source Control - Downgradient	GZA 14A	--	Overburden	1.5	0 - 15	1	1		1					1	1										
Source Control - Downgradient	MW-4	--	Overburden	1.5	18 - 28	1	1	1	1					1	1										
Source Control - Downgradient	MW-4A	--	Overburden	1.5	38 - 48	1	1	1	1					1	1										
Source Control - Downgradient	MW-5	--	Overburden	1.5	28 - 38	1	1		1																
Source Control - Downgradient	MW 7	--	Overburden	1.5	15 - 25	1	1		1																
Source Control - Downgradient	PS-1D	--	Overburden	0.62	49.25 - 54.25	1	1		1																
Source Control - Downgradient	PS-1M	--	Overburden	0.62	34.25 - 39.25	1	1		1																
Source Control - Downgradient	PS-1S	--	Overburden	0.62	12 - 17	1	1		1																
Source Control Downgradient	PS 2D	--	Overburden	0.62	49.1 - 54.1	1	1		1																

Table 8-1
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Former GE Facility - 50 Fordham Rd, Wilmington, MA

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Source Control - Downgradient	PS-2M	--	Overburden	0.62	34 - 39	1	1		1																
Source Control - Downgradient	PS-2S	--	Overburden	0.62	12.5 - 17.5	1	1		1																
Source Control - Downgradient	PS-3	--	Overburden	0.62	2.7 - 7.7	1	1		1																
Source Control - Downgradient	PS-4	--	Overburden	0.62	12.9 - 17.9	1	1		1																
Source Control - Downgradient	PS-5D	--	Overburden	0.62	24.1 - 29.1	1	1		1																
Source Control - Downgradient	PS-5S	--	Overburden	0.62	13 - 18	1	1		1																
Source Control - Downgradient	PS-8D	--	Overburden	0.62	51.8 - 56.8	1	1		1																
Source Control - Downgradient	PS-8M	--	Overburden	0.62	34.3 - 39.3	1	1		1																
Source Control Downgradient	PS 8S	--	Overburden	0.62	13 - 18	1	1		1																
Source Control - Onsite	TRC-201R	--	Bedrock	6"	38 - 161	1	1		1																
Source Control - Onsite	IP 1R2	--	Overburden	2	54 - 74	1	1		1																
Source Control Onsite	TRC 401R	--	Overburden	0.5	38 - 58	1	1		1																
				Total number of samples		152	152	57	152	16	0	23	23	33	33	23	23	23	23	23	21	23	23	22	16
				Duplicates (1 per 20)		--	8	3	0	0	0	2	2	2	2	2	2	2	2	2	2	2	0	0	0
				Equipment blanks (1 per 20)		--	2	2	0	0	0	0	0	2	0	2	2	2	2	2	2	2	0	0	0
				Trip blanks (1 per 20)		--	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				Grand Total		--	**182**	**62**	**152**	**16**	**0**	**25**	**25**	**37**	**35**	**27**	**27**	**27**	**27**	**27**	**25**	**27**	**23**	**22**	**16**

The sampling scope provided herein is an example of the groundwater monitoring scope to be executed annually in support of the Temporary Solution.
* All wells site-wide to be measured during site wide synoptic water level event.

Notes:
AS=arsenic
DCE=dichloroethene
DO=dissolved oxygen
EPH=extractable petroleum hydrocarbons
EPL=Eastern Parking Lot
FE=Iron
ft bgs=feet below ground surface
LTGMP=Long Term Groundwater Monitoring Program area
Mn=manganese
ORP=oxidation reduction potential
PAH=polycyclic aromatic hydrocarbon
PCE=tetrachloroethene
SW846=USEPA Test Methods for Evaluating Solid Waste: Physical/Chemical Methods
TCE=trichloroethene
USEPA=United States Environmental Protection Agency
VC=vinyl chloride
VOC=volatile organic compounds
VPH=volatile petroleum hydrocarbons
WG=Groundwater

APPENDIX A – ACTIVITY AND USE LIMITATION

NOTICE OF ACTIVITY AND USE LIMITATION

M.G.L. c. 21E, §6 and 310 CMR 40.0000

Note: Pursuant to 310 CMR 40.1074(5), upon transfer of any interest in or a right to use the property or a portion thereof that is subject to this Notice of Activity and Use Limitation, the Notice of Activity and Use Limitation shall be incorporated either in full or by reference into all future deeds, easements, mortgages, leases, licenses, occupancy agreements or any other instrument of transfer. Within 30 days of so incorporating the Notice of Activity and Use Limitation in a deed that is recorded or registered, a copy of such deed shall be submitted to the Department of Environmental Protection.

Disposal Site Name: 50 Fordham Road
DEP Release Tracking No.: 3-0000518

This Notice of Activity and Use Limitation ("Notice") is made as of this ____ day of ____________, 2015, by Rosemarie Stanieich, Victoria J. Miyara, and Annette Maria Given as Trustees of the Wilmington Realty Trust, established by Declaration of Trust dated September 7, 1973, registered in the Middlesex North Registry District of the Land Court as Document No. 63541 and noted on Certificate of Title No. 19837 and registered further in the Middlesex South Registry of the Land Court as Document No. 515729 and noted on Certificate of Title No. 142138, together with their successors and assigns (collectively "Owner").

WITNESSETH:

WHEREAS, the Wilmington Realty Trust, of Wilmington, Middlesex County, Massachusetts is the owner in fee simple of those certain parcels of land located at 40 and 50 Fordham Road in Wilmington, Middlesex County, Massachusetts, with the buildings and improvements thereon;

WHEREAS, said parcels of land, which are more particularly bounded and described in Exhibit A, attached hereto and made a part hereof ("Property"), are subject to this Notice of Activity and Use Limitation. The Property is shown on plans registered in the Middlesex County North Registry District of the Land Court as Land Court Plan Nos. 31713-C, 34588-B, 34588-E, and 36899-B, and in the Middlesex County South Registry District of the Land Court as Land Court Plan No. 31713-D;

WHEREAS, a portion of the Property ("Portion of the Property") is more specifically subject to this Notice of Activity and Use Limitation. This Portion of the Property is more particularly bounded and described in Exhibit A-1, attached hereto and made a part hereof. The Portion of the Property is shown on a sketch plan attached hereto and filed herewith for registration;

WHEREAS, the Portion of the Property comprises part of a disposal site as the result of a release of oil and/or hazardous materials. Exhibit B is a sketch plan showing the relationship of the Portion of the Property subject to this Notice of Activity and Use Limitation to the boundaries of said disposal site existing within the limits of the Property and to the extent such boundaries have been established. Exhibit B is attached hereto and made a part hereof; and

WHEREAS, one or more response actions have been selected for the Portion of the Disposal Site in accordance with M.G.L. c.21E ("Chapter 21E") and the Massachusetts Contingency Plan, 310 CMR 40.0000 ("MCP"). Said response actions are based upon (a) the restriction of human access to and contact with oil and/or hazardous material in soil and/or groundwater, and (b) the restriction of certain activities occurring in, on, through, over or under the Portion of the Property. A description of the basis for such restrictions, and the oil and/or hazardous material release event(s) or site history that resulted in the contaminated media subject to the Notice of Activity and Use Limitation is attached hereto as Exhibit C and made part hereof.

NOW, THEREFORE, Notice is hereby given that the activity and use limitations set forth in this Notice of Activity and Use Limitation are as follows:

1. Activities and Uses Consistent with Maintaining No Substantial Hazard Conditions. The following Activities and Uses are consistent with maintaining a condition of No Substantial Hazard and, as such, may occur on the Portion of the Property pursuant to 310 CMR 40.0000:

i. Industrial and commercial uses;

ii. Such other activities which, in the Opinion of a Licensed Site Professional, shall present no greater risk of harm to health, safety public welfare or the environment than the activities and uses set forth in this Paragraph; and

iii. Such other activities and uses not identified in Paragraph 2 as being Activities and Uses inconsistent with maintaining No Substantial Hazard Conditions.

2. Activities and Uses Inconsistent with Maintaining No Substantial Hazard. The following Activities and Uses are inconsistent with maintaining a condition of No Substantial Hazard pursuant to 310 CMR 40.0000, and, as such, may not occur on the Portion of the Property:

i. Residential, school, playground, park, or daycare use; and

ii. In the area as defined by the Activity and Use Limitation ("AUL") boundary presented in Figure 1 of the Activity and Use Limitation Opinion annexed hereto as Exhibit C, activities that would result in exposure to or the disturbance of potentially contaminated soils, bedrock, groundwater, and indoor air, unless appropriate precautions to prevent human exposure are taken as described in paragraph 3 below.

3. Obligations and Conditions. The following obligations or conditions are necessary and shall be undertaken and/or maintained at the Portion of the Property to maintain a condition of No Substantial Hazard:

i. The concrete floors within the footprint of the AUL boundary, if present, must be maintained in a condition that will prevent potential exposure to potentially contaminated soil, groundwater, and soil gas. Interior building floors will be inspected annually with repairs made to seal cracks larger than one-fourth (1/4) inch in width. The penetration of and the subsequent repairs made to the concrete floor of any buildings within the AUL boundary will be evaluated by a Licensed Site Professional to maintain the safety of construction and on-site workers.

ii. Excavated soil and bedrock removed from the AUL area must be managed in accordance with the Soil Management Procedures pursuant to 310 CMR 40.0030.

a. If the soils and bedrock are suspected or are pre-determined by a Licensed Site Professional to be Remediation Waste as defined under 310 CMR 40.0006, then the soils and bedrock will be managed under a Release Abatement Measure ("RAM") set forth by the MCP at 310 CMR 40.0440, as determined by a Licensed Site Professional.

b. If the excavated soils and bedrock from the AUL area are determined not to be Remediation Waste, then they will be managed under a RAM or in accordance with the Similar Soils Provisions Guidance, WSC#-13-500, as determined by a Licensed Site Professional.

iii. If groundwater dewatering activities are required within the AUL area, then the groundwater will be managed appropriately as described here:

a. If the groundwater is determined to be a Remediation Waste, then it will be managed under a Release Abatement Measure ("RAM") set forth by the MCP at 310 CMR 40.0440, as determined by a Licensed Site Professional.

b. If the groundwater removed from the AUL area is not determined to be a Remediation Waste, then other appropriate options may be used to manage the water as determined by a Licensed Site Professional.

iv. Activities that could result in exposure to or the disturbance of soils, bedrock or groundwater in the AUL area, must be conducted in accordance with the performance standards for RAMs set forth by the MCP at 310 CMR 40.0440, the Soil Management Procedures pursuant to 310 CMR 40.0030, the Similar Soils Provisions Guidance (WSC#-13-500), Construction of Buildings in Contaminated Areas (Policy WSC#-00-425) and applicable Health and Safety procedures outlined in 310 CMR 40.0018, as determined by a Licensed Site Professional.

4. Proposed Changes in Activities and Uses. Any proposed changes in activities and uses at the Portion of the Property which may result in higher levels of exposure to oil and/or hazardous material than currently exist shall be evaluated by a Licensed Site Professional who shall render an Opinion, in accordance with 310 CMR 40.1080 *et seq*., as to whether the proposed changes are inconsistent with maintaining a condition of No Substantial Hazard. Any and all requirements set forth in the Opinion to meet the objective of this Notice shall be satisfied before any such activity or use is commenced.

5. Violation of the AUL. The activities, uses and/or exposures upon which this Notice is based shall not change at any time to cause a significant risk of harm to health, safety, public welfare, or the environment or to create substantial hazards due to exposure to oil and/or hazardous material without the prior evaluation by a Licensed Site Professional in accordance with 310 CMR 40.1080, and without additional response actions, if necessary, to maintain a condition of No Substantial Hazard.

If the activities, uses, and/or exposures upon which this Notice is based change without the prior evaluation and additional response actions determined to be necessary by a Licensed Site Professional in accordance with 310 CMR 40.1080, the owner or operator of the Portion of the Property subject to this Notice at the time the activities, uses and/or exposures change, shall comply with the requirements set forth in 310 CMR 40.0020.

6. Incorporation Into Deeds, Mortgages, Leases, and Instruments of Transfer. This Notice shall be incorporated either in full or by reference into all future deeds, easements, mortgages, leases, licenses, occupancy agreements or any other instrument of transfer, whereby an interest in and/or a right to use the Property or a portion thereof is conveyed in accordance with 310 CMR 40.1074(5).

Owner herby authorizes and consents to the filing and recordation and/or registration of this Notice, said Notice to become effective when executed under seal by the undersigned Licensed Site Professional, and recorded and/or registered with the appropriate Registry(ies) of Deeds and/or Land Registration Office(s).

[Remainder of Page Intentionally Left Blank]

WITNESS the execution hereof under seal this 13th day of July, 2015.

Rosemarie Stanieich
Owner
Rosemarie Stanieich, as
Trustee of the Wilmington Realty Trust

COMMONWEALTH OF MASSACHUSETTS

Middlesex ,ss July 13, 2015

On this 13th day of July, 2015 before me, the undersigned notary public, personally appeared Rosemarie Stanieich (name of document signer), proved to me through satisfactory evidence of identification, which were a Driver's License, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that she signed it voluntarily for its stated purpose as trustee for Wilmington Realty Trust.

Alexandra Danilov
Notary Public:
My Commission Expires: 12-26-2019

ALEXANDRA DANILOV
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
December 26, 2019

WITNESS the execution hereof under seal this 14th day of July, 2015

Owner
Victoria J. Miyara, as
Trustee of the Wilmington Realty Trust

~~COMMONWEALTH OF MASSACHUSETTS~~
State of New Hampshire

Merrimack, ss July 14, 2015

On this 14th day of July, 2015 before me, the undersigned notary public, personally appeared Victoria J. Miyara (name of document signer), proved to me through satisfactory evidence of identification, which were Florida Drivers license to be the person whose name is signed on the preceding or attached document, and acknowledged to me that she signed it voluntarily for its stated purpose as trustee for Wilmington Realty Trust

Notary Public:
My Commission Expires: 8-22-17

RHONDA L. ROLLINS
STATE OF NEW HAMPSHIRE
MY COMMISSION EXPIRES AUGUST 22, 2017
NOTARY PUBLIC

WITNESS the execution hereof under seal this 13th day of July, 2015

Owner
Annette Maria Given, as
Trustee of the Wilmington Realty Trust

COMMONWEALTH OF MASSACHUSETTS

Middlesex ,ss July 13, 2015

On this 13th day of July, 2015 before me, the undersigned notary public, personally appeared Annette Maria Given (name of document signer), proved to me through satisfactory evidence of identification, which were Driver's License, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that she signed it voluntarily for its stated purpose as trustee for Wilmington Realty Trust

Notary Public:
My Commission Expires: 12-26-19

ALEXANDRA DANILOV
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
December 26, 2019

The undersigned Licensed Site Professional hereby certifies that in his Opinion this Notice of Activity and Use Limitation is consistent with maintaining a condition of No Substantial Hazard.

Date: 7-21-2015

Daniel W. Folan

Daniel W. Folan, PhD, PG, LSP,
Licensed Site Professional Seal

COMMONWEALTH OF MASSACHUSETTS LICENSED SITE PROFESSIONAL
DANIEL W. FOLAN
No. 1736
REGISTERED

COMMONWEALTH OF MASSACHUSETTS

Middlesex, ss 21 July, 20

On this 21 day of July, 2015, before me, the undersigned notary public, personally appeared Daniel Folan (name of document signer), proved to me through satisfactory evidence of identification, which were driver's license, to be the person whose name is signed on the preceding or attached document, and acknowledged to me that he signed it voluntarily for its stated purpose.

Maryanne V Cleary

Notary Public: Maryanne Cleary
My Commission Expires: May 23, 2019

Upon recording, return to:

Ronald Dardeno, Esq.
Law Offices of Frank N. Dardeno LLP
424 Broadway
Somerville, MA 02145-2619

and

Beth M. Kramer, Esq.
Associate General Counsel -- Energy,
Environment, Safety & Health
Lockheed Martin Corporation
6801 Rockledge Drive
Bethesda, MD 20817

EXHIBIT A

DESCRIPTION OF PROPERTY SUBJECT TO THE AUL

LEGAL DESCRIPTION

LOT 4 and LOT 6

Two (2) certain parcels of land located in the Town of Wilmington, County of Middlesex, Massachusetts; said two (2) parcels of land located easterly of Fordham Road, in Wilmington, Massachusetts; and said two (2) parcels of land shown as Lot 4 and Lot 6 on "Plan of land in Wilmington, Mass." dated February 28, 1978, Dana F. Perkins & Assoc., Inc., Civil Engineers and Surveyors, Reading-Lowell, Massachusetts; which plan is filed in Middlesex North Registry District of the Land Court, as Plan No. 36899-B.

The said two (2) parcels of land are bounded and described as follows:

LOT 4 as shown on said plan.

NORTHWESTERLY:	by land now or formerly of Carl Realty, Inc., seven hundred thirty-one and 40/100 (731.40) feet;
NORTHEASTERLY:	by Lot 6 as shown on said plan, two hundred seventy-five and 02/100 (275.02) feet;
EASTERLY:	by Lot 3 as shown on said plan, ninety-two and 44/100 (92.44) feet; and
SOUTHEASTERLY:	by land now or formerly of George E. Dunn, along the Town Line dividing Wilmington and North Reading, seven hundred fifty-five and 87/100 (755.87) feet; and
SOUTHWESTERLY:	by land now or formerly of South Mass. Land Developers, Inc., two hundred thirty and 27/100 (230.27) feet.

LOT 6 as shown on said plan.

NORTHWESTERLY:	by land now or formerly of Carl Realty, Inc., two hundred ninety-seven and 00/100 (297) feet;
SOUTHEASTERLY:	by Lot 5 as shown on said plan, four hundred thirty-five and 67/100 (435.67) feet; and
NORTHEASTERLY:	by Lot 4 as shown on said plan, two hundred seventy-five and 02/100 (275.02) feet.

For title of Trustees of THE WILMINGTON REALTY TRUST to said Lot 4 and Lot 6, see Middlesex North Registry District of the Land Court, Certificate of Title No. 19842, recorded in Registration Book 102, Page 83.

<u>LOT 7</u>

A certain parcel of land, located in the Town of Wilmington, County of Middlesex, Commonwealth of Massachusetts, said parcel shown as Lot 7 upon a plan entitled "Plan of Land in NORTH READING & WILMINGTON, MASS.", dated September 21, 1983, DANA F. PERKINS and Assoc., Inc., Civil Engineers and Surveyors, and filed with the Engineering Division of the Land Court of Massachusetts as Plan 31713^C and Plan 31713^D bounded and described as follows:

<u>NORTHWESTERLY</u>	by the Northeasterly line of Fordham Road, eighty-four and 60/100 (84.60) feet;
<u>NORTHWESTERLY</u>	by a radius 1081.41 along the Northeasterly line of Fordham Road, six hundred fifty-nine and 84/100 (659.84) feet;
<u>NORTHERLY</u>	by the Northeasterly line of Fordham Road, two hundred (200) feet;
<u>NORTHEASTERLY</u>	by lands shown on said Plan as "Lot 30", six hundred twenty-one and 74/100 (621.74) feet;
<u>NORTHERLY</u>	by lands shown on said Plan as "Lot 30", ninety-two and 55/100 (92.55) feet;
<u>NORTHEASTERLY</u>	by lands shown on said Plan as "Lot 30", two hundred thirty and 29/100 (230.29) feet;
<u>SOUTHWESTERLY</u>	by the Town Line between Wilmington and North Reading, as shown on said plan, nine hundred seven and 9/100 (907.9) feet;
<u>WESTERLY</u>	by Lot 8, as shown on said Plan, eighty-eight and 69/100 (88.69) feet;
<u>SOUTHEASTERLY</u>	by Lot 8, as shown on said Plan, eighty (80) feet; and
<u>SOUTHWESTERLY</u>	by Lot 8 as shown on said Plan, two hundred fifty-five (255) feet.

Said Lot 7, all within the Town of Wilmington, comprises 12.63 acres, more or less, (549,973 square feet of land, more or less), as shown on said plan.

Said Lot 7 is a subdivision of certain lots, title to which is registered in the Land Registration Office, North Registry District of Middlesex County, and as follows:

- of Lot 31, as shown on Plan No. 34588-C (Certificate of Title No. 19837); *Book 102-73*
- ~~of Lot 25, as shown on Plan No. 34588-A (Certificate of Title No. 19841)~~; and
- of ~~Lots 4~~, as shown on Plan No. 31713-A (Certificate of Title No. 19838), *Book 102-75*
  2+4

For

LOT 10

A certain parcel of land, located in the Town of North Reading, County of Middlesex, Commonwealth of Massachusetts, said parcel shown as Lot 10 upon a plan entitled "Plan of Land in NORTH READING & WILMINGTON, MASS.", dated September 21, 1983, DANA F. PERKINS and Assoc., Inc., Civil Engineers and Surveyors, and filed with the Engineering Division of the Land Court of Massachusetts as Plan 31713C and Plan 31713D bounded and described as follows:

NORTHERLY	by the Town Line between North Reading and Wilmington, as shown on said Plan, nine hundred seven and 09/100 (907.09) feet;
NORTHWESTERLY	by land shown on said Plan as "Town of North Reading", ninety-eight and 43/100 (98.43) feet;
SOUTHEASTERLY	by Lot 9, as shown on said Plan, four hundred twenty-three and 16/100 (423.16) feet;
SOUTHWESTERLY	by Lot 9, as shown on said Plan, one hundred ten and 41/100 (110.41) feet;
SOUTHEASTERLY	by Lot 9, as shown on said Plan, three hundred ninety and 49/100 (390.49) feet; and
SOUTHWESTELRY	by Lot 9, as shown on said Plan, two hundred forty-eight and 36/100 (248.36) feet.

Said Lot 10, all within the town of North Reading, comprises 3.91 acres of land, more or less (170,477) square feet of land, more or less), as shown on said Plan.

Said Lot 10 is a subdivision of certain lots, title to which is registered in the Land Registration Office, South Registry District of Middlesex County, and as follows:

~~- of Lot 26, as shown on Plan No. 24508-A (Certificate of Title No. 142137)~~; and

Ø of Lot 6, as shown on Plan No. 31713-B (Certificate of Title No. 142138), Bk 840-188

LOT 30

That certain parcel of land situate in Wilmington, County of Middlesex, Commonwealth of Massachusetts bounded and described as follows:

SOUTHWESTERLY by the Northeasterly line of Fordham Road, two hundred fifty (250) feet;

NORTHWESTERLY by land now or formerly of Carl Realty, Inc., six hundred seventy-two and 36/100 (672.36) feet;

EASTERLY by land now or formerly of So. Mass. Land Developers, Inc., two hundred fifty-five and 07/100 (255.07) feet; and

SOUTHEASTERLY by land now or formerly of Carl Realty, Inc., six hundred twenty-one and 74/100 (621.74) feet.

All of said boundaries are determined by the Land Court to be located as shown on subdivision plan 34588-B, drawn by Dana F. Perkins & Sons, Inc., Surveyors, dated April 9, 1968, as approved by the Court, filed in the Land Registration Office, a copy of a portion of which is filed with Certificate of title 16261, and said land is shown as Lot thirty (30) on said plan.

Being the same premises evidenced by Certificate of Title No. 19839 (Middlesex North Registry District). Bk. 102-77

LOT 33

That certain parcel of land situate in Wilmington, in the County of Middlesex Commonwealth of Massachusetts, bounded and described as follows:

WESTERLY	by the Easterly line of Fordham Rd. by several lines measuring together, eleven hundred eighty-seven and 97/100 (1,187.97) feet;
NORTHEASTERLY	by land now or formerly of Carl Realty, Inc., five hundred thirty-two and 01/100 (532.01) feet;
NORTHEASTERLY	again by land now or formerly of Max Siegel et al, two hundred ninety-seven (297) feet;
EASTERLY	by land now or formerly of So. Mass. Land Developers, Inc., five hundred ninety-nine and 28/100 (599.28) feet; and
SOUTHEASTERLY	by Lot 30, six hundred seventy-two and 36/100 (672.36) feet.

All of said boundaries are determined by the Land Court to be located as shown on subdivision plan 34588-E, drawn by Dana F. Perkins and Sons, Inc., Surveyors, dated January 27, 1969, as approved by the Court, filed in the Land Registration Office, a copy of a portion of which is filed with Certificate of Title 16620, and said land is shown as Lot thirty-three (33) on said plan.

Being the same premises evidenced by Certificate of Title No. 19840 (Middlesex North Registry District). Bk. 102-77

THE ABOVE DESCRIPTIONS ARE TAKEN FROM LAND COURT RECORD DOCUMENT NUMBER 172247 NORTH MIDDLESEX COUNTY

Raymond P. Shea
Massachusetts PLS No. 33192
Holden Engineering & Surveying, Inc.

COMMONWEALTH OF MASSACHUSETTS
RAYMOND P. SHEA
No. 33192
PROFESSIONAL LAND SURVEYOR

EXHIBIT A-1

LEGAL DESCRIPTION OF PORTION OF PROPERTY SUBJECT TO AUL

AUL BOUNDARY LEGAL DESCRIPTION

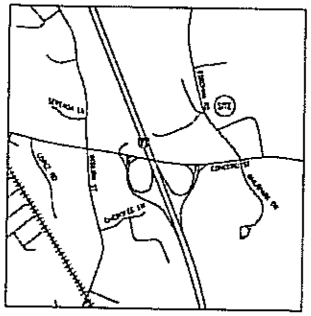
Beginning at a stone bound on the easterly sideline of Fordham Road at the northwest corner of lot ID 91-131 Lot 7 and the southwest corner of lot ID 91-131A Lot 30 and the point of beginning of the AUL Boundary, thence along the easterly sideline of Fordham Road North 11° 54' 17" West 285.10 feet past the northwest corner of lot ID 91-131 Lot 30 to lot ID 91-131A Lot 33, thence over lot ID 91-131A Lot 33 North 81° 02' 45" East 443.90 feet, thence over lot ID 91-131A Lot 33, North 16° 31' 27" West 142.97 feet, thence over lot ID 91-131A Lot 33, North 75° 45' 44" East 108.12 feet, thence over lot ID 91-131A Lot 33, North 01° 02' 35" West 85.99 feet, thence over lot ID 91-131A Lot 33, and lot ID 99-1 Lot 4 North 78° 32' 00" East 334.19 feet, thence over lot ID 99-1 Lot 4 South 07° 25' 18" East 335.96 feet, thence over lot ID 99-1 Lot 4 and lot ID 213-212 Lot 10 and along lot ID 213-2-11 South 12° 48' 00" East 847.35 feet, to the southeast corner of the AUL Boundary and southeast corner of lot ID 91-131 Lot 7 at land of lot ID 213-2-11 thence along lot ID 213-2-11 South 72° 23' 59" West 293.36 feet, thence along lot ID 213-2-11 South 63° 19' 49" West 26.31 feet, thence along lot ID 213-2-11 South 63° 19' 49" West 88.69 feet, thence along lot ID 213-2-11 South 25° 37' 41" East 80.00 feet, thence along lot ID 213-2-11 South 64° 22' 25" West 255.00 feet to the southwesterly corner of the AUL Boundary and southwesterly corner of lot ID 91-131 Lot 7 at the easterly sideline of Fordham Road, thence along the easterly sideline of Fordham Road North 48° 17' 49" West 84.60 feet to a point of curvature, thence along the easterly sideline of Fordham Road having a curve to the right having a Radius of 1081.41 feet and a length of 659.84 feet and a chord bearing of North 29° 23' 07" West 649.65 feet to the point of tangency, thence along the easterly sideline of Fordham Road North 11° 54' 17" West 200.00 feet to the point of beginning.

Containing 970,499 Square Feet or 22.280 Acres

Raymond P. Shea
Massachusetts PLS No. 33192
Holden Engineering & Surveying, Inc.

EXHIBIT A-2

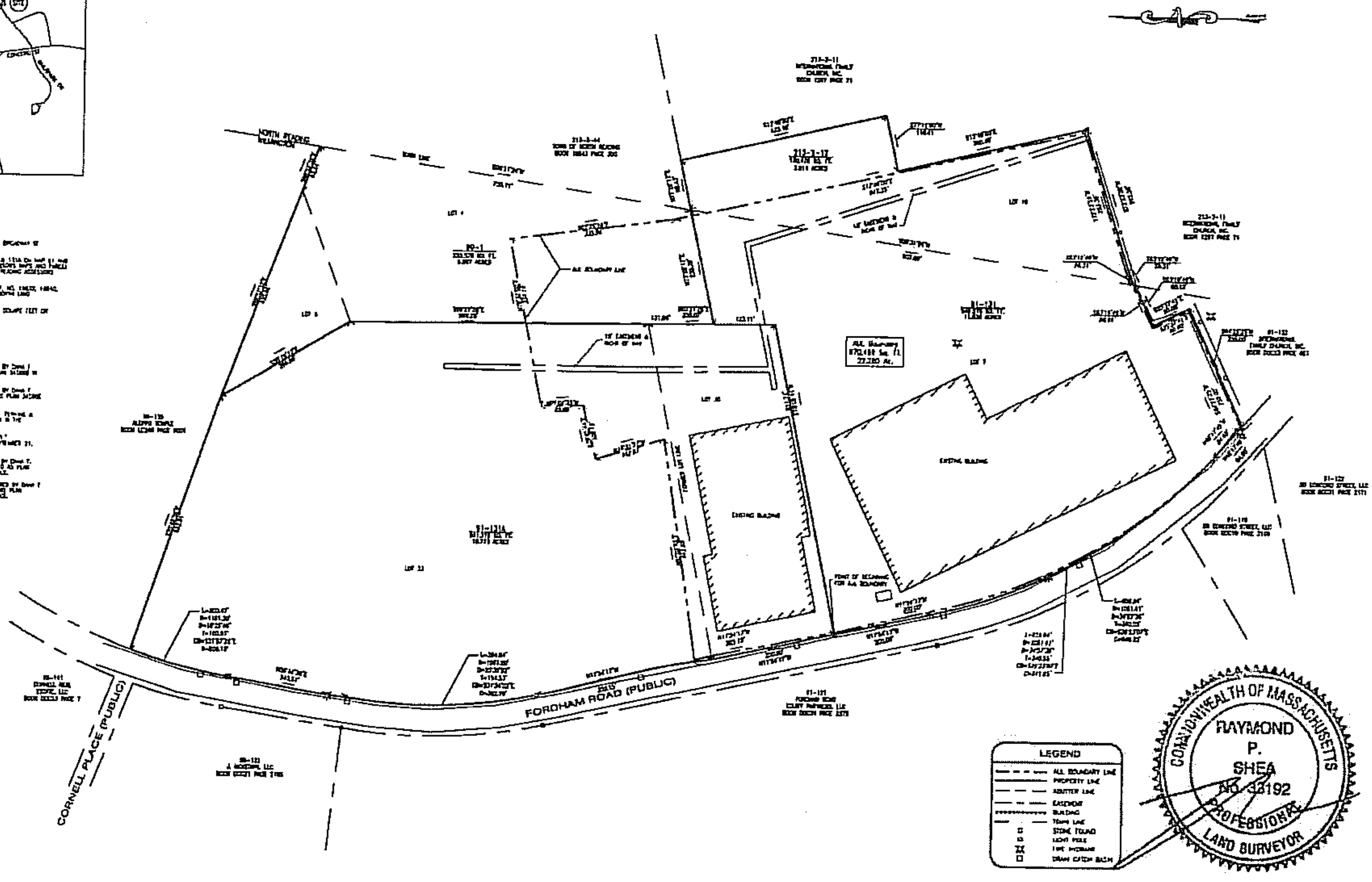
PLAN OF THE PORTION OF THE PROPERTY SPECIFICALLY SUBJECT TO THE AUL PREPARED BY REGISTERED LAND SURVEYOR



VICINITY MAP

NOTES:

PLAN REFERENCES:



HOLDEN ENGINEERING & SURVEYING, Inc.

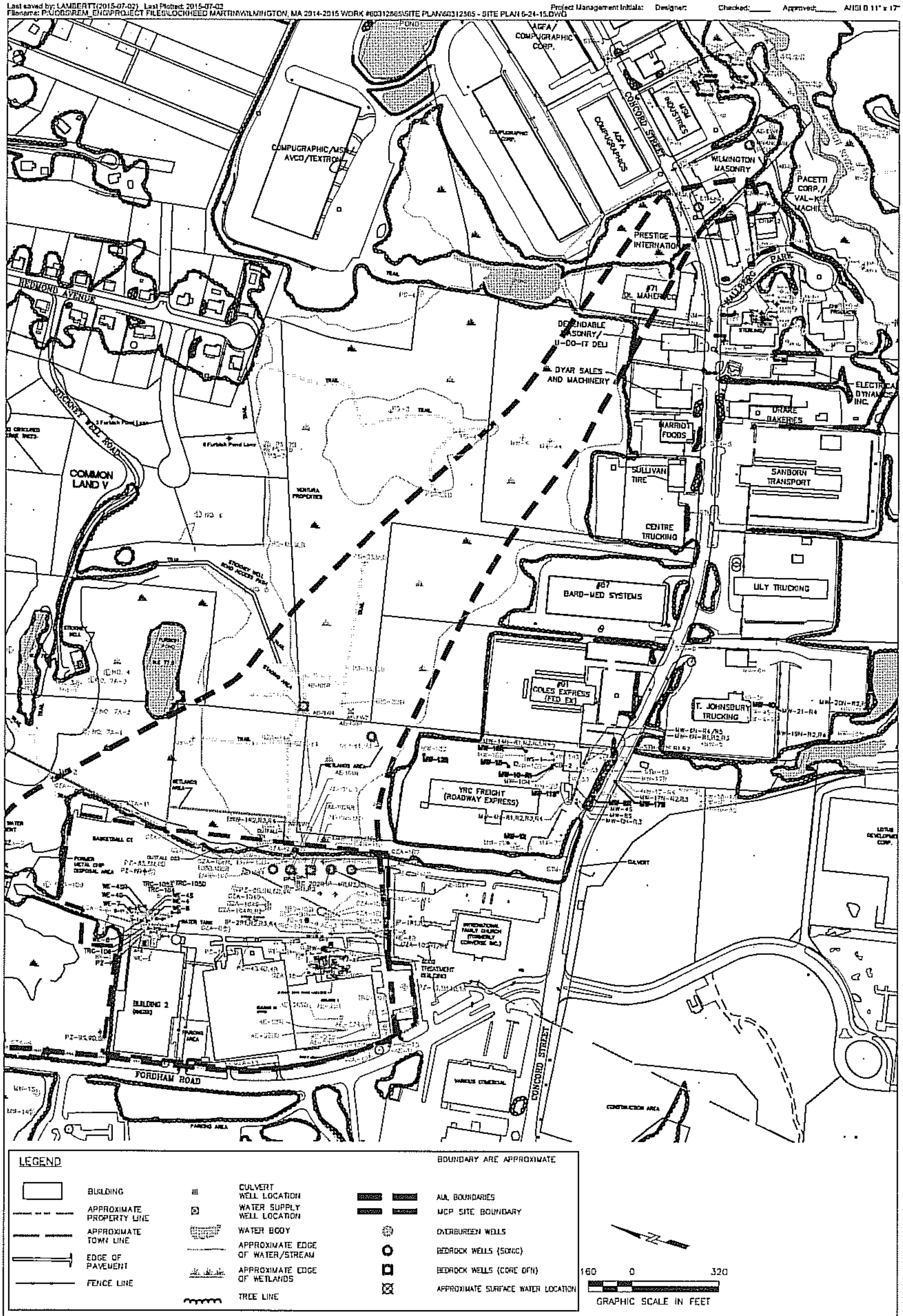
AUL BOUNDARY PLAN
ROSEMARIE STANIEICH
NORTH READING/WILMINGTON, MA

Book	Page	
		Date: 05/04/2015 Scale: 1" = 100' Dr. By: SP Ck By: DJ Job No. 1320358 Sheet no 1 of 1

EXHIBIT B

RELATIONSHIP OF THE PORTION OF THE PROPERTY SUBJECT TO THE AUL TO THE BOUNDARIES OF THE DISPOSAL SITE (Sketch Plan)

Last saved by: LAMBERTT(2015-07-02) Last Plotted: 2015-07-02
Filename: P:\JOBS\REM_ENG\PROJECT FILES\LOCKHEED MARTIN\WILMINGTON, MA 2014-2015 WORK #60312865\SITE PLAN\60312865 - SITE PLAN 6-24-15.DWG
Project Management Initials: Designer: Checked: Approved: ANSI B 11" x 17"



WORKPLAN
#50 FORDHAM ROAD, WILMINGTON, MA
Lockheed Martin
60312865 2015-07-01

SKETCH PLAN

AECOM
EXHIBIT B

EXHIBIT C

ACTIVITY AND USE LIMITATION OPINION

EXHIBIT C - ACTIVITY AND USE LIMITATION OPINION

Purpose of the AUL

This Notice of Activity and Use Limitation ("AUL") provides notice to current and future interest holders of the property commonly known as 50 Fordham Road (including the addresses of 40 and 50 Fordham Road), Wilmington, Massachusetts (the "Property") of residual contamination remaining at the Property. It should be noted that this AUL is being used voluntarily, in accordance with Section 40.1012(3)(h) of the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000, and is not required by the MCP, to confirm certain assumptions regarding future uses at the Property for purposes of Risk Characterization of human health and ecological risks at the Disposal Site. This AUL describes certain restrictions upon the use of the Property to promote the ongoing protection of human health and the environment.

This AUL will serve as a notification, concerning appropriate health and safety measures to be taken during any future construction-related or other activities that disturb the subsurface, including (but not limited to) penetration of concrete building slabs, subsurface soil or bedrock excavations and groundwater dewatering activities. It will also be protective of human health and the environment by requiring that any contaminated media generated during construction activities be managed in accordance with Massachusetts Contingency Plan (MCP) Soil Management procedures as described in 310 CMR 40.0030 and the Massachusetts Department of Environmental Protection (MassDEP) guidance documents, including Construction of Buildings in Contaminated Areas (Policy WSC#-00-425) and the Similar Soils Provisions Guidance (WSC#-13-500), as determined by a Licensed Site Professional ("LSP").

Relevant Property History

Contamination of the Stickney Well, a currently inactive public supply well for the town of North Reading, was discovered in the late 1970s. Subsequent investigations of multiple surrounding properties, including the Property (formerly owned and operated by GE Aerospace (sometimes referred to as "GE" herein)), began in the early 1980s. The Property has been subject to remedial investigations and cleanup since 1986, when the MassDEP (then the Department of Environmental Quality Engineering or DEQE) issued GE a Notice of Responsibility. In 1987, the MassDEP classified the former GE facility as a Priority Disposal Site,[1] and in 1994 the MassDEP assigned Release Tracking Number (RTN) RTN-3-0518 to the site.[2]

The Property has had a history of manufacturing processes that have contributed to releases of fuels, oils, solvents, and metals to the environment. Analytical data have shown that six primary types of organic and inorganic compounds are associated with RTN 3-0518. These include chlorinated volatile organic compounds (CVOCs); total petroleum hydrocarbons (TPH); benzene, toluene, ethyl benzene and xylenes (BTEX) compounds; methyl tertiary butyl ether (MTBE); several metals; and light non-aqueous phase liquids (LNAPL) identified as Stoddard fuel (solvent). Known impacted areas of the Property include four separate operating units (OU), as well as the Tank F and Building 1 Areas, and are summarized in the following table and shown on the attached Figure 1. These areas are designated "Restricted Areas."

Restricted Areas	Description	Affected Media	Compounds of Concern	Regulatory Status
OU-1	Former Tank Farm source area and adjacent Eastern Parking Lot (EPL). Tank Farm had 4 underground storage tanks (USTs) removed in 1987.	Vadose zone soils, and shallow groundwater	Stoddard Solvent LNAPL in groundwater and extractable petroleum hydrocarbons (EPH)-volatile petroleum hydrocarbons (VPH) in both soils and groundwater; associated arsenic	Open
OU-2	Former Tank Farm source area and down-gradient plume on- and off-property	Groundwater	CVOCs and 1,4-dioxane	Open
OU-3	Storm water/Waste water Outfalls 001 and 002	Sediment	Metals and petroleum hydrocarbons	Closed, Partial Class A-2 Response Action Outcome (RAO) (Submitted 2004)

[1] Under 310 CMR 40.0006 (1)(b), the term "Disposal Site" is used to refer to a place or area where an uncontrolled release of oil and/or hazardous material from or at a site or vessel has come to be located.

[2] Martin Marietta acquired GE Aerospace in 1993 and subsequently Martin Marietta and Lockheed merged to form Lockheed Martin Corporation.

Restricted Areas	Description	Affected Media	Compounds of Concern	Regulatory Status
OU-4	Former Tank K source area and immediately down-gradient of plume.	Vadose zone soils and shallow groundwater	Gasoline related petroleum hydrocarbons (VOCs) from former gasoline UST. UST was removed in 1986.	Closed, Partial Class A-2 RAO (Submitted 2010)
Tank F/Building 1 Area	Former Tank F area and area below concrete slab of Building 1	Vadose zone soils and groundwater	CVOCs and petroleum hydrocarbons	Open

OU-1 Area

The Response Actions taken at the Tank Farm/EPL Petroleum Area (OU-1) have included LNAPL recovery, removal of Building 3 and the Oil House/drum storage, and excavation and off-site disposal of petroleum contaminated soil. Since 2011, LNAPL gauging has indicated the absence of measurable LNAPL in any wells that have been gauged. Soil impacts in the OU-1 appear to be consistent with current MCP Industrial/Commercial standards; however, the deeper groundwater and down-gradient plume is impacted with the CVOCs emanating from the former Tank Farm OU-2 Area (see below).

OU-2 Area

The Response Actions taken at the Tank Farm CVOC Source Area (OU-2) have been extensive and included:

- Removal in 1987 of four Underground Storage Tanks ("USTs") at the Tank Farm (Tank D, a 10,000-gal "waste fuel" tank that received waste fuel and oil, thinners, and solvents; Tank G, a 10,000-gal tank used for storing jet fuel and oil; Tank H, a 1,000- gal tank used for storing JP-4 jet fuel; and Tank I, a 500-gal tank used for storing methanol).
- Groundwater pump and treat at the Tank Farm Area between 1993 and 2002. During operation, approximately 1.9 million gallons of groundwater were treated, and approximately 31 pounds of VOCs were removed from the groundwater.
- Groundwater pump and treat in a bedrock well (TRC-202R) located down-gradient of the Tank Farm Area between 2003 and 2008. During operation, approximately 4.3 million gallons of groundwater were treated, and approximately 159 pounds of VOCs were

removed from the groundwater. Groundwater data trends did not indicate significant reductions in contaminant concentrations. The system remains shut down at the present time.

- Addition of a remedial treatment solution known as Emulsified Zero Valent Iron (EZVI) in 2005 through 2006. EZVI was injected directly into bedrock fractures and into the overburden-bedrock interface within the Tank Farm Area. The EZVI treatment was not considered successful.

- Analysis of monitored natural attenuation (MNA) geochemical and microbiological parameters in 2012 for groundwater, indicating conditions supportive of limited enhanced reductive dechlorination. A review of plume geometry and other trends indicate that the off-site CVOC impacts appear to be stable or shrinking.

- Additional groundwater investigation activities from 2012 through 2014 in the Tank Farm, the EPL and off-site in the adjacent wetland areas. This work is on-going and the data will be evaluated and presented in a Supplemental Phase II report in the future.

OU-3 and OU-4 Areas

Areas within OU-3 and OU-4 have been remediated and closed under the MCP in 2004 and 2010, respectively. Response Actions taken at OU-3 included excavation of metal-impacted sediments and wetland restoration. Response Actions taken at OU-4 have included UST removal, soil excavation, and biosparge/soil vapor extraction. Although these areas have been closed under the MCP, it should be noted that contaminated media were cleaned up to Industrial/Commercial standards and that low level impacts may remain. That is, the soil, sediments and groundwater have not been cleaned up to conditions such that these locations would be suitable for Residential, Institutional, or park/playground land use without first completing further response actions.

Tank F and Building 1 Areas

Tank F, formerly located on the southwest side of Building 1 on the former GE facility property, which received acid and caustic wastes plus other degreasing solvent and fuel wastes through floor drains from Building 1, was removed from the Property in 1990. No obvious impacts were observed during its removal or from samples obtained from soils and other liquids associated with the tank prior to its removal. No remedial efforts have been associated with this tank area.

Investigation results suggest CVOC impacts in the southwestern area of Building 1 and/or the former Tank F area. Shallow groundwater in the overburden does not exhibit elevated CVOC concentrations; however, bedrock wells in this area exhibited much higher concentrations of both PCE and TCE. In June 1987, a small tank was removed adjacent to Tank F and field screening levels of VOCs ranging from 100 to 200 parts per million (ppm) were encountered near the bottom of the excavation. In addition, sampling of sediment from within the chase troughs in Building 1 exhibited petroleum hydrocarbon and CVOC impacts. Soils within the top foot under the metals finishing floor sumps indicated low levels of CVOCs.

Sub-slab and indoor air sampling has been conducted within Building 1 between 2009 through 2014. Elevated levels of petroleum hydrocarbons and CVOCs have been detected below the concrete slab of Building 1. Low levels of CVOCs have also been detected in indoor air samples, however, they have consistently been below MassDEP available MA Commercial/Industrial (C/I) Threshold Values and do not pose a risk to industrial/ commercial workers. It is therefore the opinion of the LSP that industrial and commercial use is a permissible use under the AUL.

In 2013 and 2014, additional soil and groundwater investigation activities have been performed underneath Building 1. This work is on-going and the data will be evaluated and presented in a Supplemental Phase II report in the future.

Nature and Extent of Contamination

The lateral extent of the MCP Disposal Site encompasses a large portion of the Property as shown on the attached **Figure 1.** Within this site boundary, residual levels of contaminants are likely present within soil or groundwater or both. Higher concentrations are expected within the Operable Units and the Tank F/Building 1 Areas than in areas outside of these designated areas. However, low level residual contamination above applicable MCP standards may be present in areas outside of these areas within the Disposal Site boundary. The AUL boundary has been set to encompass a large portion of the Property, including the Restricted Areas, but exclusive of the northern wetland areas where future construction-related activities are considered to be highly unlikely, and exclusive of the areas beneath and between Buildings 1A and 2.

