THIRD FIVE-YEAR REVIEW REPORT FOR LIBERTY INDUSTRIAL FINISHING SUPERFUND SITE FARMINGDALE, TOWN OF OYSTER BAY, NASSAU COUNTY, NEW YORK

Prepared by

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LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order on Consent
AWQS	Ambient Water Quality Standards
BHHRA	Baseline Human Health Risk Assessment
bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CY	cubic yards
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
GAC	granulated activated carbon
GRS	Groundwater Remediation System
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
MCLs	Maximum Contaminant Levels
mg/kg	milligrams per kilogram
µg/l	micrograms/liter
MA	Magothy Aquifer
MNA	monitored natural attenuation
NOAEL	no-observed-adverse-effect level
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OU	Operable Unit
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PFAS	Per- and Polyfluoroalkyl Substances
PRP	Potentially Responsible Party
RA	Remedial Action
RD/RA	Remedial Design/Remedial Action
RAO	Remedial Action Objective
RAR	Remedial Action Report
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SCOs	Soil Cleanup Objectives
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
TCE	Trichloroethene
UGA	Upper Glacial Aquifer
UST	Underground Storage Tank
VI	Vapor Intrusion

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment and is functioning as intended by the decision documents. The methods, findings, and conclusions of reviews are documented in the FYR. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

This is the third FYR for the Liberty Industrial Finishing Superfund site (Site), located in Farmingdale, Nassau County, New York. This review was conducted pursuant to Section 121 (c) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. §9601 et seq. and 40 CFR 300.430(f)(4)(ii), and in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). This report will become part of the Site file.

The triggering action for this statutory review is the completion date of the previous FYR. A FYR is required at the Site due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. The Site is addressed under one operable unit (OU) which is the subject of this FYR.

The EPA FYR team consisted of: Lorenzo Thantu - Remedial Project Manager (RPM), Damian Duda - Supervisor, Abbey States - Human Health Risk Assessor, Liana Agrios – Hydrogeologist, Michael Clemetson - Ecological Risk Assessor, Michael Mintzer – Site attorney, and Shereen Kandil - Community Involvement Coordinator (CIC).

The FYR process began on September 1, 2021.

Site Background

The Site is located approximately one mile south of Bethpage State Park in Farmingdale, Town of Oyster Bay, Nassau County, New York. The Site includes a 30-acre property located at 55 Motor Avenue (**Figure 1**). The property is bordered by the Long Island Railroad to the north, Motor Avenue to the south, Main Street to the east and a small town park, Ellsworth Allen Park, to the west. The surrounding area is primarily residential with several commercial establishments on the major roads.

The Site includes a former aircraft parts manufacturing and metal-finishing facility that began its operation in the early 1930's. From 1940 to 1944, the federal government and private corporate interests utilized the Site to develop and maintain production of materials needed for World War II. From 1944 through 1957, aircraft-related manufacturing activities predominated at the Site. Starting about 1957 through the 1980's, the facility operated as an industrial park and was used for various operations, including metal plating and finishing and fiberglass product manufacturing. Since the 1980's, the Site was used for light manufacturing and warehousing until these activities ceased in 2009.

The 30-acre Liberty Industrial Finishing site property consists of three tax parcels (**Figure 2)**. The Town of Oyster Bay (TOB) acquired the 15-acre Western Parcel and 7.5-acre Central Parcel in September 2003 and July 2010, respectively, to expand adjacent Ellsworth Allen Recreational Park. With the exception of the groundwater treatment system on the southwestern portion of the Western Parcel, the

15-acre Western Parcel and 7.5-acre Central Parcel were redeveloped in August 2019 for new softball and baseball fields, a t-ball field, a multi-purpose field for various sports activities, a pedestrian/bicycle pathway, restroom facilities and a parking area. In May 2010, the 7.5-acre Eastern Parcel was also redeveloped and paved over with a large-scale grocery/retail store and adjacent parking lot.

There are no private drinking wells in the vicinity of the Site. People living near the Site are connected to a public water supply system.