Recommendations

It is the opinion of the LSP that the restrictions on Activities and Uses of the Property and the Obligations and Conditions contained in the AUL are appropriate, based on the foregoing.

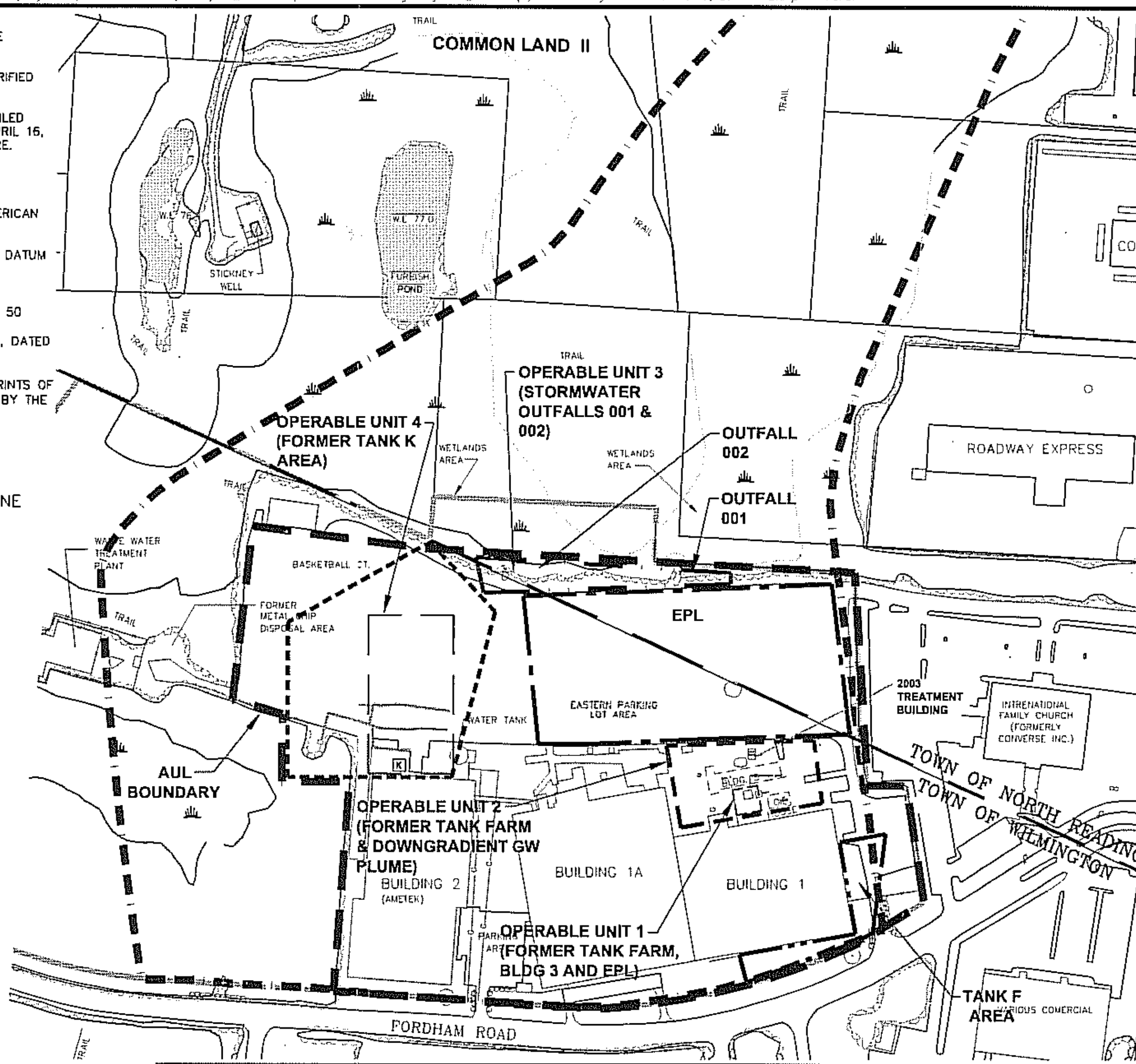
File: J:\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2012 #60267214\Project Implementation files\CADD\ROS_2013-04\AUL Site Plan 2.dwg Layout: _ACM-0 (3) User: barryk Plotted: Oct 13, 2014 - 2:04pm Xref's:

NOTES:

1. SOURCE: "BASE MAP" (TRC ENVIRONMENTAL CORP., 2003). THE ACCURACY OF THE SURVEY INFORMATION PRESENTED HEREIN, INCLUDING THE HORIZONTAL COORDINATE SYSTEM AND THE HORIZONTAL AND VERTICAL DATUMS HAVE BEEN PARTIALLY VERIFIED BY AECOM.
2. TOPOGRAPHIC AND PLANIMETRIC FEATURES SHOWN WERE COMPILED PHOTOGRAMMETRICALLY FROM AERIAL PHOTOGRAPHY DATED APRIL 16, 1992 BY EAST COAST MAPPING INC., CONCORD, NEW HAMPSHIRE. MAPPING GROUND CONTROL ESTABLISHED BY FIELD SURVEYS CONDUCTED IN APRIL 1992.
3. THE GRID SYSTEM DEPICTED ON THIS PLAN IS BASED ON THE MASSACHUSETTS STATE PLAN COORDINATE SYSTEM NORTH AMERICAN DATUM OF 1929.
4. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929.
5. PROPERTY AND TOWN LINE BOUNDARIES WERE ADAPTED FROM:
 A) "REGIONAL EXPLORATION PLAN", GENERAL ELECTRIC COMPANY, 50 FORDHAM ROAD PROPERTY, WILMINGTON/NORTH READING, MASSACHUSETTS, BY GOLDBERG – ZOINO & ASSOCIATES, INC., DATED APRIL 1990;
 B) MODIFIED PER NORTH READING GIS DATA, JUNE 2002; AND
 C) DIGITIZED BY MASSGIS FROM A SET OF STABLE BASED FILM PRINTS OF THE 125:000 7.5' QUADRANGLES PURCHASED FROM THE USGS BY THE MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS.

LEGEND

APPROXIMATE PROPERTY LINE
APPROXIMATE TOWN LINE
MCP SITE BOUNDARY
AUL BOUNDARY



0' 150' 300' 600'

APPROXIMATE SCALE IN FEET
1"=300'

AECOM

FORMER GE FACILITY 50 FORDHAM ROAD WILMINGTON, MA	AUL SITE PLAN
DATE: 10/14 DRWN: K.P.B.	FIGURE 1

EXHIBIT D

TRUSTEE CERTIFICATE

WILMINGTON REALTY TRUST
TRUSTEES' CERTIFICATE

The undersigned, Rosemarie Stanieich, Victoria J. Maiyara, and Annette Maria Given, as Trustees of Wilmington Realty Trust under Declaration of Trust dated September 7, 1973, registered in the Middlesex North Registry District of the Land Court as Document No. 63541 and noted on Certificate of Title No. 19837 and registered further in the Middlesex South Registry of the Land Court as Document No. 515729 and noted on Certificate of Title No. 142138 (the "Trust"), hereby certify as follows:

1. That they are all of the current Trustees of the Trust;

2. That the Trust is in full force and effect and has not been revoked, terminated or rescinded in whole or in part;

3. That the undersigned Trustees have been duly authorized and specifically directed by all of the beneficiaries of the Trust to execute, acknowledge and deliver that certain Activity and Use Limitation with respect to the property owned by the Trust and having an address of 50 Fordham Road in Wilmington, Massachusetts, and:

4. No beneficiary of the Trust is a minor, a Massachusetts corporation selling all or substantially of all its Massachusetts assets, or a personal representative of an estate subject to an estate tax lien, deceased, or under any other legal incapacity.

EXECUTED as a sealed instrument this 13th day of July, 2015

WILMINGTON REALTY TRUST

Rosemarie Stanieich

Rosemarie Stanieich, as Trustee and not individually

Victoria J. Maiyara, as Trustee and not individually

Annette Maria Given Trustee

Annette Maria Given, as Trustee and not individually

THE COMMONWEALTH OF MASSACHUSETTS

County of Middlesex, ss.

On this 13th day of July, 2015 before me, the undersigned notary public, personally appeared Rosemarie Stanieich, proved to me through satisfactory evidence of identification, which was [✓] photographic identification with signature issued by a federal or state government agency, [ ] oath or affirmation of a credible witness, or [ ] personal knowledge of the undersigned, to be the person whose name is signed on the preceding document as Trustee of Wilmington Realty Trust as aforesaid and acknowledged to me that she signed it voluntarily, for its stated purpose.

Alexandra Danilov

Notary Public
Name: Alexandra Danilov
My Commission Expires: 12-26-19

ALEXANDRA DANILOV
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
December 26, 2019

Rhonda L. Rollins
7-14-15

RHONDA L. ROLLINS
STATE OF NEW HAMPSHIRE
MY COMMISSION EXPIRES AUGUST 22, 2017
NOTARY PUBLIC

~~THE COMMONWEALTH OF MASSACHUSETTS~~
THE STATE OF NEW HAMPSHIRE

Merrimack
County of ~~Middlesex~~, ss.

On this 14th day of July, 2015 before me, the undersigned notary public, personally appeared Victoria J. Maiyara proved to me through satisfactory evidence of identification, which was [x] photographic identification with signature issued by a federal or state government agency, [ ] oath or affirmation of a credible witness, or [ ] personal knowledge of the undersigned, to be the person whose name is signed on the preceding document as Trustee of Wilmington Realty Trust as aforesaid and acknowledged to me that she signed it voluntarily, for its stated purpose.

RHONDA L. ROLLINS
STATE OF NEW HAMPSHIRE
MY COMMISSION EXPIRES AUGUST 22, 2017
NOTARY PUBLIC

[signature]
Notary Public
Name: Rhonda L. Rollins
My Commission Expires: 8/22/17

THE COMMONWEALTH OF MASSACHUSETTS

County of Middlesex, ss.

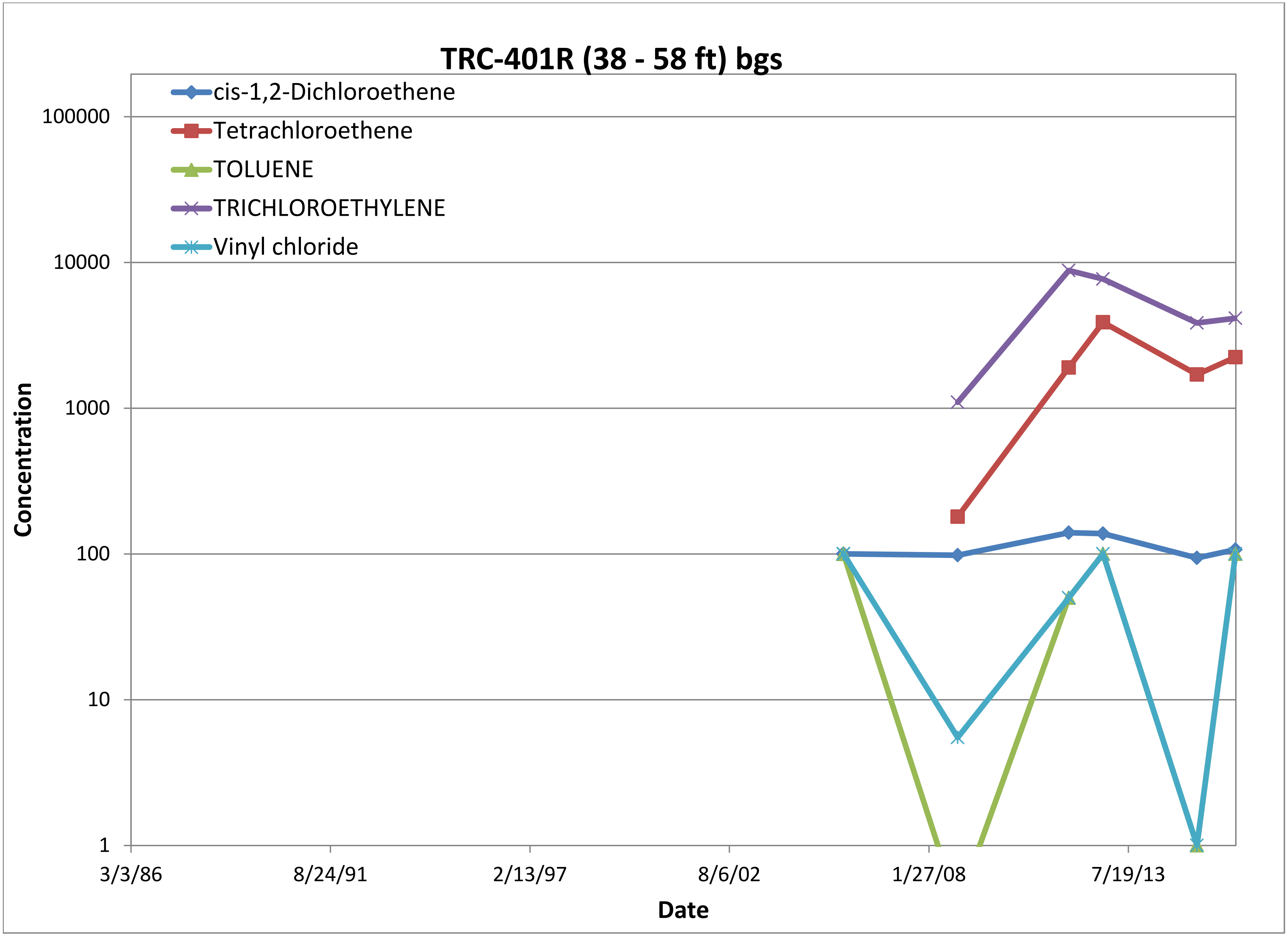
On this 13th day of July, 2015 before me, the undersigned notary public, personally appeared Annette Maria Given proved to me through satisfactory evidence of identification, which was [X] photographic identification with signature issued by a federal or state government agency, [ ] oath or affirmation of a credible witness, or [ ] personal knowledge of the undersigned, to be the person whose name is signed on the preceding document as Trustee of Wilmington Realty Trust as aforesaid and acknowledged to me that she signed it voluntarily, for its stated purpose.

[signature]
Notary Public
Name: Alexandra Danilov
My Commission Expires:
12.26.19

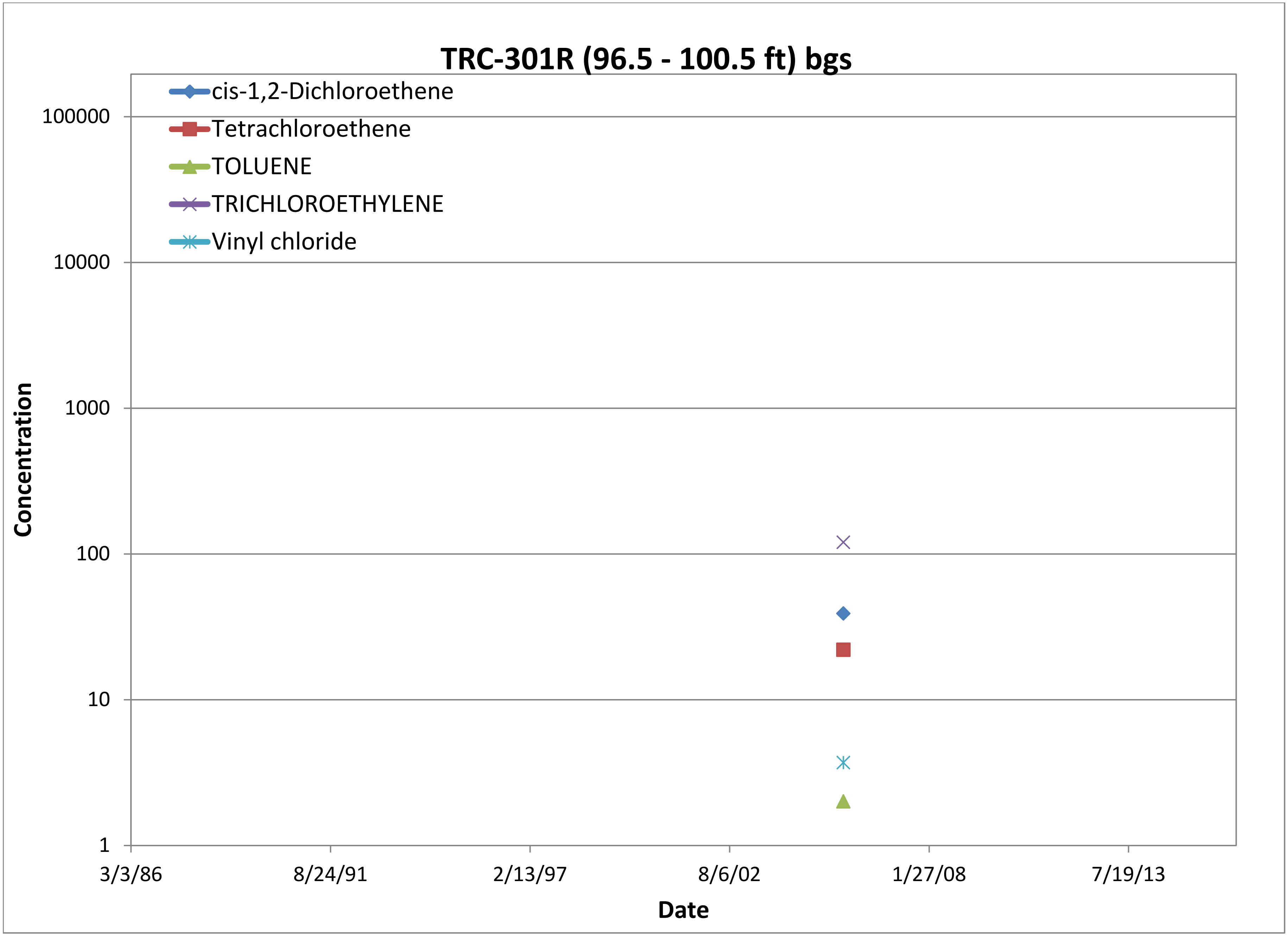
ALEXANDRA DANILOV
Notary Public
COMMONWEALTH OF MASSACHUSETTS
My Commission Expires
December 26, 2019

APPENDIX B CONCENTRATION TREND PLOTS

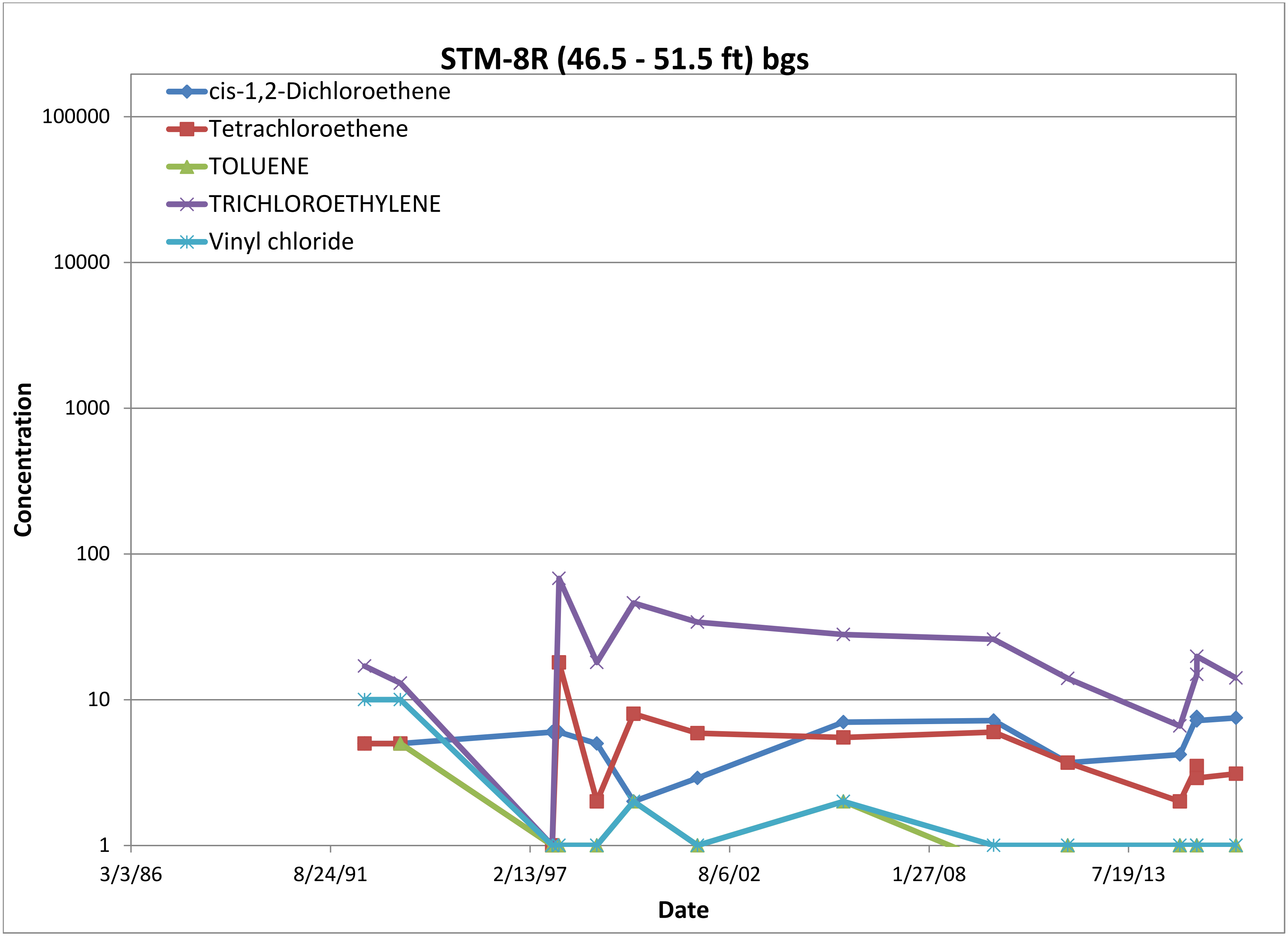
Chlorinated Solvent Groundwater Concentration Trend Plots – 1989 - 2016

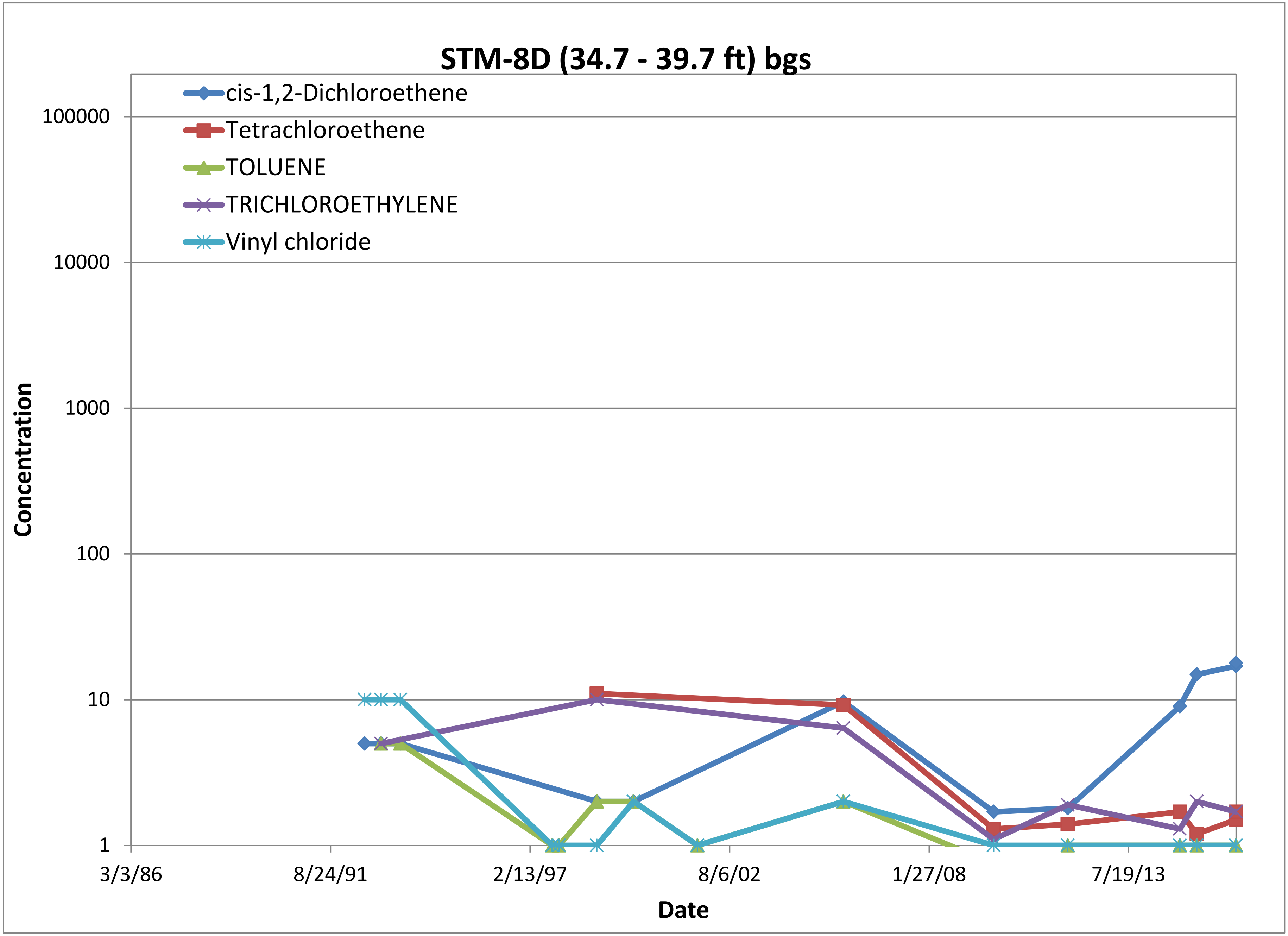


TRC-401R (38 - 58 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

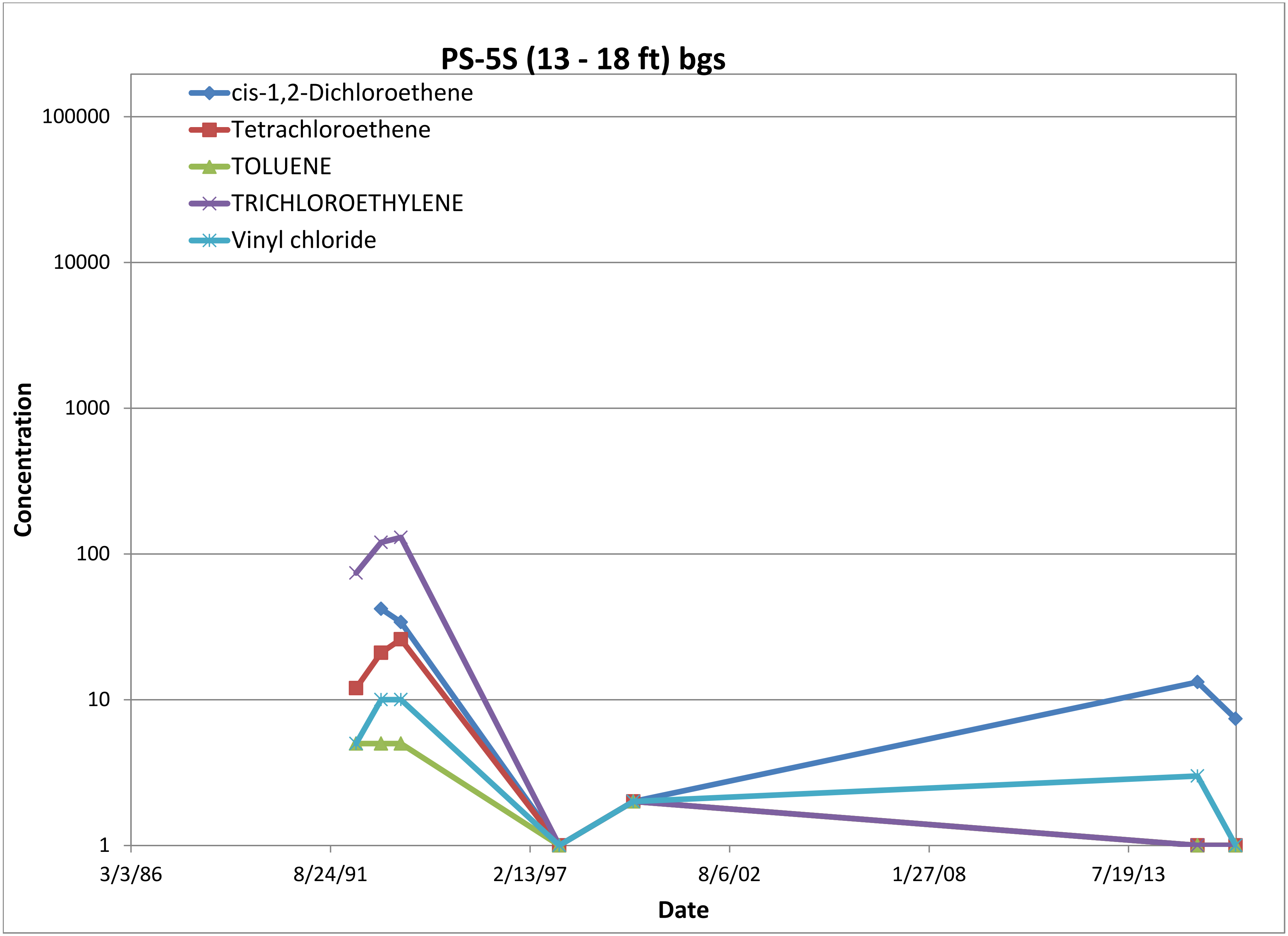


TRC-301R (96.5 - 100.5 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

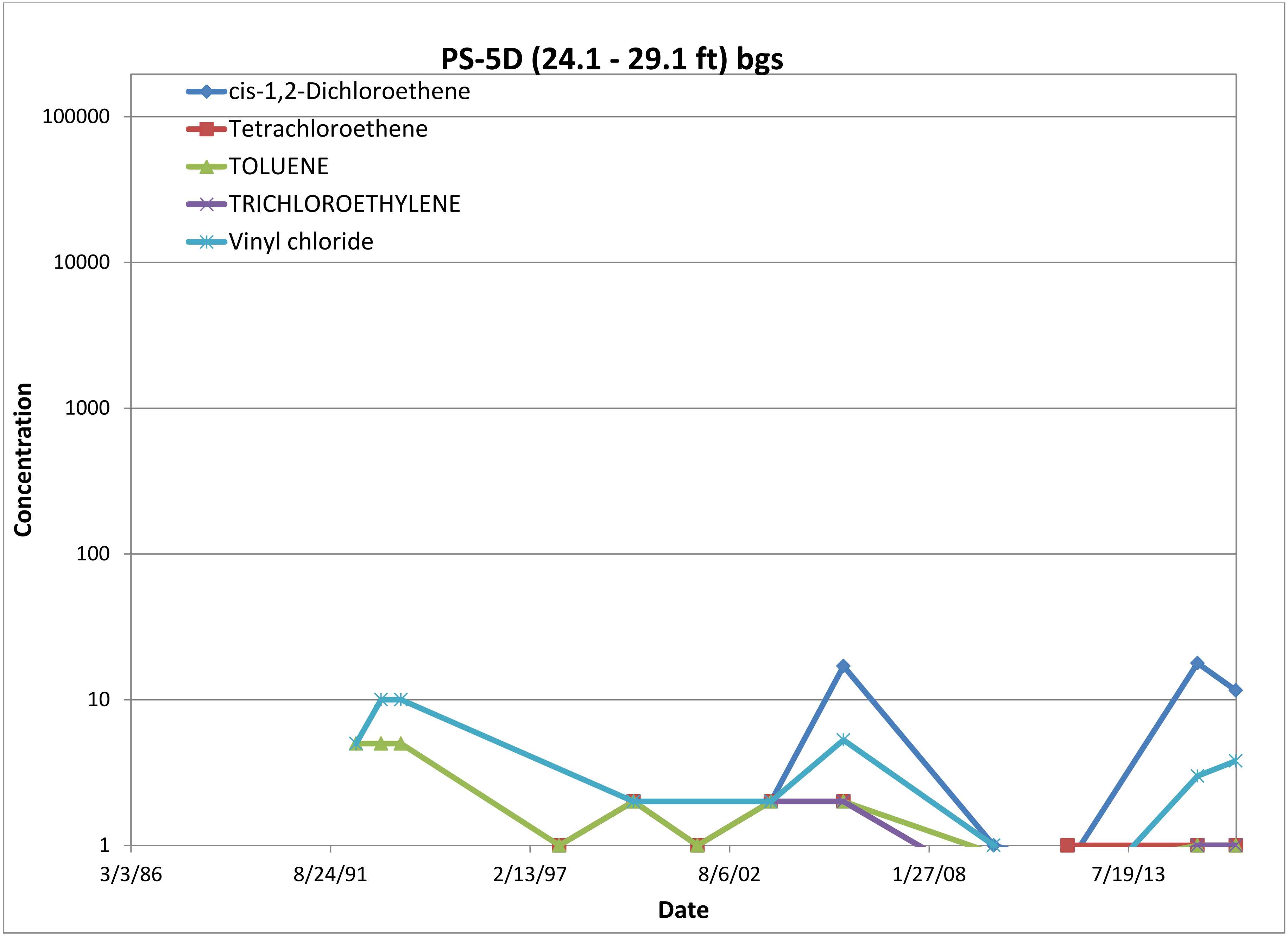

STM-8R (46.5 - 51.5 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date



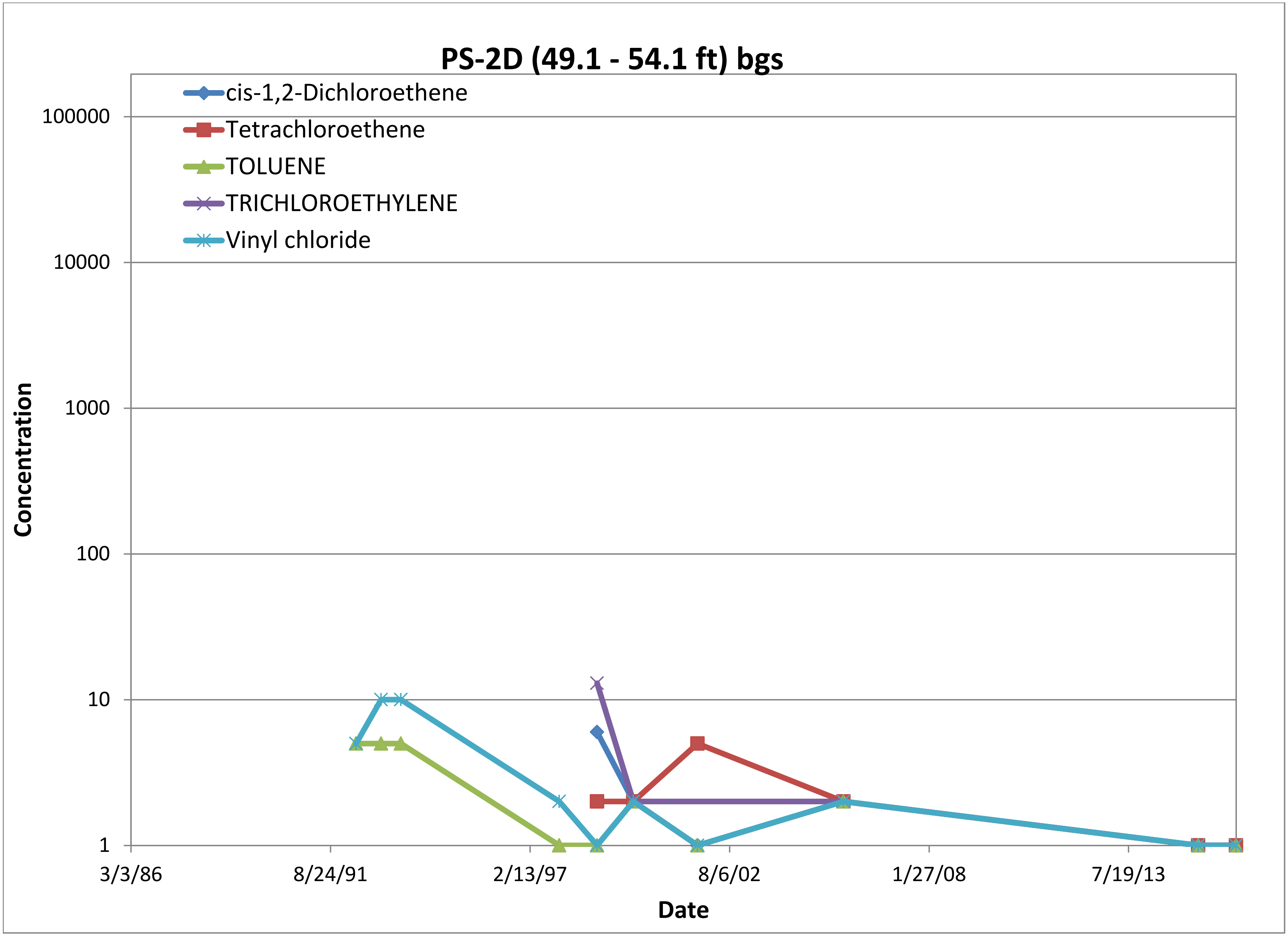
STM-8D (34.7 - 39.7 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date



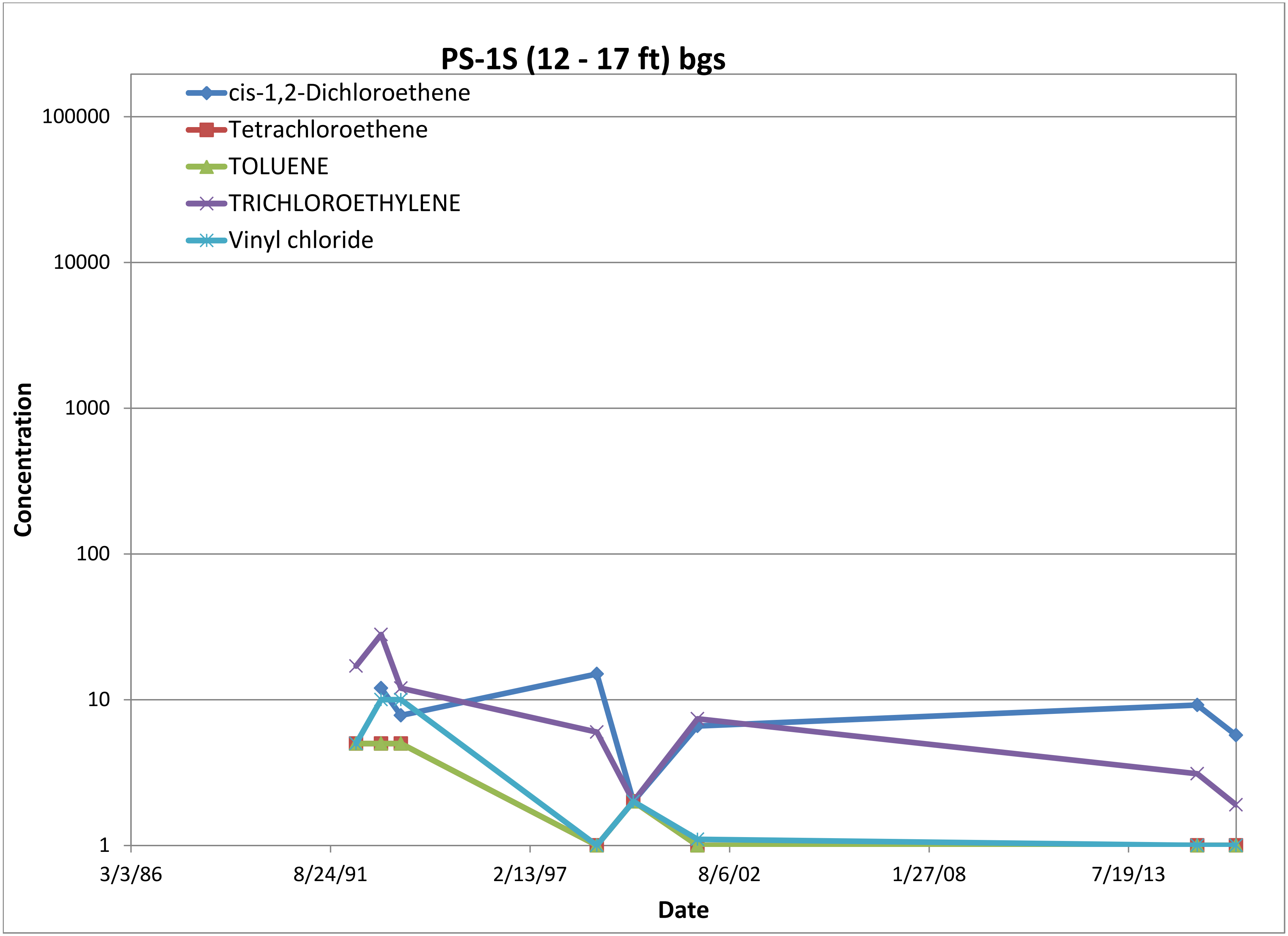
PS-5S (13 - 18 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date



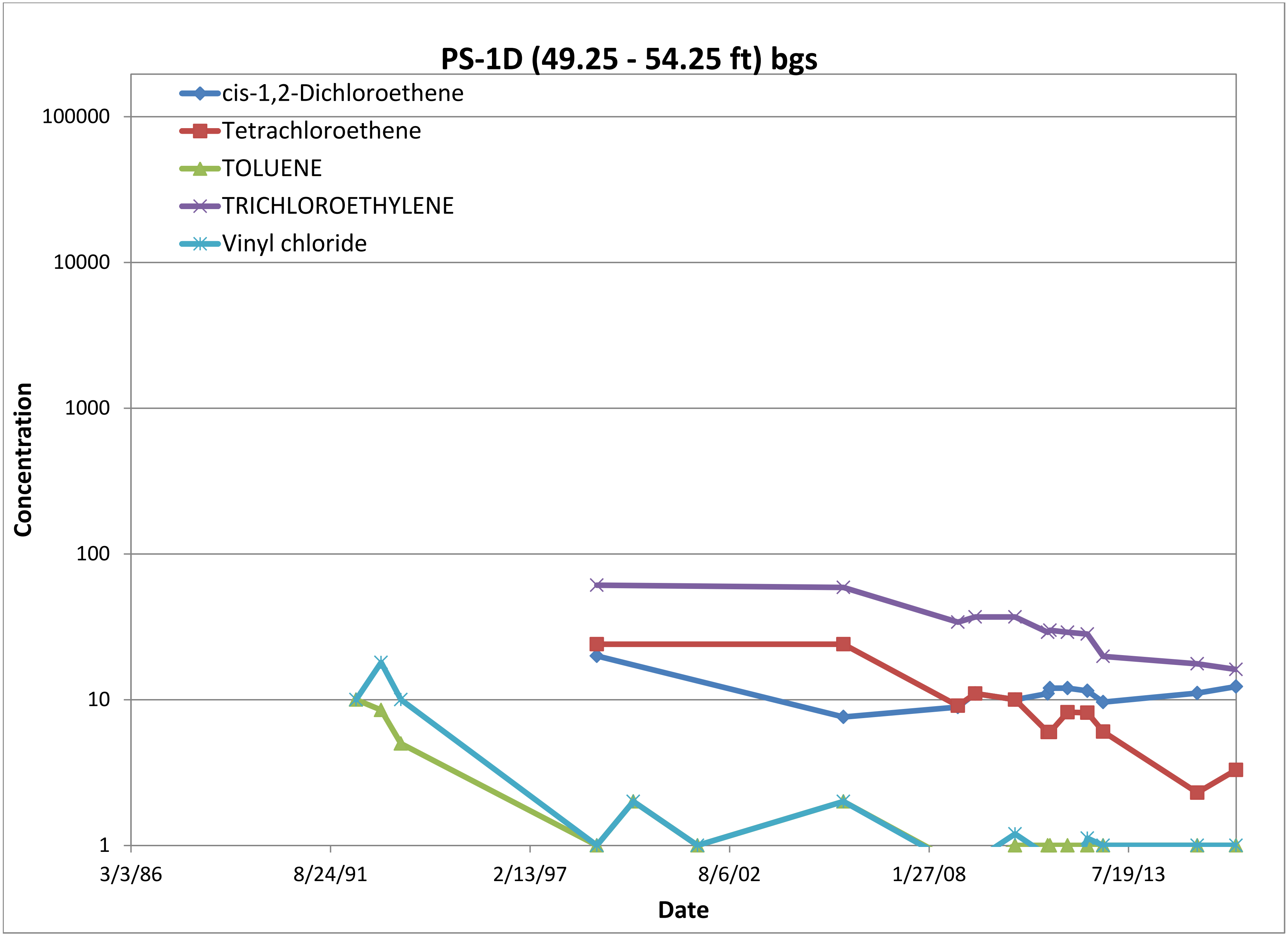
PS-5D (24.1 - 29.1 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

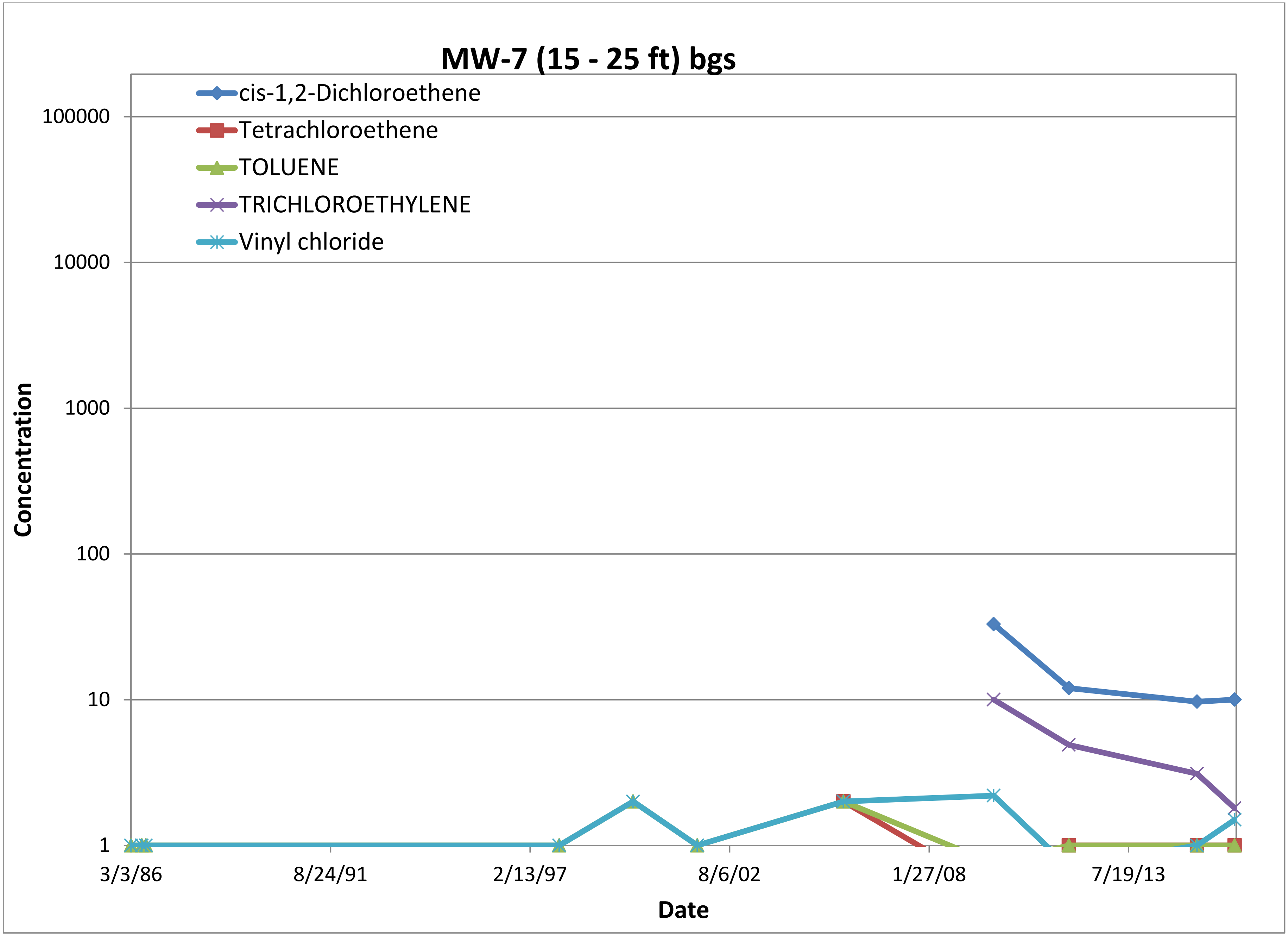


PS-2D (49.1 - 54.1 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

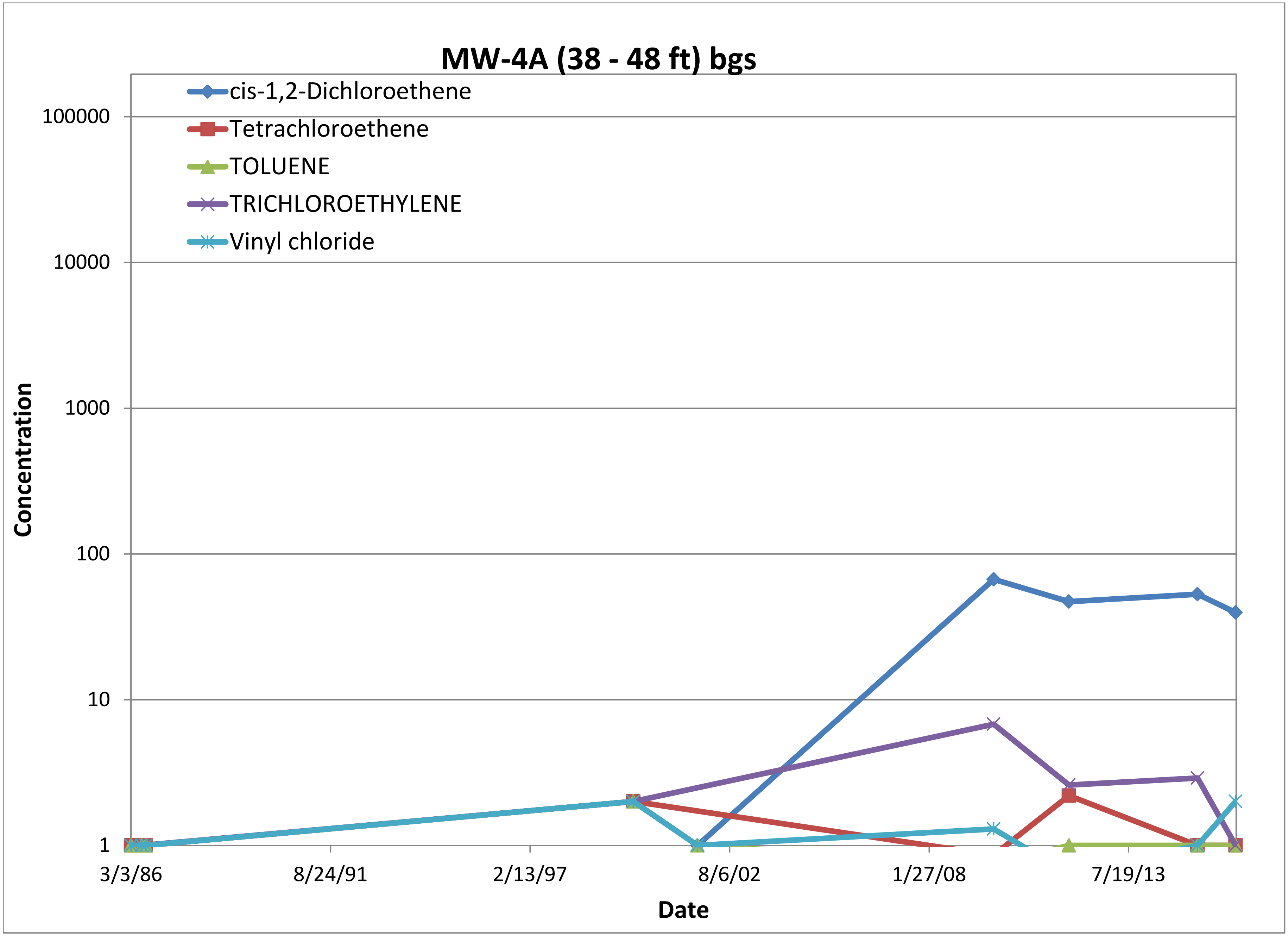


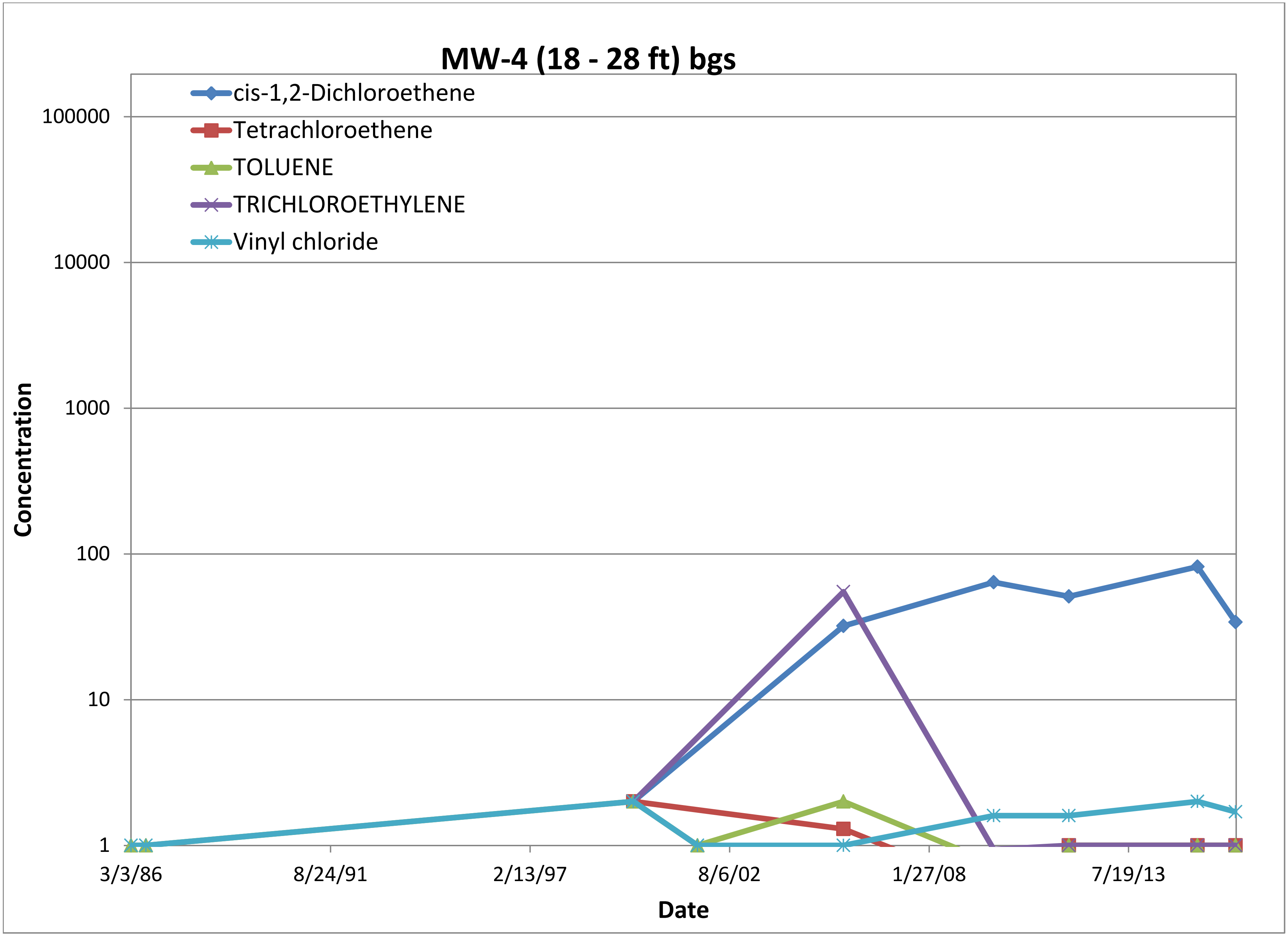
PS-1S (12 - 17 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

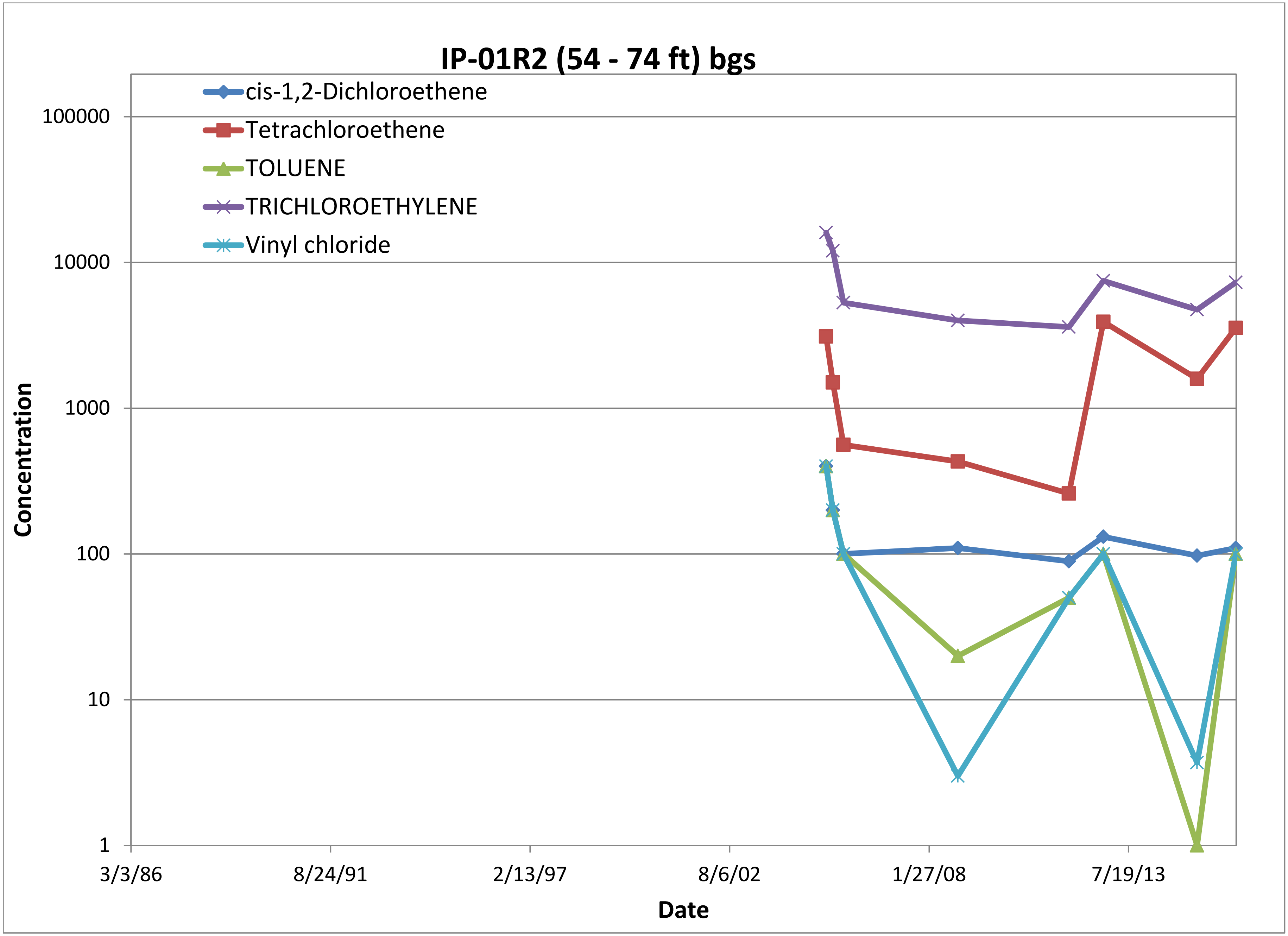

PS-1D (49.25 - 54.25 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

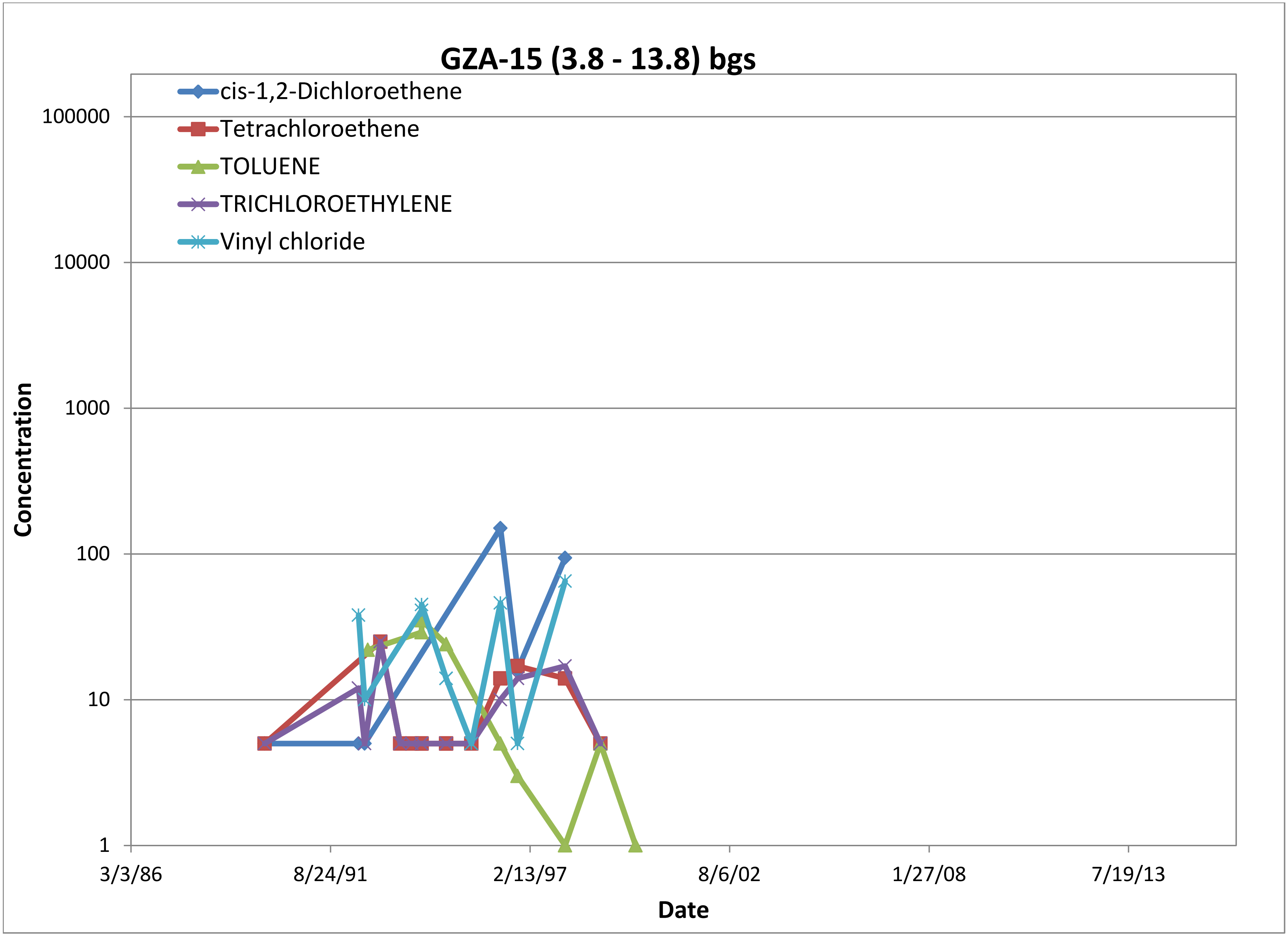


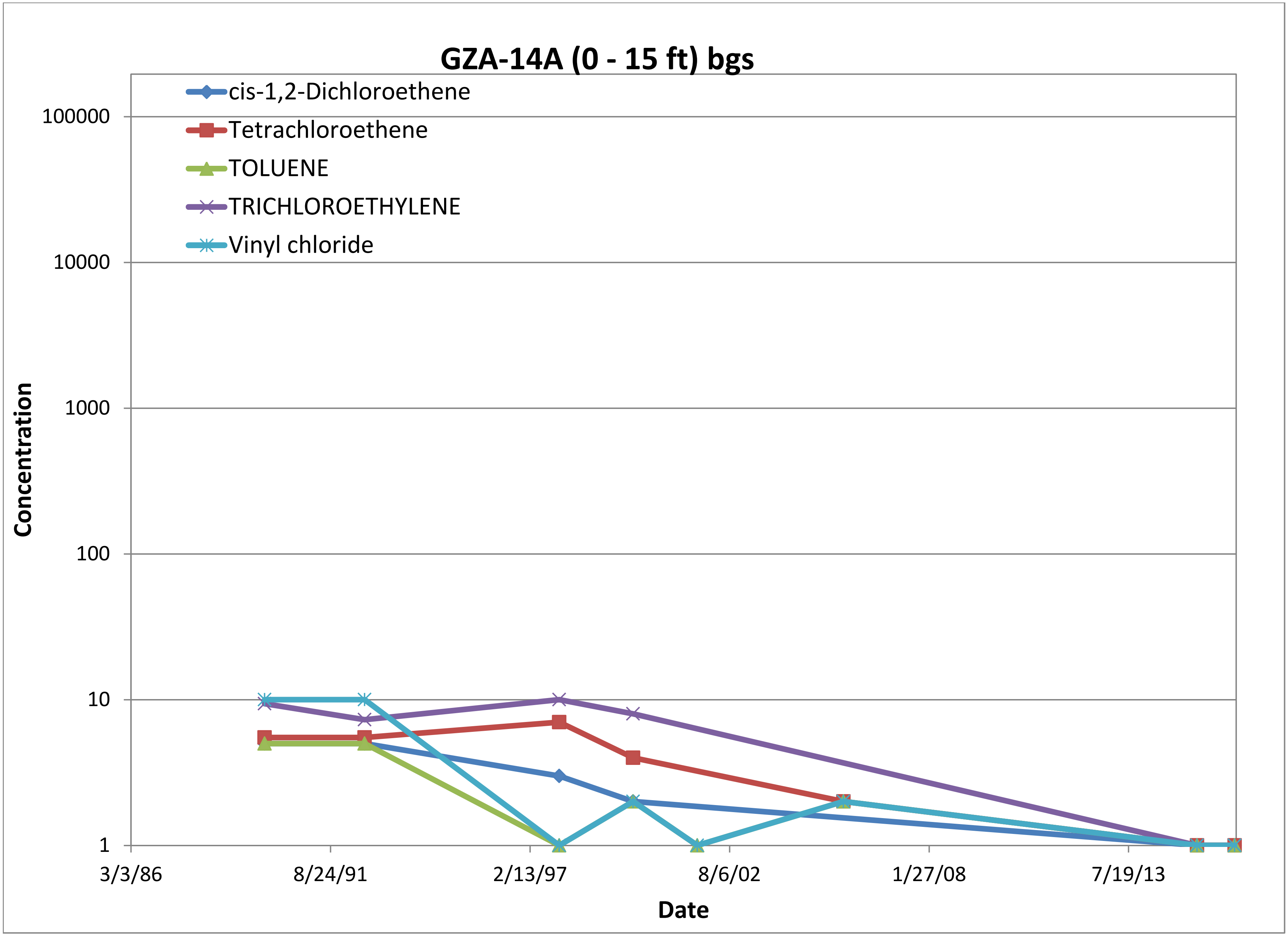
MW-7 (15 - 25 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


MW-4A (38 - 48 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


MW-4 (18 - 28 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


IP-01R2 (54 - 74 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


GZA-15 (3.8 - 13.8) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


GZA-14A (0 - 15 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
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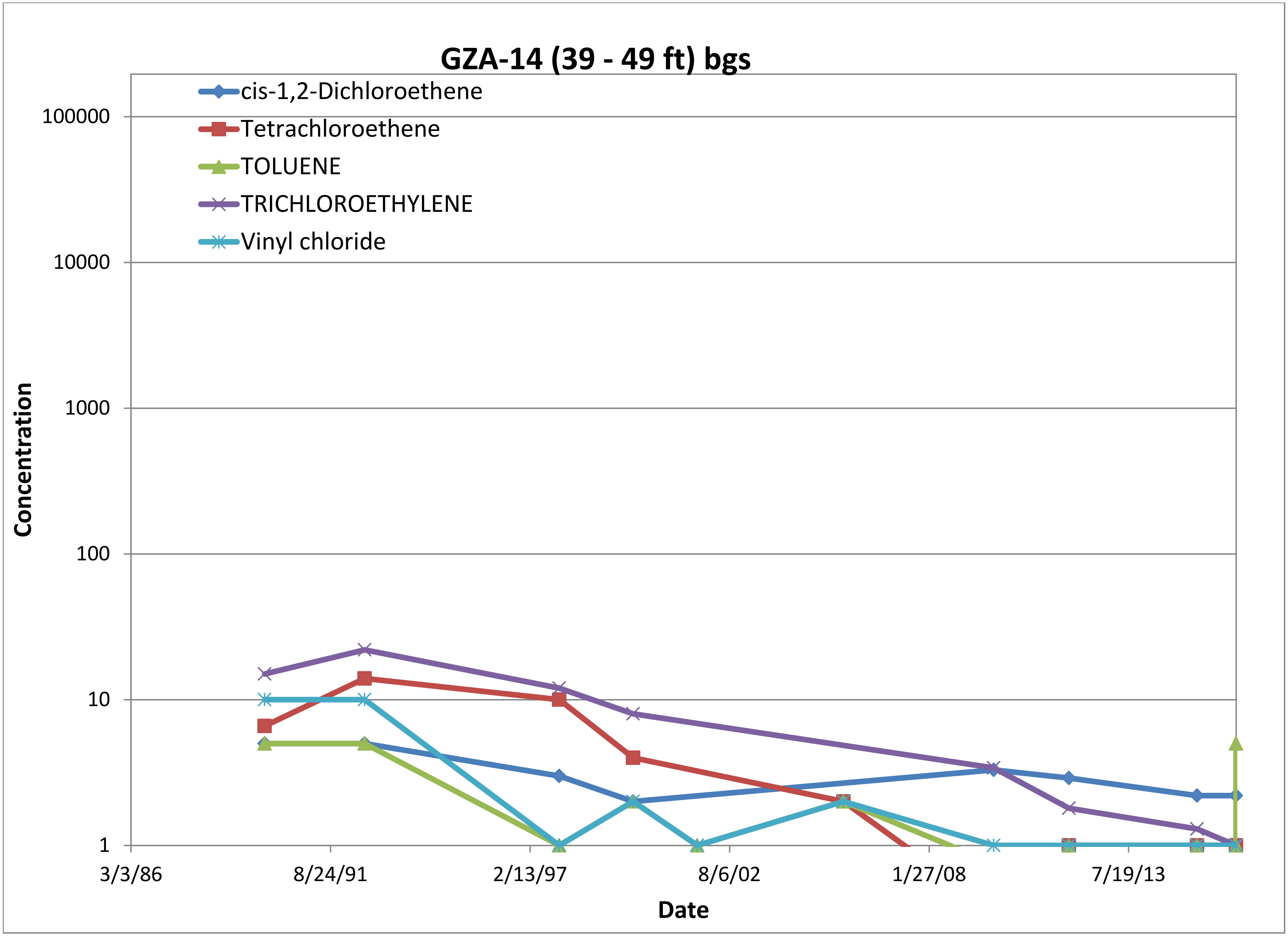
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date



GZA-14 (39 - 49 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
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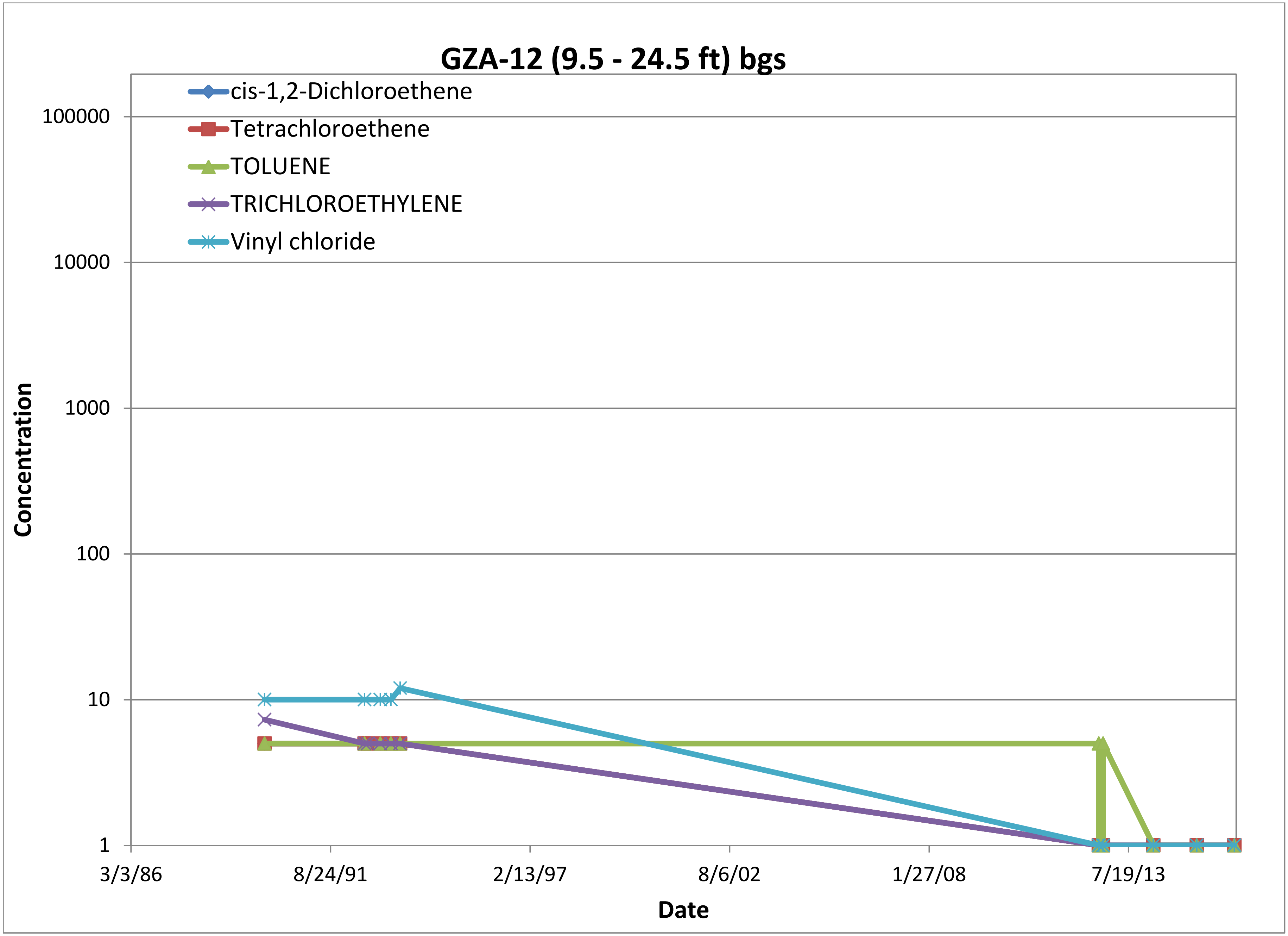
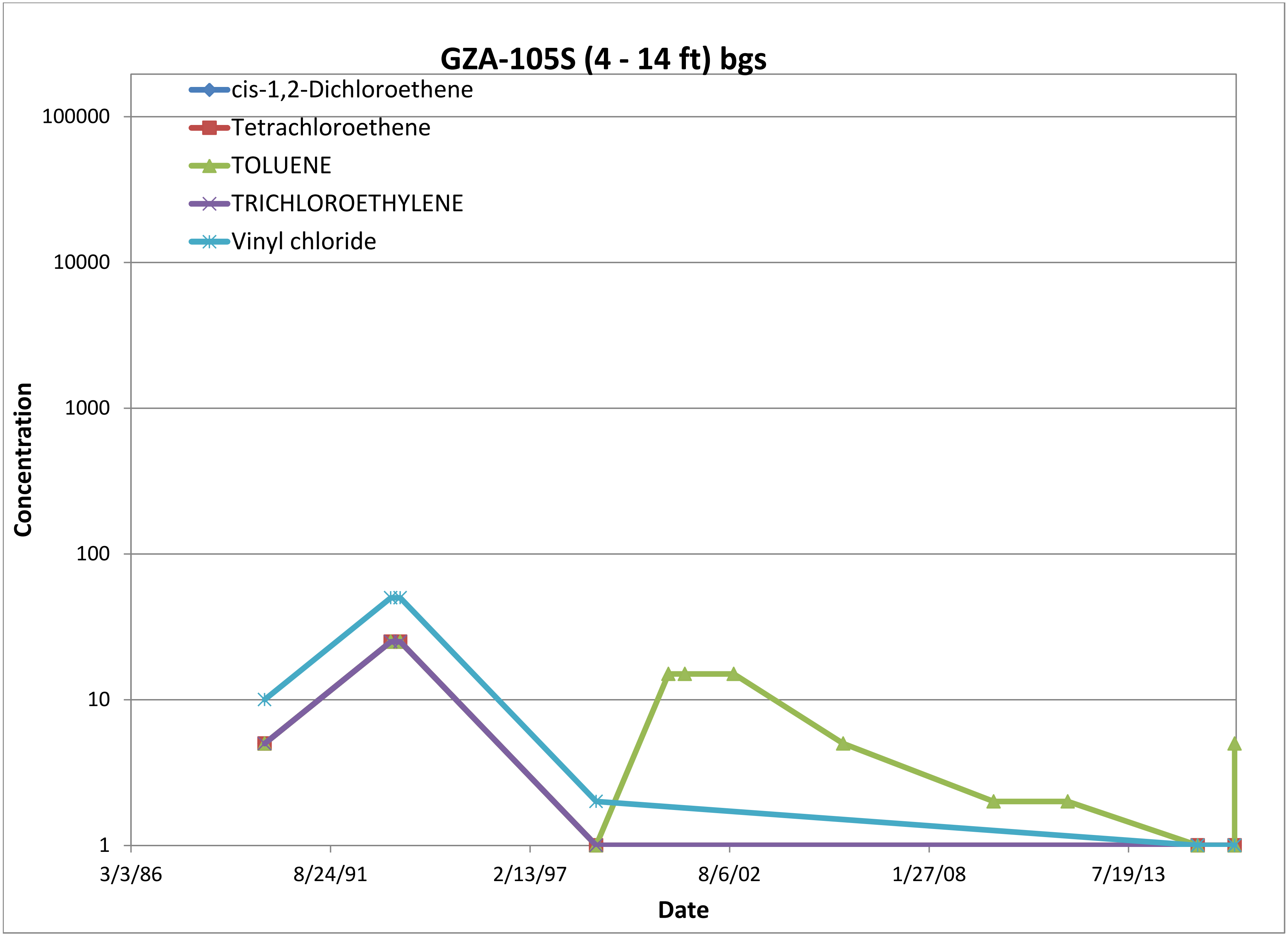
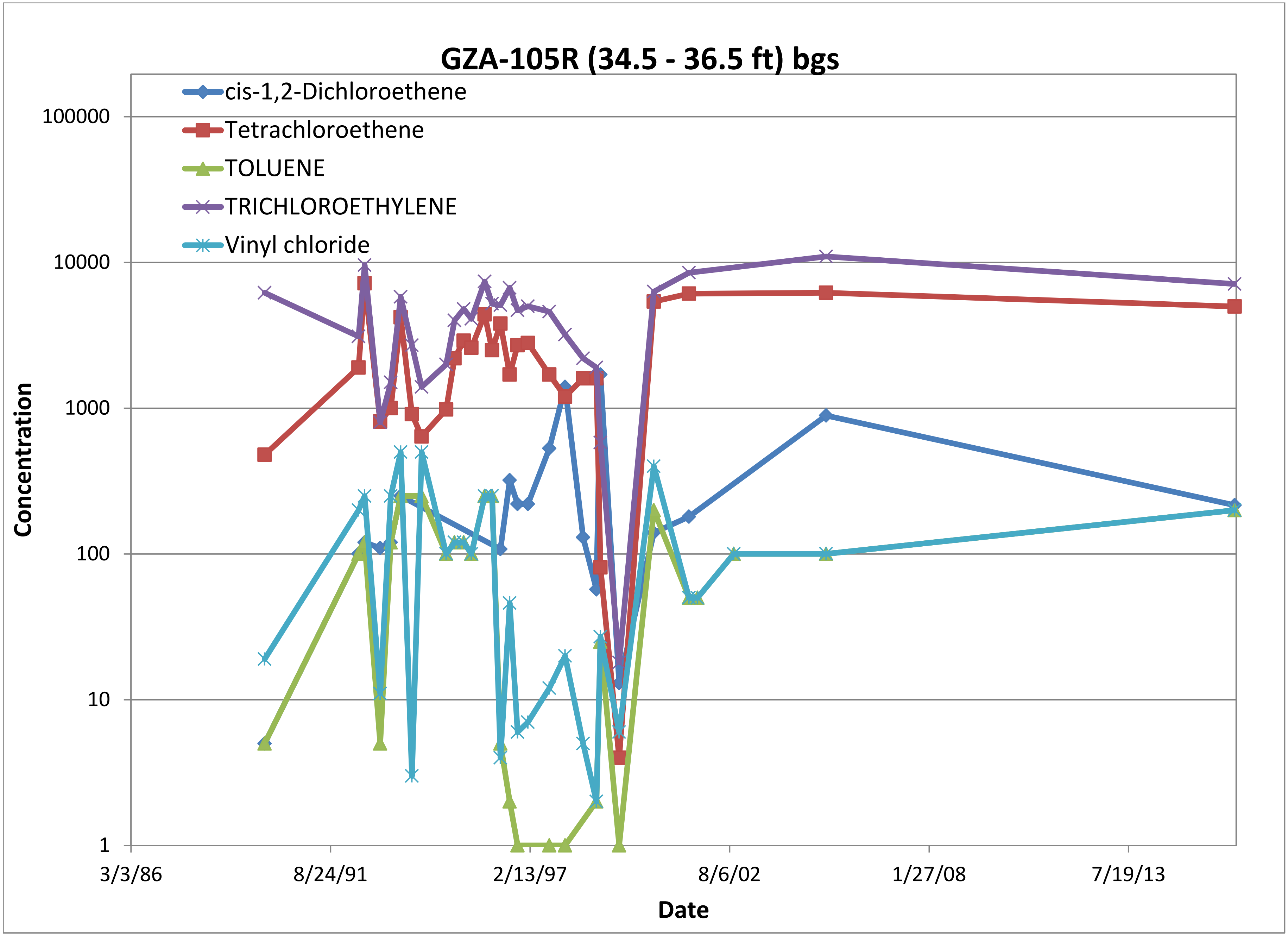
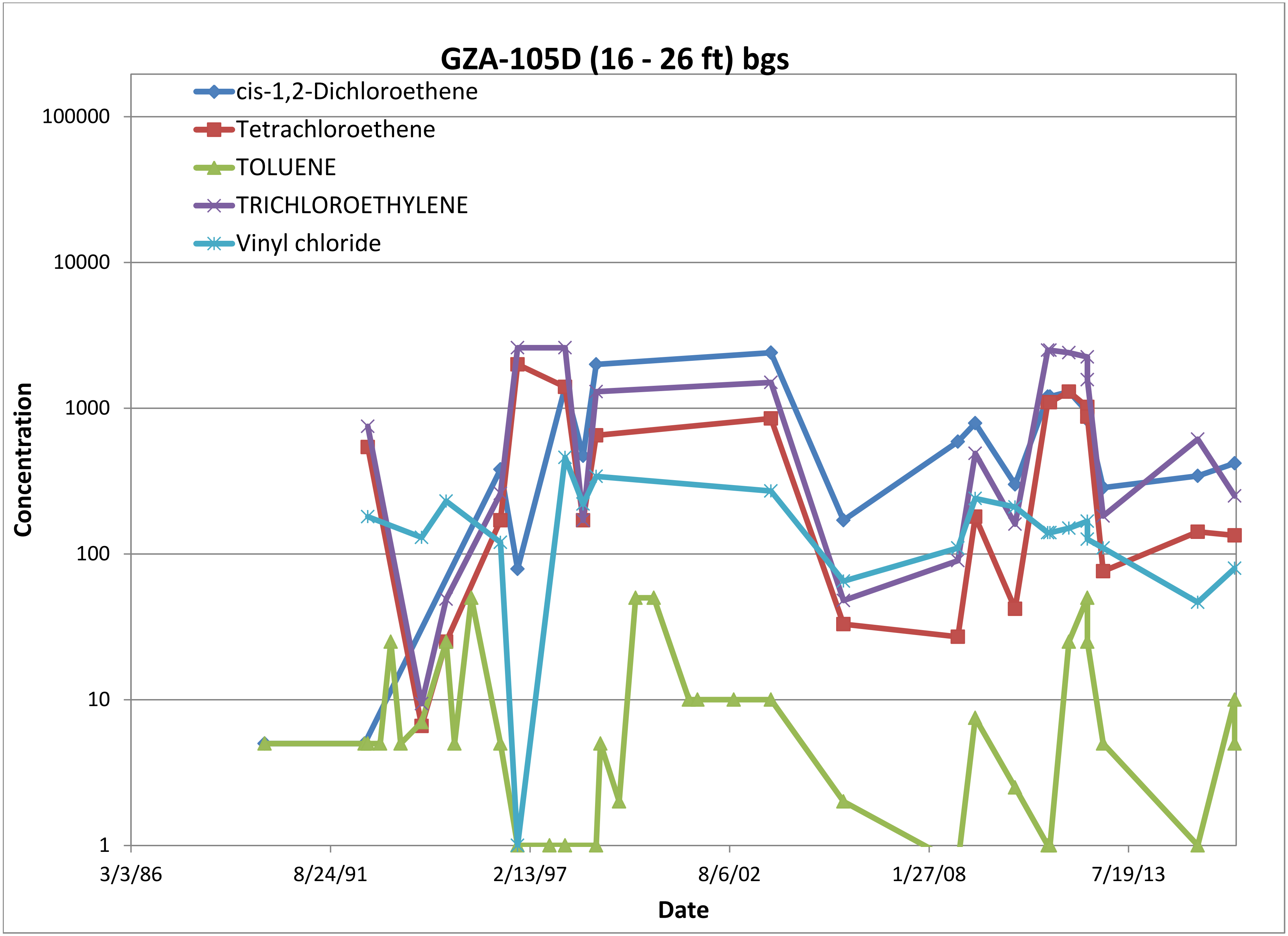
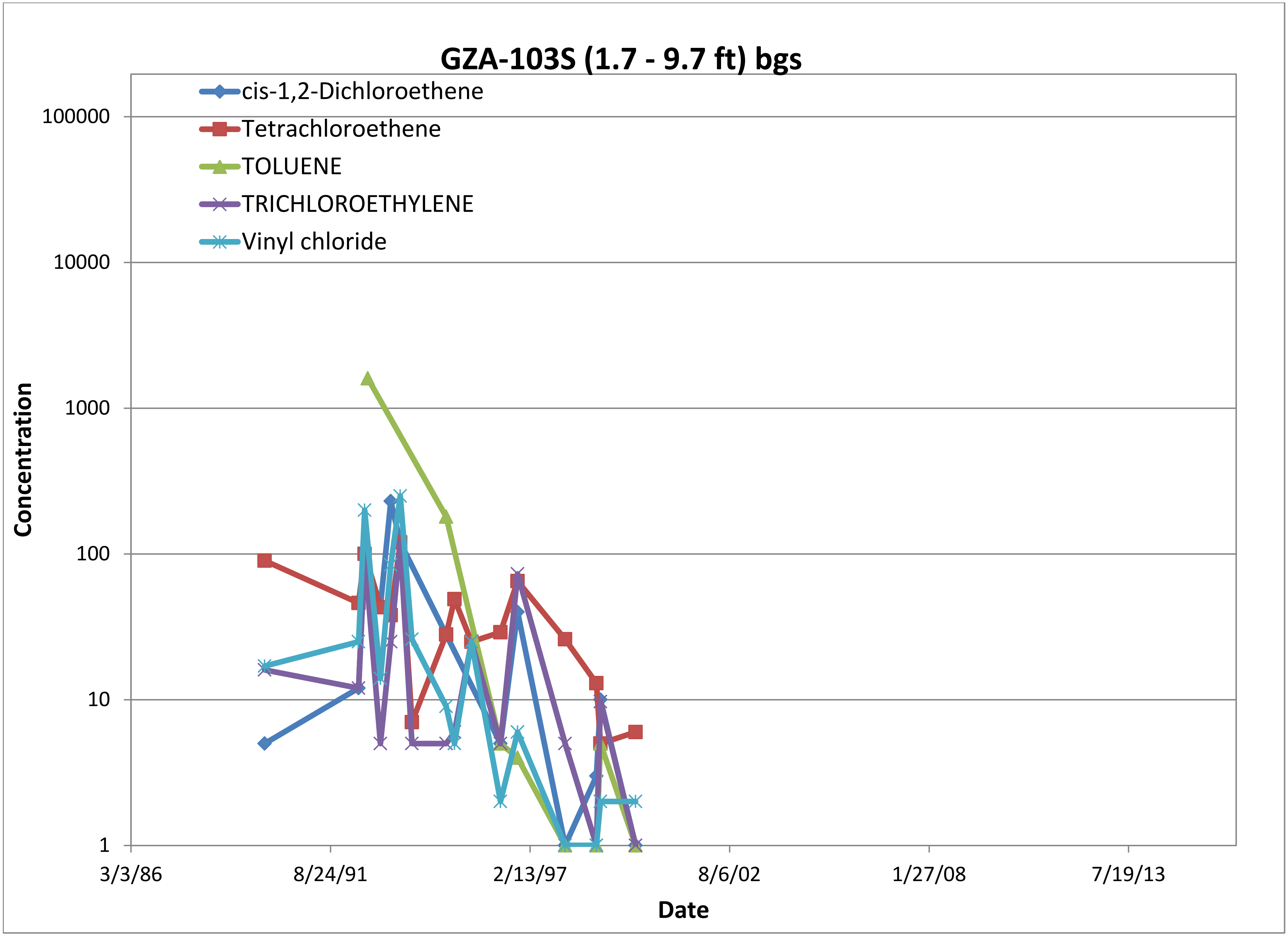
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