The Site was placed on the National Priorities List on June 10, 1986.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Liberty Industrial Finishing Superfund Site		
EPA ID: NYD000337295		
Region: 2	**State:** NY	**City/County:** Farmingdale/Nassau County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Lorenzo Thantu		
Author affiliation: EPA		
Review period: 7/18/2017 - 4/1/2022		
Date of site inspection: 11/18/2021		
Type of review: Statutory		
Review number: 3		
Triggering action date: 7/18/2017		
Due date *(five years after triggering action date)*: 7/18/2022		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In 2001, under an Administrative Order on Consent (AOC), the potentially responsible parties (PRPs) completed a Supplemental Remedial Investigation (RI). The Supplemental RI identified contamination on the facility property, in nearby Massapequa Creek, and in two distinct groundwater plumes (Plume A and Plume B) at the Site (**Figure 3)**. A risk assessment was conducted based upon the results of the RI.

For the western portion of the Site, the Baseline Human Health Risk Assessment (BHHRA) showed several locations where cadmium and chromium were the major risk factors. For the eastern portion of the Site, the primary risk factors were benzo(a)pyrene and dibenzo(a,h)anthracene, as well as chromium and polychlorinated biphenyls (PCBs). For the off-property residential areas, the primary risk factors were vinyl chloride and 1,1-dichloroethene (1,1-DCE), as well as cadmium, chromium and manganese. Massapequa Creek Pond A showed potential risks to ecological receptors including benthic invertebrates and fish.

Response Actions

In 1978 and 1987, under AOCs issued by NYSDEC, several of the PRPs at the Site removed contaminated soil and sludge from industrial waste disposal basins.

During late 1993 and early 1994, EPA conducted a Removal Site Evaluation at the Site and determined that electrical transformer areas contaminated with PCBs, wastes contained in underground storage tanks (USTs), and drums located at the Site posed an immediate risk to trespassers. At EPA's request, a number of PRPs agreed to remove these materials and transport them to appropriate facilities for treatment and disposal. This removal action was completed in April 1996.

On March 31, 1998, EPA issued an Action Memorandum selecting a non-time-critical removal action as an interim response action at the Site in order to prevent contaminated groundwater from migrating beyond the boundary of the Liberty property, until the comprehensive soil and groundwater remedy could be implemented. Initially, in 1998, this work was implemented by the PRPs, pursuant to an EPA AOC. Since August 2004, the PRPs have continued this work pursuant to a Consent Judgment.

Additionally, pursuant to an EPA AOC issued per Section 16(a) of the Toxic Substances Control Act, in late 1999, the owners of the Liberty site removed approximately 1.5 million pounds of PCB-contaminated shredded auto-fluff that had been previously stored at the Site.

On March 28, 2002, EPA selected a remedy for the Site. The Record of Decision included the following remedial action objectives (RAOs):

On-Site Soils

- Prevent the direct exposure of receptors to Site-related contaminants through inhalation, direct contact or ingestion, or mitigate soil contaminant concentrations to a level that will not pose unacceptable risks to human health and the environment.
- Reduce the concentration or mobility of soil contaminants to a level which will prevent further degradation of groundwater.
- Remove all Resource Conservation and Recovery Act (RCRA) hazardous waste from the Site.
- Remove any structural impediments that might interfere with pre-design sampling and implementation of soil, subsurface feature, and groundwater remediation.

On-Site Subsurface Features (on Eastern Portion of the Site) and Underground Storage Tanks

- Removal of contaminated aqueous and/or solid materials from subsurface features and underground storage tanks.

On-Site and Off-Site Groundwater

- Prevent or minimize ingestion, dermal contact and inhalation of inorganic- and organic-

contaminated groundwater that are above State and Federal maximum contaminant levels (MCLs).
- Restore groundwater quality to levels which meet State and Federal MCLs.

Massapequa Creek Pond A Sediments
- Prevent adverse effects to ecological receptors within the Massapequa Creek and associated ponds caused by exposure to Site-related contaminants.