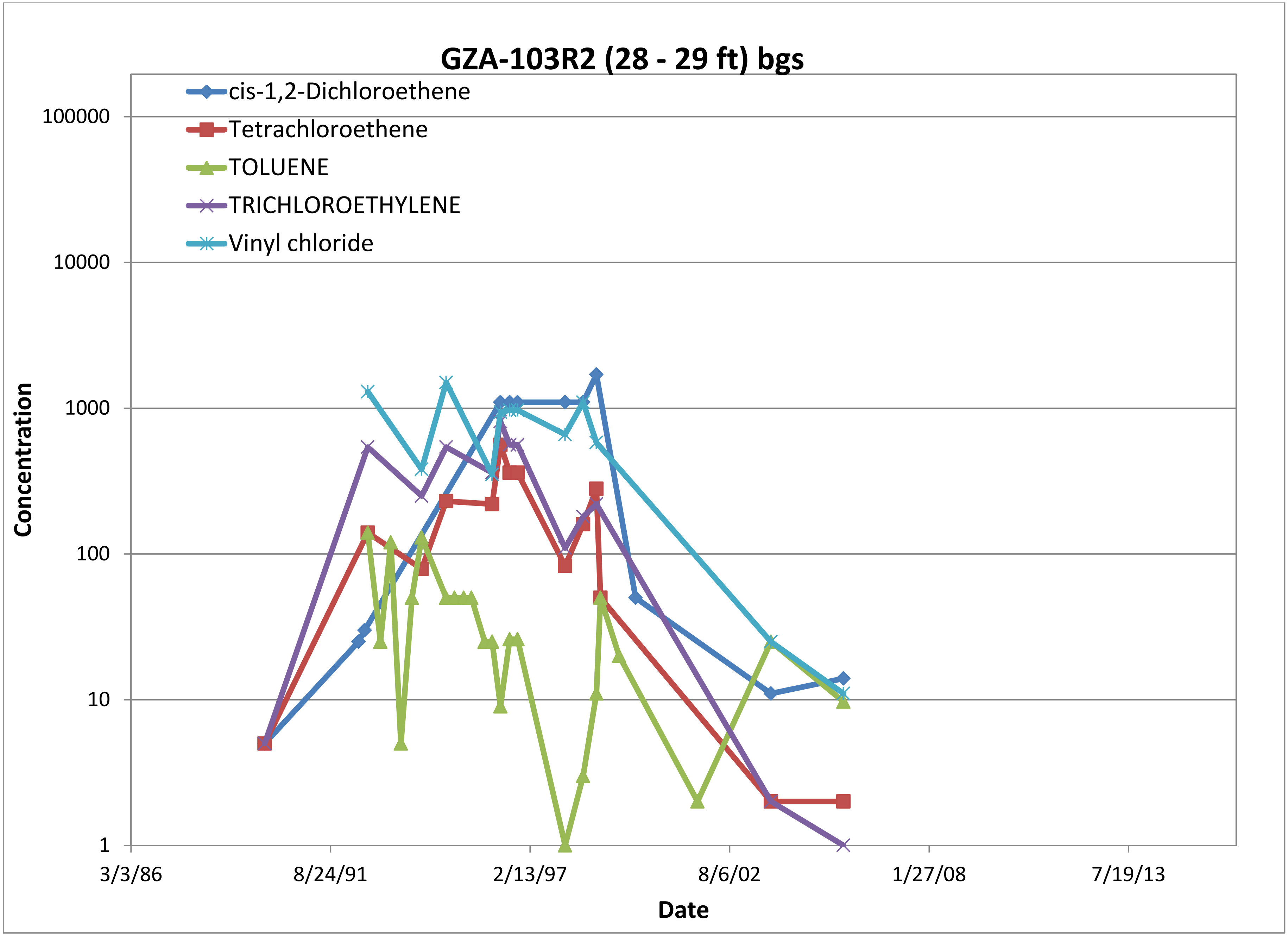

GZA-12 (9.5 - 24.5 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

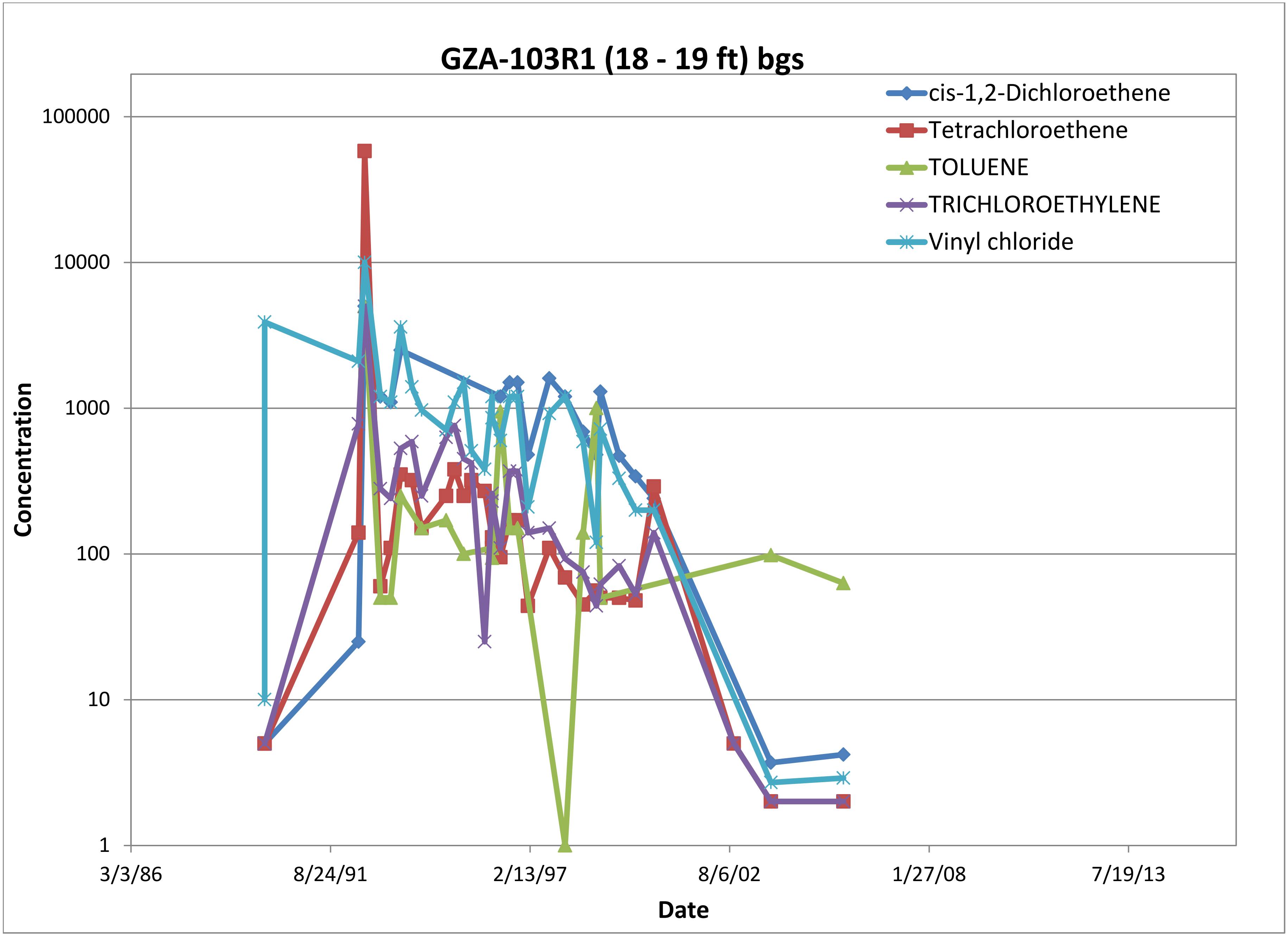

GZA-105S (4 - 14 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

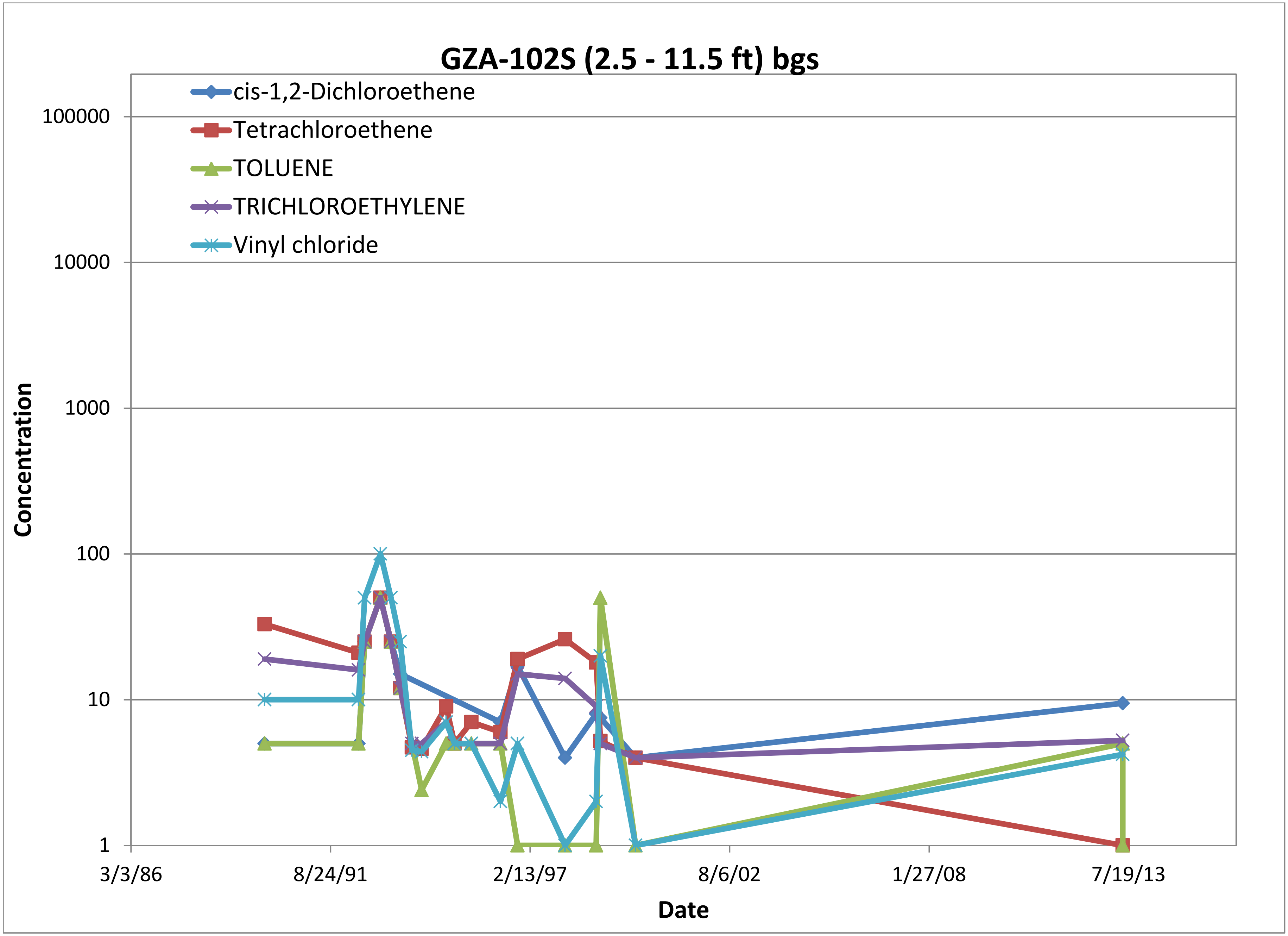

GZA-105R (34.5 - 36.5 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

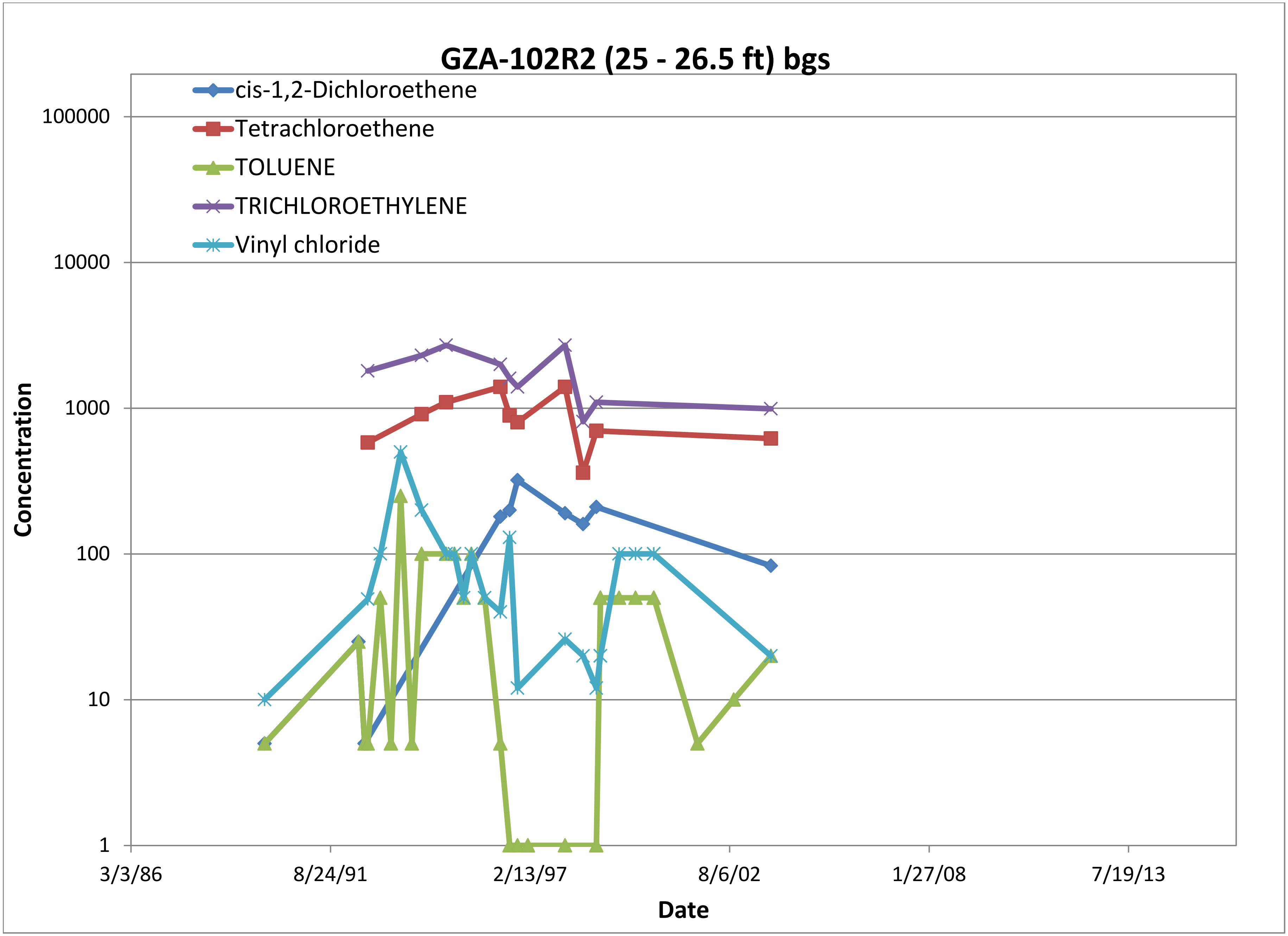

GZA-105D (16 - 26 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

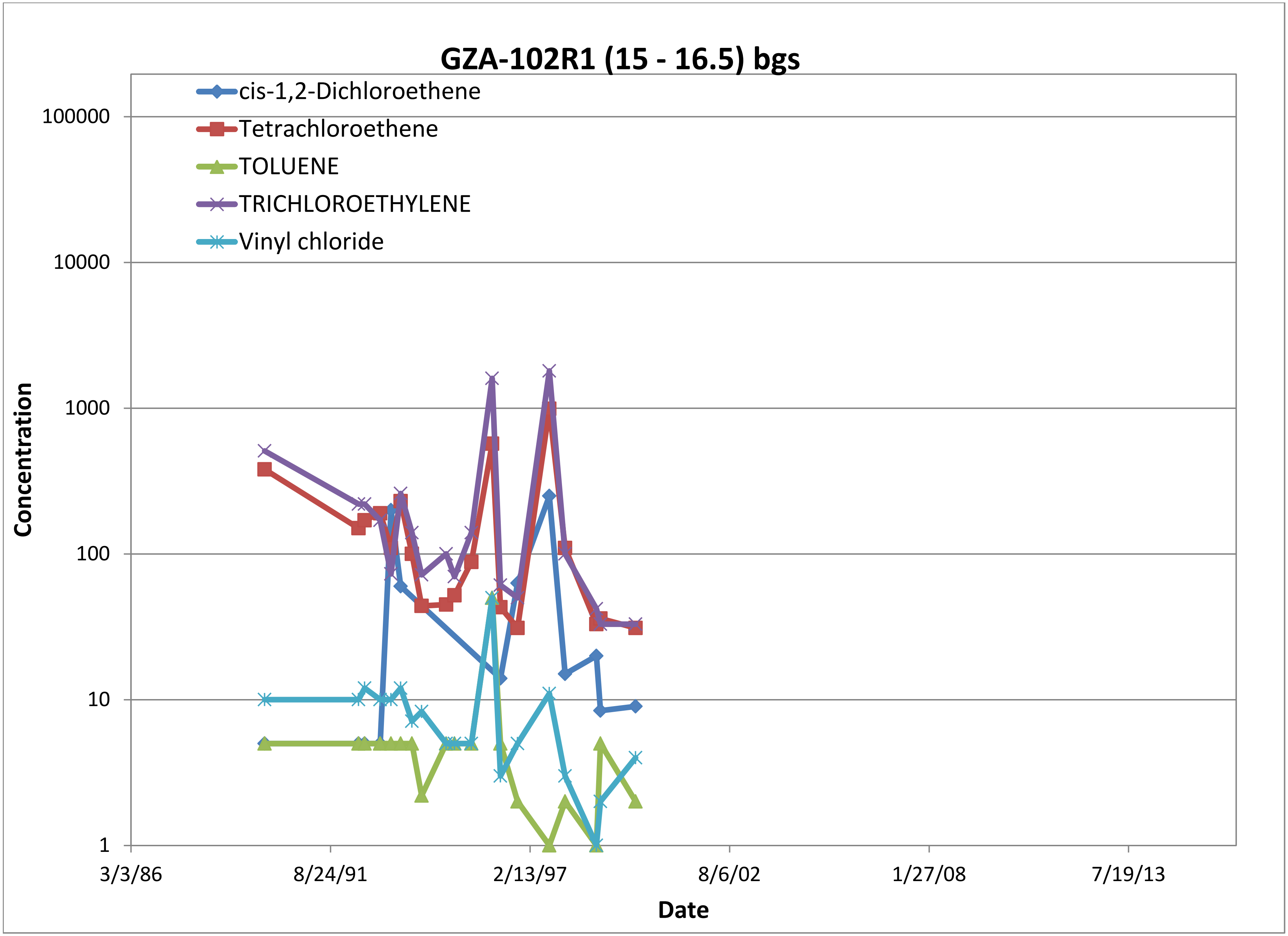

GZA-103S (1.7 - 9.7 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

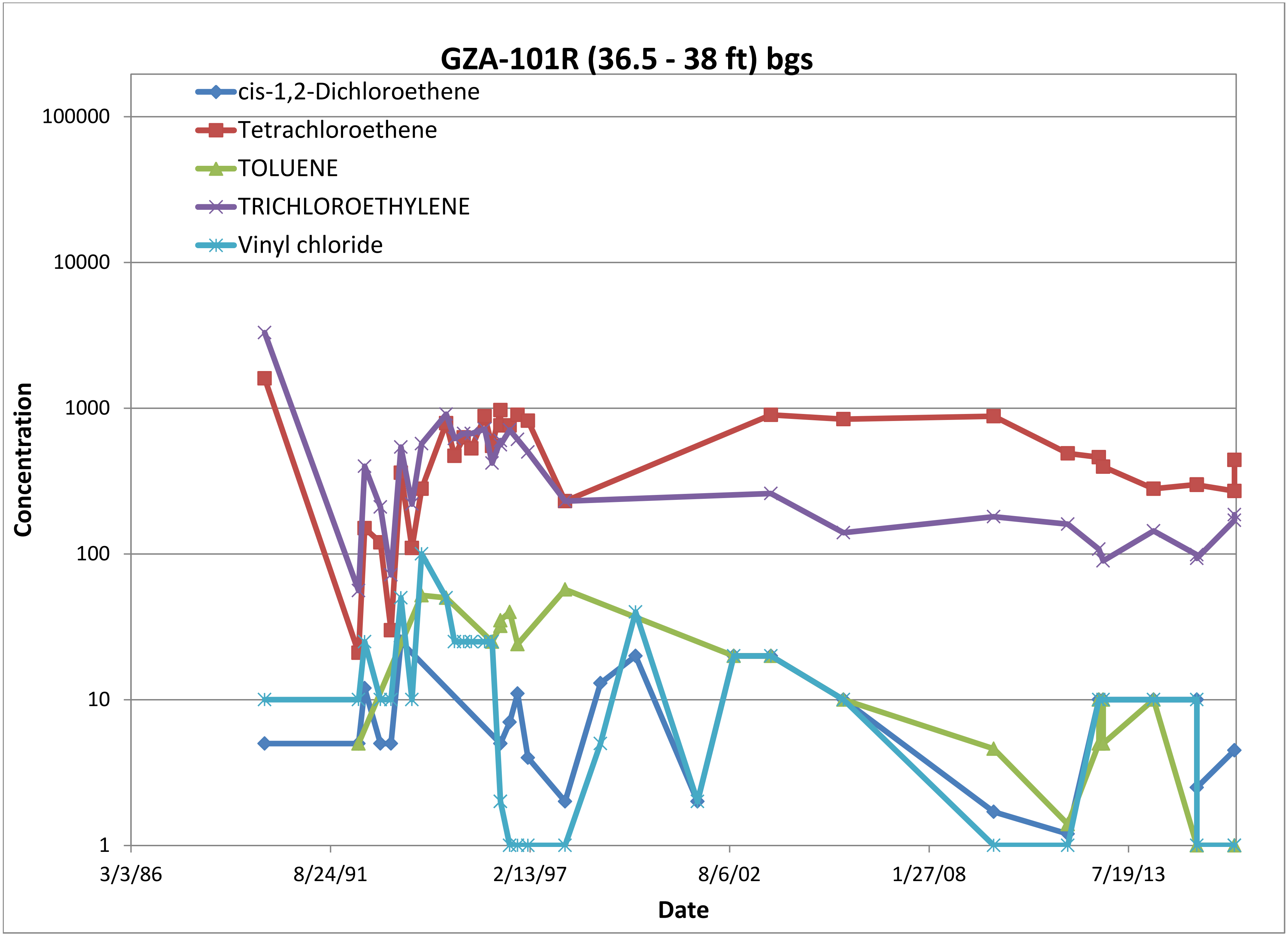

GZA-103R2 (28 - 29 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

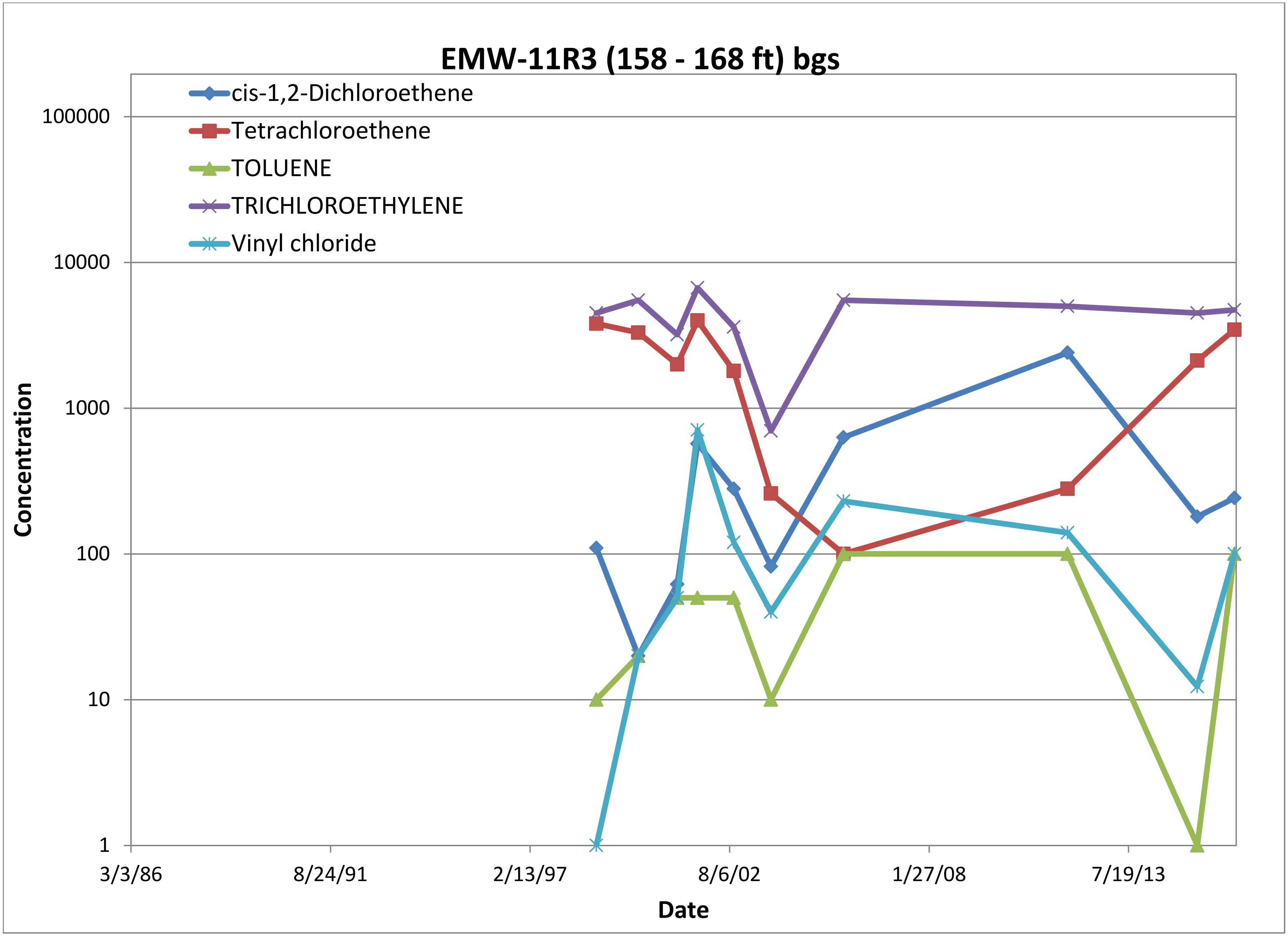

GZA-103R1 (18 - 19 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

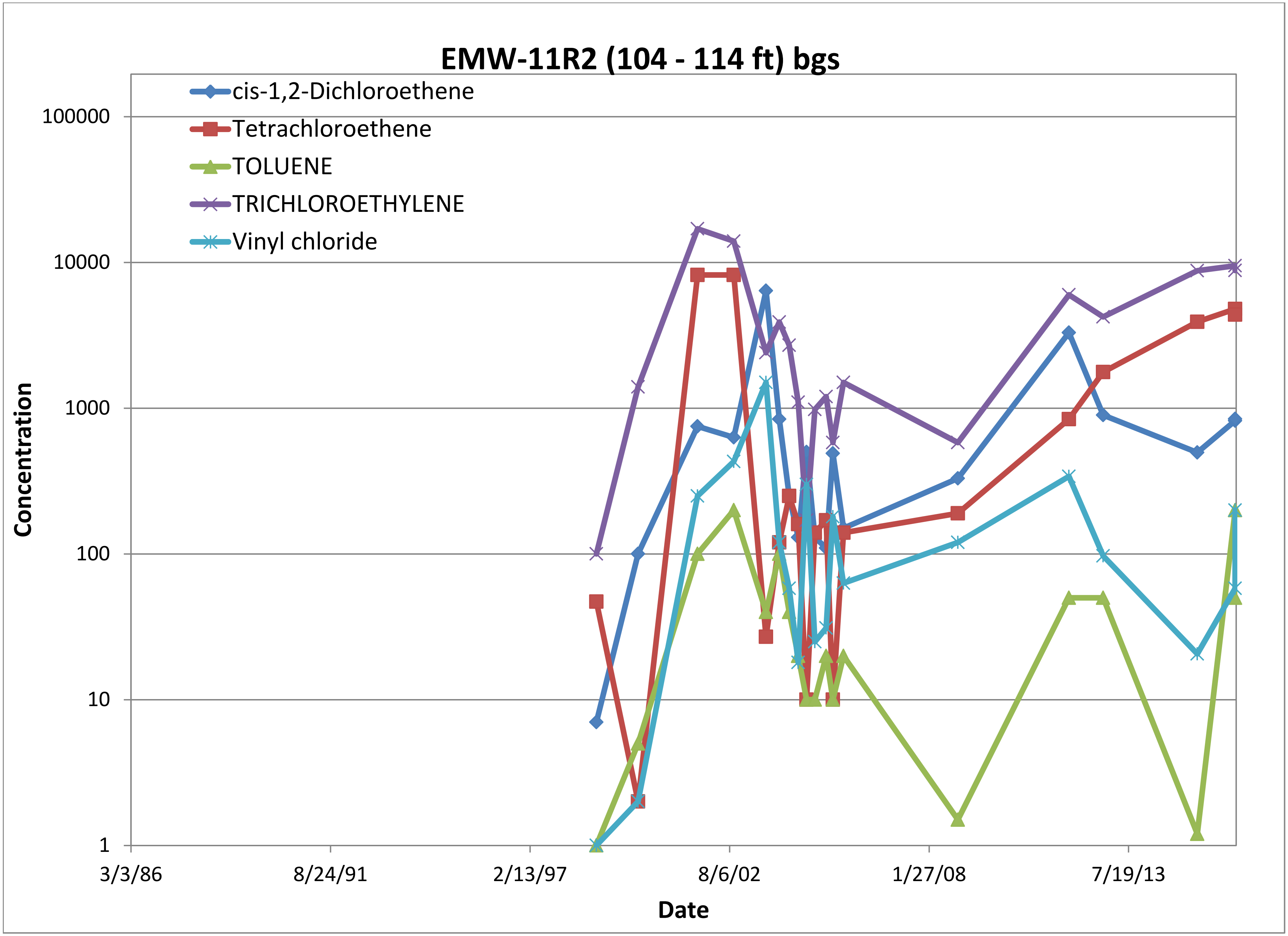

GZA-102S (2.5 - 11.5 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


GZA-102R2 (25 - 26.5 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

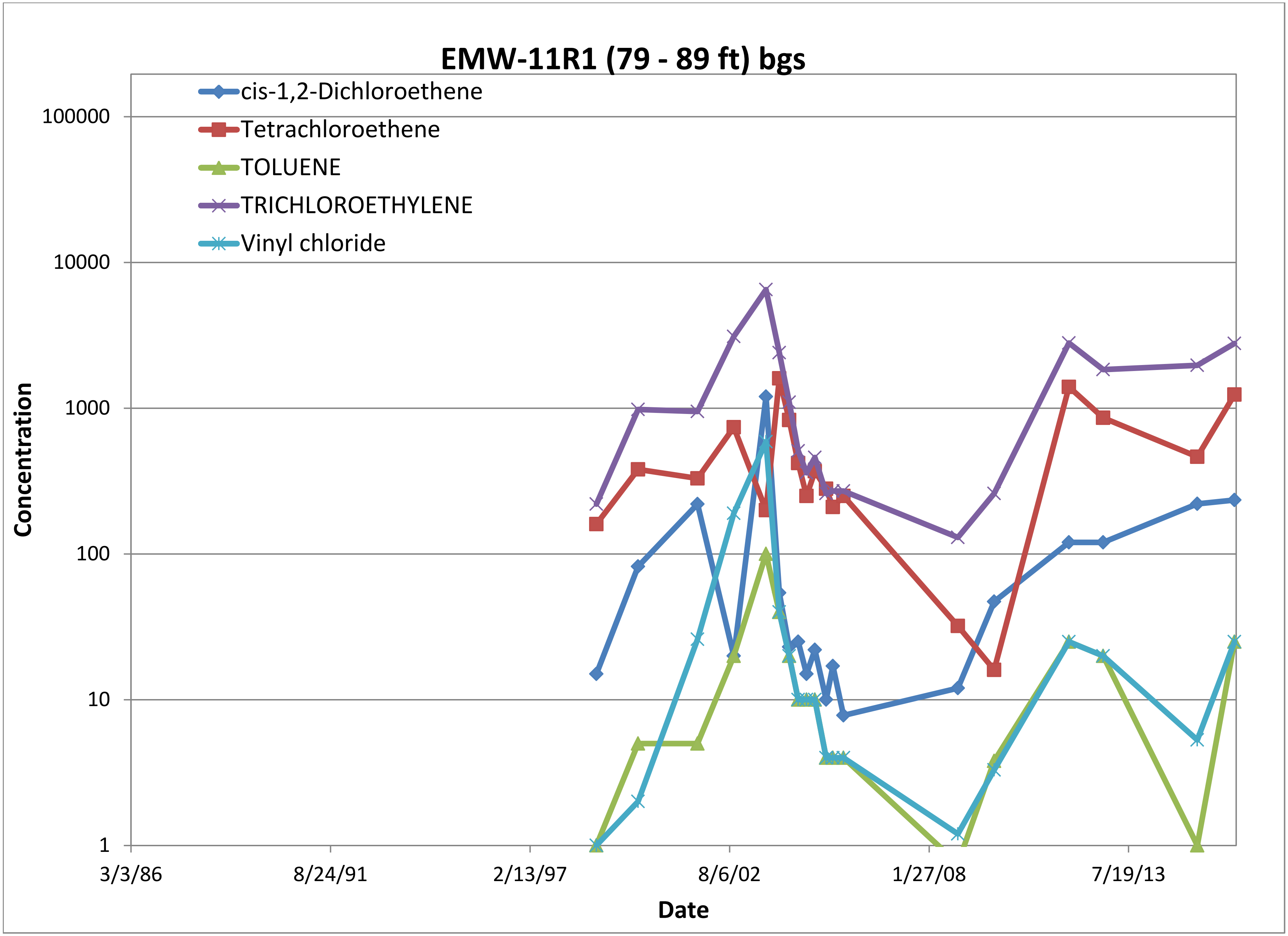

GZA-102R1 (15 - 16.5) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

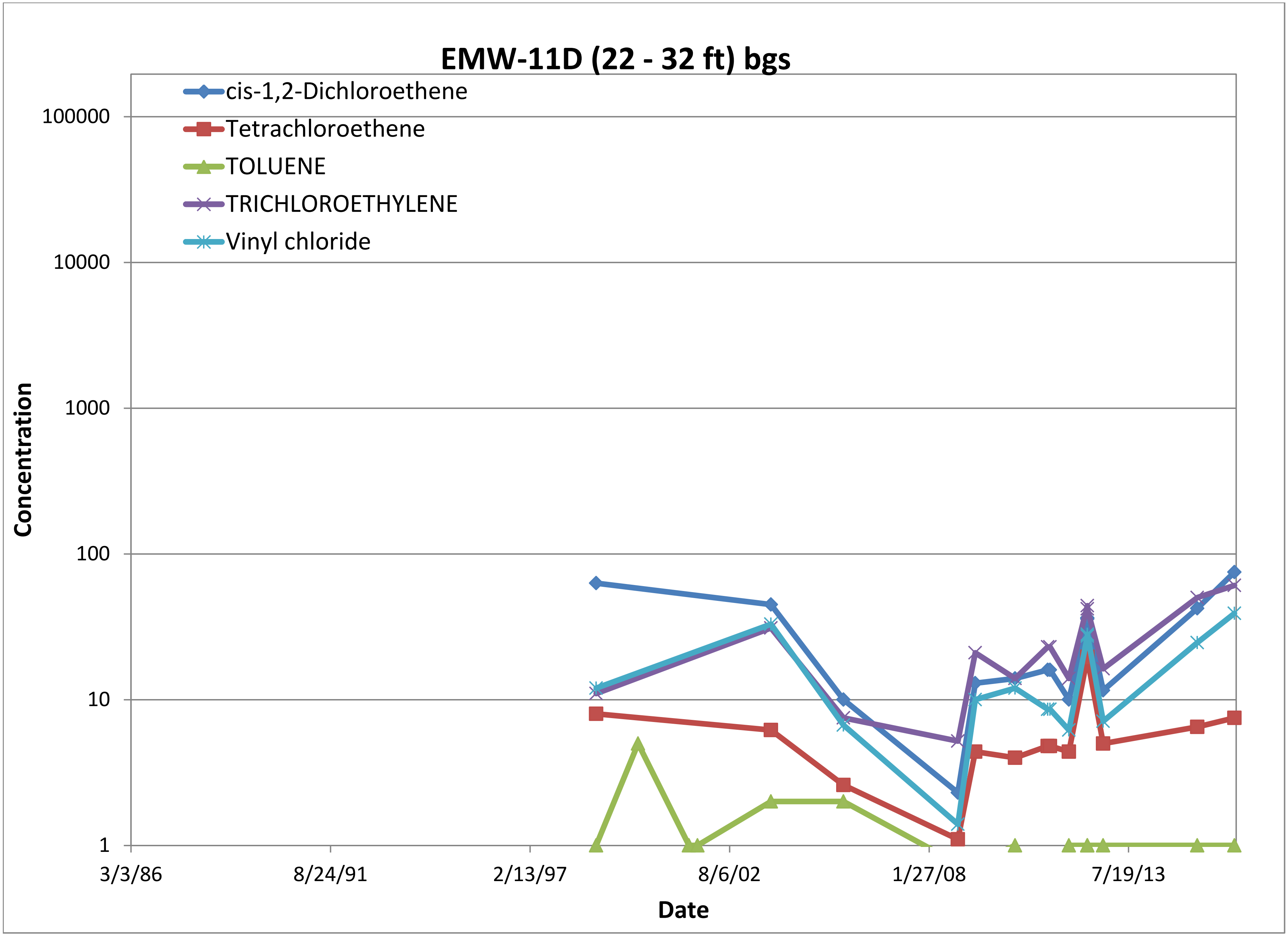

GZA-101R (36.5 - 38 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

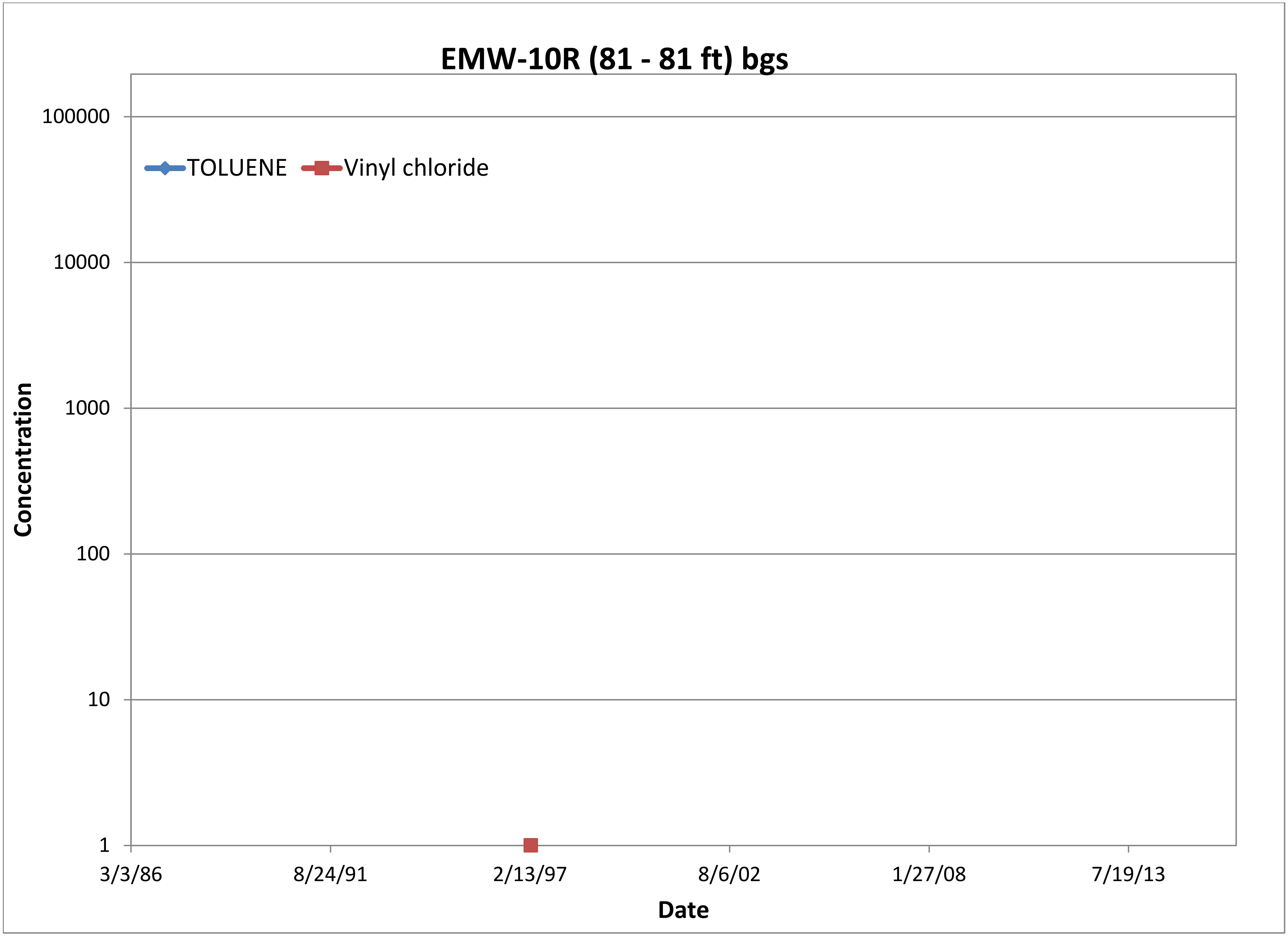

EMW-11R3 (158 - 168 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

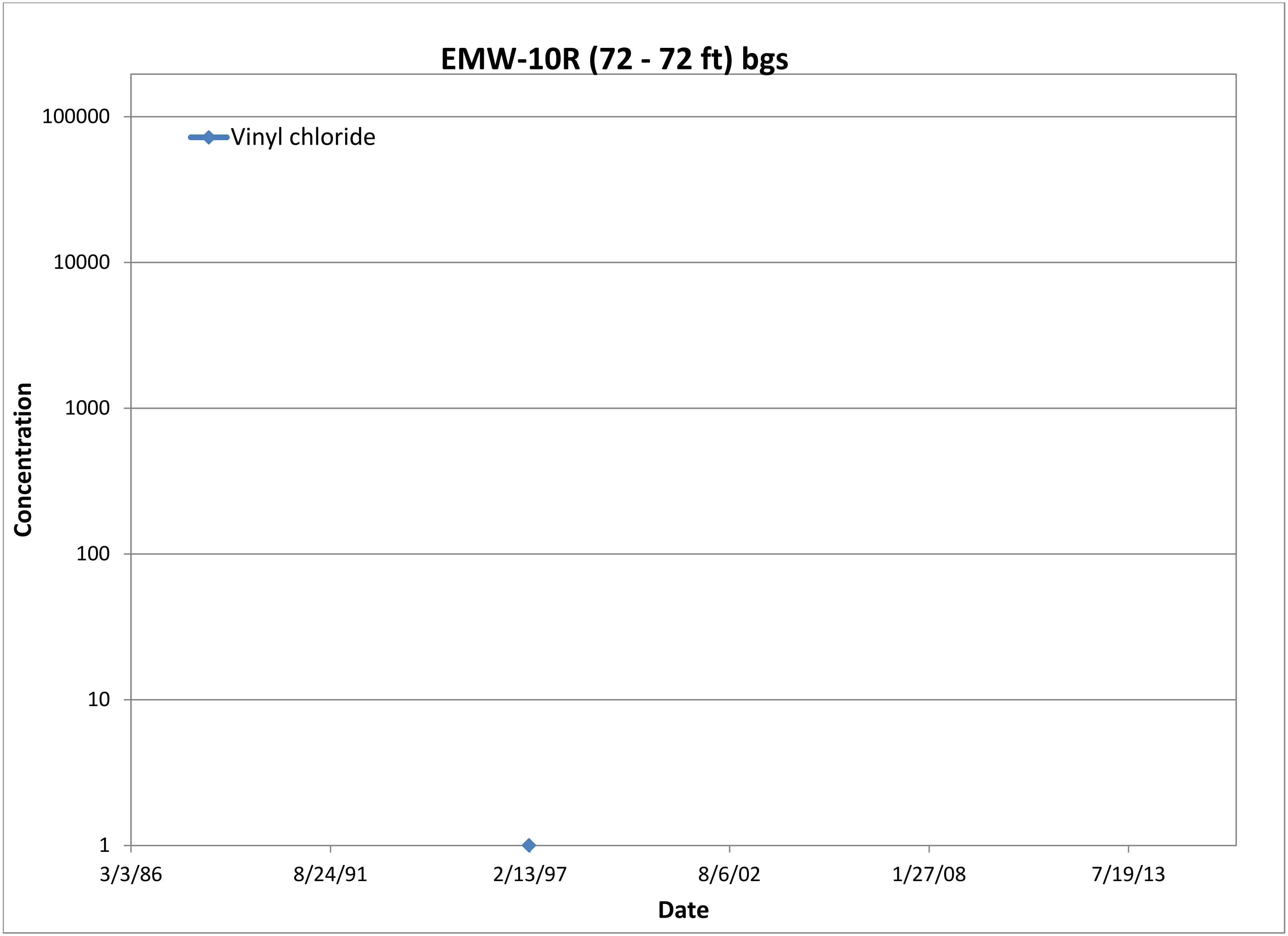


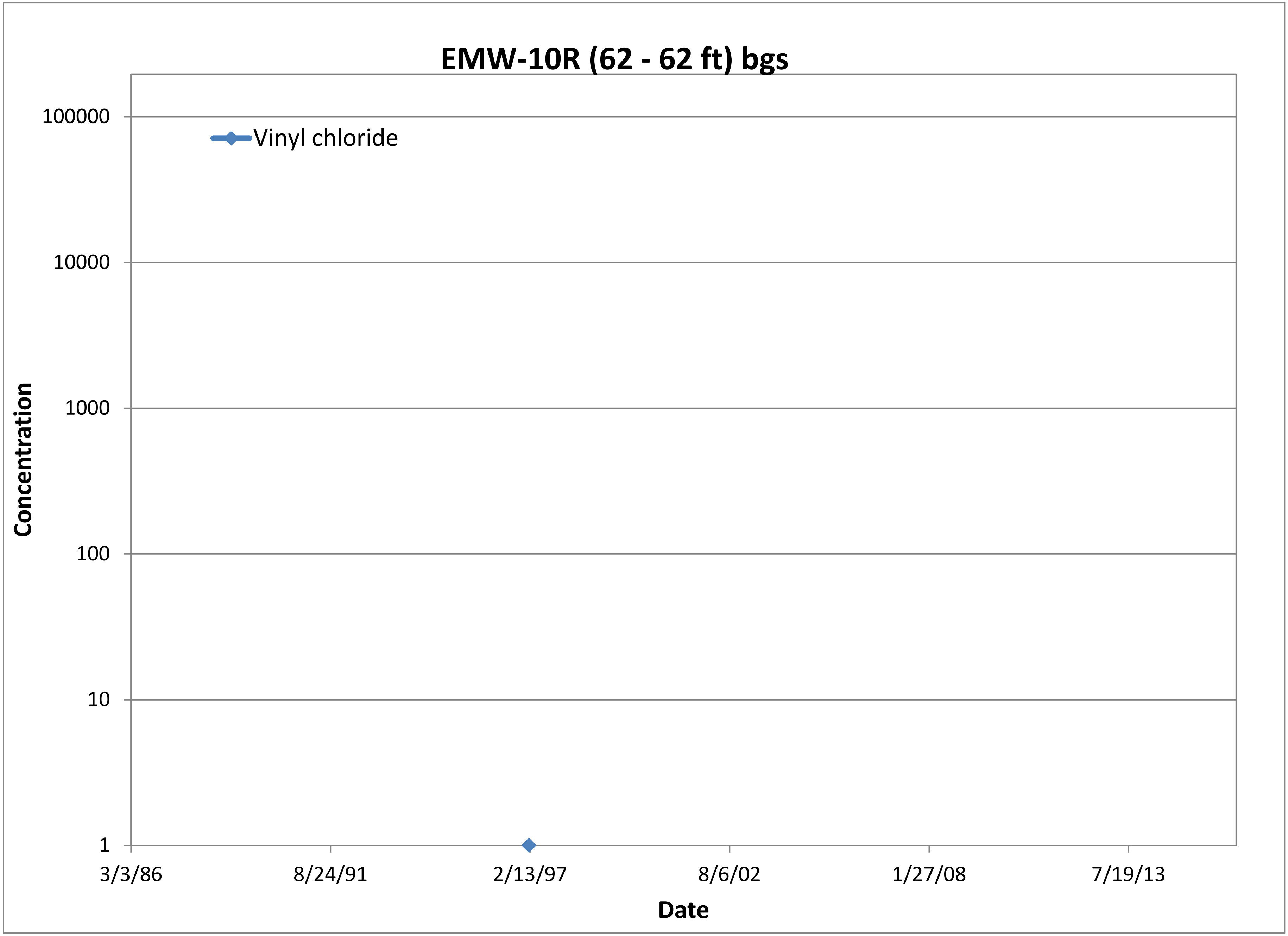
EMW-11R2 (104 - 114 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

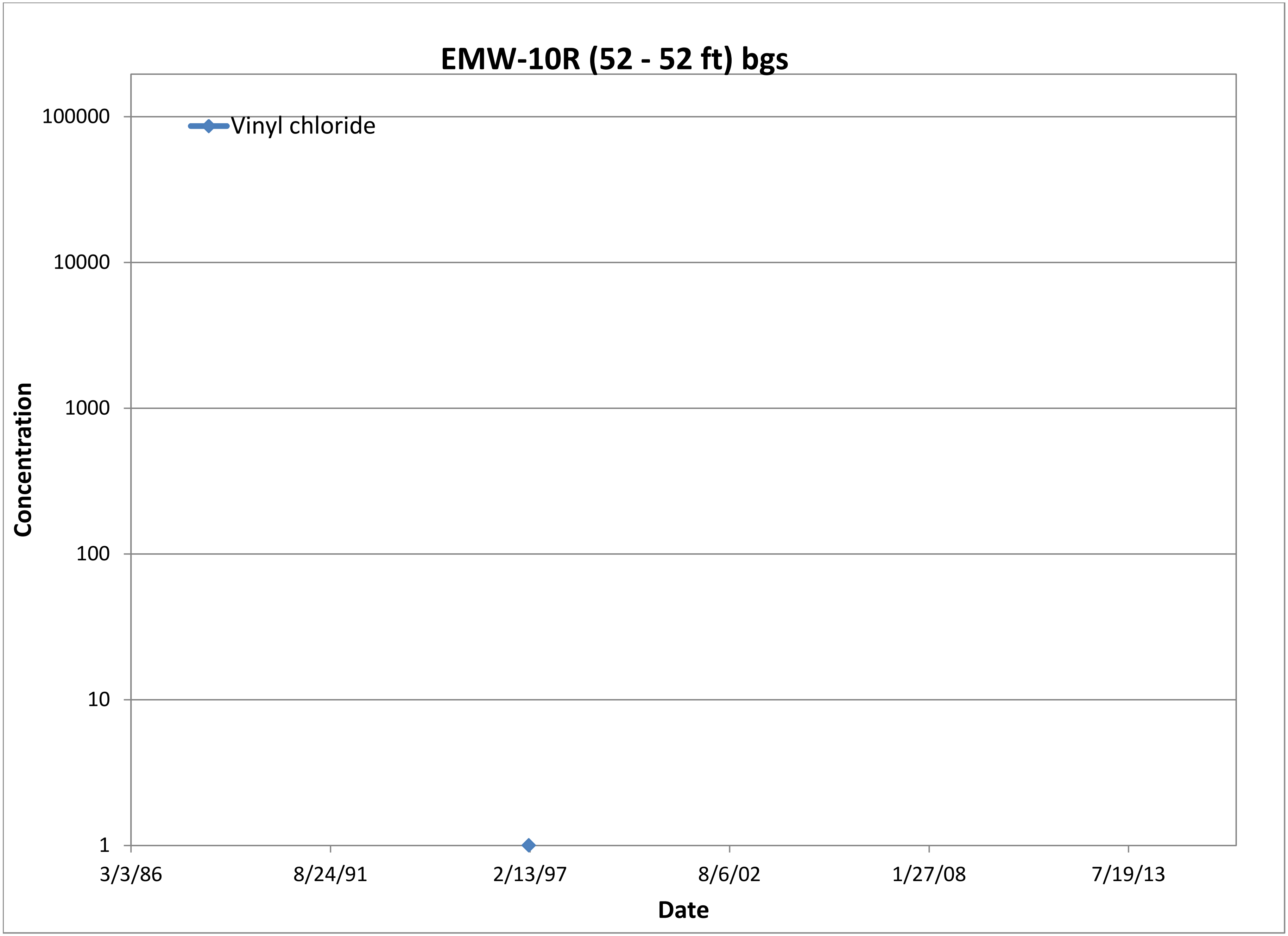

EMW-11R1 (79 - 89 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

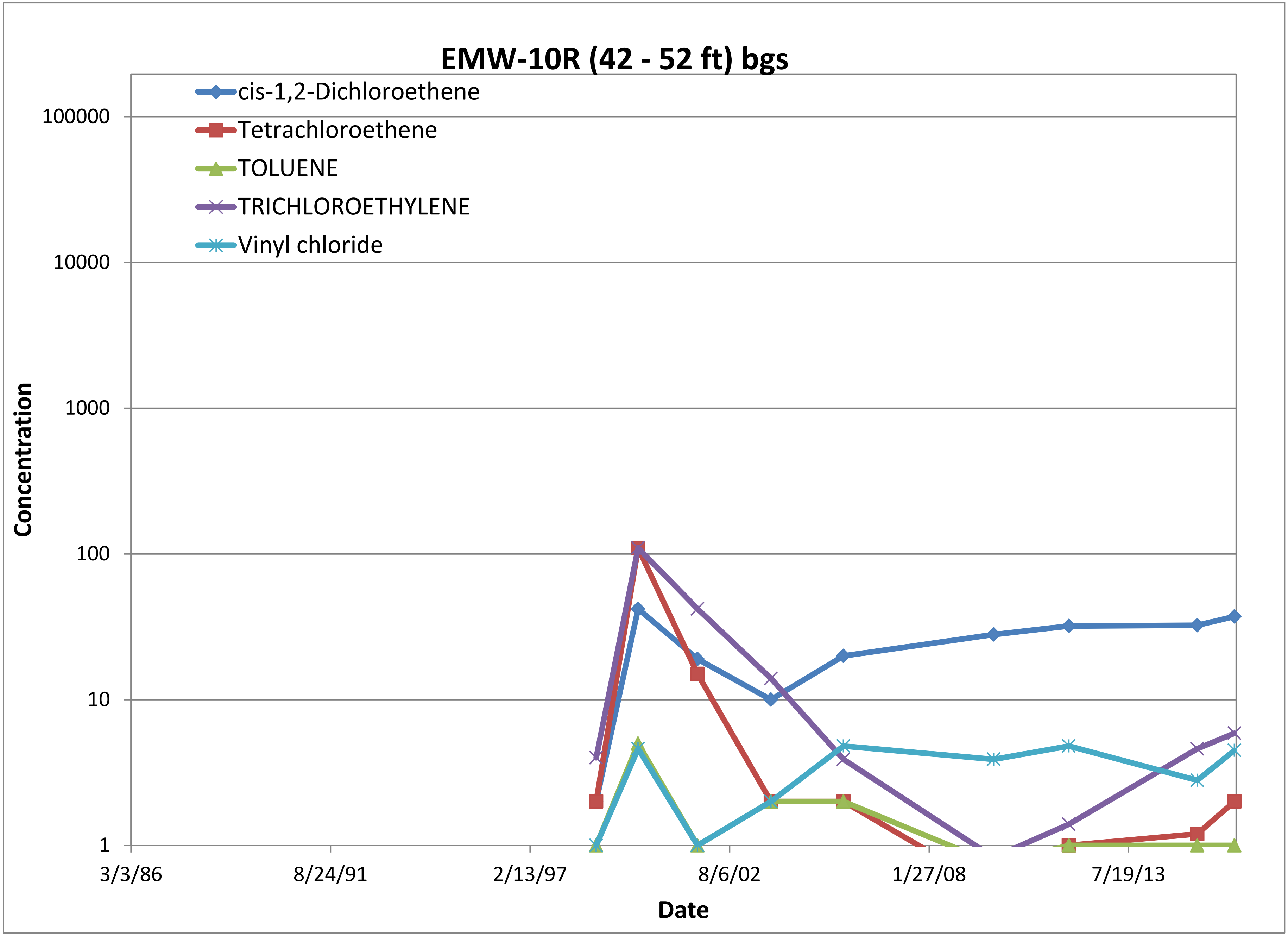

EMW-11D (22 - 32 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


EMW-10R (81 - 81 ft) bgs
TOLUENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

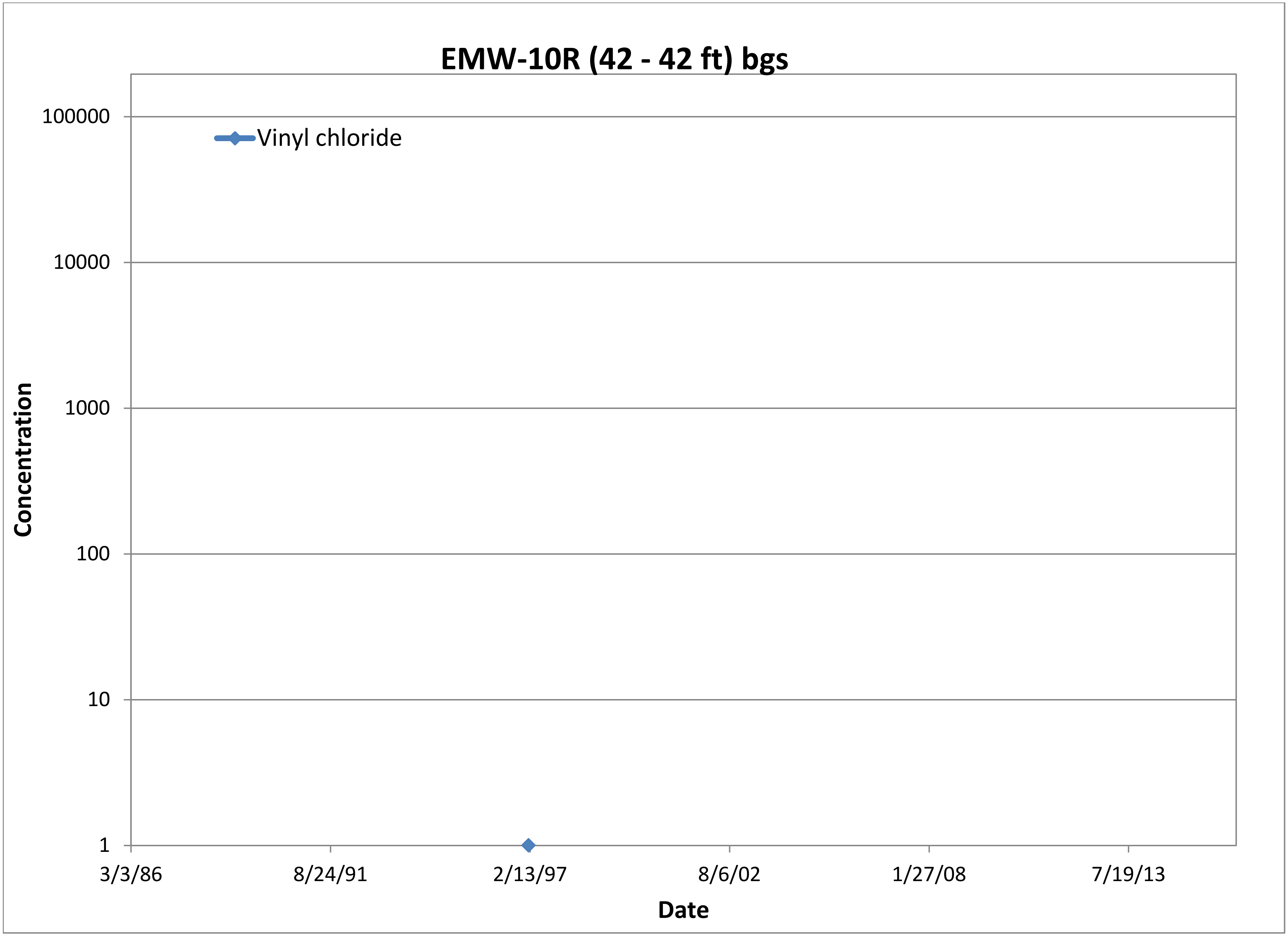

EMW-10R (72 - 72 ft) bgs
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

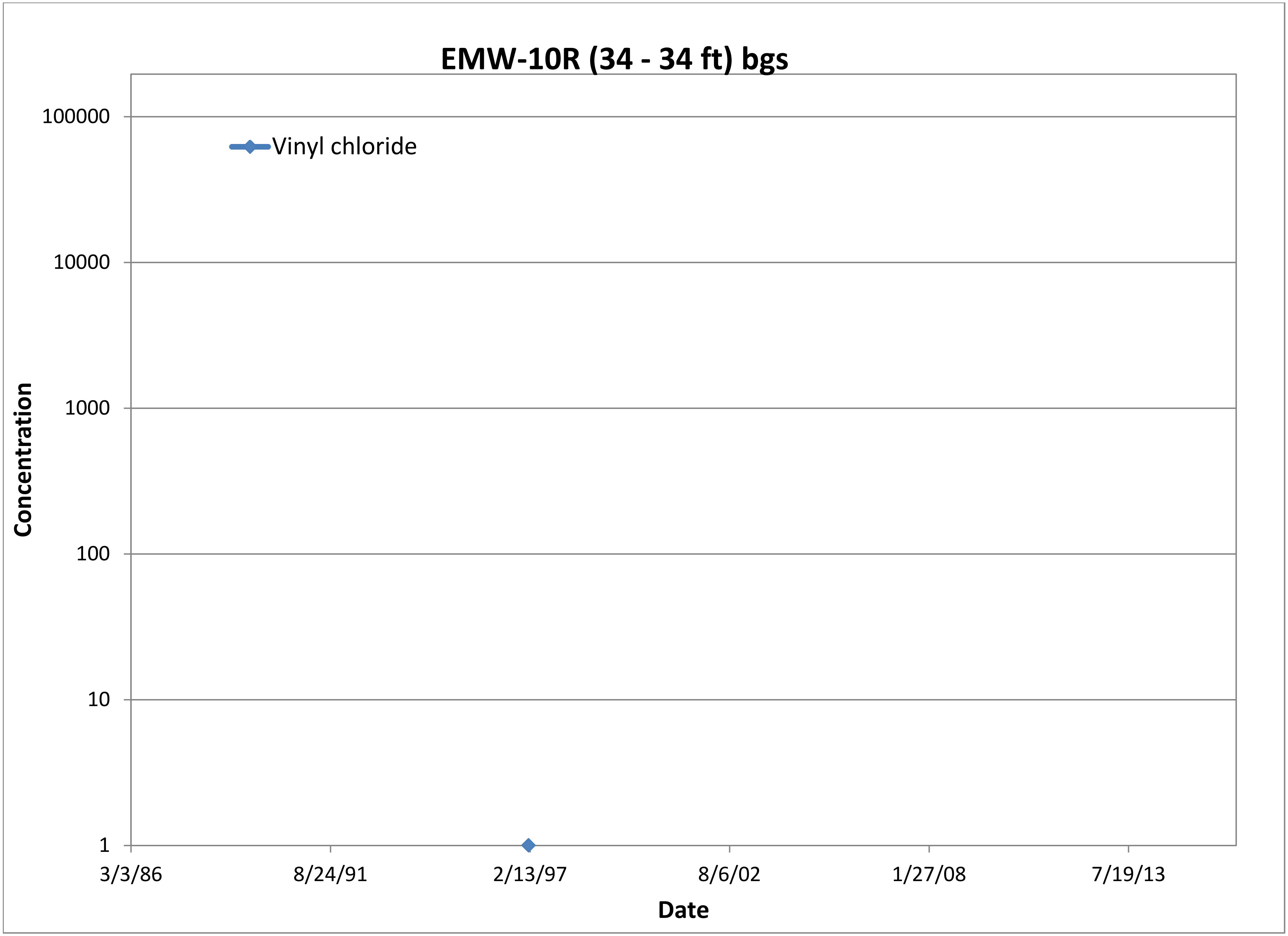

EMW-10R (62 - 62 ft) bgs
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

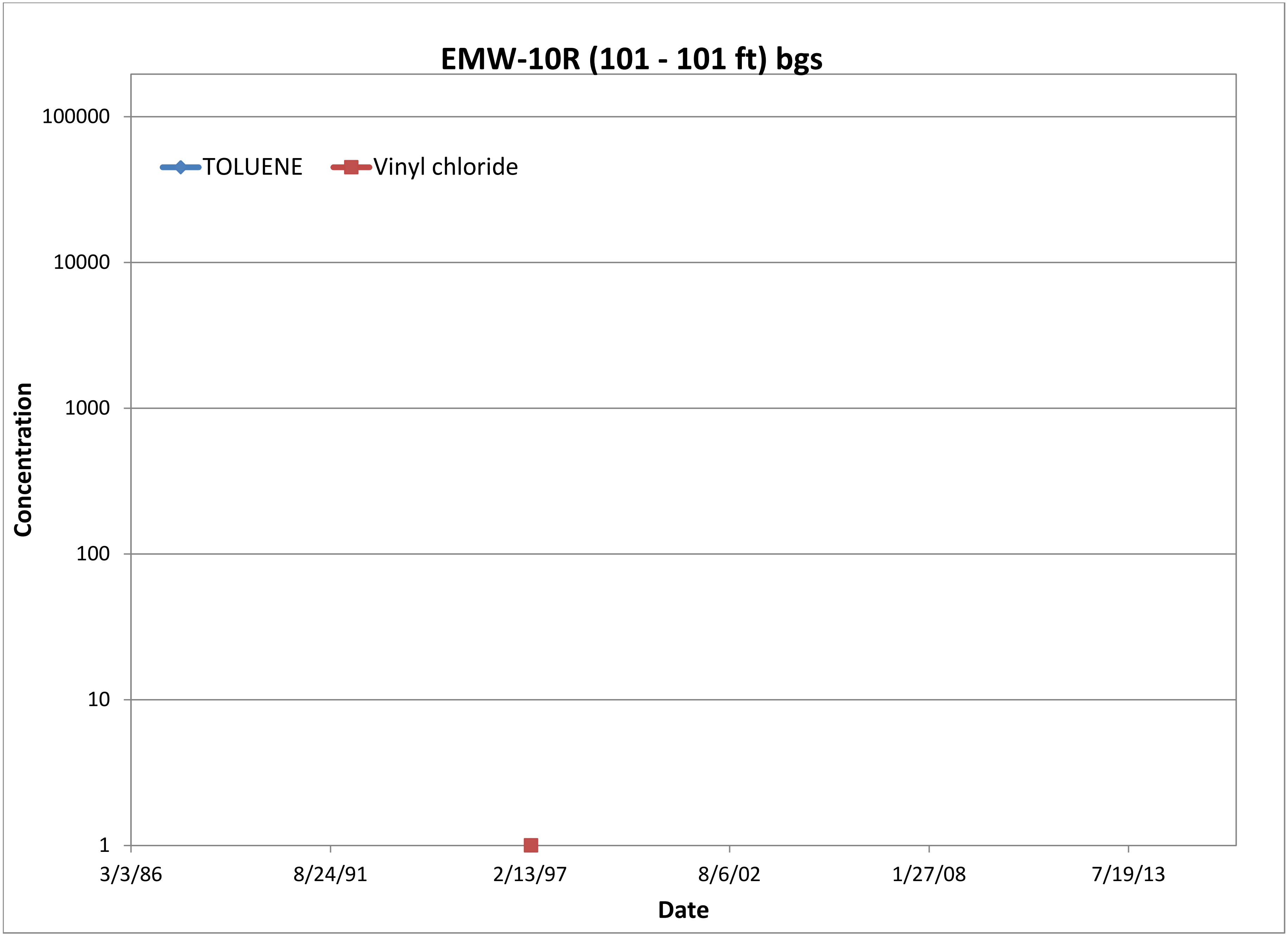

EMW-10R (52 - 52 ft) bgs
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

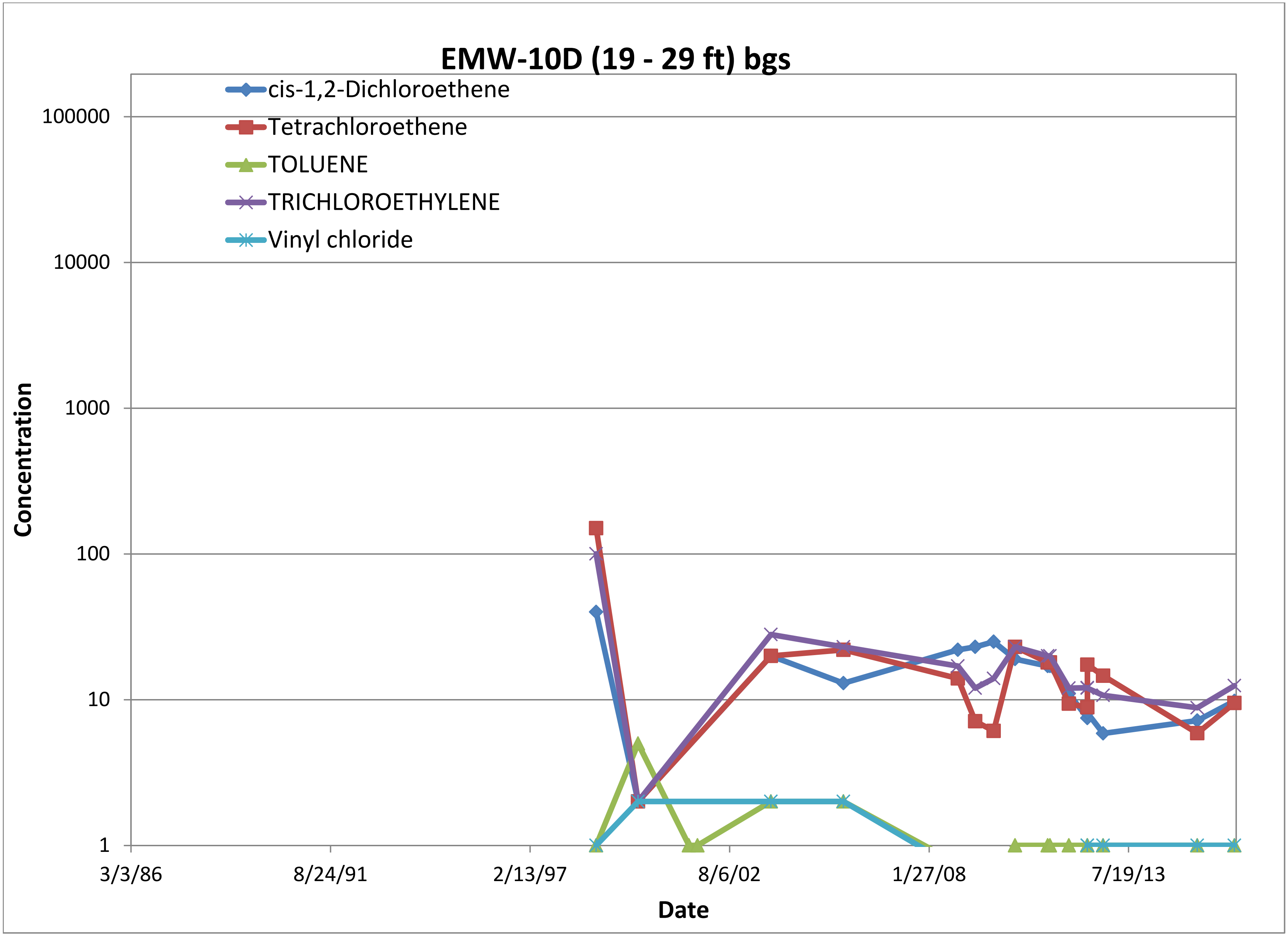


EMW-10R (42 - 52 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

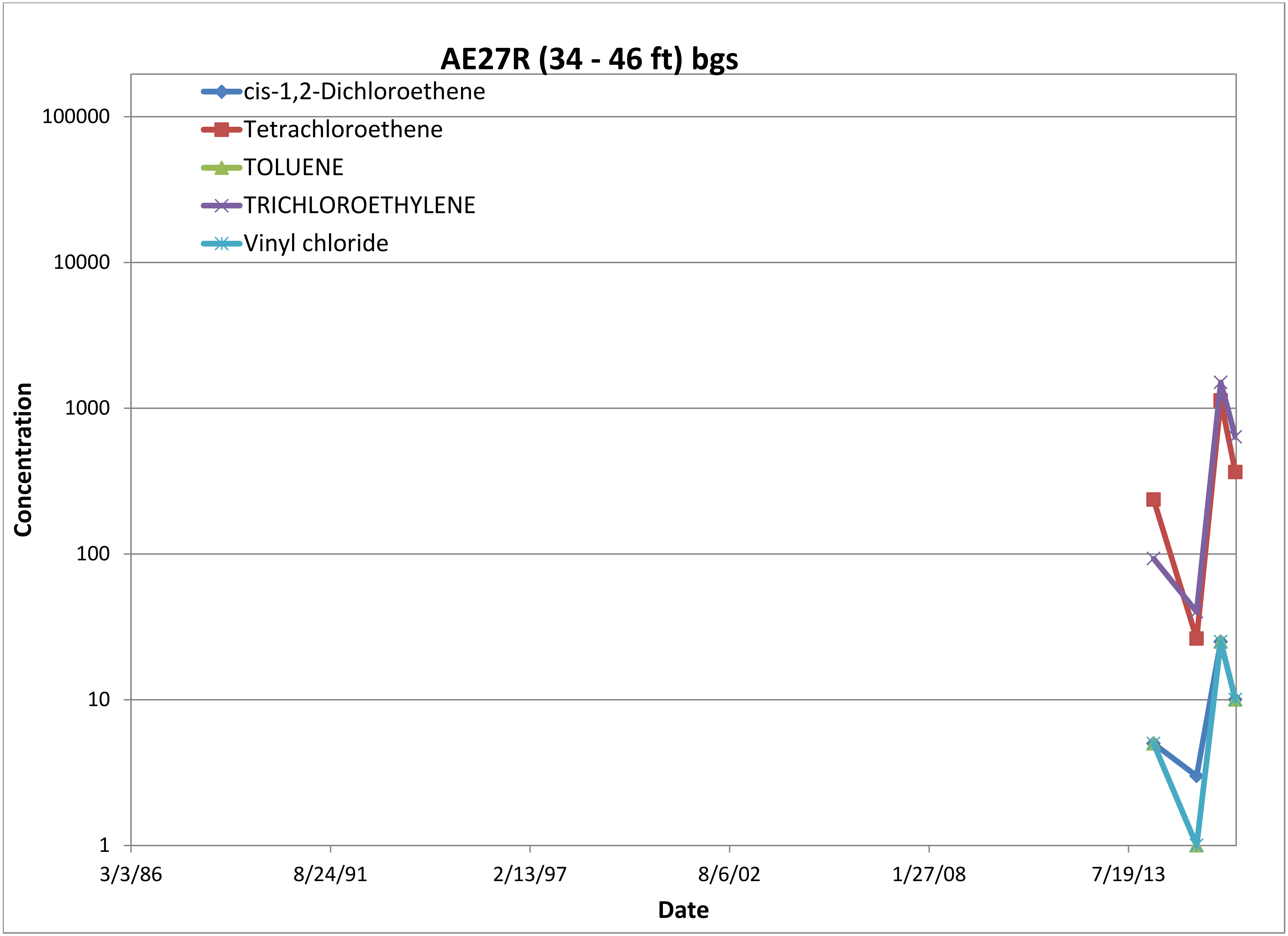

EMW-10R (42 - 42 ft) bgs
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date


EMW-10R (34 - 34 ft) bgs
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

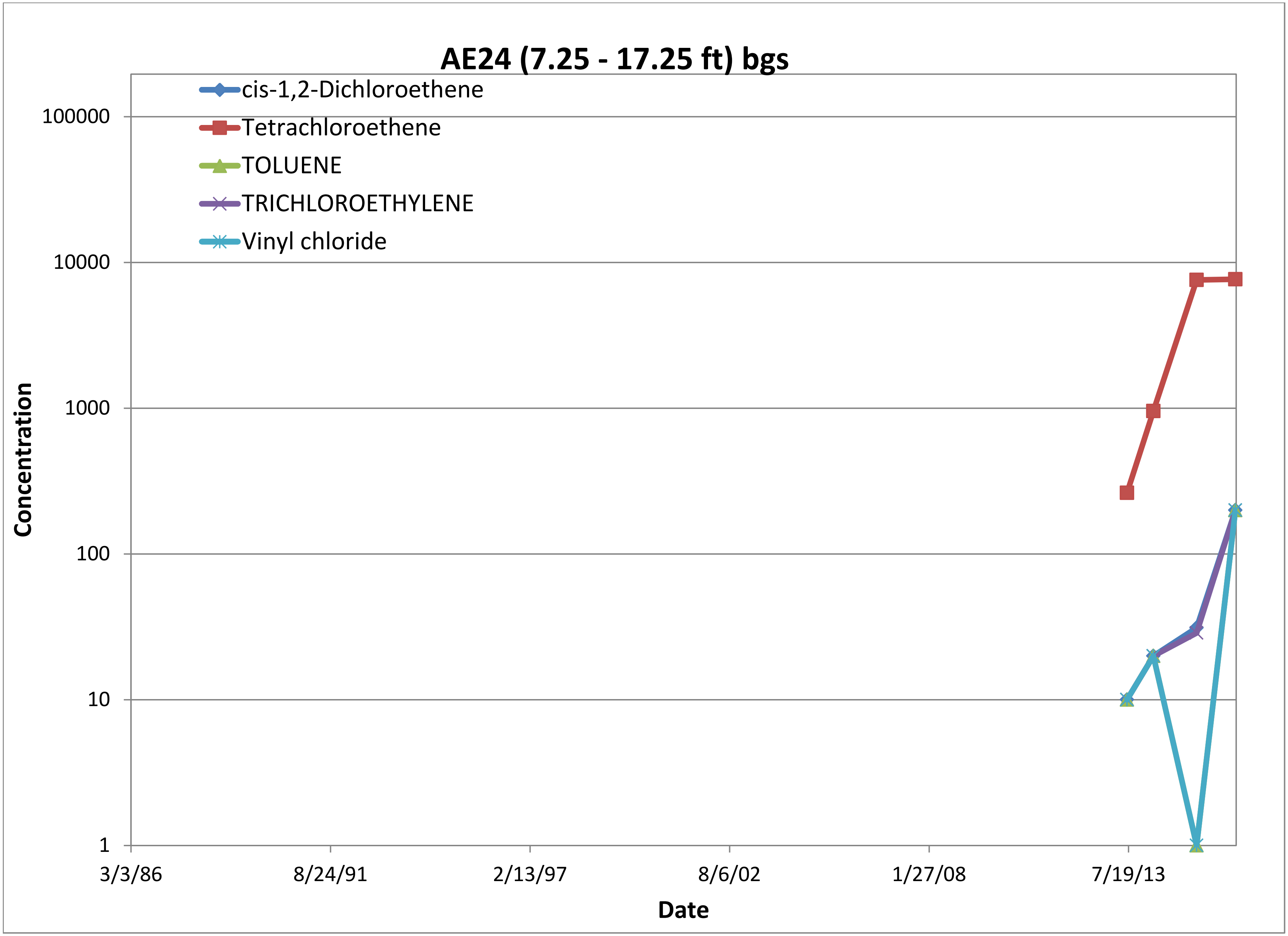

EMW-10R (101 - 101 ft) bgs
TOLUENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date



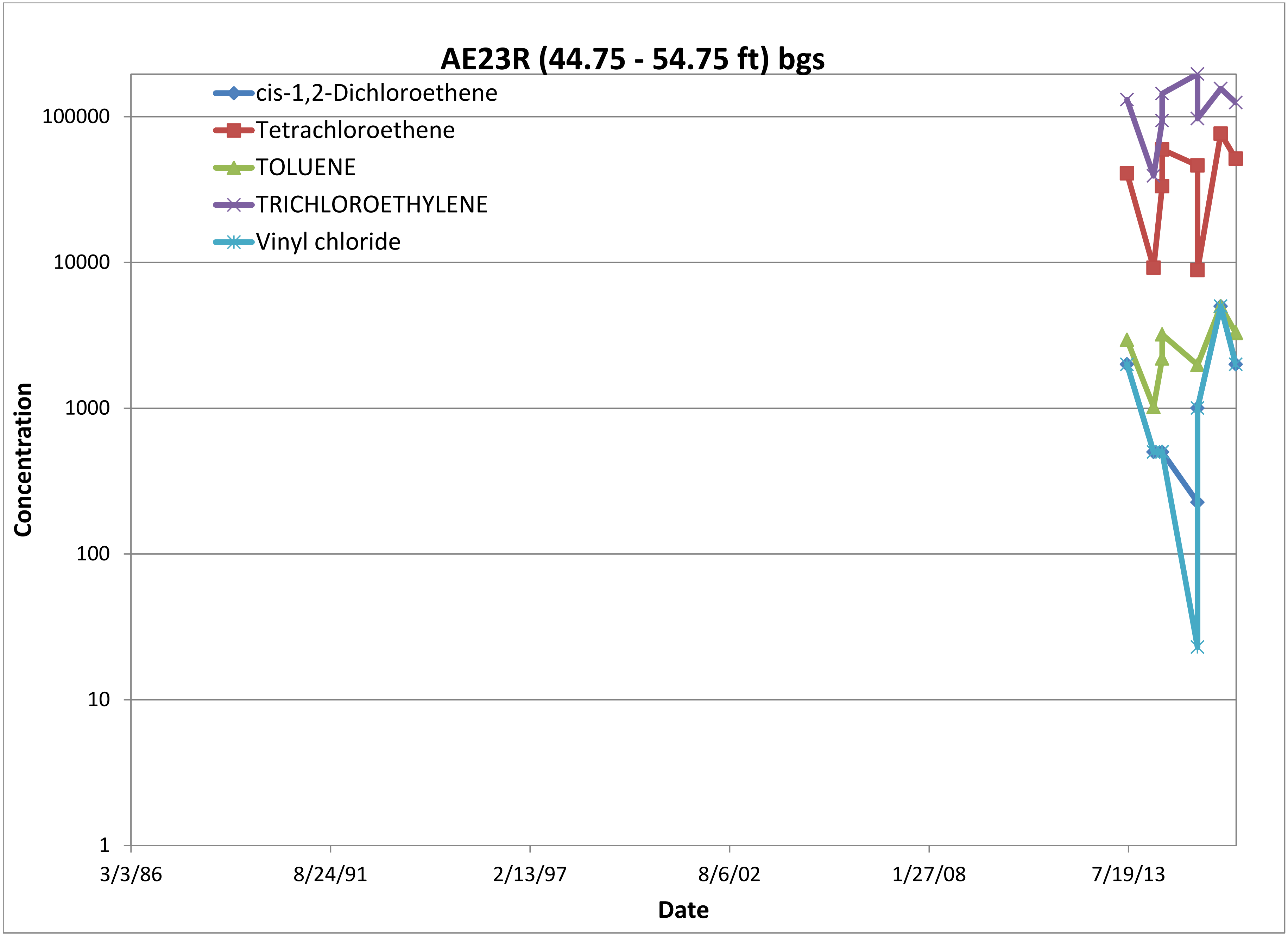
EMW-10D (19 - 29 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

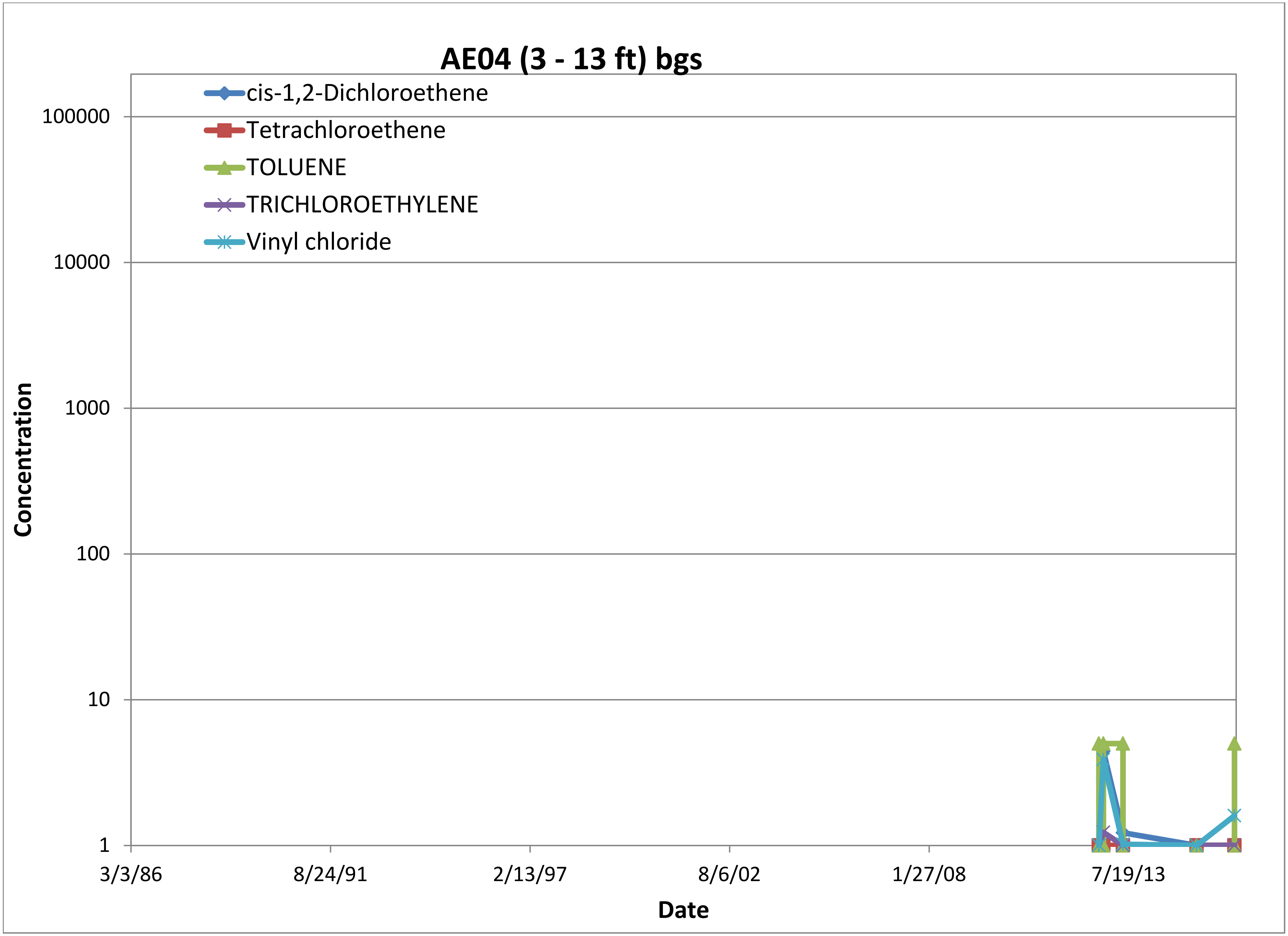


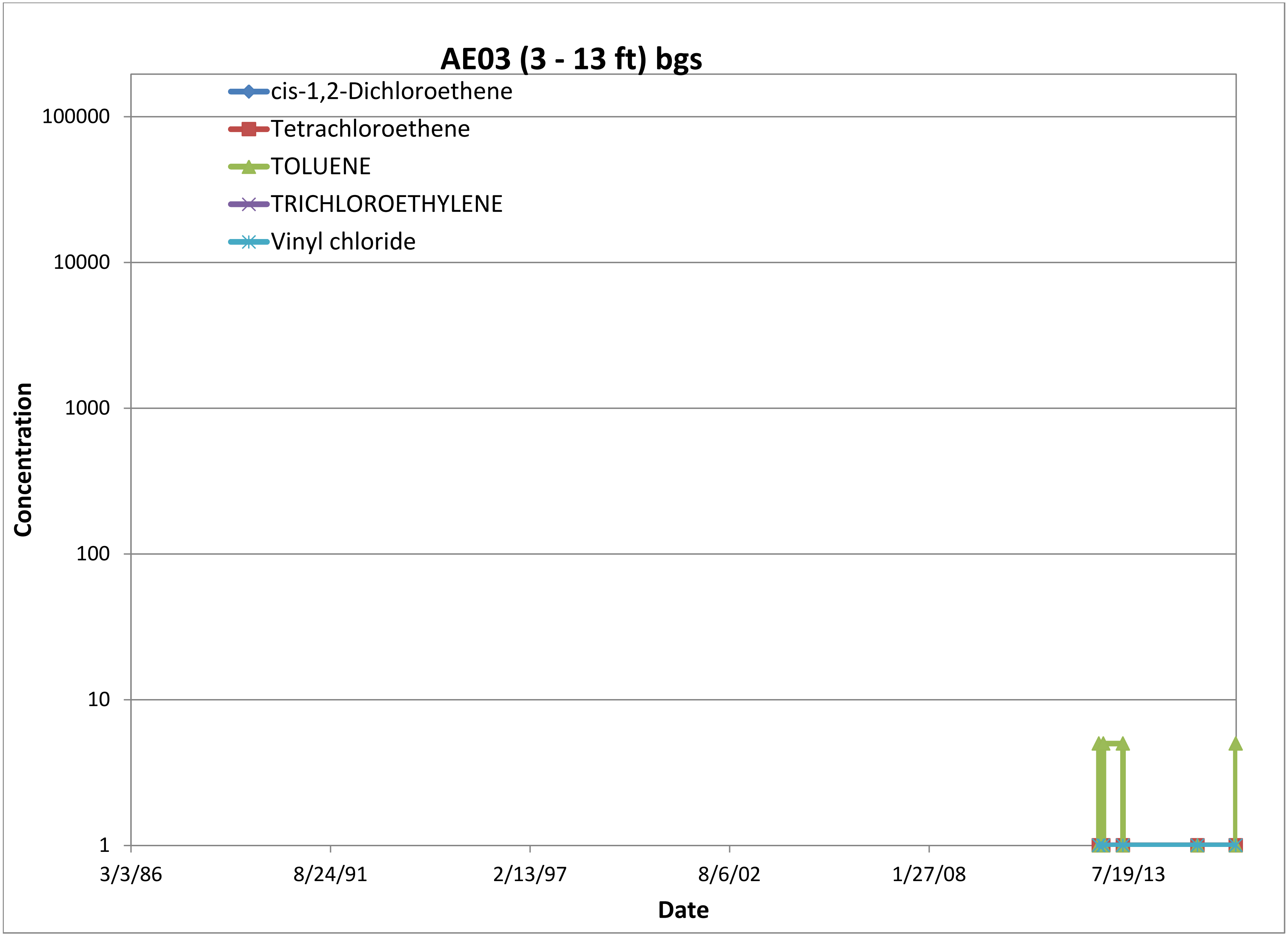
AE27R (34 - 46 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date