In order to achieve these RAOs, EPA selected the following remedial action components as described in the 2002 ROD:

On-Site Soils
- Excavation and off-Site disposal of all soils contaminated above groundwater protection levels, estimated at 73,100 cubic yards (CY).
- Institutional Control (ICs) to restrict the use of the Site to commercial/industrial or, where applicable, to recreational uses.

On-Site Subsurface Features (on Eastern Portion of the Site) and Underground Storage Tanks
- Removal of contaminated aqueous and/or solid materials from underground storage tanks and other subsurface features (structures).

On-Site and Off-Site Groundwater
- Continued operation of the ongoing interim groundwater treatment system that is being converted to a conventional pump-and-treat system to address the groundwater underlying the Site property contaminated by previous operations at the Site.
- Continuation of the interim groundwater action by construction and operation of a conventional pump-and-treat system to address groundwater underlying the Site property which is believed to have been contaminated by an upgradient source.
- Construction and operation of a conventional pump-and-treat system to treat off-property groundwater contamination.
- Implementation of a groundwater monitoring program.
- ICs to prohibit installation or use of groundwater wells for human consumption until the aquifer is restored.

Massapequa Creek Pond A Sediments
- Excavation and off-Site disposal of approximately 2,600 CY of contaminated sediments within Pond A of the Massapequa Preserve.
- Implementation of a monitoring program for the remainder of the ponds within the Massapequa Preserve.

On September 27, 2012, EPA issued an Amendment to the 2002 ROD to 1) implement a No Further Action/Natural Attenuation remedy for the on-property Plume B extraction and treatment system component and 2) give NYSDEC the lead agency role to address Plume B, including any Plume B remediation, as part of its response action at the Farmingdale Plaza Cleaners site (**Figure 4**).

In addition, in July 2012, EPA published an Explanation of Significant Differences (ESD), as part of the Post-Decision Proposed Plan for the September 27, 2012 ROD Amendment, in order to announce that a

land use change from commercial/industrial to recreational for the Central Parcel would continue to be protective.

The 2002 ROD identified the following Site-specific soil cleanup levels:

Cadmium	10 mg/kg
Chromium	143 mg/kg
TCE	0.7 mg/kg
Cis-1,2-DCE	0.25 mg/kg
PCE	1.4 mg/kg
Benzo(a)pyrene	0.29 mg/kg
Dibenz(a,h)anthracene	0.29 mg/kg
Cyanide	35 mg/kg
PCBs between 0 and 1-foot bgs	1 mg/kg
PCBs 1-foot or more bgs	10 mg/kg

The following State and Federal MCLs were selected for restoration of groundwater quality:

Cadmium	5 µg/l
Chromium	50 µg/l
TCE	5 µg/l
cis-1, 2-DCE	5 µg/l
PCE	5 µg/l

The following Site-specific sediment cleanup levels were selected for the Massapequa Creek Pond A Sediments in the 2002 ROD:

Cadmium	50 mg/kg
Chromium	260 mg/kg

Table 1 presents a chronology of events conducted at the Site.

Status of Implementation

The remedial activities were undertaken in accordance with the September 30, 2003 Remedial Design/Remedial Action (RD/RA) Consent Judgment. Several of the USTs and subsurface features were also addressed and removed, in accordance with a March 21, 2002 AOC for Removal Action for Phase I Demolition Area. **Figure 5**, Phase I Demolition Area/Stop & Shop Parcel and Subsurface Features Location Map, shows locations of subsurface features on the Western Parcel (Lot 327) and Central Parcel (Lot 331) that were remediated per the March 21, 2002 AOC.

On-Site Soils (Remedial Work Element I) and Subsurface Features and Underground Storage Tanks (Remedial Work Element II)

From March 2007 until May 2011, the remedial activities for on-Site soils and subsurface features and USTs were performed. Based on the total waste volume disposal log, 57,967 tons of non-hazardous soils, 24,897 tons of hazardous soils, 436 tons of construction and demolition materials, 2,098 tons of mixed soil and debris, 880 CY of wood chips, 15.8 tons of scrap metal, 17,704 gallons of oil, 177 tons of

asphalt, and 5,899 tons of concrete were removed from the Site in the performance of Remedial Work Elements I and II. A total of 125 subsurface features and 15 USTs were remediated and removed pursuant to the September 30, 2003 RD/RA Consent Judgment and the March 21, 2002 AOC, in the performance of Remedial Work Element II.