AE24 (7.25 - 17.25 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

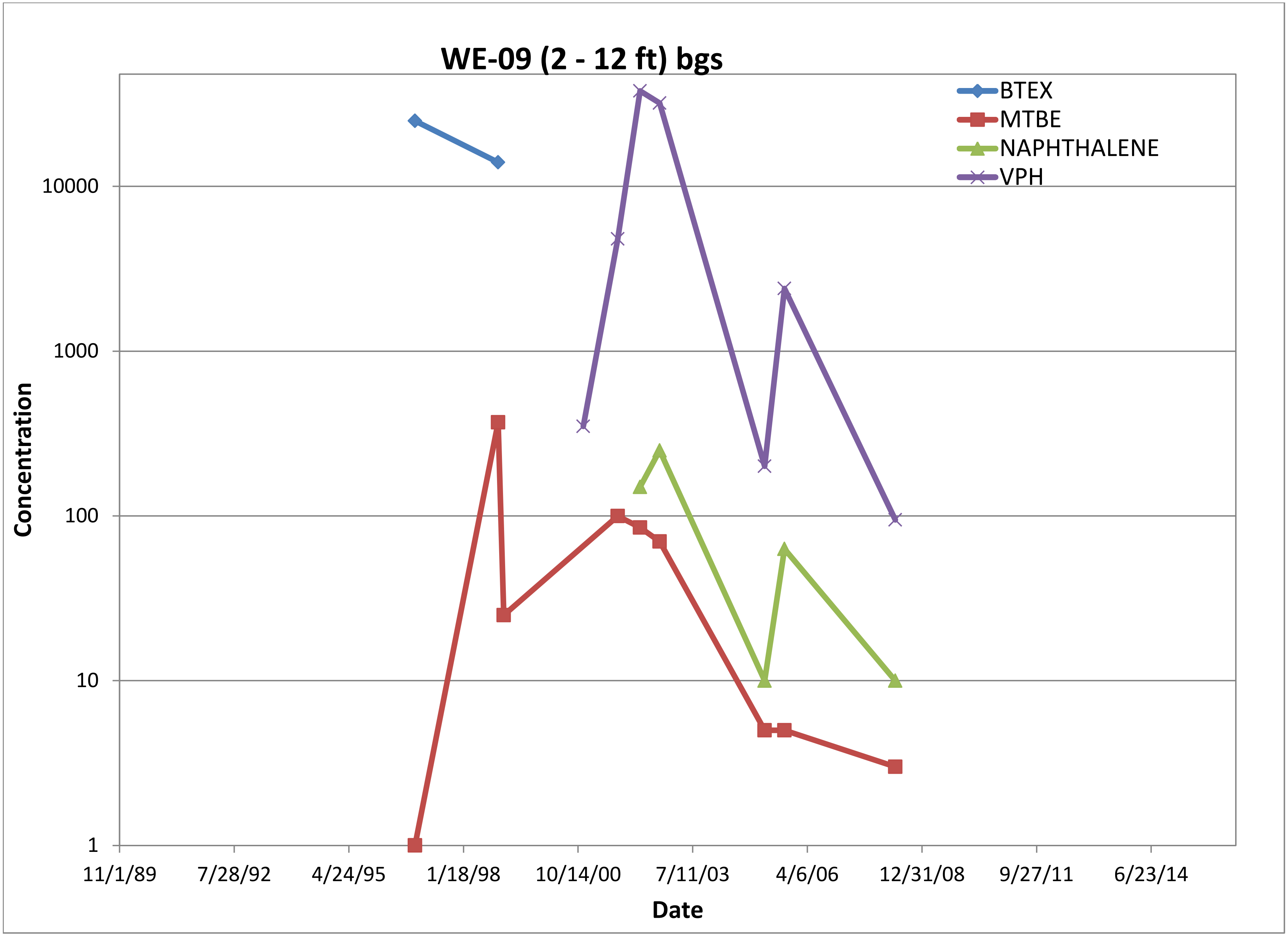

AE23R (44.75 - 54.75 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

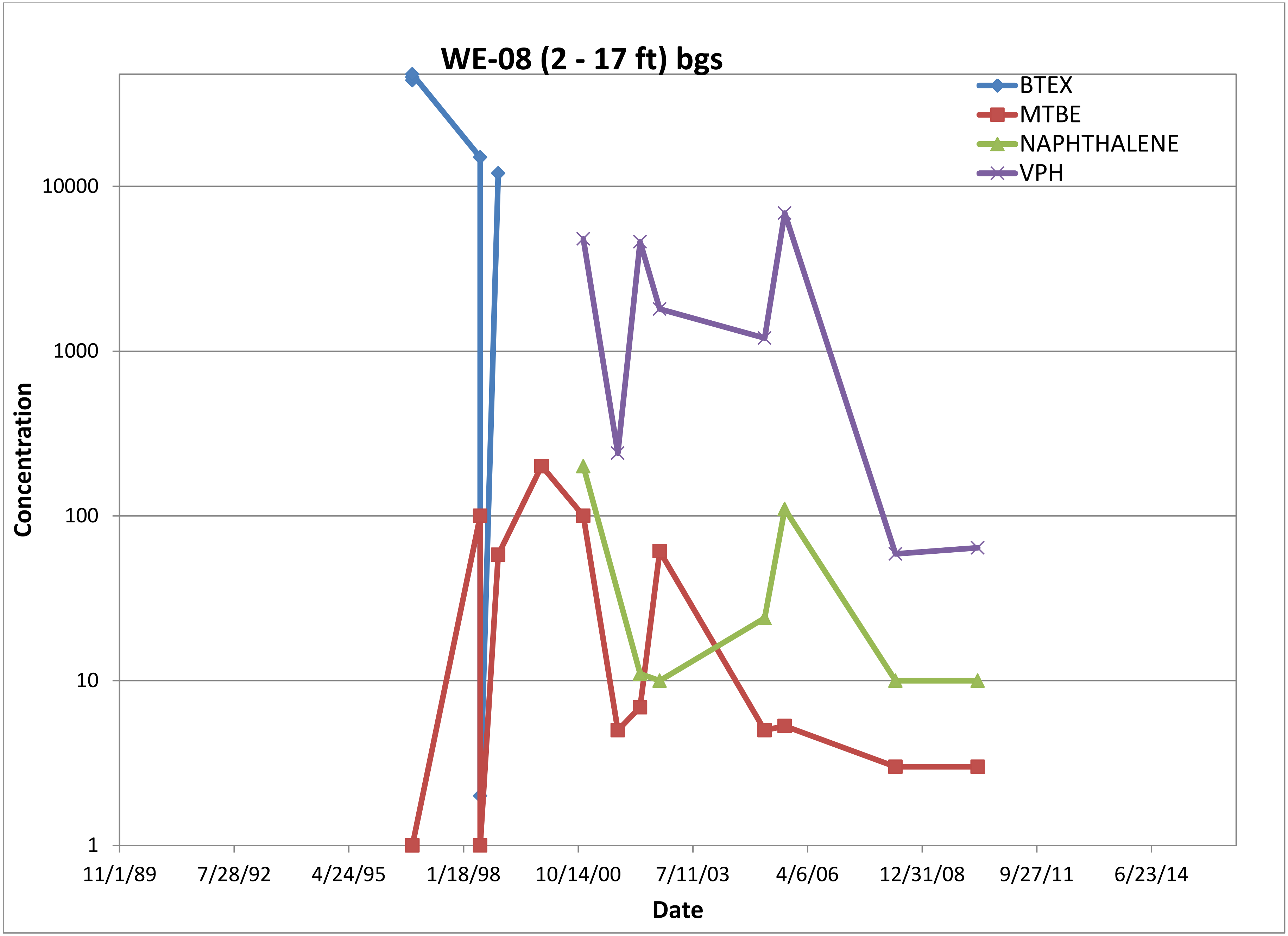

AE04 (3 - 13 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
100000
10000
1000
100
10
1
Concentration
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

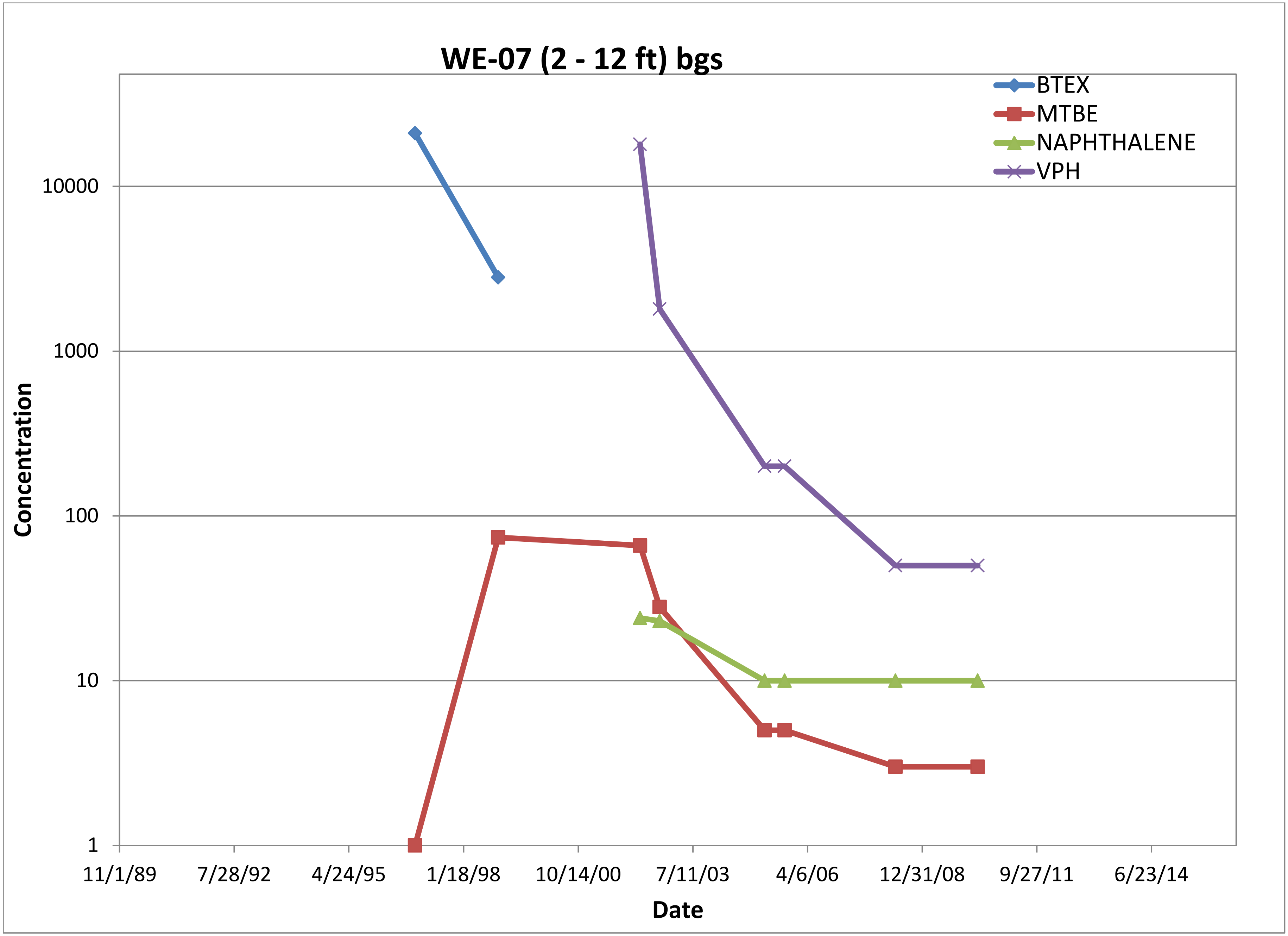

AE03 (3 - 13 ft) bgs
cis-1,2-Dichloroethene
Tetrachloroethene
TOLUENE
TRICHLOROETHYLENE
Vinyl chloride
Concentration
100000
10000
1000
100
10
1
3/3/86
8/24/91
2/13/97
8/6/02
1/27/08
7/19/13
Date

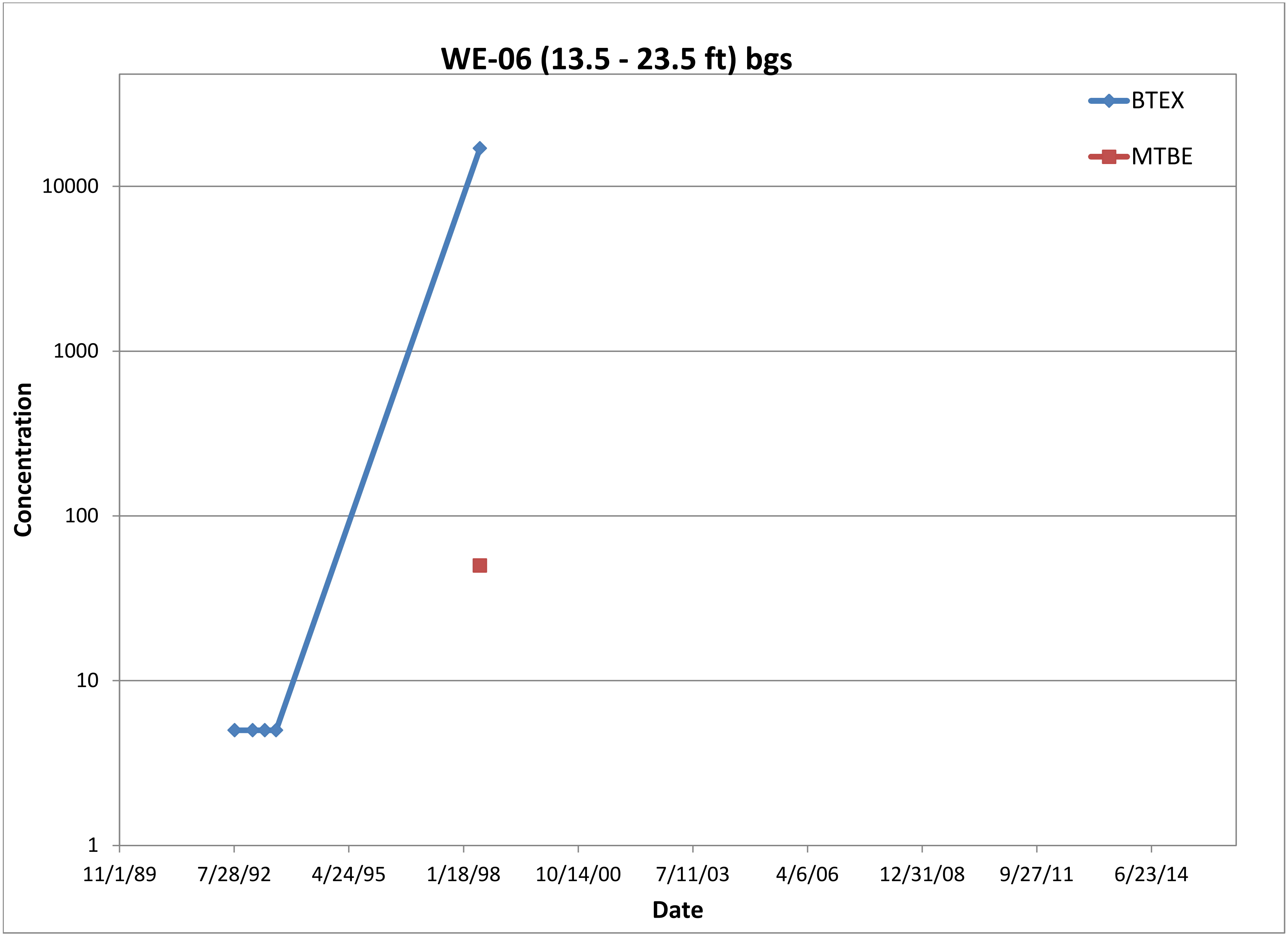
Petroleum Groundwater Concentration Trend Plots

1989 – 2016

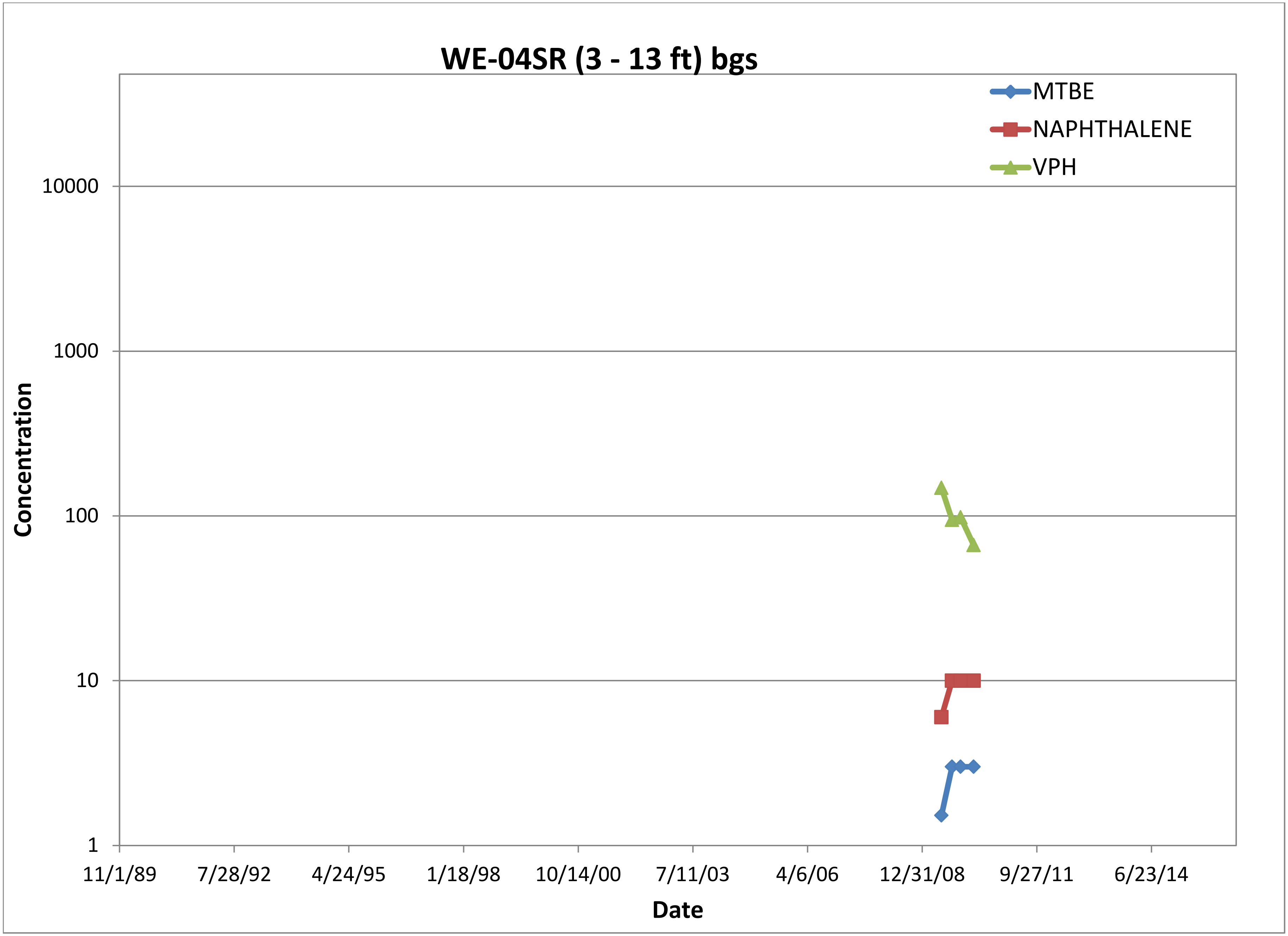

WE-09 (2 - 12 ft) bgs
BTEX
MTBE
NAPHTHALENE
VPH
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

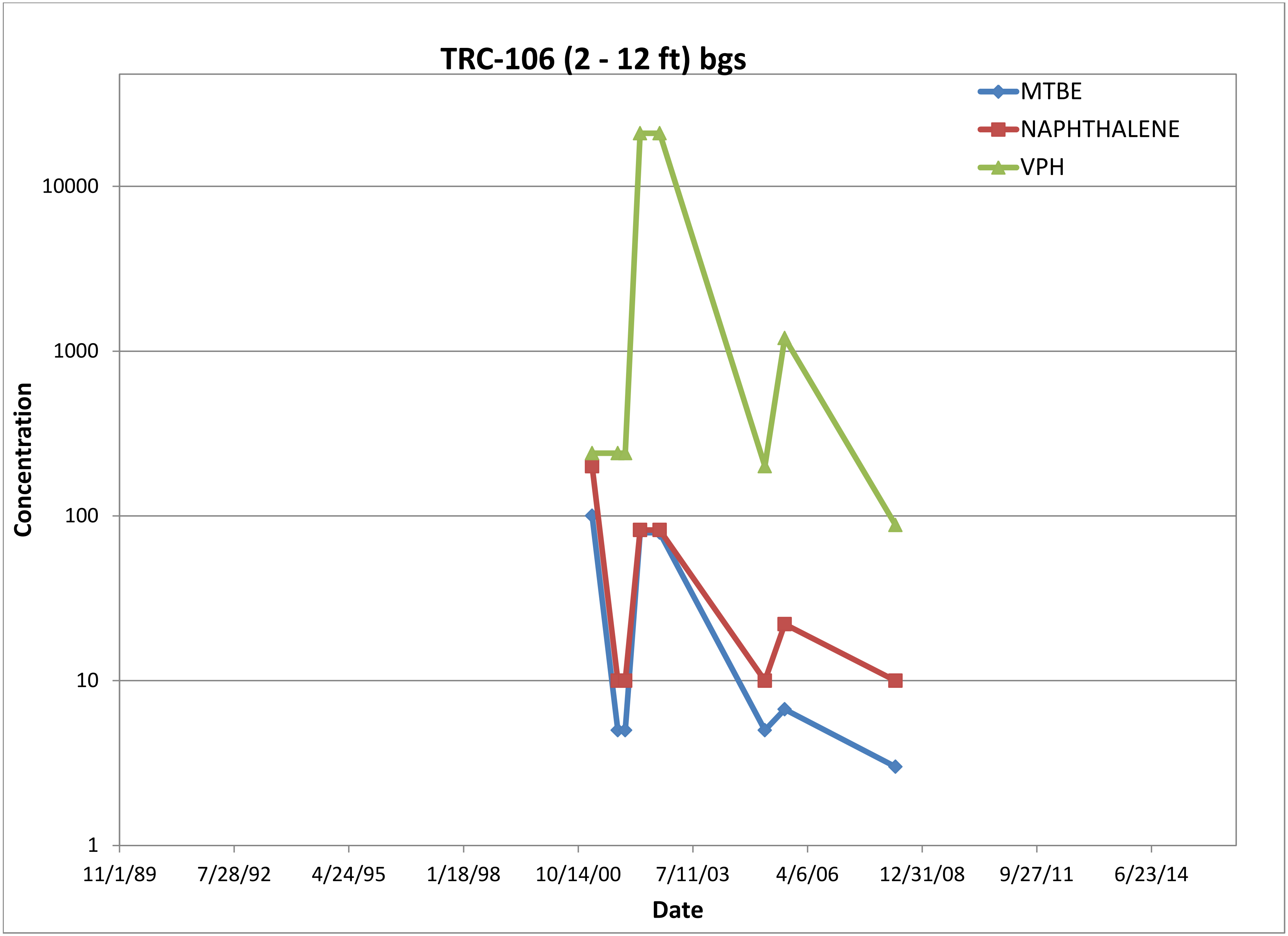

WE-08 (2 - 17 ft) bgs
BTEX
MTBE
NAPHTHALENE
VPH
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

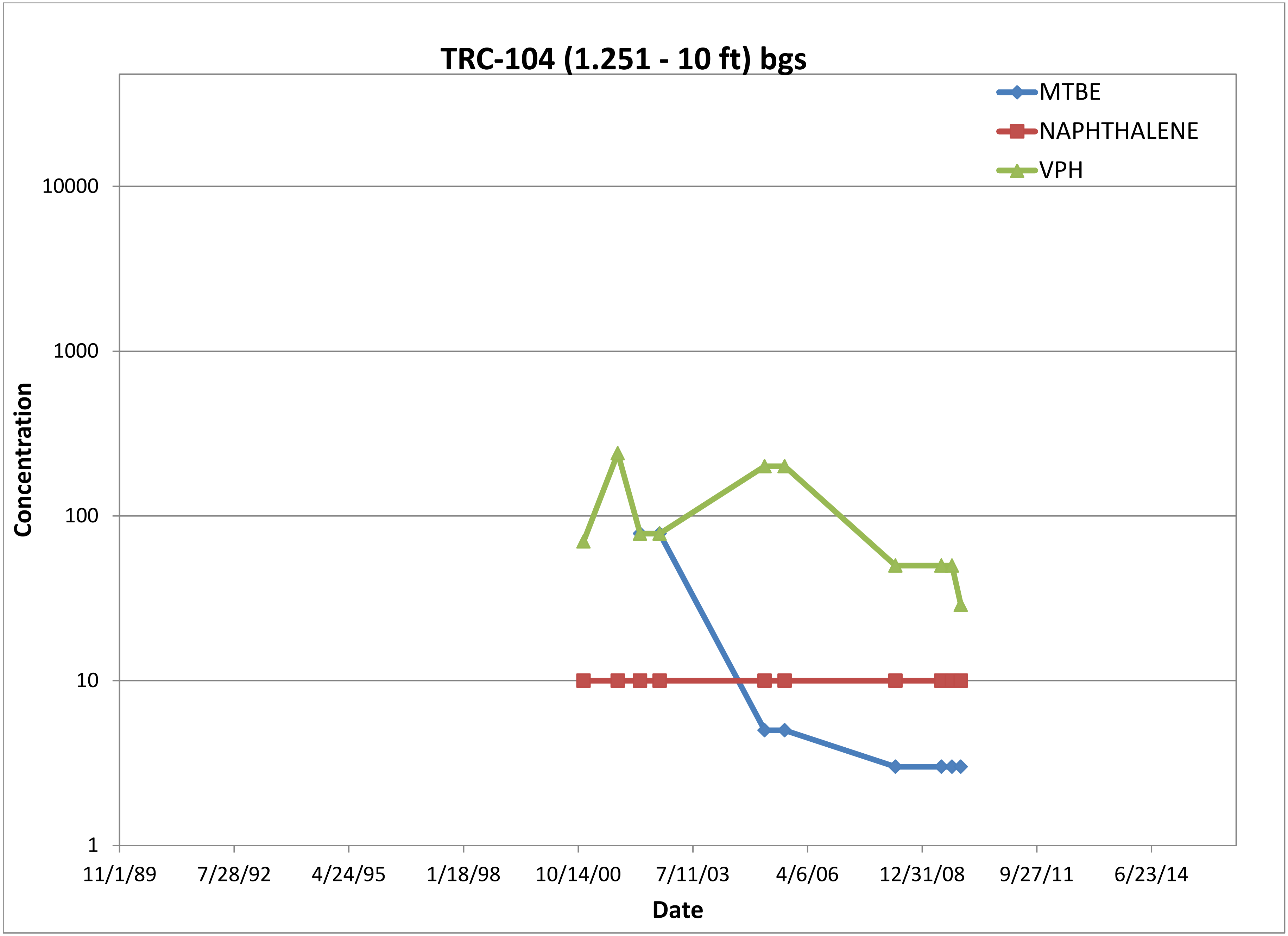

WE-07 (2 - 12 ft) bgs
BTEX
MTBE
NAPHTHALENE
VPH
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



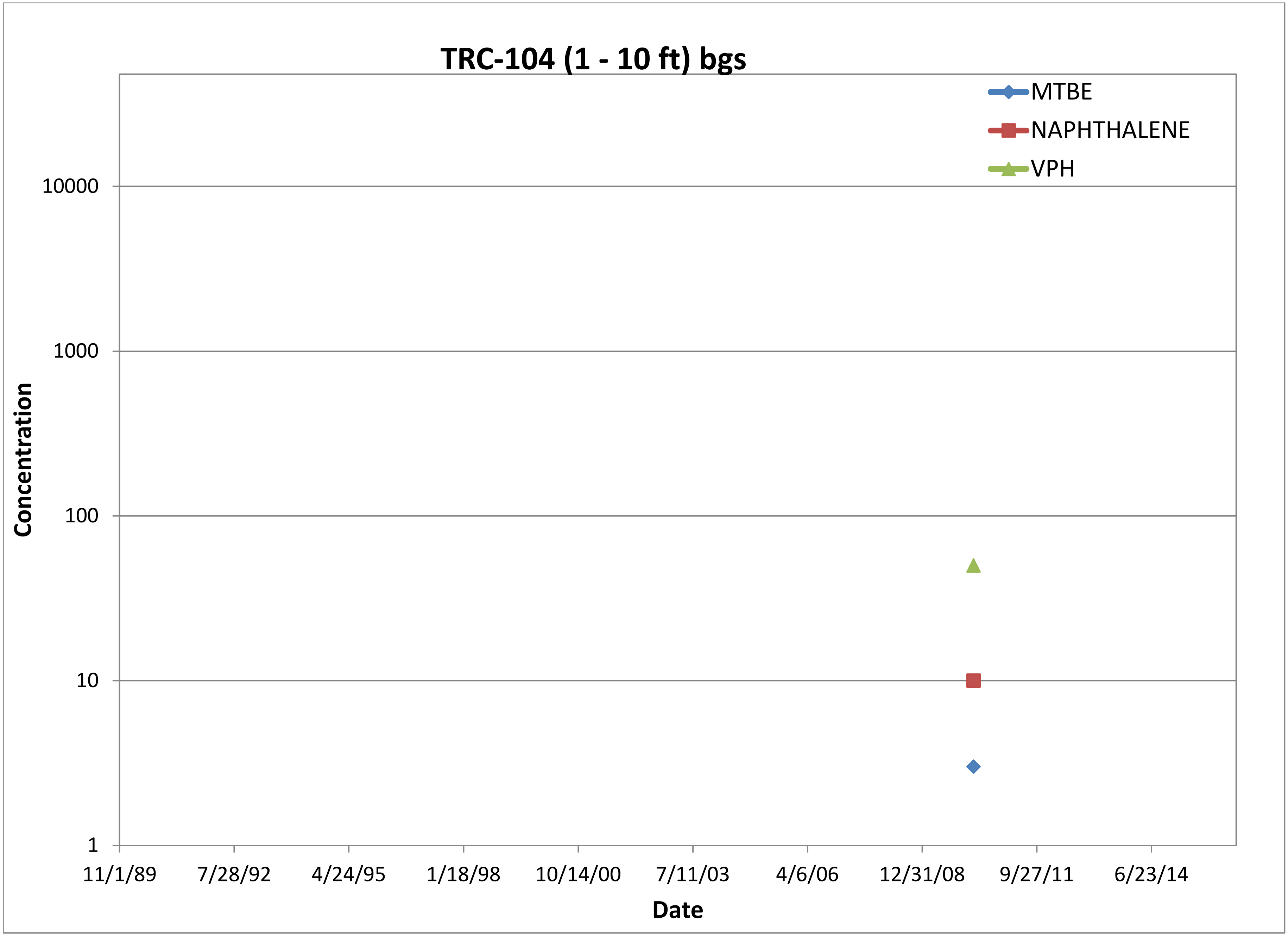
WE-06 (13.5 - 23.5 ft) bgs
BTEX
MTBE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date


WE-04SR (3 - 13 ft) bgs
MTBE
NAPHTHALENE
VPH
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

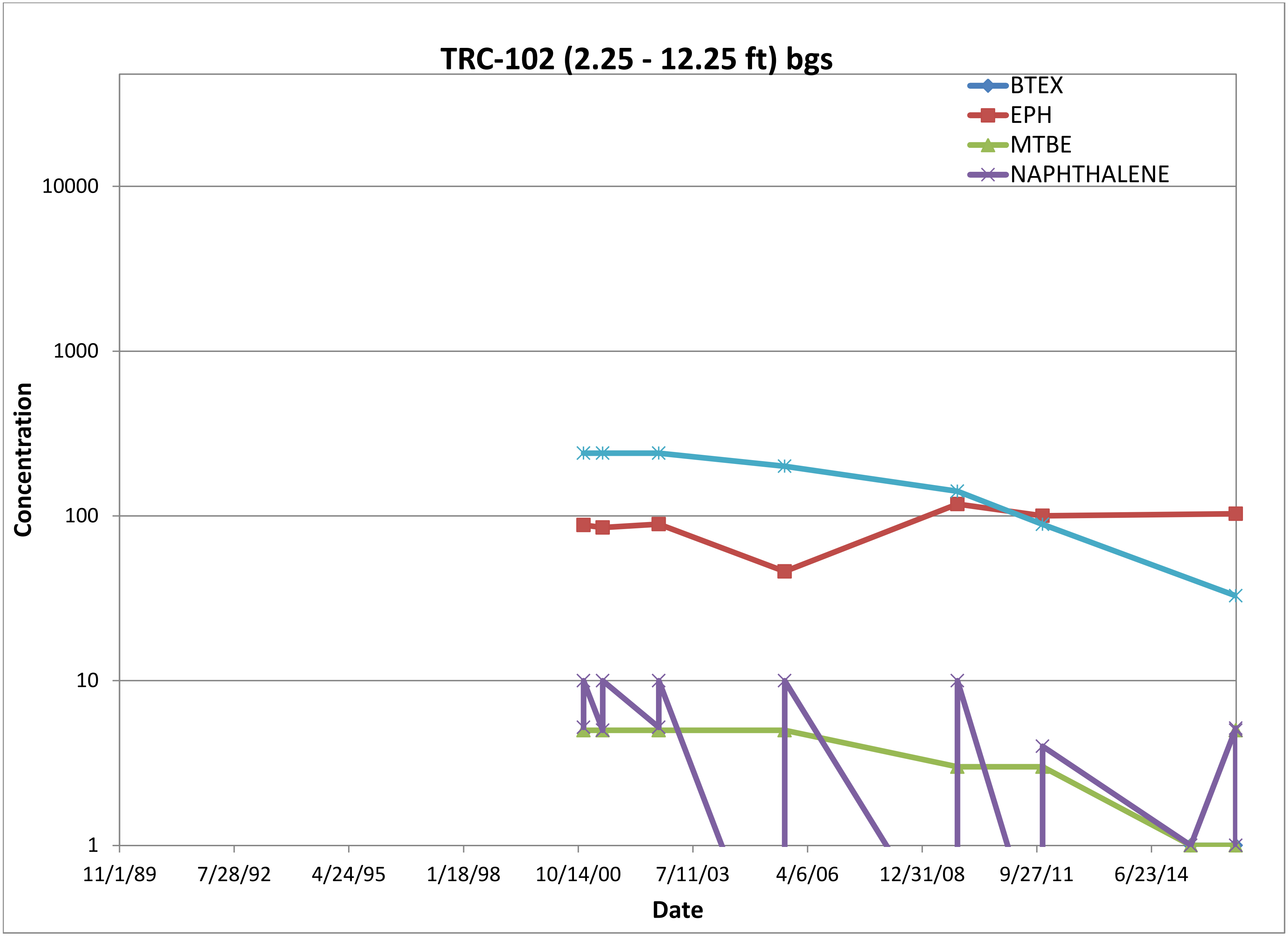

TRC-106 (2 - 12 ft) bgs
MTBE
NAPHTHALENE
VPH
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



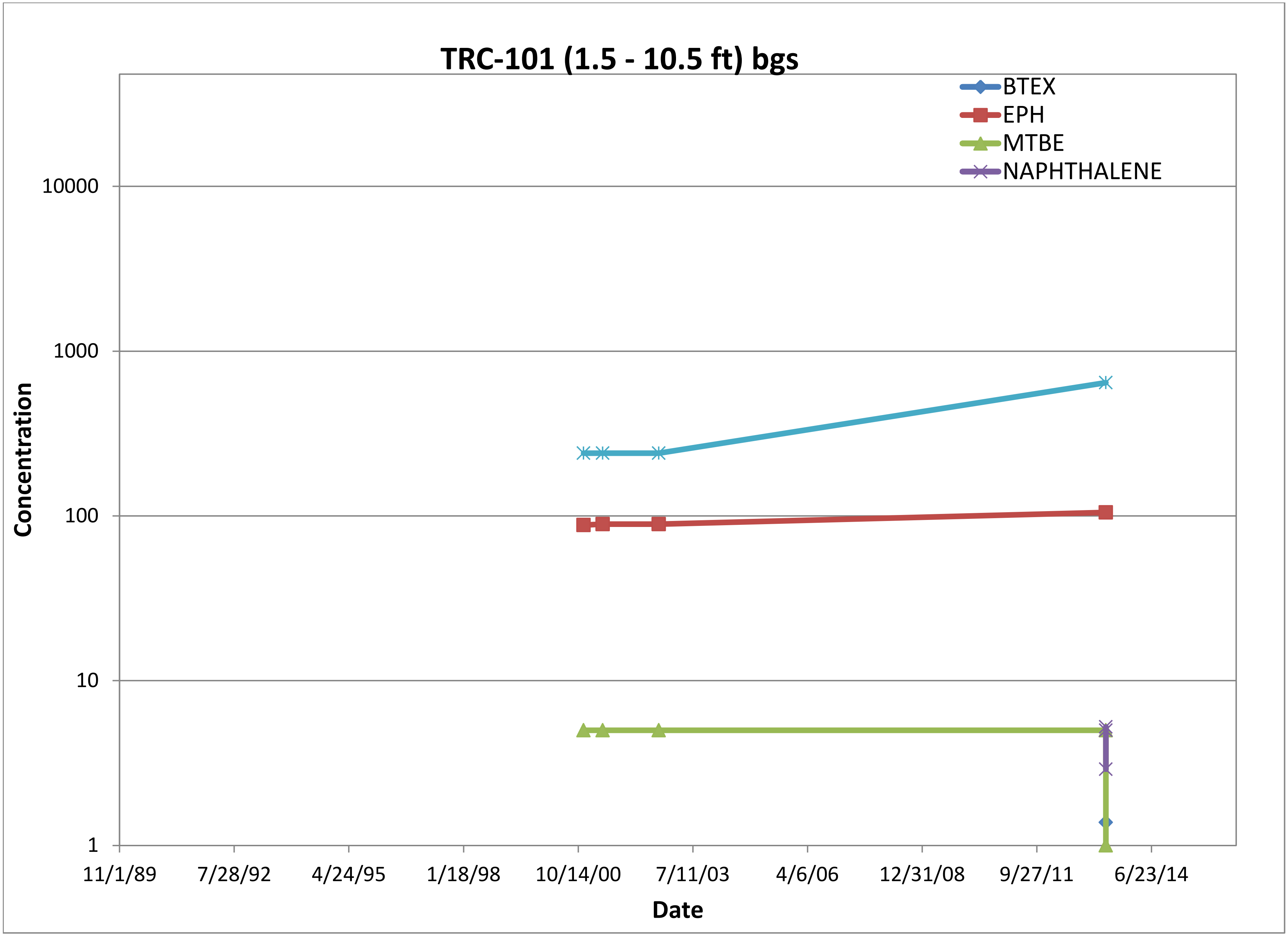
TRC-104 (1.251 - 10 ft) bgs
MTBE
NAPHTHALENE
VPH
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

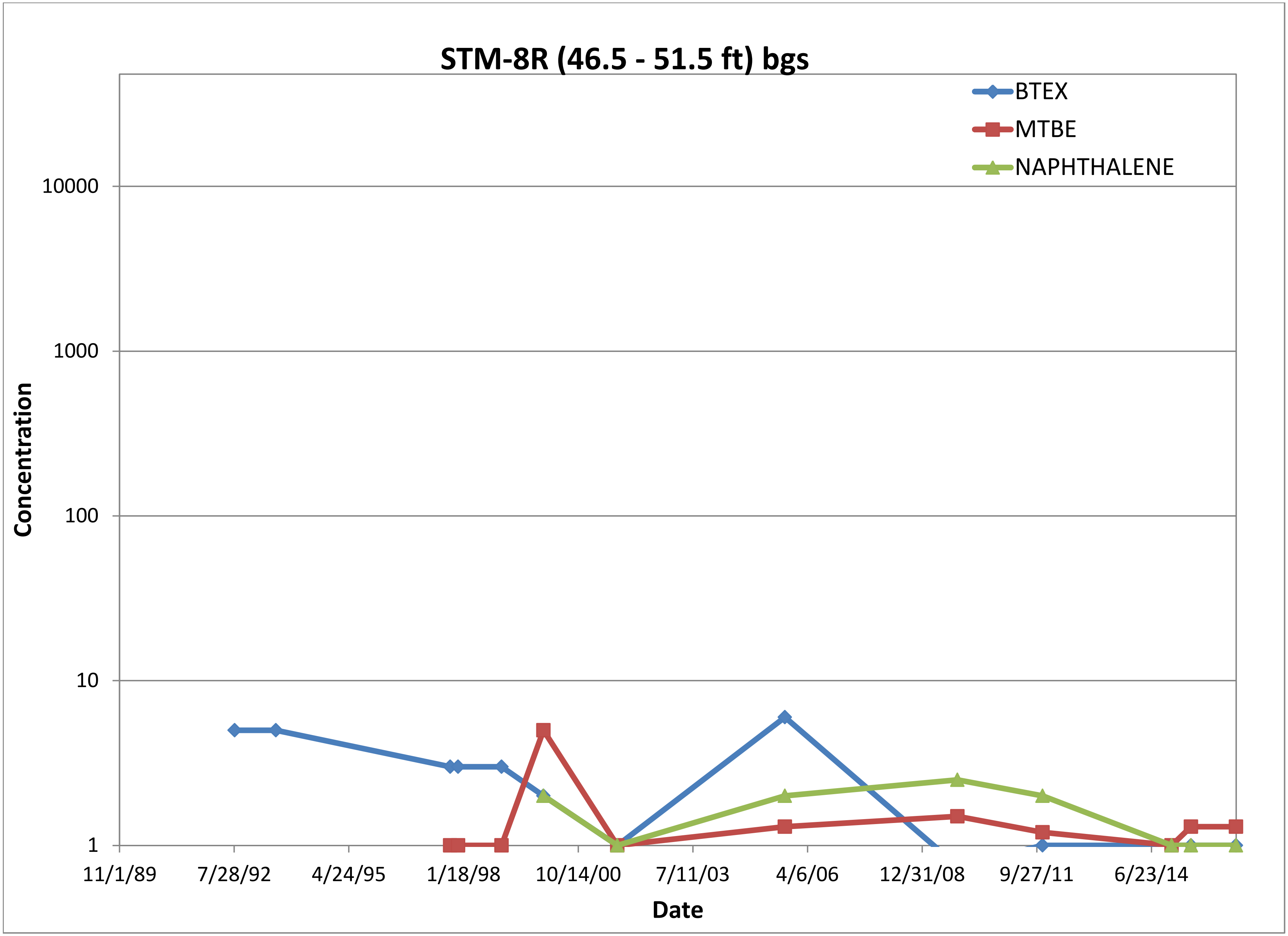


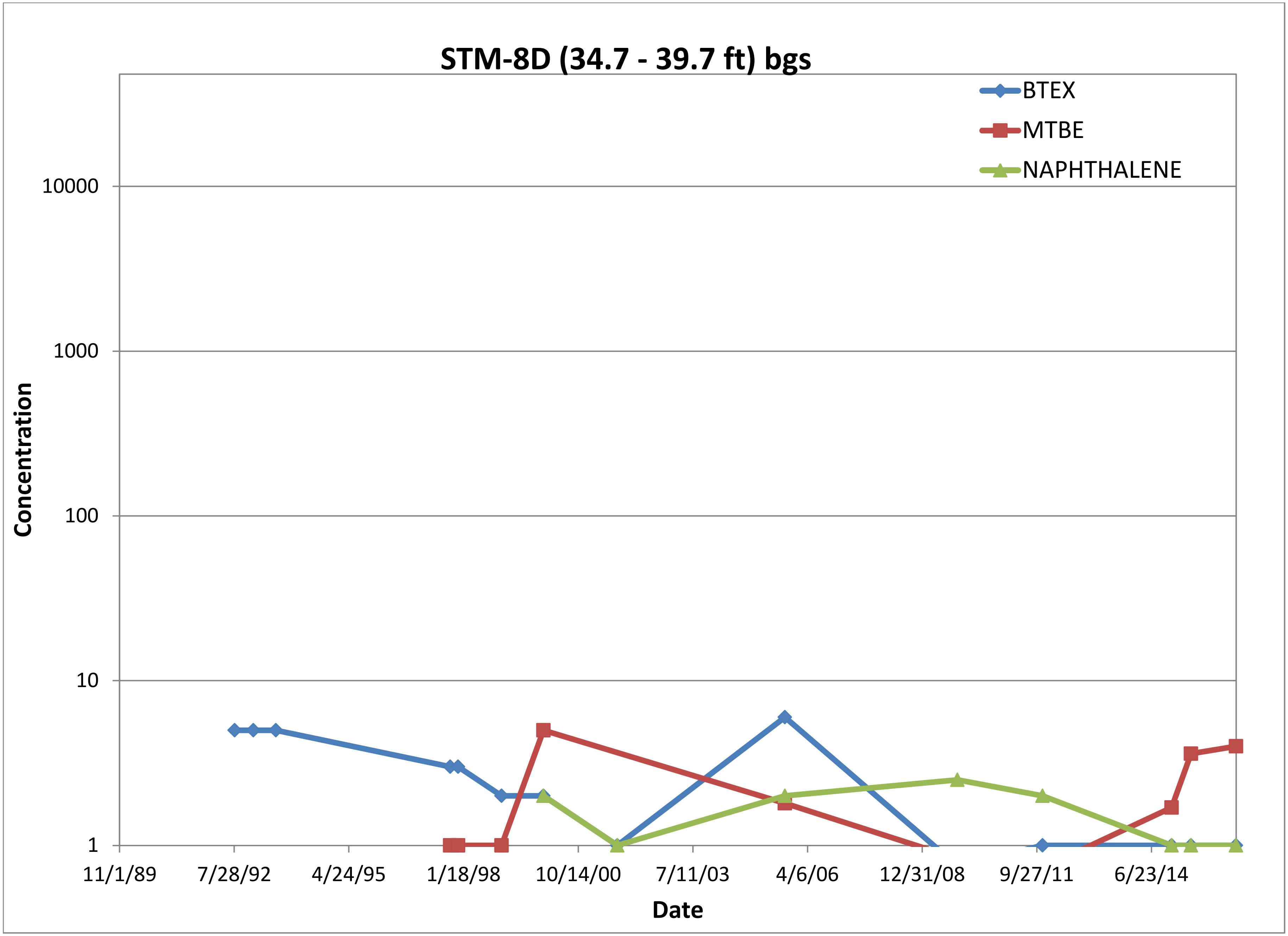
TRC-104 (1 - 10 ft) bgs
MTBE
NAPHTHALENE
VPH
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



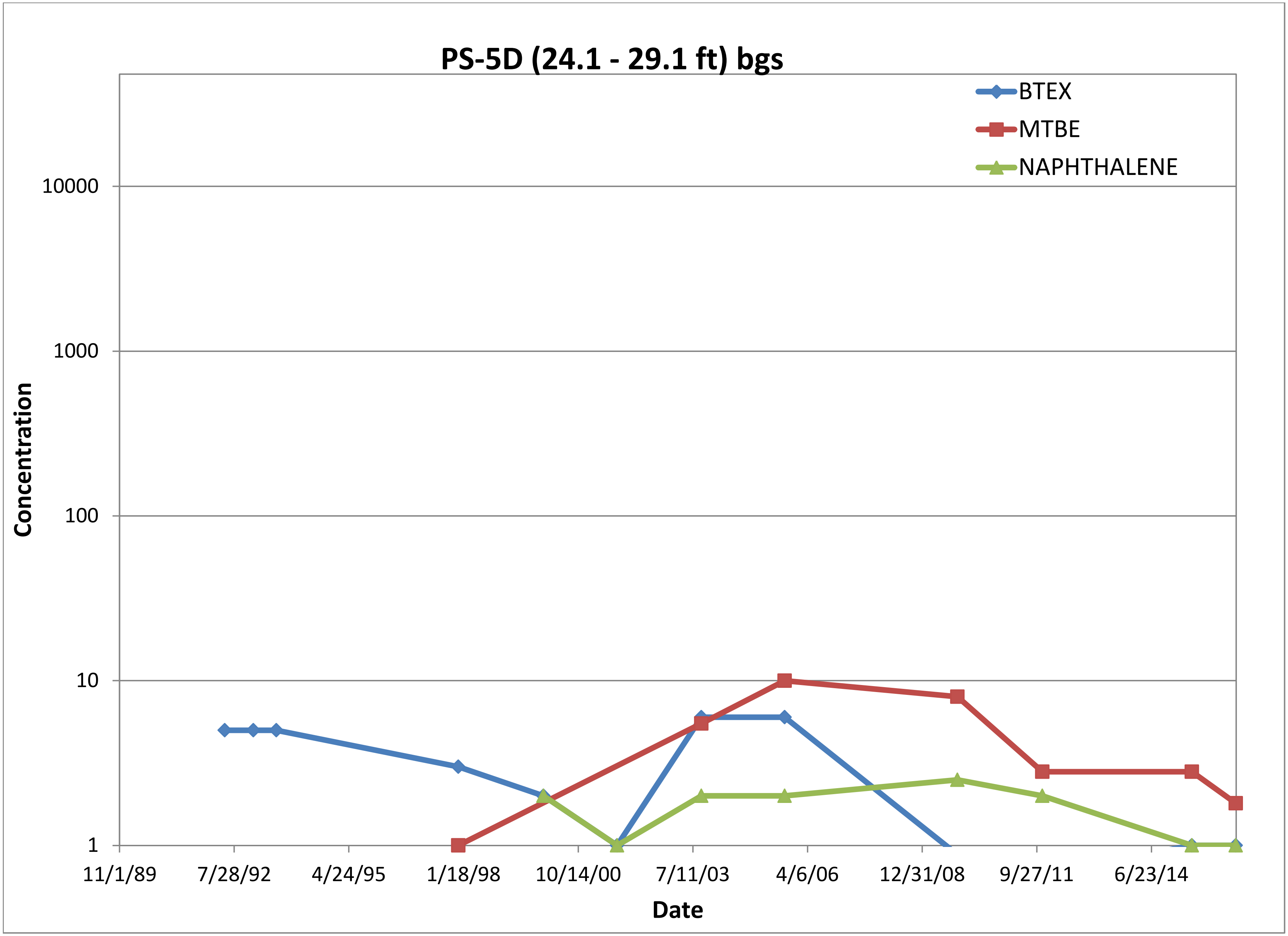
TRC-102 (2.25 - 12.25 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

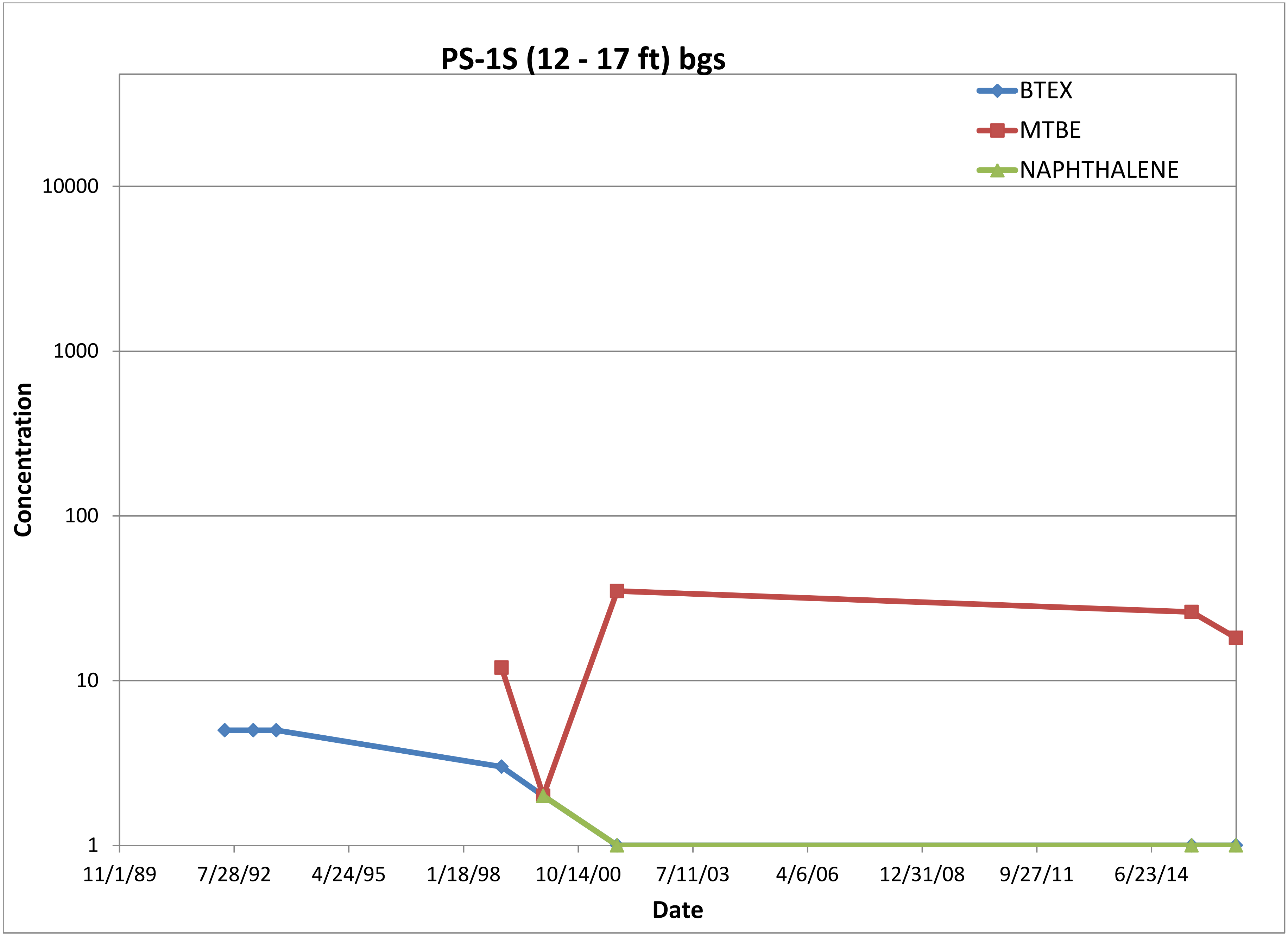

TRC-101 (1.5 - 10.5 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

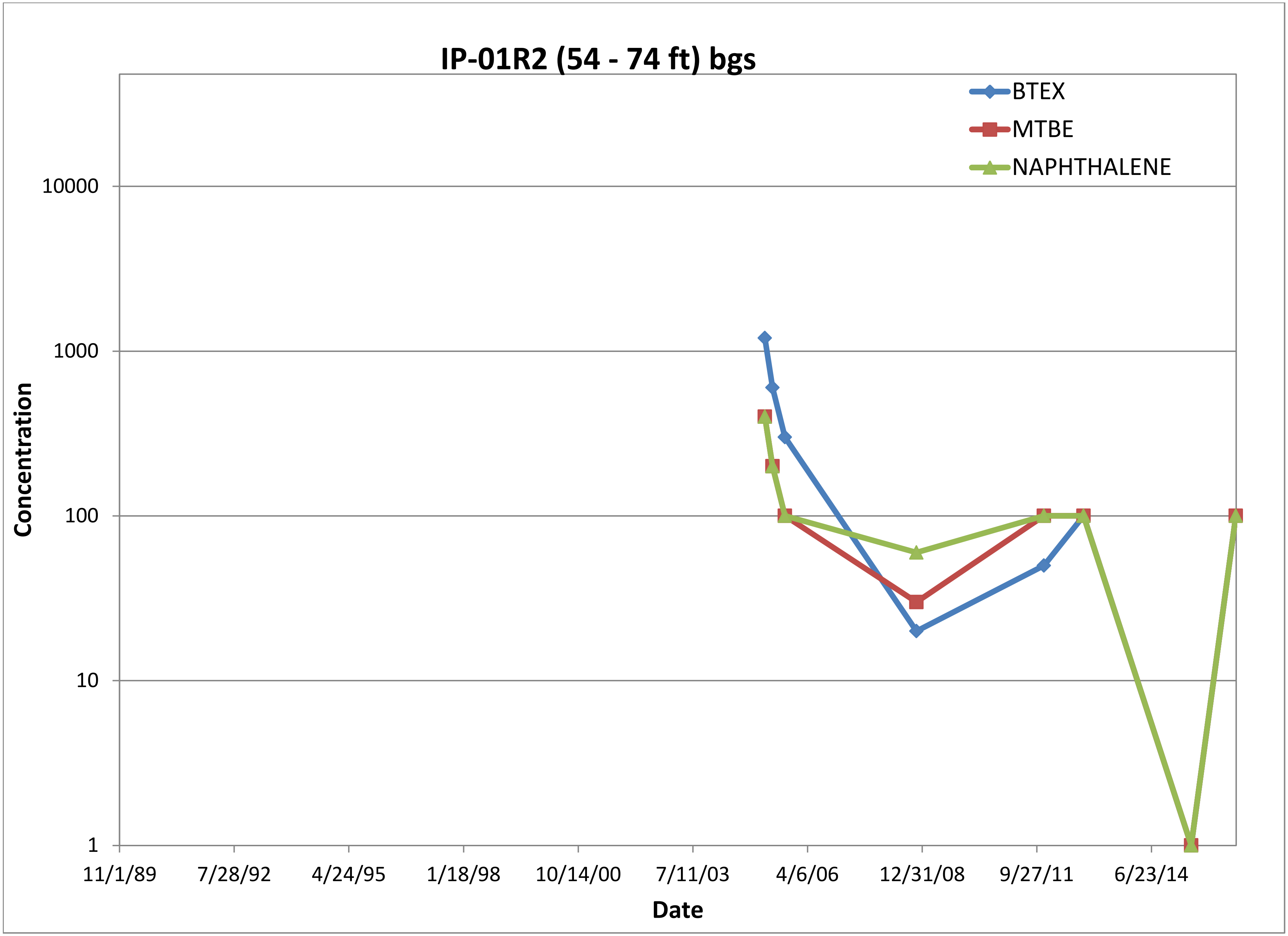

STM-8R (46.5 - 51.5 ft) bgs
BTEX
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



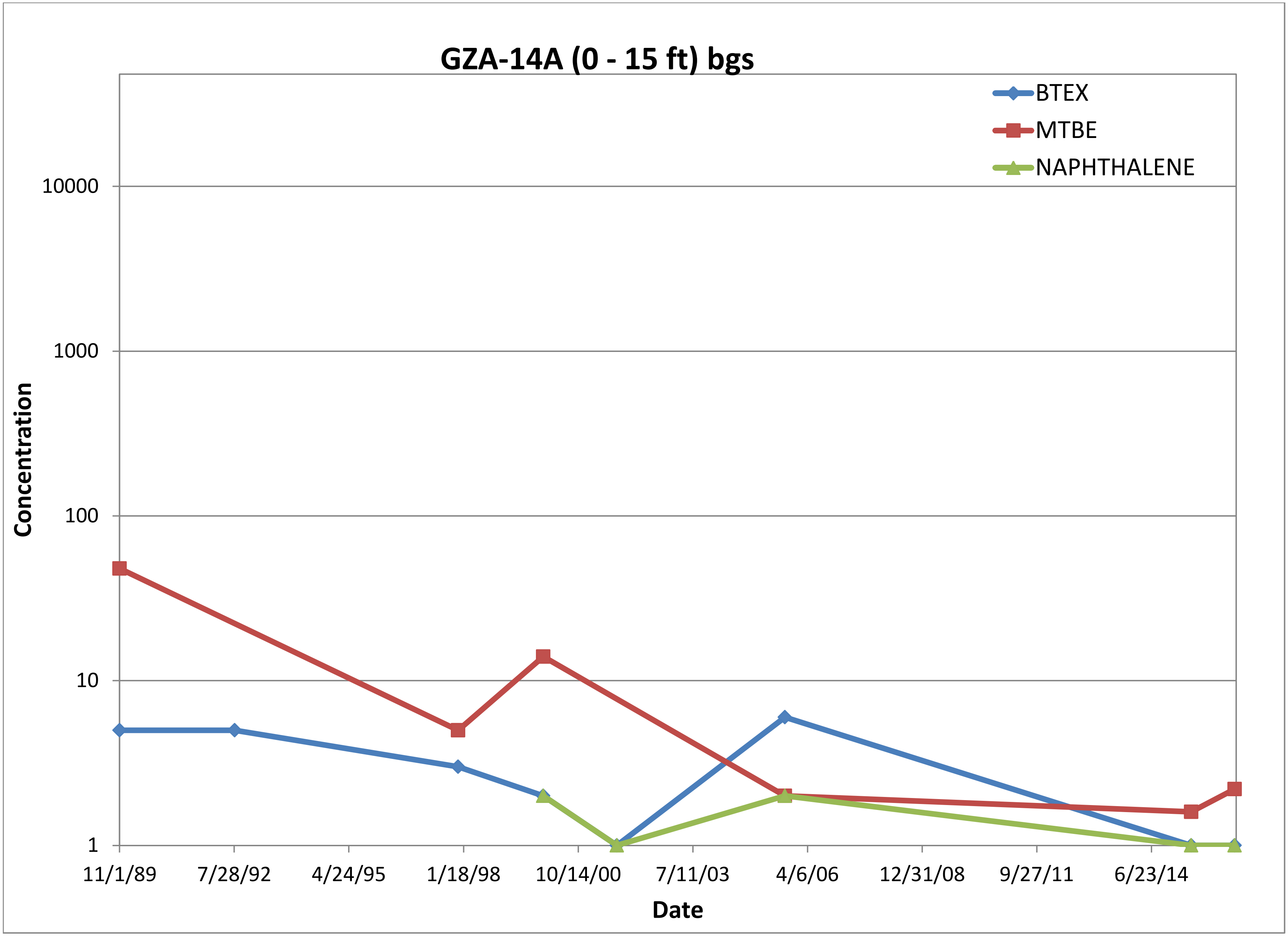
STM-8D (34.7 - 39.7 ft) bgs
BTEX
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date


PS-5D (24.1 - 29.1 ft) bgs
BTEX
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

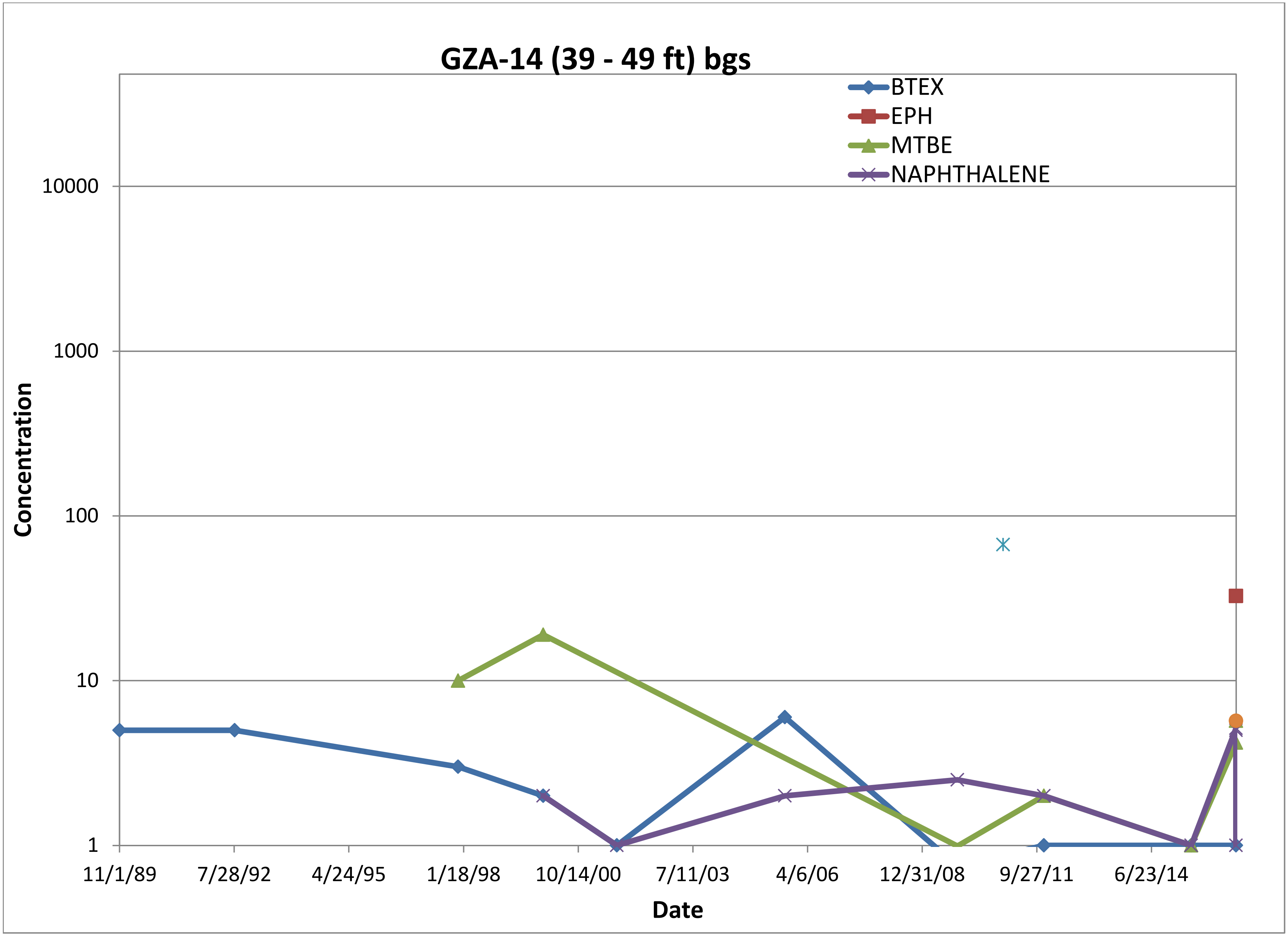

PS-1S (12 - 17 ft) bgs
BTEX
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



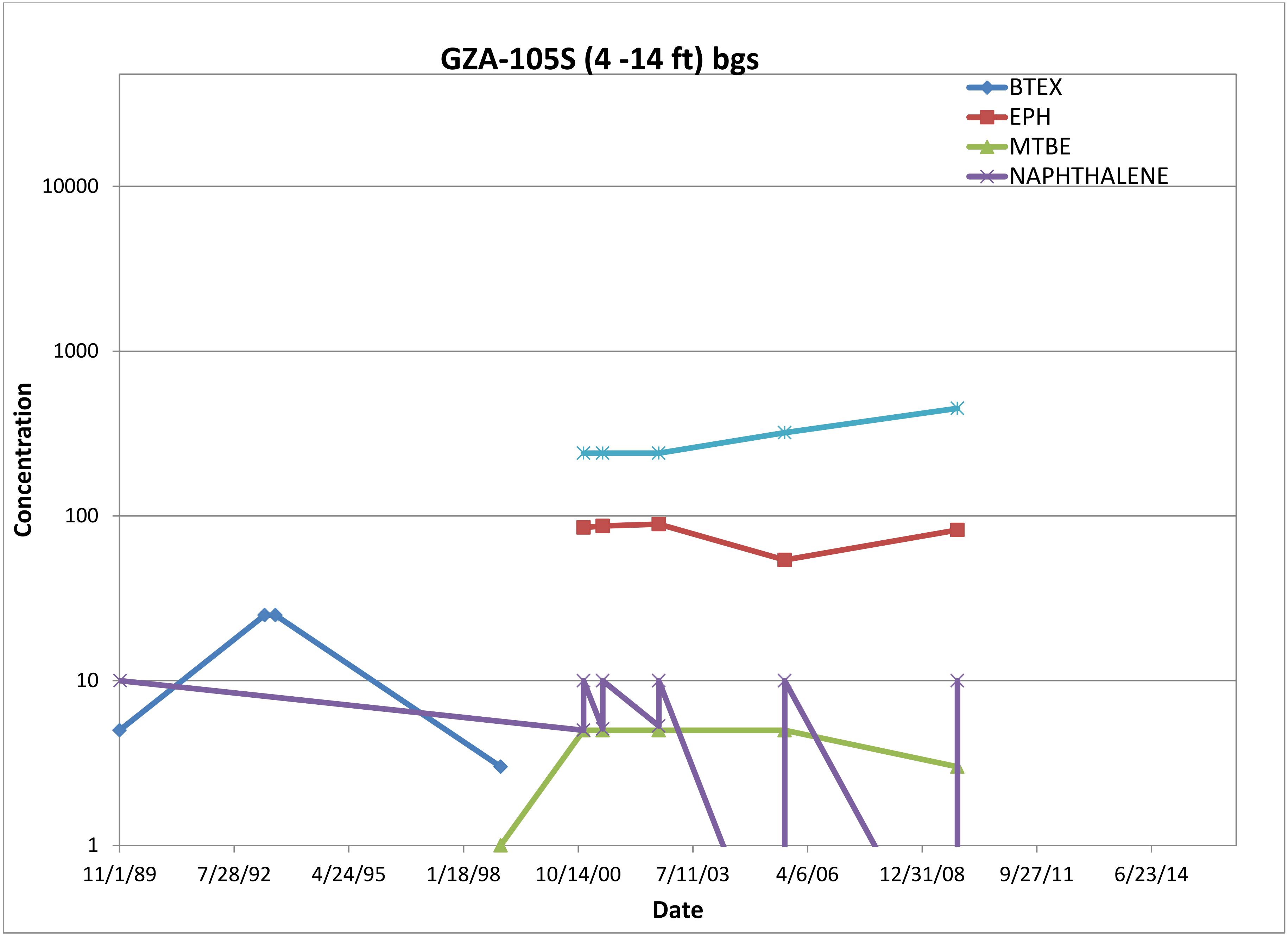
IP-01R2 (54 - 74 ft) bgs
BTEX
MTBE
NAPHTHALENE
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



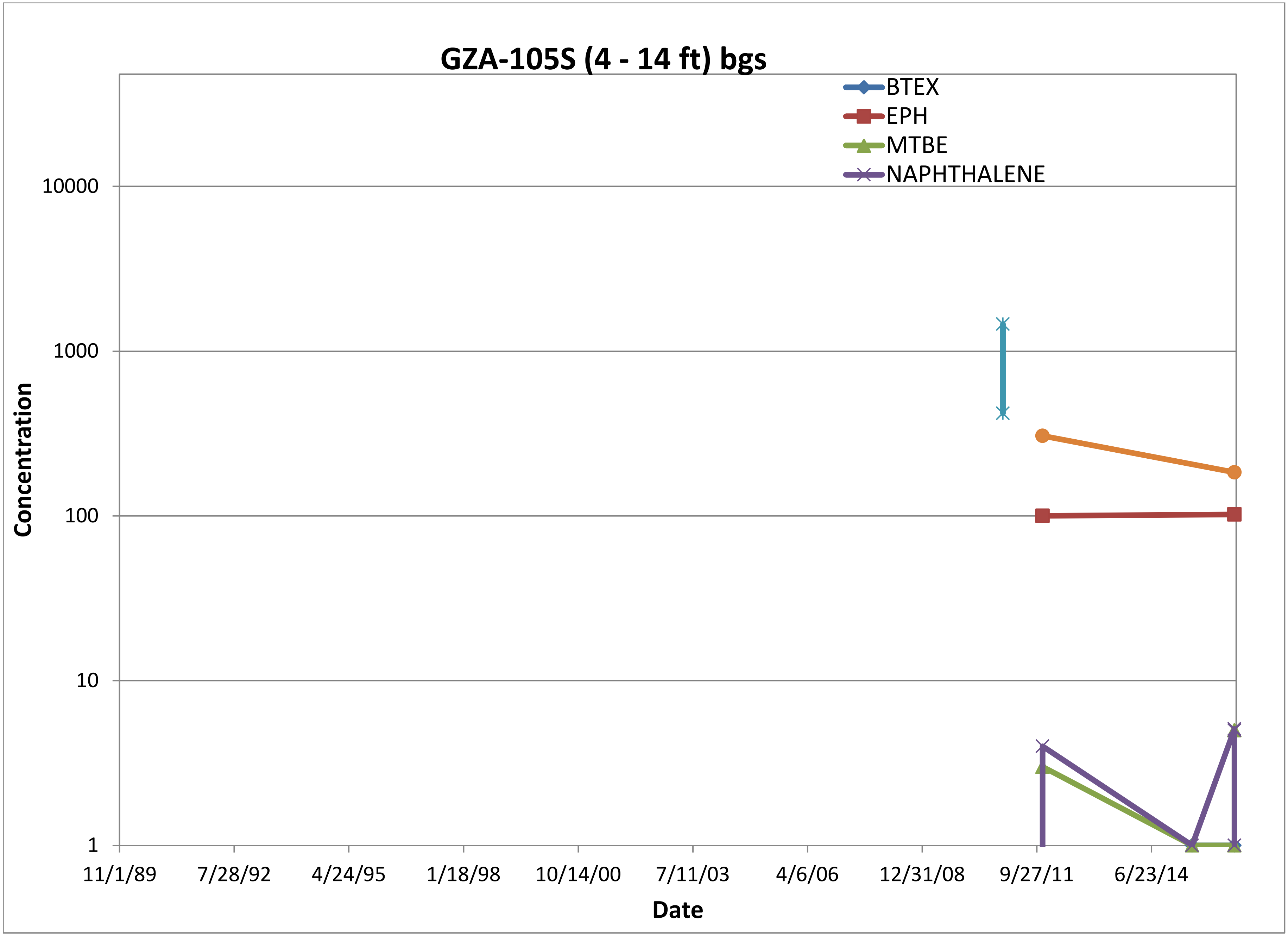
GZA-14A (0 - 15 ft) bgs
BTEX
MTBE
NAPHTHALENE
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

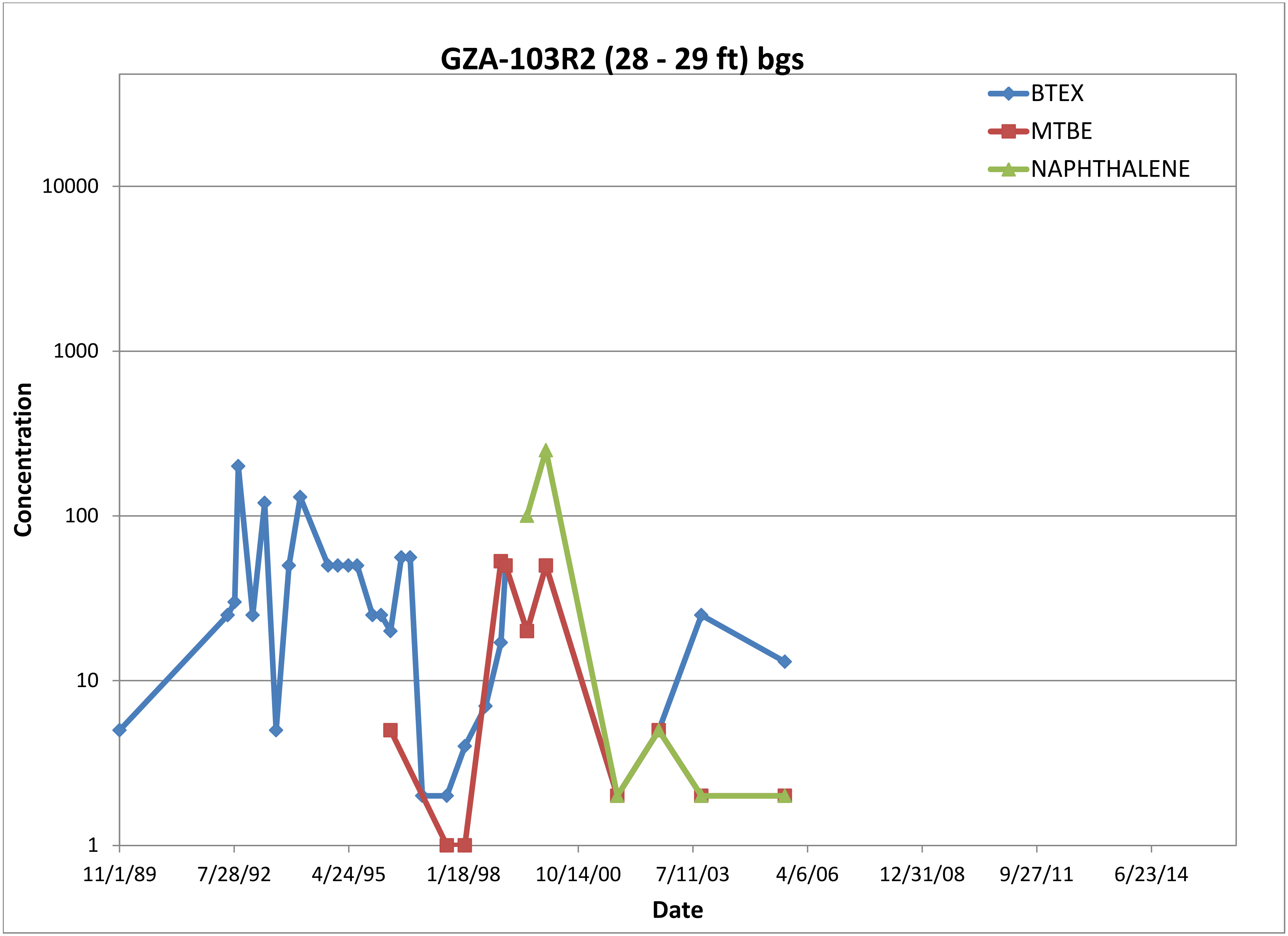


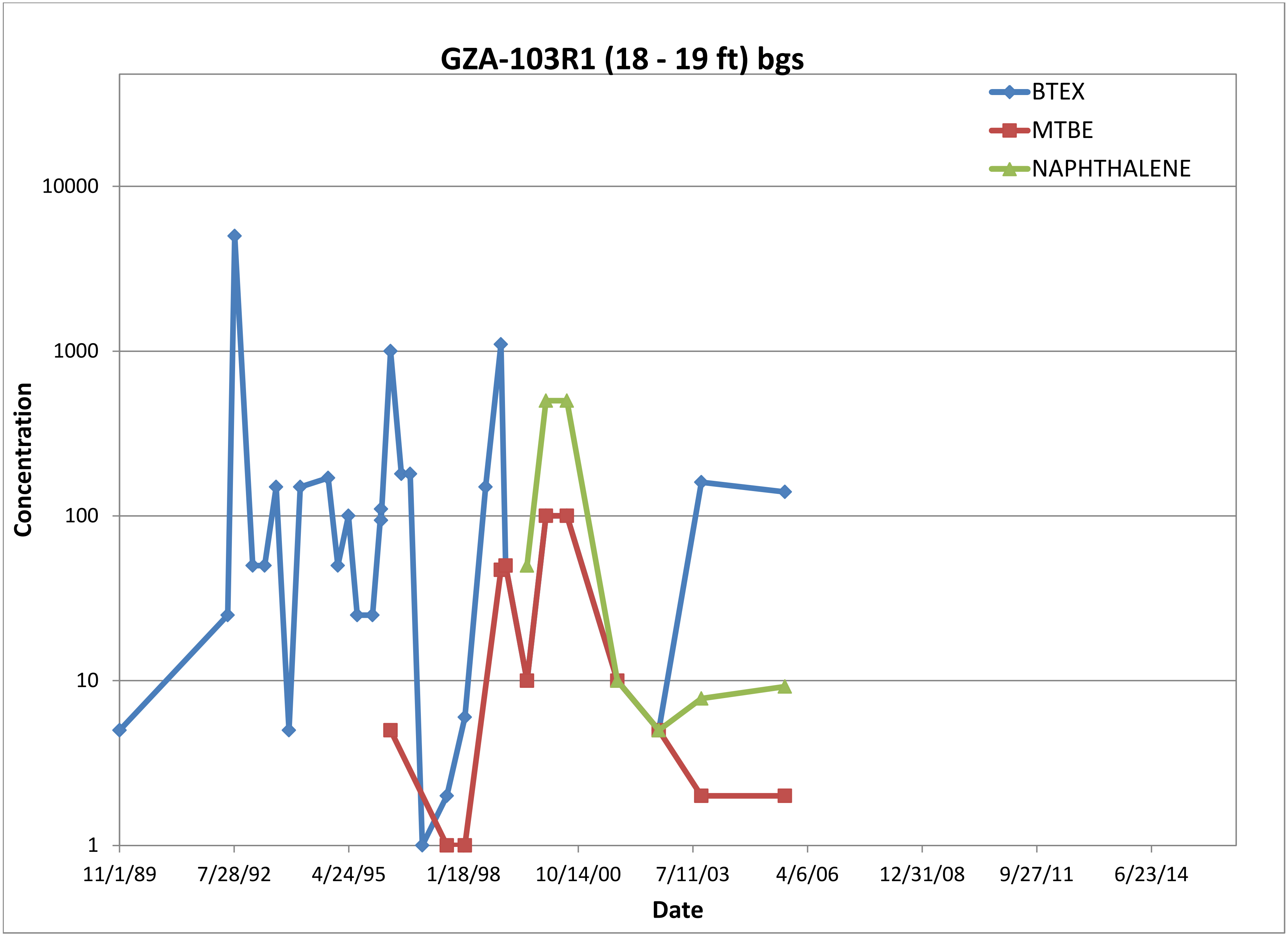
GZA-14 (39 - 49 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



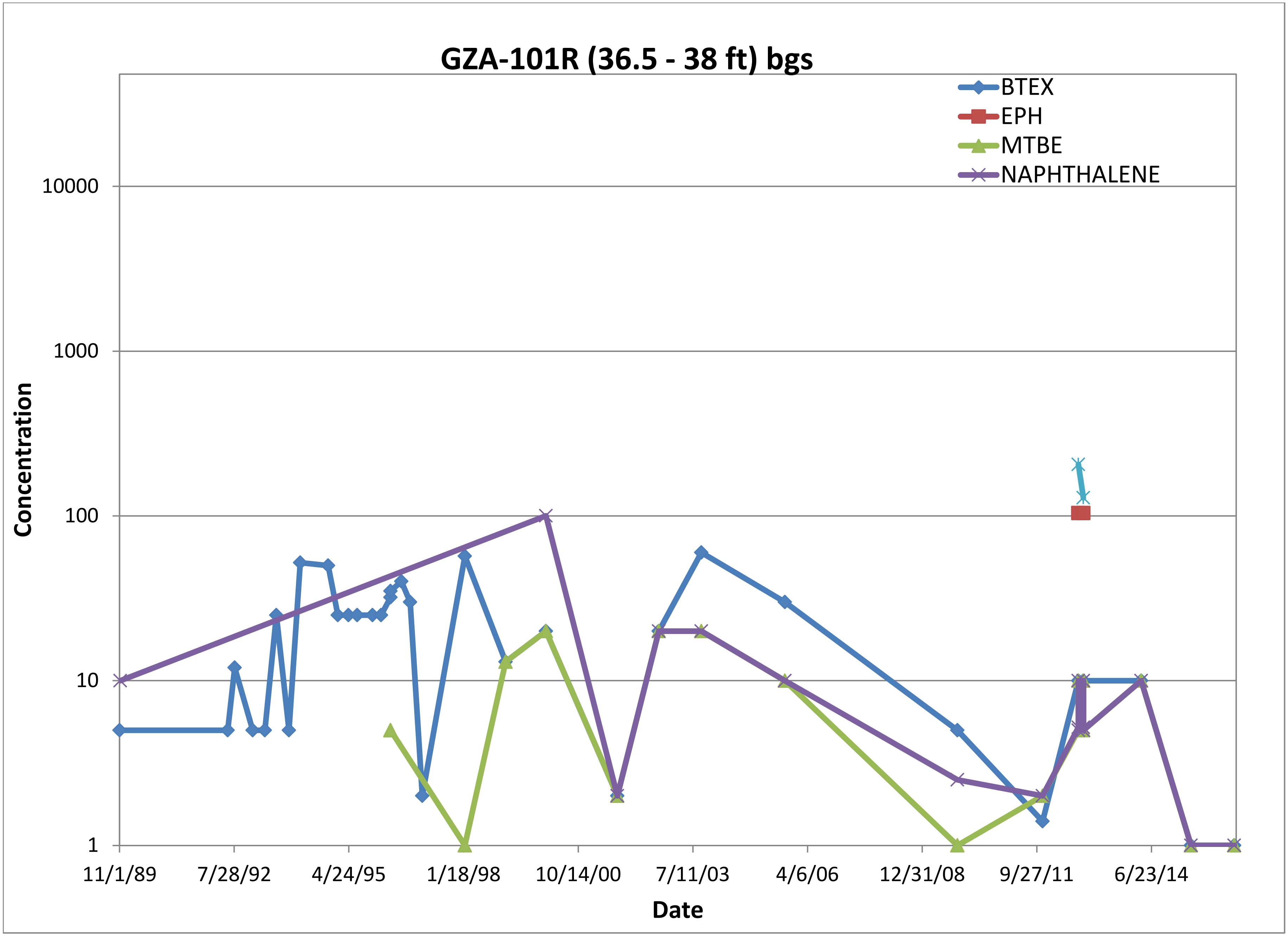
GZA-105S (4 -14 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

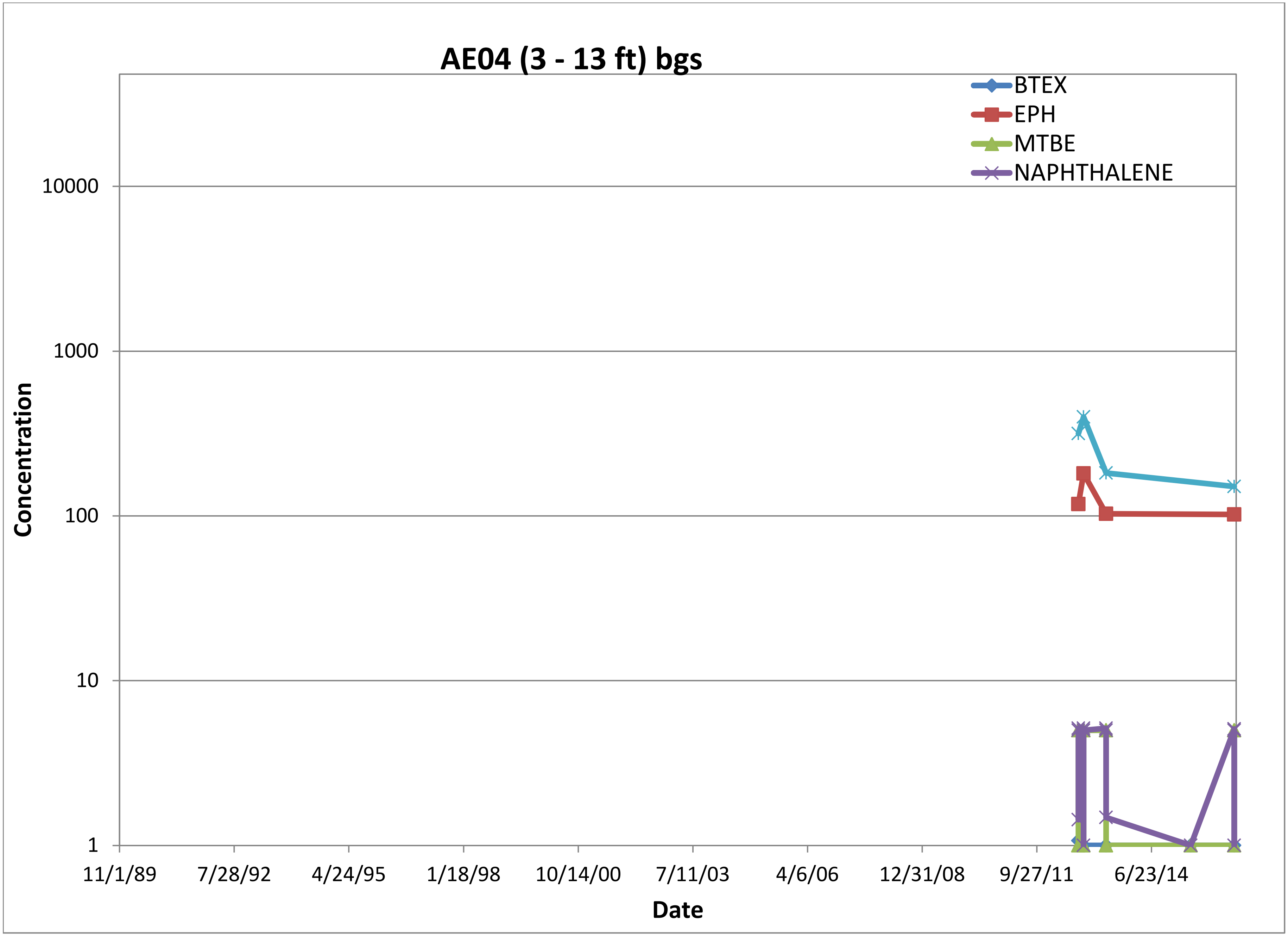

GZA-105S (4 - 14 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

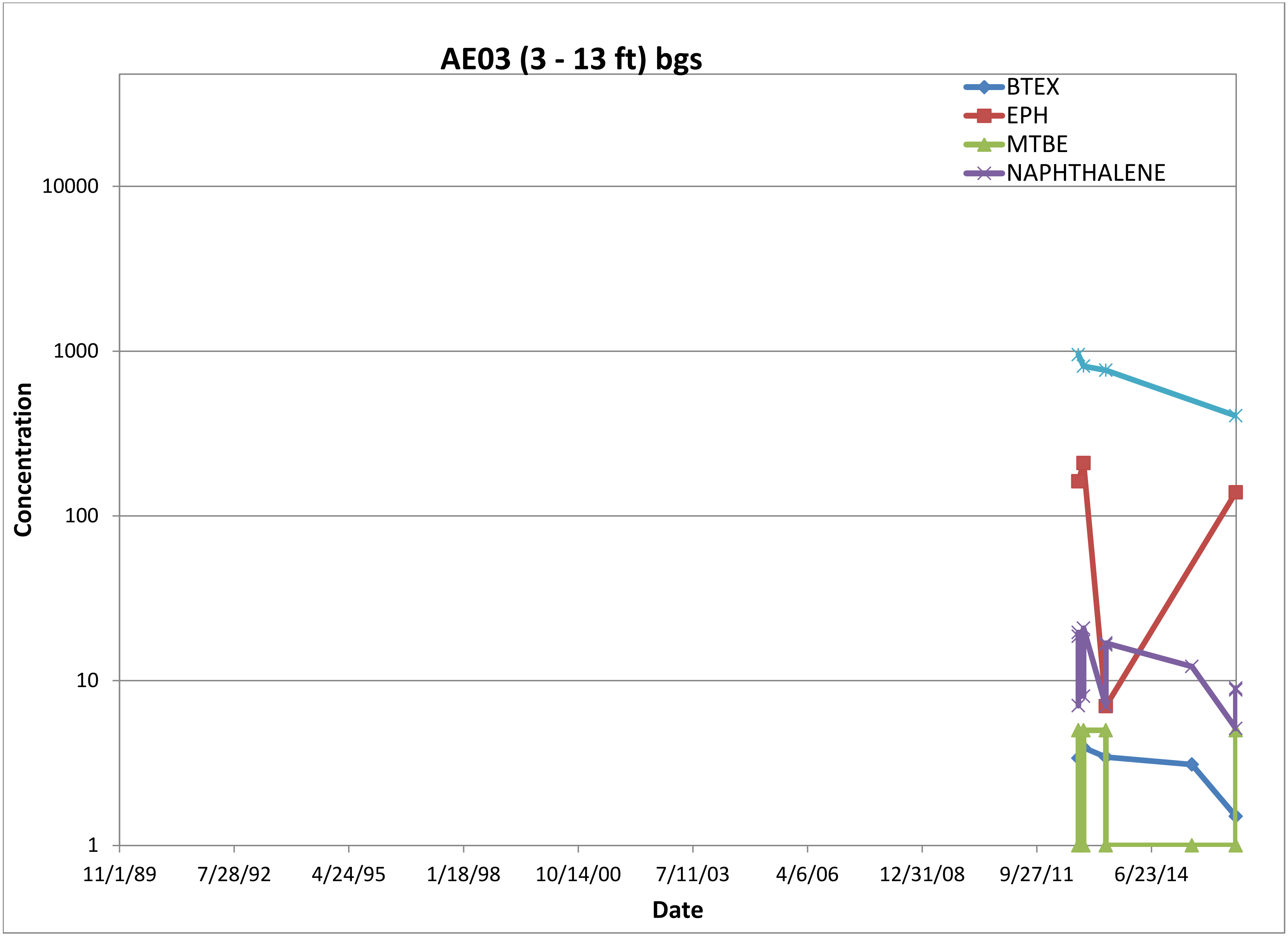

GZA-103R2 (28 - 29 ft) bgs
BTEX
MTBE
NAPHTHALENE
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date



GZA-103R1 (18 - 19 ft) bgs
BTEX
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date


GZA-101R (36.5 - 38 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date


AE04 (3 - 13 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
Concentration
10000
1000
100
10
1
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date


AE03 (3 - 13 ft) bgs
BTEX
EPH
MTBE
NAPHTHALENE
10000
1000
100
10
1
Concentration
11/1/89
7/28/92
4/24/95
1/18/98
10/14/00
7/11/03
4/6/06
12/31/08
9/27/11
6/23/14
Date

APPENDIX C SELECTED WELL STATISTICS FOR TREND PLOTS

Well Statistics for Trends

GZA-101R		
COMPOUND CONCENTRATIONS	PCE (ug/l)	TCE (ug/l)
11/1/1989	1600	3300
6/1/1992	21	56
8/1/1992	150	400
1/6/1993	120	210
4/22/1993	30	72
7/30/1993	360	540
11/17/1993	110	220
2/23/1994	280	570
10/26/1994	790	910
1/18/1995	470	620
4/21/1995	630	670
7/6/1995	530	670
11/17/1995	880	720
1/30/1996	550	420
4/22/1996	970	600
4/22/1996	760	560
7/24/1996	760	710
10/10/1996	900	610
1/23/1997	820	500
1/30/1998	230	230
9/24/2003	900	260
9/21/2005	840	140
11/4/2009	880	180
11/16/2011	490	160
9/24/2012	461	108
11/6/2012	397	90
3/25/2014	280	144
6/3/2015	298	93
6/14/2016	441	186

Calculation Notes

STATISTICS

Analysis Count	29	29
(1) S	64	-119
(2) Mann-Kendall P	0.12	0.013
(3) Trend Test Result at: 90% confidence	No Trend	Downward Trend
(4) 80% confidence	Upward Trend	Downward Trend
CV	0.65	1.24

Notes:
(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.
Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

Well Statistics for Trends

EMW10D		
COMPOUND CONCENTRATIONS	**PCE (ug/l)**	**TCE (ug/l)**
12/8/1998	150	100
2/2/2000	1	1
9/24/2003	20	28
9/21/2005	22	23
11/11/2008	14	17
5/4/2009	7.1	12
11/4/2009	6.3	14
6/7/2010	23	23
5/1/2011	18	20
5/24/2011	18	20
11/28/2011	9.4	12
5/31/2012	8.86	12.1
5/31/2012	17.4	12
11/6/2012	14.6	10.7
6/8/2015	5.9	8.8
6/13/2016	9.5	12.5

Calculation Notes

Both ND 2U; 1/2 DL Used

STATISTICS

Analysis Count	16	16
(1) S	-29	-51
(2) Mann-Kendall P	0.1055	0.0115
(3) Trend Test Result at:	No Trend	Downward Trend
(4) 80% confidence	Downward Trend	Downward Trend
CV	1.62	1.09

Notes:

(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.
Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

Well Statistics for Trends

IP-01R2		
COMPOUND CONCENTRATIONS	PCE (ug/l)	TCE (ug/l)
3/30/2005	3100	16000
6/6/2005	1500	12000
9/22/2005	590	5600
11/11/2008	410	5000
11/11/2008	440	2600
11/28/2011	260	3600
11/7/2012	3910	7490
6/5/2015	1590	4750
6/27/2016	3560	7290

Calculation Notes

STATISTICS

Analysis Count	9	9
(1) S	2	-12
(2) Mann-Kendall P	0.46	0.13
(3) Trend Test Result at:	No Trend	No Trend
(4) 80% confidence	No Trend	Downward Trend
CV	0.85	0.60

Notes:

(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.

Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

Well Statistics for Trends

GZA-103S			
COMPOUND CONCENTRATIONS	PCE (ug/l)	TCE (ug/l)	Calculation Notes
11/1/1989	90	16	
6/1/1992	46	6	TCE ND 12U; 1/2 DL Used
8/1/1992	100	50	TCE ND 100U; 1/2 DL Used
1/5/1993	43	2.5	TCE ND 5U; 1/2 DL Used
4/19/1993	38	12.5	TCE ND 25U; 1/2 DL Used
7/22/1993	60	60	Both ND 120U; 1/2 DL Used
11/17/1993	7	2.5	TCE ND 5U; 1/2 DL Used
10/26/1994	28	2.5	TCE ND 5U; 1/2 DL Used
1/18/1995	49	6	
7/6/1995	12.5	12.5	Both ND 25U; 1/2 DL Used
4/22/1996	29	2.5	TCE ND 5U; 1/2 DL Used
10/10/1996	65	73	
1/30/1998	26	5	
12/10/1998	13	0.5	TCE ND 1U; 1/2 DL Used
1/21/1999	2.5	9.7	PCE ND 5U; 1/2 DL Used
1/7/2000	6	1	

STATISTICS

STATISTICS	PCE	TCE
Analysis Count	16	16
(1) S	-62	-30
(2) Mann-Kendall P	0.002	0.097
(3) Trend Test Result at:	Downward Trend	Downward Trend
(4) 80% confidence	Downward Trend	Downward Trend
CV	0.76	1.40

Notes:

(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.
Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

Well Statistics for Trends

GZA-14			
COMPOUND CONCENTRATIONS	PCE (ug/l)	TCE (ug/l)	Calculation Notes
11/1/1989	6.6	15	
8/1/1992	14	22	
12/2/1997	10	12	
12/14/1999	4	8	
9/22/2005	1	5.30	PCE ND 2U; 1/2 DL Used
11/5/2009	0.36	3.4	
11/28/2011	0.5	1.8	PCE ND 1U; 1/2 DL Used
6/5/2015	0.5	1.3	PCE ND 1U; 1/2 DL Used
6/30/2016	0.5	0.5	Both ND 1U; 1/2 DL Used

STATISTICS		
Analysis Count	8	8
(1) S	-19	-28
(2) Mann-Kendall P	0.0115	0
(3) Trend Test Result at:	Downward Trend	Downward Trend
(4) 80% confidence	Downward Trend	Downward Trend
CV	1.37	1.07

Notes:

(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.

Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

Well Statistics for Trends

PS-2D		
COMPOUND CONCENTRATIONS	PCE (ug/l)	TCE (ug/l)
12/16/1998	2	13
12/16/1999	1	1
9/19/2001	2.5	8.40
9/20/2005	1	1
6/17/2015	0.5	0.5
6/29/2016	0.5	0.5

Calculation Notes

Date	Calculation Notes
12/16/1998	
12/16/1999	Both ND 2U; 1/2 DL Used
9/19/2001	PCE ND 5U; 1/2 DL Used
9/20/2005	Both ND 2U; 1/2 DL Used
6/17/2015	Both ND 1U; 1/2 DL Used
6/29/2016	Both ND 1U; 1/2 DL Used

STATISTICS

Analysis Count	6	6
(1) S	-9	-11
(2) Mann-Kendall P	0.068	0.028
(3) Trend Test Result at: 90% confidence	Downward Trend	Downward Trend
(4) 80% confidence	Downward Trend	Downward Trend
CV	0.66	1.31

Notes:
(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.
Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

Well Statistics for Trends

STM-8R		
COMPOUND CONCENTRATIONS	PCE (ug/l)	TCE (ug/l)
8/1/1992	2.5	17
7/26/1993	2.5	13
9/24/1997	0.5	1
12/1/1997	18	68
12/15/1998	2	18
12/17/1999	8	46
9/20/2001	5.9	34
9/21/2005	5.5	28
11/5/2009	6	26
11/16/2011	3.7	14
12/15/2014	2	6.6
6/3/2015	2.9	19.8
6/30/2016	3.1	14.1

Calculation Notes

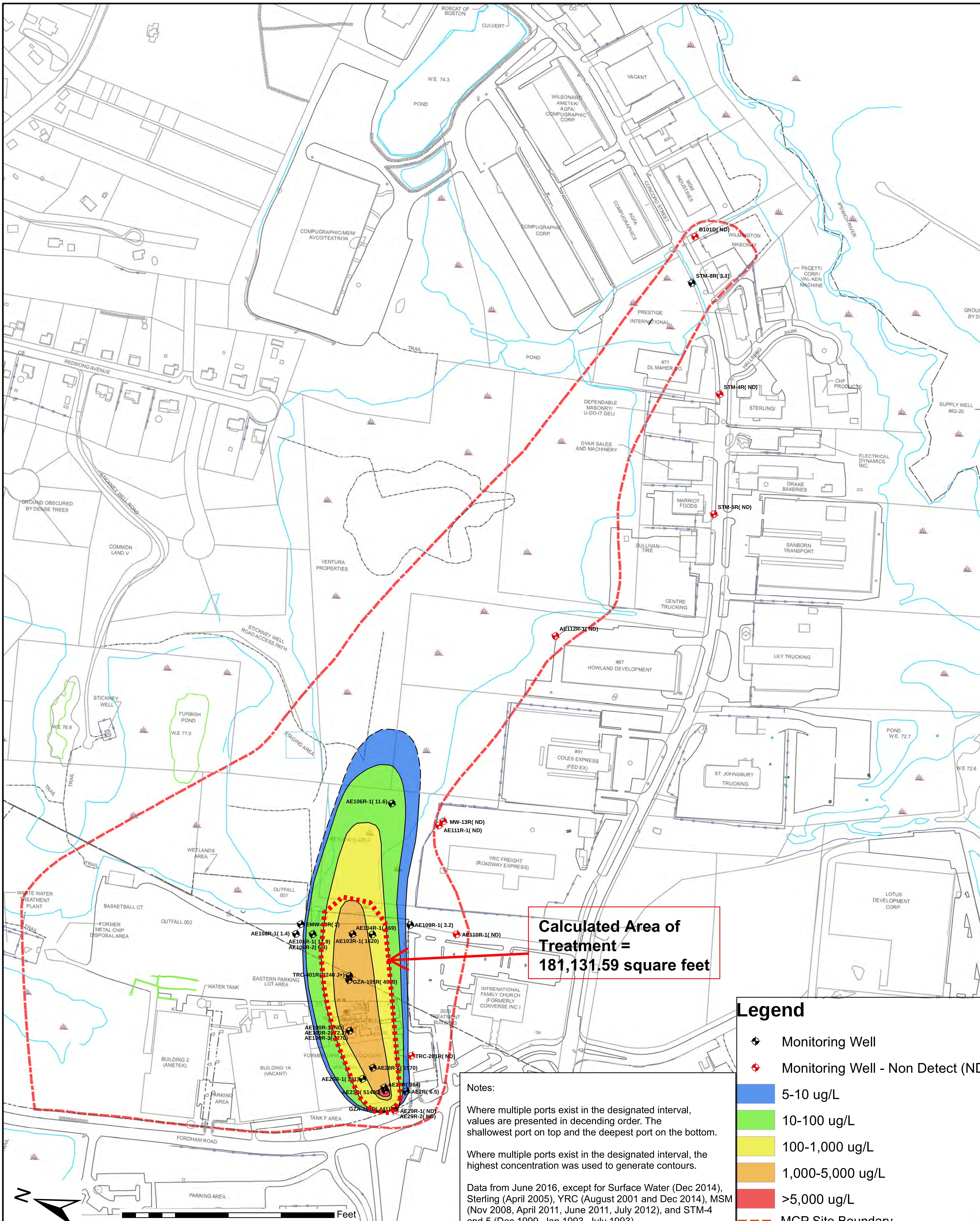
PCE ND 5U; 1/2 DL Used
PCE ND 5U; 1/2 DL Used
PCE ND 1U; 1/2 DL Used

STATISTICS

Analysis Count	13	13
(1) S	0	-8
(2) Mann-Kendall P	0.524	0.338
(3) Trend Test Result at: 90% confidence	No Trend	No Trend
(4) 80% confidence	No Trend	No Trend
CV	0.93	0.76

Notes:
(1) S on worksheet indicates the calculated Mann-Kendall Statistic for the column of data.
(2) P is the probability (out of 1.0) of no significant trend (> 3 analyses req'd)
(3) The Trend Test Result must be < 0.1 for a significant trend to exist at 90% confidence (Gilbert 1987).
(4) The Trend Test result must be < 0.2 for a significant trend to exist at 80% confidence (Gilbert 1987).
(5) Trend analysis is not typically performed at locations where the majority of concentration values were non-detect.
Shading on the columns of data indicates where 1/2 DL was used in place of a non-detect.

APPENDIX D – COSTING ESTIMATES



Notes:

Where multiple ports exist in the designated interval, values are presented in decending order. The shallowest port on top and the deepest port on the bottom.

Where multiple ports exist in the designated interval, the highest concentration was used to generate contours.

Data from June 2016, except for Surface Water (Dec 2014), Sterling (April 2005), YRC (August 2001 and Dec 2014), MSM (Nov 2008, April 2011, June 2011, July 2012), and STM-4 and 5 (Dec 1999, Jan 1993, July 1993).

Legend

- Monitoring Well
- Monitoring Well - Non Detect (ND)
- 5-10 ug/L
- 10-100 ug/L
- 100-1,000 ug/L
- 1,000-5,000 ug/L
- >5,000 ug/L
- MCP Site Boundary

AECOM	Former GE Facility 50 Fordham Road, Wilmington, MA	**TCE in Upper Bedrock (0 - 60 ft bgs)**

Path: \\USCHL1FP001\Data\Projects\Jobs\Rem_Eng\Project Files\Lockheed Martin\Wilmington, MA 2016-2017 Work 60478638\Regulatory\Phase II CSA\Report Figures\2016 Plume Figures\MXD\TCE_upper BR_2016.mxd

Appendix D: Details and Assumptions
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

		Bio Treatment		Chem Treatment		
	Parameters	Value	Units	Value	Units	Description
	OVERBURDEN					
Treatment Volumes	Total Treatment Area	181,000	sqft	181,000	sqft	used area of TCE impacts below 1000 ug/l in bedrock
	Well Spacing	15	ft	15	ft	well point spacing
	Number of Injection Points	804		804		treatment area divided by well spacing squared
	Treatment Thickness	30	ft	30	ft	estimated thickness of contaminated overburden in area
	Porosity	30%		30%		estimated porosity of overburden soils
	% Pore Volume	15%		20%		targeted pore volume injection goal
	Mobile Porosity	5%		6%		Porosity x % PV
	Total Volume of Solution	244,350	cft	325,800	cft	Tmt Volume x porosity x % PV
	Target inj volume for total soil treat	1,915,704	gal	2,554,272	gal	conversion: 7.84 gal/cf
EVO Dosing & Cost	EVO Dosing Concentration	5%		--		based on vendor recommendations and AECOM project experience
	Total Required Volume of EVO	95,785	gal	--	gal	Volume of Solution x 5%
	Unit Cost of EVO	$ 12	$/gal	--	$/gal	based on vendor estimates
	Total Cost of Required EVO	$ 1,149,422		--		EVO Vol x Unit Cost of EVO
Permanganate Dosing & Cost	Permanganate Dosing Concentration	--		20%	by wt	based on vendor recommendations and AECOM project experience
	Total Required Mass of Reagent			544,086	lb	1.67 lb permanganate/cf of solution conversion
	Unit Cost of Permanganate	--		$ 2.10	$/lb	based on vendor estimates
	Total Cost of Required Permanganate	--		1,142,581		
	BEDROCK					
Treatment Volumes	Total Treatment Area	181,000	sqft	181,000	sqft	
	Well Spacing	75	ft	75	ft	
	Number of Injection Points	32		32		
	Treatment Thickness	130	ft	130	ft	
	Porosity	1.60E-05		1.60E-05		
	% Pore Volume	100%		100%		
	Mobile Porosity	0%		0%		Porosity x % PV
	Total Volume of Solution	376	cft	376	cft	Tmt Volume x porosity x % PV
	Target inj volume for total rock treat	2,952	gal	2,952	gal	conversion: 7.84 gal/cf
EVO Dosing & Cost	EVO Dosing Concentration	5%		--		based on vendor recommendations and AECOM project experience
	Total Required Volume of EVO	148	gal	--	gal	Volume of Solution x 5%
			gal			
	Unit Cost of EVO	$ 12	$/gal	--	$/gal	based on vendor estimates
	Total Cost of Required EVO	$ 1,771		--		EVO Vol x Unit Cost of EVO
Permanganate Dosing & Cost	Permanganate Dosing Concentration	--		20%	by wt	based on vendor recommendations and AECOM project experience
	Total Required Mass of Reagent			629	lb	1.67 lb permanganate/cf of solution conversion
	Unit Cost of Permanganate	--		$ 2.10	$/lb	based on vendor estimates
	Total Cost of Required Permanganate	--		1,320		

Notes
1. Mobile porosity = total porosity * target percent pore volume

Appendix D: Cost Estimates
Site Groundwater Alternative: In-Situ Biological Treatment
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

Line Item	Applied Area	Unit	Quantity Calculation	Quantity	Units	Unit Cost	Total Cost	Subtotal	Assumptions
Capital Costs								**$ 865,000**	
Design and permitting				1	LS	$ 75,000	$ 75,000		
Technology Development, Treatability / Pilot Studies				1	LS	$ 40,000	$ 40,000		
Status Reports (every 6 months) for 30 years				60	LS	$ 10,000	$ 600,000		
Waste Disposal (drill cuttings, etc)				1	LS	$ 150,000	$ 150,000		
Overburden								**$ 4,080,000**	
Capital Costs								*$ 3,280,000*	
Overburden Drive Point Injections (15' centers)	181,000	SF	225 SF/well	800	Each	$ 550	$ 440,000		30 ft average treatment thickness
Biological Treatment - EVO	181,000	SF	5% Dose	100,000	gal	$ 12	$ 1,200,000		30% porosity, 15% Pore Volume, 5% EVO Dose
Additional Injection Events				2	each	$ 820,000	$ 1,640,000		Assumes targeting 50% of initial injection area for follow up injections
Labor								*$ 800,000*	
Labor for Injection OMM	800	well		800	Each	$ 500	$ 400,000		
Labor for Additional Injection Events				2	each	$ 200,000	$ 400,000		
Bedrock								**$ 541,771**	
Capital Costs								*$ 451,771*	
Bedrock Injection Wells (75' centers)	181,000	SF	5625 SF/well	30	Each	$ 15,000	$ 450,000		130 ft average treatment thickness
Biological Treatment - EVO	181,000	SF	5% Dose	148	gal	$ 12	$ 1,771		5% EVO Dose
Additional Injection Events				2	each	$ 885	$ 1,771		Assumes targeting 50% of initial injection area for follow up injections
Labor								*$ 90,000*	
Labor for Injection OMM	30	Wells		30	Each	$ 3,000	$ 90,000		multiple days to inject into deep bedrock wells
Labor for Additional Injection Events				2	each	$ 45,000	$ 90,000		
Long-Term Monitoring								**$ 4,500,000**	
Cost Per Event (used same level of effort for bio, isco, containment and MNA,								*$ 150,000*	
Sample Collection/Analytical/Validation				1	Each	$ 150,000	$ 150,000		
Number of Events								*30*	
Yr 1-30: Annual	30								
Overall Costs								*$ 4,500,000*	
Sample Collection/Analytical/Validation				30	Event	$ 150,000	$ 4,500,000		
Subtotal								**$ 9,990,000**	
Project Management, Engineering Support			5% of subtotal	0.05			$ 499,500		
Total								**$ 10,500,000**	

Appendix D: Cost Estimates
Site Groundwater Alternative: In-Situ Chemical Treatment
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

Line Item	Applied Area	Unit	Quantity Calculation	Quantity	Units	Unit Cost	Total Cost	Subtotal	Assumptions
Capital Costs								**$ 865,000**	
Design and permitting				1	LS	$ 75,000	$ 75,000		
Technology Development, Treatability / Pilot Studies				1	LS	$ 40,000	$ 40,000		
Status Reports (every 6 months) for 30 years				60	LS	$ 10,000	$ 600,000		
Waste Disposal (drill cuttings, etc)				1	LS	$ 150,000	$ 150,000		
Overburden								**$ 4,710,000**	
Capital Costs								*$ 3,910,000*	
Overburden Injection Wells (15' centers)	181,000	SF	225 SF/well	800	Each	$ 2,000	$ 1,600,000		30 ft average treatment thickness
Chemical Treatment - Permanganate	181,000	SF	20% Dose	550,000	lb	$ 2.1	$ 1,155,000		30% porosity, 20% Pore Volume, 20% Permanganate Dose
Additional Injection Events				2	each	$ 577,500	$ 1,155,000		Assumes targeting 50% of initial injection area for follow up injections
Labor								*$ 800,000*	
Labor for Injection OMM	800	well		800	Each	$ 500	$ 400,000		
Labor for Additional Injection Events				2	each	$ 200,000	$ 400,000		
Bedrock								**$ 632,641**	
Capital Costs								*$ 452,641*	
Bedrock Injection Wells (75' centers)	181,000	SF	5625 SF/well	30	Each	$ 15,000	$ 450,000		130 ft average treatment thickness
Chemical Treatment - Permanganate	181,000	SF	20% Dose	629	lb	$ 2.1	$ 1,320		20% Permanganate Dose
Additional Injection Events				2	each	$ 660	$ 1,320		Assumes targeting 50% of initial injection area for follow up injections
Labor								*$ 180,000*	
Labor for Injection OMM	30	Wells		30	Each	$ 3,000	$ 90,000		multiple days to inject in deep bedrock wells
Labor for Additional Injection Events				2	each	$ 45,000	$ 90,000		
Long-Term Monitoring								**$ 4,500,000**	
Cost Per Event (used same level of effort for bio, isco, containment, and MNA,								*$ 150,000*	
Sample Collection/Analytical/Validate				1	Each	$ 150,000	$ 150,000		
Number of Events								*30*	
Yr 1-30: annual	30								
Overall Costs								*$ 4,500,000*	
Sample Collection/Analytical/Validate				30	Event	$ 150,000	$ 4,500,000		
Subtotal								**$ 10,710,000**	
Project Management, Engineering Support			5% of subtotal	0.05			$ 535,500		
Total								**$ 11,200,000**	

Appendix D: Cost Estimates
Source Area Groundwater: Hydraulic Containment
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

Line Item	Applied Area	Unit	Quantity Calculation	Quantity	Units	Unit Cost	Total Cost	Subtotal
Capital Costs								**$ 975,000**
Design and permitting				1	LS	$ 25,000	$ 25,000	
Technology Development, Work Plan, Pilot Studies				1	LS	$ 100,000	$ 100,000	
Status Reports (every 6 months) for 30 years				60	LS	$ 10,000	$ 600,000	
Waste Disposal (drill cuttings, IDW, etc)				1	LS	$ 250,000	$ 250,000	
Pump & Treat System Installation								**$ 1,010,000**
Capital Costs								*$ 890,000*
GW Extraction Wells (50' Centers)	120,000	SF	2,500 SF/well	48	Each	$ 15,000	$ 720,000	
Pumps, Electrical Service, and Transfer lines for Extraction Wells	48	wells		48	wells	$ 2,500	$ 120,000	
System Installation (subcontractors)				1	LS	$ 50,000	$ 50,000	
Labor								*$ 120,000*
System Installation Oversight	48	wells		48	wells	$ 2,500	$ 120,000	
System Operation, Maintenance, and Monitoring								**$ 22,824,000**
Capital Costs								*$ 19,824,000*
Annual System Maintenance & Repair material-equip	30	years	annual repairs	30	each	$ 10,000	$ 300,000	
Groundwater Monitoring	1	annual	30 yrs	30	yrs	$ 150,000	$ 4,500,000	
Utility and Waste Discharge	30	years	operations	30	each	$ 500,000	$ 15,000,000	
Well Decommissioning	48	wells		48	Each	$ 500	$ 24,000	
Labor								*$ 3,000,000*
System operating Labor	30	years	annual operator	30	each	$ 100,000	$ 3,000,000	
Subtotal								**$ 24,810,000**
Project Management, Engineering Support			2% of subtotal	0.02			$ 1,240,500	
Total								**$ 26,100,000**

Appendix D: Cost Estimates
Site Groundwater Alternative: Monitored Natural Attenuation
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

Line Item	Applied Area	Unit	Quantity Calculation	Quantity	Units	Unit Cost	Total Cost	Subtotal
Capital Costs								**$ 610,000**
Design and permitting				1	LS	$ -	$ -	
Technology Development and Feasibility Evaluation, Biogeochemical Modeling				1	LS	$ -	$ -	
Post Temp Solution Status Reports (every 12 months)				30	LS	$ 20,000	$ 600,000	
Waste Disposal (gw IDW, sampling materials, etc) 30 yrs				1	LS	$ 10,000	$ 10,000	
Long-Term Monitoring								**$ 4,500,000**
Cost Per Event								*$ 150,000*
Sample Collection/Analytical/Validation				1	Each	$ 150,000	$ 150,000	
Number of Events								*30*
Yrs 1-30: Annual	30							
	0							
	0							
Overall Costs								*$ 4,500,000*
Sample Collection/Analytical/Validation				30	Event	$ 150,000	$ 4,500,000	
Subtotal								**$ 5,110,000**
Project Management, Engineering Support			5% of subtotal	0.05			$ 255,500	
Total								**$ 5,400,000**

Appendix D: Cost Estimates
Site NAPL Alternative: Free Product Recovery System
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

Line Item	Applied Area	Unit	Quantity Calculation	Quantity	Units	Unit Cost	Total Cost	Subtotal
Capital Costs								**$ 315,000**
Design and permitting				1	LS	$ 10,000	$ 10,000	
Technology Development, Work Plan, Pilot Studies				1	LS	$ 5,000	$ 5,000	
Post-Temp Solution Status Reports (every 6 months) for 30 years				60	LS	$ 4,000	$ 240,000	
Waste Disposal (assume 2 gal per 6 month period)				120	Gal	$ 500	$ 60,000	
Free Product Recovery System Installation								**$ 33,000**
Capital Costs								*$ 25,000*
Passive NAPL Collection System Installation				1	LS	$ 25,000	$ 25,000	
Labor								*$ 8,000*
System Installation Oversight				1	LS	$ 8,000	$ 8,000	
System OMM								**$ 270,000**
Capital Costs								*$ 30,000*
System Maintenance & Repairs	30	years	annual repairs	30	each	$ 1,000	$ 30,000	
Quarterly Inspection and Monitoring	4	qrtr	30 yrs operation	120	events	$ -	$ -	
Labor								*$ 240,000*
Labor for Performance OMM	30	years	qrtly OMM	120	each	$ 2,000	$ 240,000	
Subtotal								**$ 620,000**
Project Management, Engineering Support			5% of subtotal	0.05			$ 31,000	
Total								**$ 700,000**

Appendix D: Cost Estimates
Site NAPL: Alternative 4 Monitored Natural Attenuation
Phase III Remedial Action Plan
Former General Electric Site
50 Fordham Road
Wilmington, MA

Line Item	Applied Area	Unit	Quantity Calculation	Quantity	Units	Unit Cost	Total Cost	Subtotal
Capital Costs								**$ 135,000**
Design and permitting				1	LS	$ -	$ -	
Technology Development and Feasibility Evaluation, Biogeochemical Modeling				1	LS	$ -	$ -	
Post-Temp Solution Status Reports (every 6 months) for 30 years				60	LS	$ 2,000	$ 120,000	
Waste Disposal (assume one adsorbent sock=1 gal) per year				30	Gal	$ 500	$ 15,000	
Long-Term Monitoring and Passive NAPL Collection OM&M								**$ 120,000**
Cost Per Event								*$ 120,000*
NAPL/GW Sample Collection		4 per yr		30	yr	$ 1,000	$ 120,000	
Subtotal								**$ 260,000**
Project Management, Engineering Support			3% of subtotal	0.03			$ 7,800	
Total								**$ 300,000**

APPENDIX E – PUBLIC INVOLVEMENT PLAN NOTIFICATIONS

NOTICE OF PUBLIC INVOLVEMENT PLAN MEETING - ME 4.26.17

LEGAL NOTICE

NOTICE OF PUBLIC INVOLVEMENT PLAN MEETING

FORMER GENERAL ELECTRIC COMPANY SITE
50 FORDHAM ROAD, WILMINGTON, MA
RELEASE TRACKING NUMBER (RTN) 3-0518

A release of oil and/or hazardous materials has occurred at this location, which is a disposal site as defined by M.G.L. c. 21E, § 2 and the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000. On November 17, 2000, the Massachusetts Department of Environmental Protection (MassDEP) issued a Public Involvement Plan (PIP) that included the Former General Electric Company disposal site. On May 3, 2017, Lockheed Martin Corporation ("Lockheed Martin"), the entity that is conducting response actions at the site, intends to publish three MCP documents: *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement.* As a result, a public meeting will be held at the North Reading Town Hall, 235 North Street, on May 11, 2017 between 6 PM and 8 PM to present the *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement,* to solicit public comment on the *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement,* and to provide information about disposal site conditions.

The MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement will be made available for public review on or before May 11, 2017 at the designated public repository established in the Flint Memorial (N. Reading) Library, 147 Park Street, North Reading, MA (telephone 781-664-4942). Copies of the *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement* also will be made available at the meeting.

Any questions regarding this meeting or the *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement* should be directed to:

Mékell Mikell, Lockheed Martin Corporation
6801 Rockledge Drive, MP-179, Bethesda, MD 20817
301-897-6934
Mekell.T.Mikell@lmco.com

The disposal site file can be can be viewed at MassDEP website using RTN 3-0518 at http://public.dep.state.ma.us/SearchableSites2/Search.aspx or at MassDEP, Northeast Regional Office, 205B Lowell Street, Wilmington, MA 01887. Main Phone: 978-694-3200.

4.26.17

Lockheed Martin Corporation
1195 Sarasota Center Blvd
Sarasota, Florida 34240

LOCKHEED MARTIN

Via U.S. Mail

April 24, 2017

Subject: **NOTIFICATION OF DOCUMENT AVAILABILITY AND PUBLIC MEETING-PUBLIC COMMENT PERIOD**
Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement, Public Involvement Plan (PIP) Meeting
Former General Electric Facility, 50 Fordham Road, Wilmington, MA, RTN 3-0518

Dear Community Members,

Lockheed Martin Corporation ("Lockheed Martin") wishes to inform the community of upcoming informational and participation opportunities. In accordance with the Massachusetts Contingency Plan (MCP), Lockheed Martin has prepared the *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement* for the former General Electric Facility located at 50 Fordham Road, Wilmington, Massachusetts (the site). Lockheed Martin will host a public meeting on May 11, 2017, to discuss the information provided in these documents.

Background – Supplemental site investigation activities were performed from 2013 to 2016 at the site to evaluate subsurface bedrock conditions utilizing specialized techniques to further investigate the extent, potential movement and possible impact of contaminants to human health and the environment. Based on this work, and efforts over the previous 25 years, a comprehensive site assessment was developed to define the nature and extent of impacts and characterize the human health and ecological risks for the site. Subsequent to this assessment, a Remedial Action Plan was developed that evaluated cleanup options for the groundwater plume at the site. The chosen solution includes monitored natural attenuation, a method that relies on natural processes to help clean up contaminants over time. A Temporary Solution Statement was prepared that outlines the monitoring program to be performed until a permanent solution can be achieved.

Documents – AECOM, on behalf of Lockheed Martin, prepared the documents that are available for public review and comment, which include the *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement.*

Document Availability – The *MCP Phase II Comprehensive Site Assessment, Phase III Remedial Action Plan, and Temporary Solution Statement* will be made available for public review on May 3, 2017 at the designated public repository established in the Flint Memorial (N. Reading) Library, 147 Park Street, North Reading, MA (telephone 781-664-4942). *Please note this is a new location for the site's document repository.* Library hours are as follows: Monday, Tuesday and Thursday 10 AM to 8 PM; Wednesday and Friday 10 AM to 5 PM; Saturday (Labor Day to Memorial Day) 10 AM to 5 PM then closed for the summer; closed on Sunday.

Public Meeting and Comment Period – In accordance with the November 2000 PIP, Lockheed Martin will host a public meeting at the North Reading Town Hall on May 11, 2017 from 6 PM to 8 PM. The public is welcome to attend the open house poster session between 6 PM and 7 PM, followed by a formal presentation between 7 PM and 8 PM and ask questions or provide comments related to the submitted documents and future monitoring activities planned for the site. The public comment period for the submitted MCP documents will begin on May 12, 2017 and will end on May 31, 2017.

Submitting Comments – Comments or questions should be provided in writing or e-mailed directly to:

Comments may be provided to the address below:

Daniel W. Folan, PhD, Licensed Site Professional,
AECOM
250 Apollo Drive
Chelmsford, MA 01824
(978) 905-2100
dan.folan@aecom.com

We look forward to seeing you at the public information session.

Sincerely,

Paul E. Calligan

Paul E. Calligan, P.G.
Project Manager, Environmental Remediation
Lockheed Martin Corporation

cc: PIP Notification List
PIP Mailing List

Mailing List

Former GE Site
Wilmington, MA

Last Name	First Name	Title	Organization Name	Address	City	State	PostalCode	HomePhone	WorkPhone	Petition	36615	36619	36739	37341	37354
Aldrich	Marke and Deborah			458 Park Street	North Reading	MA	01864	(978) 664-4571							
Anthony	Camille			26 Orchard Park Drive	Reading	MA	01867				a				
Armstrong	Kay		Armstrong and Associates	455 Hillside Trail	Eddyville	KY	42038		(270) 388-0347			a	a		
Barker	Chris			82 Middlesex Avenue	Reading	MA	01864								
Barrett	Eileen			90 Sunnyside Avenue	Reading	MA	01867				a		a		
Barry	Lorraine	Head of Information Services	Reading Public Library	64 Middlesex Avenue	Reading	MA	01867		(781) 944-0840						
Basbanes	Leah	Conservation Agent	North Reading Conservation Commission	235 North Street	North Reading	MA	01864		(978) 664-6050						
Baster	Terry			116 North Street	North Reading	MA	01864	(978) 664-8059			a				
Beagan	Michael and Andrea			1 Redmond Avenue	North Reading	MA	01864	(978) 664-3461							
Blanchard	Steven and Rebecca			474 Park Street	North Reading	MA	01864	(978) 664-3935							
Boulas	Helen			5 Furbish Pond Lane	North Reading	MA	01864	(978)207-0139							
Bracey	Robert	Health Agent/Director of Public Health	North Reading Health Department	235 North Street	North Reading	MA	01864		(978) 664-6042						
Brennan	Francis and Catherine			472 Park Street	North Reading	MA	01864	(978) 664-3359							
Byerley	Ruben		YRC Freight	10990 Roe Ave	Overland Park	KS	66211		913-344-3644						
Cadena	Rosa			31 Redmond Avenue	North Reading	MA	01864								
Carter	Joanne			16 Redmond Avenue	North Reading	MA	01864								
Carucci	Amy			10 Redmond Avenue	North Reading	MA	01864	(978) 664-9708							
Clark	Mark	Water Superintendent	North Reading Department of Public Works	235 North Street	North Reading	MA	01864		(978) 664-6046						
Conary, Jr.	William			13 Henzie Street	Reading	MA	01867			a				a	
Coogan	Richard and Mary			8 Redmond Avenue	North Reading	MA	01864	(978) 664-0218							
Costigan	John	Board of Health	Reading Town Hall	16 Lowell Street	Reading	MA	01867		(781) 942-6618			a			
Couture	Amy			18 Redmond Avenue	North Reading	MA	01864								
Curtice	Scott and Julie			9 Redmond Avenue	North Reading	MA	01864	(978) 664-3146							
Cusolito	Maureen			5 Redmond Avenue	North Reading	MA	01864	(978) 664-6335							
Dardeno, Jr.	Ron		Law Offices of Frank Dardeno	424 Broadway	Somerville	MA	02145						a		
Davis	Meredith	Senior Manager, Env. Communications	Lockheed Martin Corporation	6801 Rockledge Drive	Behtesda	MD	20817								
Dee	Brendan			20 Redmond Avenue	North Reading	MA	01864	(978) 207-1665							
Deming	Christopher			8 Surrey Lane	North Reading	MA	01864	(978) 664-6855							
Doke	Daniel			429 Park Street	North Reading	MA	01864								
Drummy	Michael and Suzanne			15 Jill Circle	North Reading	MA	01864	(978) 664-9012							
Dwyer	James	State Representative 30th Middlesex District	State House	24 Beacon St - Room 254	Boston	MA	02133		(617) 722-2220						
Eaton	Nancy L.			13 Short Street	Reading	MA	01867				a	a			
Ferrara	Mike	Water & Sewer Foreman	Wilmington Water & Sewer Division	121 Glen Road	Wilmington	MA	01887		(978) 658-4711						
Finch	William			51 Mill Road	Reading	MA	01867			a	a		a		a
Fitzgerald	Daniel and Barbara			6 Redmond Avenue	North Reading	MA	01864	(978) 664-9096							
Fitzgerald	John	Regional Engineer	DEP Northeast Region	1 Winter Street	Boston	MA	02108		(978) 694-3308						
Fitzpatrick, Jr., Esq.	Robert		Hale & Dorr, LLP	60 State Street	Boston	MA	02026								
Flanders	Ken			47 Winslow Road	Reading	MA	01867	(781) 942-7342		a	a	a		a	a
Fletcher	Nathan and Lindsey			3 Furbish Pond Lane	North Reading	MA	01864	(978) 276-3436							
Forest	Michael			34 Westwood Circle	North Reading	MA	01864	(978) 664-6630			a				
Gallant	John and Donna			29 Redmond Avenue	North Reading	MA	01864	(978) 664-2740							
Garrison	Brevard			11 Jadem Terrace	Reading	MA	01867			a					
Gemme	Laura	Town Clerk	Reading Town Hall	16 Lowell Street	Reading	MA	01867		(781) 942-6647						
George	Sharon	Town Clerk	Wilmington Town Hall	121 Glen Road	Wilmington	MA	01887		(978) 658-2030						
Gettings	Arthur and Carol			6 Furbish Pond Lane	North Reading	MA	01864								
Gillberto	Michael	Town Administrator	North Reading Town Hall	235 North Street	North Reading	MA	01864								
Gingrich	Valerie	Director	Wilmiington Planning & Conservation	121 Glen Road	Wilmington	MA	01887		(978) 658-8238						
Gordon	Kenneth	State Representative 21st Middlesex District	State House	24 Beacon St - Room 466	Boston	MA	02133		(617) 722-2017						
Grant	Mark and Nancy			6 Jill Circle	North Reading	MA	01864	(978) 664-8147							
Gray	Alfred			3 Jill Circle	North Reading	MA	01864	(978) 664-0052							
Guidebeck	Joseph			21 Redmond Avenue	North Reading	MA	01864								
Gupta	Kavita and Sunil			14 Jill Circle	North Reading	MA	01864	(978) 664-1503							
Hanson	Kirk			9 Jill Circle	North Reading	MA	01864	(978) 664-0026							
Hayes	Robert and Kathleen			7 Jill Circle	North Reading	MA	01864	(978) 664-8284							
Heald	Deborah			21 Redmond Avenue	North Reading	MA	01864	(978) 207-1515							
Hoey	David and Deborah			8 Jill Circle	North Reading	MA	01864	(978) 664-8286							
Honetschlager	Kim			51 Mill Road	Reading	MA	01867			a	a	a	a	a	
Hoskins	Bruce	LSP - bruce.hoskins@comcast.net	Geosphere Environmental Management	51 Portsmouth Ave	Exeter	NH	03833		.				a		
Hull	Jeff	Town Manager	Wilmington Town Hall	121 Glen Road	Wilmington	MA	01887								
Indelicato	Steven			14 Redmond Avenue	North Reading	MA	01864	(978) 207-1069							
Isbell	Peter	Water Department	Reading Department of Public Works	75 Newcrossing Road	Reading	MA	01867		(781) 942-9092						
Johnson	Stephen	Chief, Bureau of Waste Site Cleanup	DEP Northeast Region	205B Lowell Street	Wilmington	MA	01887		(978) 694-3350				a		
Jones, Jr.	Bradley	State Representative 20th Middlesex District	State House	24 Beacon St - Room 124	Boston	MA	02133		(617) 722-2100			a			
Kastrinos	John			1137 Main Street	Reading	MA	01867	(781) 942-7910							a
Keeffe	Paul and Kathleen			10 Jill Circle	North Reading	MA	01864	(978) 664-8292							
Koupsogiannopolos	S.			7 Furbish Pond Lane	North Reading	MA	01864	(978) 664-1895							

Mailing List

Former GE Site
Wilmington, MA

Last Name	First Name	Title	Organization Name	Address	City	State	PostalCode	HomePhone	WorkPhone	Petition	36615	36619	36739	37341	37354
Lafferty	Andrew	Director of Public Works	North Reading Department of Public Works	235 North Street	North Reading	MA	01864		(978) 357-5227						
Lamkin	Rodene		DEP Northeast Region	205B Lowell, Street	Wilmington	MA	01887		(978) 694-3354						
Latowsky	Gretchen			93 King Street	Reading	MA	01867			a					
LeLacheur, Jr.	Robert	Town Manager	Reading Town Hall	16 Lowell Street	Reading	MA	01867		(781) 942-9043						
Libby	William			5 Surrey Lane	North Reading	MA	01864								
Lilly	Randy		Northstone LLC	P.O. Box 220	North Reading	MA	01864	(978) 664-9500							
Luker	James		Gale Associates	163 Libbey Park P.O. Box 890189	Weymouth	MA	02189		(781) 335-6465					a	a
Lupin	Rich		Teradyne	600 Riverpark Drive	North Reading	MA	01864	(978) 370-2700							
Lynds	Mary			11 Redmond Avenue	North Reading	MA	01864	(978) 664-3024							
Magliozzi	Paul			12 Concord Street	North Reading	MA	01864	(978) 664-3530							
Maher	Robert		Edward J. Maher Income Trust (DL Maher)	71 Concord Street	North Reading	MA	01864	(781) 933-3210							
Marchetti	Harry and Kathleen			24 Redmond Avenue	North Reading	MA	01864	(978) 276-3200							
Markey	Edward	U.S. Senator		255 Dirksen Senate Office Building	Washington DC		20510		(202) 224-2742						
Martinez	Ray J			21 Concord Street	North Reading	MA	01864	(978) 664-1948							
Matathia	Bethann			10 Stonewall Road	Reading	MA	01867								
McGowen	Winifred	Assistant Director and Conservation Agent	Wilmiington Planning & Conservation	121 Glen Road	Wilmington	MA	01887		(978) 658-8238						
Mclean	George			25 Redmond Avenue	North Reading	MA	01864								
Melanson	Edward		Melanson Development Group, Inc.	11 Jill Circle	North Reading	MA	01864		(978) 985-6646						
Melanson	Ed and Gail			11 Jill Circle	North Reading	MA	01864	(978) 664-1889							
Melius	Rebecca			5 Surrey Lane	North Reading	MA	01864								
Miceli	James	State Representative 19th Middlesex District	State House	24 Beacon St - Room 237	Boston	MA	02133		(617) 722-2305						
Miller	Andy		COM	50 Hampshire Street	Cambridge	MA	02139	(617) 452-6532							a
Moulton	Seth	US Representatve 6th Congressional District		1408 Longworth House Office Building	Washington DC		20515		(202) 225-8020						
Mulik	Charles and Michele			23 Redmond Avenue	North Reading	MA	01864								
Mulleh	Susan			15 Redmond Avenue	North Reading	MA	01864	(978) 664-5518							
Mullet	Michael			15 Redmond Avenue	North Reading	MA	01864	(978) 664-5518							
Newhouse	Shelly	Director of Public Health	Wilmington Health Department	121 Glen Road	Wilmington	MA	01887		(978) 658-4298			a			
Niemeyer	Dave		Geosphere Environmental Management	51 Portsmouth Ave	Exeter	NH	03833		(888) 838-657, (603) 773-0075, fax 773-0077						
O'Brien	Colin and Frances			382 Park Street	North Reading	MA	01864	(978) 664-2478							
Parzziale, Jr.	Joseph			59 Van Norden Road	Reading	MA	01867								
Pisecco	Pamela			429 Park Street	North Reading	MA	01864								
Randazzo	Michael			2 Redmond Avenue	North Reading	MA	01864	(978) 664-5495							
Regan	Terry		TR Associates	22 Highland Avenue	Newburyport	MA	01950								
Ryan	Karl and Jennifer			12 Redmond Avenue	North Reading	MA	01864								
Rzakhanov	Gyulyara			12 Jill Circle	North Reading	MA	01864	(978) 664-3741							
Sandberg	Carol			1494 Main Street	Reading	MA	01867								
Scammon	Jonathan and Kristen			22 Redmond Avenue	North Reading	MA	01864	(978) 664-1715							
Smith	John and Filomena			4 Redmond Avenue	North Reading	MA	01864	(978) 664-4780							
Snyder	Gina			11 Jadem Terrace	Reading	MA	01867	(978) 944-3874		a	a	a	a	a	a
St. Germain	Patricia			7 Surrey Lane	North Reading	MA	01864	(978) 664-6421							
Stanieich	Gary	Co-Manager	Wilmington Realty Trust	424 Broadway	Somerville	MA	02145-2619	603-860-5508							
Stanuchenski	Frank			17 Redmond Avenue	North Reading	MA	01864	(978) 664-4822							
Stats	Barbara	Town Clerk	North Reading Town Hall	235 North Street	North Reading	MA	01864		(978) 357-5230						
Stead	Christien and Matthew			7 Redmond Avenue	North Reading	MA	01864	(978) 207-1138							
Stevenson	Martha K.			7 Chandler Road	Wilmington	MA	01887								
Stewart	Scott and Keiren			421 Park Street	North Reading	MA	01864	(978) 664-2905							
Stromberg	Karen	PIP Coordinator	DEP Northeast Region	1 Winter Street	Boston	MA	02108		(978) 694-3322						
Sullivan	Brian and Susan			5 Jill Circle	North Reading	MA	01864	(978) 276-0018							
Talkington	Ray		Geosphere Environmental Management	51 Portsmouth Ave	Exeter	NH	03833				a				
Tarr	Bruce	State Senator First Essex/Middlesex District	State House	24 Beacon St - Room 308	Boston	MA	02133		(617) 722-1600						
Thelen	John		Lockheed Martin Corporation	6801 Rockledge Drive, CLE6135	Bethesda	MD	20817		(303) 971-1884						
Thomas	Mary			26 Redmond Avenue	North Reading	MA	01864								
Tirone	Charles	Conservation Administrator	Reading Town Hall	16 Lowell Street	Reading	MA	01867		(781) 942-6616						
Trevor	Brian and Jennifer			4 Furbish Pond Lane	North Reading	MA	01864	(978) 207-0307							
Ward	Ann			14 Bay Croft Avenue	Reading	MA	01867	(978) 942-0293				a			
Warren	Elizabeth	U.S. Senator		317 Hart Senate Office Building	Washington DC		20510		(202) 224-4543						
Weiss	Martin		Capitol Environmental Engineering	348 Park Street, Suite 207E	North Reading	MA	01864	(978) 664-5301			a				
Williams	David			117 Oak Street	Reading	MA	01867	(781) 944-8118					a	a	
Wilson	Matthew			385 Summer Avenue	Reading	MA	01867			a		a			
Woods	Michael	Public Works Director	Wilimington Public Works Department	121 Glen Road	Wilmington	MA	01887		(978) 658-4481						
Taddeo	Arthur	Senior Program Manager	AECOM	250 Apollo Drive	Chelmsford	MA	01824		978-905-2423						
Calligan	Paul	Project Lead	Lockheed Martin	1195 Sarasota Center Blvd	Sarasota	FL	34240		240-687-1813						
Mikell	Mékell	Environmental Communications	Lockheed Martin	6801 Rockledge Drive, MP-179	Bethesda	MD	20817		301-897-6934						
Armstrong	Kay		Armstrong and Associates	PO Box 2687; 3 Moore Avenue-upstairs/bac	Tybee Island	GA	31328		270-853-9450						