On-Site and Off-Site Groundwater (Remedial Work Element III)

Construction activities for Remedial Element III were performed at the Site property, as well as at off-property locations, including the Massapequa Preserve, various TOB and Nassau County rights-of-way and the Woodward Parkway Elementary School located at 95 Woodward Parkway in Farmingdale (**Figure 6**). **Table 2** provides a chronological summary of major events for the Groundwater Remediation System (GRS) construction and upgrades for Remedial Work Element III. The on-property GRS extracts water from the Upper Glacial Aquifer (UGA). The off-property GRS includes recovery wells screened in both the UGA and Magothy Aquifer (MA), with the deepest Magothy well set to approximately 185 feet below grade, which is shallower than public water supply wells within the TOB. The GRS operates on a continuous basis, 24 hours per day. **Table 3** provides the design flow rate for each on- and off-site recovery well. Extracted groundwater is piped from the well locations into the on-site treatment building. Water pumped from the UGA recovery wells is processed through granulated activated carbon (GAC) vessels and then discharged to the sewer as treated effluent.

Discharge permits exist for both sewer water (350 gpm limit) and groundwater (300 gpm limit) through an on-site groundwater infiltration gallery. MA wells (RW-8, RW-9, and RW-10) discharge to the on-site infiltration gallery. The remaining recovery wells (all UGA wells) discharge primarily to the sewer system. A portion of the UGA flow from mid-field wells RW-4, RW-5, and RW-6 and far-field well RW-7 can be blended into the infiltration gallery discharge in order to maximize treated groundwater discharge to the gallery while still meeting permitted discharge limitations. Overall, from October 2002 through December 2020, the GRS extracted a total volume of 1,494 million gallons (Mgal).

Massapequa Creek Pond A Sediments (Remedial Work Element IV)

The remedial activities for Pond A sediments were initiated in September 2007 and were completed in March 2009. **Table 4** provides a chronological summary of major pond sediments remedial action construction events for Remedial Work Element IV. A total of approximately 4,200 CY, or the equivalent of approximately 5,000 tons, of impacted sediment was excavated as determined by pre- and post-excavation surveys of the Site. The excavated sediments were transported to, and disposed of at, EPA-approved disposal facilities.

The remedy for Pond A sediments has been fully implemented, including the enhanced monitoring for the five lower ponds downstream of Pond A (required by the 2002 ROD and also as a recommendation/follow-up action in the first FYR Report). This component of the remedy consisted of surface water and sediment sampling and bioassays. The results of the enhanced monitoring program further supported the Agency's determination that only Pond A required remediation and demonstrates that, over time, removal of the contaminant source in Pond A will have a beneficial effect on downstream pond sediment quality.

Vapor Intrusion Investigation

The various vapor intrusion (VI) investigations that have been conducted at the Site did not show any adverse health impacts. The most recent vapor sampling event (January 2017) was conducted in the study area, including at the Woodward Parkway Elementary School, and the results confirmed that indoor air and sub-slab air sampling results remained below screening levels throughout the study area. Upon review of all VI sampling results to date, EPA determined that further VI investigation is no longer warranted at the Site.

Institutional Controls (IC) Summary Table

Summary of Planned and/or Implemented ICs[1]

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
15-acre Western Parcel (Tax Lot 327), 7.5-acre Central Parcel (Tax Lot 331), and 7.5-acre Eastern Parcel (Tax Lot 332)	Yes	Yes	Lots 327, 331, and 332	Establishing institutional controls in the form of deed restrictions on future uses of the site property	Environmental Easement and Restrictive Covenants (industrial/commercial use) (Lot 332, August 4, 2009); Prospective Purchaser Agreement limit to recreational use (Lot 327, June 10, 2003); Zoning changed for Tax Lots 327+331 from Light Industrial to Recreational (September 2011)
Groundwater	Yes	Yes	Groundwater	Restrict future groundwater use at the Site	Proprietary ICs: Environmental Protection Easement and Declaration of Restrictive Covenants (Lot 332, August 4, 2009) and Agreement and Covenant Not to Sue (Prospective Purchaser Agreement),(Lot 327, June 10, 2003); and Governmental (Legal) ICs through state and local regulations and ordinances prohibiting installation or use of groundwater wells for human consumption until the aquifer is restored

[1] The 2002 ROD required ICs to restrict the use of the Site to commercial/industrial or, where applicable, to recreational uses for the soils remedial component and to prohibit installation or use of groundwater wells for human consumption for the groundwater remedial component.

Systems Operations/Operation & Maintenance

Plume A

Post-construction operation and maintenance (O&M) of the upgraded GRS has been performed by the PRPs, in accordance with the Operation, Maintenance, and Monitoring Plan, which discusses general O&M activities, including system monitoring, discharge sampling, as well as detailed O&M for each operable piece of equipment in the system. Site-wide groundwater monitoring continues until restoration of the aquifer is complete. The current groundwater monitoring program includes 20 groundwater monitoring wells/piezometers and 10 recovery wells (see below) that are sampled on an annual basis. The approximate mass of contaminants recovered from groundwater sources from October 2002 through December 2020 includes 39.5 pounds of TCE, 505.2 pounds of cadmium, and 2,175.2 pounds of chromium.

Potential Site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the previous FYR, as well as the recommendations from the previous FYR and the current status of those recommendations.

Table A - Protectiveness Determinations/Statements from the 2017 FYR

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedy at OU 1 is protective of human health and the environment.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies implemented for the Site are protective of human health and the environment.	

This report did not identify any issues or make any recommendations for the protection of public health or the environment which was not included or anticipated by the Site decision documents. It did, however, identify the following suggestion that does not impact protectiveness:

> Because the sediment monitoring data (discussed above in Section V. TECHNICAL ASSESSMENT) indicated an exceedance of the sediment remedial goal for cadmium at one location, the enhanced monitoring program consisting of surface water and sediment sampling and bioassays for the Massapequa Preserve will be continued.

As discussed below, although the enhanced monitoring did not occur in the last five-year period, it will be implemented in the next five-year period.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On Friday, August 6, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at Superfund sites in New York, New Jersey, Puerto Rico and the U.S. Virgin Islands, including the Liberty Industrial Finishing Superfund site. The announcement can be found at the following web address: https://www.epa.gov/superfund/R2-fiveyearreviews.

In addition to this notification, the EPA CIC for the Site, Shereen Kandil, posted a public notice on the EPA Site webpage https://www.epa.gov/superfund/liberty-industrial and provided the notice to the county by email on Monday, February 14, 2022 with a request that the notice be posted in municipal offices and on the village/town webpages. This notice indicated that a FYR would be conducted at the Liberty Industrial Finishing Superfund site to ensure that the cleanup at the Site continues to be protective of human health and the environment. Once the FYR is completed, the results will be made available at the following repository: The Farmingdale Public Library, 116 Merritts Road, Farmingdale, New York 11735. In addition, the final report will be posted on the Site's webpage. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

Plume A

Generally, the direction of groundwater flow in the UGA and MA is south-southwest. Recovery wells are in both the UGA and MA. RW-1, RW-2, and RW-3A are on the property and pump from the UGA. RW-4, RW-5, RW-6, RW-7 are downgradient of the property (midfield and farfield) and extract groundwater from the UGA. RW-8, RW-9, RW-10 are downgradient of the property and extract groundwater from the MA (midfield). The capture zone from on-site UGA recovery wells extends to the width of the property and more than 150 feet downgradient (**Figure 7**) (Note: A – monitoring wells are installed in the upper UGA, while B - monitoring wells are located in the deeper UGA). Similarly, the capture zone for the downgradient UGA recovery wells are shown in **Figure 8**. The capture zone of the downgradient MA recovery wells is shown on **Figure 9**.

The on-site recovery wells (RW-1, RW-2, RW-3A) are on a pulse-pumping program in order to enhance capture of the contaminated groundwater by the existing pump and treat system. In general, recovery wells do not show a clear difference in concentration data when compared to trends prior to initiating pulse pumping in 2012. Two exceptions are RW-3A for cadmium and RW-7 for cadmium and total chromium where concentrations show increasing trends following the onset of pulse pumping. This increasing trend may be indicative of enhanced recovery during pulse-pumping cycles (**Figures 10 to 12**). Overall, under pulse pumping, a reduced volume of groundwater is extracted but contaminant concentrations are higher. Under a normal pumping regiment, a higher volume is extracted but contaminant concentrations are lower, *i.e.*, as a result of dilution. So, effectively, pulse pumping is more efficient (at least from an energy perspective).

Overall, for the period of October 2002 through December 2020, the extraction system removed a total volume of 1,494 Mgal, approximately 39.5 lbs of TCE, 505.2 lbs of cadmium, and 2,175.2 lbs of total

chromium. The recovery well data demonstrate that the pulse pumping program has been successful in maintaining the removal efficiency of cadmium and total chromium from the groundwater.

On-site/Property Boundary - Upper Glacial Aquifer - VOC Data

During this FYR period, organic constituents detected at concentrations exceeding NYSDEC groundwater criteria in the on-site/property boundary wells were reported in MW-7A, RW-1, and RW-3A. Please note that trend plots depict data only up to the September 2020 sampling event, but July 2021 sampling data are still discussed in this FYR. From 2017-2019, exceedances of 1,1,1-TCA were detected in MW-7A at 5.1 micrograms/liter (µg/l), 13 µg/l, and 29 µg/l, respectively. During the 2019 sampling event, exceedances of TCE were detected in RW-1 at 8.1 µg/l and in RW-3A at 8.6 µg/l (**Figure 13**). Monitoring well MW-38B is the only Motor Avenue boundary well to have consistently reported TCE above groundwater standards. Since 2014, however, TCE concentrations in each of these boundary wells have been below the groundwater standard of 5 µg/l (**Figure 14**). Low level concentrations of cis-1,2-DCE were present in MW-7A during this FYR period, which indicates that some dechlorination is occurring in the UGA. Overall, the groundwater quality data indicate that VOC concentrations in the UGA are generally decreasing and are below historic high concentrations measured since September 2000.

Monitoring wells located on the property and screened in the MA are not currently sampled and are used for water level measurements only. Monitoring in the MA on-site/property boundary wells was discontinued after several rounds of sampling yielded results below detection limits.

On-site/Property Boundary - Upper Glacial Aquifer - Cadmium and Chromium Data

Overall, cadmium and chromium concentrations remain above their criteria of 5 µg/l and 50 µg/l, respectively, in the UGA. During this FYR period, cadmium was detected in three recovery wells (RW-1, RW-2, and RW-3A) and 13 on-site/boundary wells at concentrations above the NYSDEC groundwater criteria of 5 µg/l. In RW-2, the highest cadmium concentration (360 µg/l) for this recovery well was detected during the September 2017 sampling event. MW-2AR and MW-2BR are two on-site wells near the mid-point of Plume A. Cadmium concentrations were historically higher in the upper portion of the UGA (MW-2AR) than the lower portion (MW-2BR), but concentrations in MW-2AR have declined considerably since June 2011 from 590 µg/l to 46.7 µg/l in July 2021. The cadmium concentration in adjacent well MW-2BR has generally been much lower than in MW-2AR but showed a historic high in June 2010 (74.3 µg/l) and has decreased to the current concentration of 5 µg/l. The cadmium concentration in MW-5 has shown an overall decline since 2008.

In the boundary monitoring wells (well pairs MW-38A/B, MW-39A/B, and MW-40A/B), cadmium concentrations in July 2021 ranged from 4.3 to 173 µg/l. While this concentration range is lower than some of the historic concentrations of cadmium found in groundwater, overall, the data show a lot of variation. In MW-38A and MW-39A, cadmium concentrations increased from 45.9 µg/l to 127 µg/l and 100 µg/l to 512 µg/l between the 2016 and 2017 sampling events but have since decreased and are more stable. Since 2010, some wells have shown decreasing concentrations, such as MW-40B, where concentrations have decreased considerably and are approaching the groundwater standard (**Figure 15**).

Throughout this FYR period, total chromium concentrations detected in three recovery wells (RW-1, RW-2, and RW-3A) and 11 on-site/property boundary wells exceeded the NYSDEC groundwater

standard of 50 µg/l. Monitoring wells remaining above the groundwater standard are typically those in the upper portion of the UGA. For example, the total chromium concentrations detected in MW-38A, MW-39A, and MW-40A continue to fluctuate mostly above the groundwater standard. Since 2004, samples collected from the majority of monitoring wells screened in the lower portion of the UGA, such as MW-39B and MW-40B, have consistently shown total chromium concentrations below the standard. MW-38B had also consistently reported total chromium concentrations below the standard; however, in 2018, there was anomalous hit of 908 µg/l. Since then, MW-38B has showed chromium levels at or below the standard.

Since monitoring was initiated, the most dramatic decline in total chromium concentrations has been observed in MW-40A; however, concentrations have been increasing since 2014 (**Figure 16**). Previous sampling data indicates that metals are not a concern in the MA on Site nor at the property boundary.

The Mann-Kendall statistical trend analytical results show that the majority of the on-site and boundary wells exhibit no statistically significant trend or a decreasing trend in cadmium and chromium concentrations. RW-3A showed an increasing trend in cadmium concentrations which could indicate enhanced capture by this recovery well during pulse pumping cycles. In the midfield UGA wells, no statistically significant trends or decreasing trends were observed in most wells for cadmium, but RW-4 showed an increasing trend. No statistically significant trends or decreasing trends were also observed in most midfield wells for total chromium, except for RW-4, RW-5, and MW-17B, which showed increasing trends during this FYR period. Decreasing trends at the Site and increasing trends in the midfield suggest a diminishing plume at its source with migration and capture by the midfield recovery wells. Similarly, detected cadmium and chromium concentrations are increasing or remaining relatively consistent at the downgradient end of the plume at recovery well RW-7 and monitoring well PZ-14 due to capture by RW-7.

Off-site – Upper Glacial Aquifer and Magothy Aquifers – VOC Data

VOC contamination within the UGA includes TCE downgradient of the Liberty property. The presence of TCE is based on a previous grab sample collected from a temporary groundwater profile boring (PW-15).

During this FYR period, VOCs reported in 20 off-site monitoring wells were detected at concentrations exceeding their respective NYSDEC groundwater standards in six monitoring wells and recovery wells (MW-11C, MW-11D, PZ-14, RW-4, RW-7, and RW-8). Most of the monitoring wells in the current sampling program are screened in the UGA. MW-11C is screened in the MA and has consistently shown TCE exceedances above the groundwater standard of 5 µg/l. During this FYR review period, the TCE concentrations continue to fluctuate between 83 µg/l to 220 µg/l; historic TCE concentrations are shown in **Figure 17**. TCE exceedances were also found in a well screened in the deeper MA in MW-11D. Detected TCE concentrations in groundwater samples collected from MW-11D were below criteria from 2015-2019, but exceeded criteria during the September 2020 (160 µg/l) and July 2021 (120 µg/l) sampling events (**Figure 18**). MW-11C and MW-11D are within the capture zone of the midfield MA recovery wells. MW-11C and MW-11D also showed low level cis-1,2-DCE concentrations indicating some dechlorination is occurring in the MA. TCE exceedances were also reported in RW-04 and RW-08 at maximum concentrations of 19 µg/l and 16 µg/l, respectively. Cis-1,2-DCE and vinyl chloride were also detected at low concentrations in RW-8 during this FYR period.

Off-site – Metals Data

As discussed above, cadmium and total chromium concentrations in groundwater remain limited to the UGA and are generally not present in the MA. While there are fewer monitoring wells screened in the MA since they were removed from the sampling program after several rounds of data showed no site related contamination, MW-29C reported a cadmium concentration of 12 µg/l in 2021. In the UGA, cadmium and total chromium concentrations are higher in the midfield area as compared to concentrations found on the property. During this FYR period, concentrations of cadmium that exceed the groundwater standard were reported in seven off-site monitoring wells and four recovery wells (RW-4, RW-5, RW-6, and RW-7). The maximum concentration of 493 µg/l was detected in midfield well MW-29B and the furthest downgradient exceedances were in the Massapequa Preserve in PZ-14 and RW-7. Concentrations of cadmium show long term declines with some exceptions. Cadmium concentrations in MW-29B had been relatively consistent around 30 µg/l, but the September 2017 sampling event reported a concentration of 493 µg/l, with subsequent concentrations ranging between 26.8 µg/l to 46.1 µg/l. Concentrations of cadmium in MW-17B fluctuated between 103 µg/l and 45.3 µg/l between 2017 and 2021 (**Figure 18).** Since MW-25B is adjacent to midfield recovery wells, this could be the reason that higher concentrations have been observed in this well. Monitoring wells in the farfield area such as MW-9A and MW-9B are exhibiting an overall decreasing trend with concentrations now fluctuating between 17.1 µg/l and 0.39 µg/l and 63.4 µg/l and 14.6 µg/l, respectively (**Figure 11**).

During this FYR period, total chromium was detected in ten off-site monitoring wells and three recovery wells (RW-4, RW-5, and RW-6) at concentrations exceeding the groundwater standard of 50 µg/l. Since 2012, total chromium in midfield wells MW-17B, MW-25B, and MW-29B) has fluctuated at concentrations greater than or equal to the groundwater standard (**Figure 12**). In MW-29B, the highest total chromium concentration (1,080 µg/l) ever recorded for this well was detected during the September 2017 sampling event (**Figure 19**). The concentration of total chromium in farfield recovery well RW-7 has been slowly increasing and was above the standard of 50 µg/l (90.1 µg/l) in July 2021. In farfield monitoring wells MW-9A and MW-9B, total chromium concentrations are exhibiting an overall decreasing trend with concentrations in MW-9B now fluctuating between 311 µg/l and 423 µg/l (**Figure 5**).

In 1998, EPA and the Massapequa Water District (MWD) and the South Farmingdale Water District (SFWD) joined in a collaborative effort and installed six "sentinel" monitoring wells between the Site property and downgradient public drinking water wells to serve as an early warning system to indicate whether any plume of contamination is beginning to migrate towards the water supply well fields. (see **Figure 3)**. Periodic monitoring of these sentinel wells by the local water districts has not detected any Site-related contamination indicating the contamination is completely captured by the system of recovery wells.

Emerging Contaminants

In November 2018, select monitoring wells, upgradient MW-4A, on-Site MW-7A, and downgradient MW-11C and MW-9A, were sampled for emerging contaminants, per- and polyfluoroakyl substances (PFAS) and 1,4-dioxane, to evaluate their potential presence in groundwater. **Table 5** provides groundwater sampling results for PFAS and 1,4-dioxane. Maximum perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) were detected at 20.7 nanograms per litre (ηg/L) and 42.7 ηg/L, respectively, at MW-4A. Maximum 1,4-dioxane (P-dioxane) was detected at 0.16 µg/l at MW-7A. No federal MCLs have been established for PFAS and 1,4-dioxane in drinking water. However, on August 26, 2020, the State of New York adopted new drinking water standards for public water systems that set

MCLs of 10 ηg/L each for PFOA and PFOS, and 1 µg/l for 1,4-dioxane. The maximum concentrations of 20.7 ηg/L for PFOA and 42.7 ηg/L for PFOS detected at MW-4A exceeded the 10 ηg/L State MCL. The maximum concentration of 0.16 µg/l for 1,4-dioxane detected at MW-7A was below the 1 µg/l State MCL. EPA will continue to work with NYSDEC to determine future sampling needs.

Sediments

The PRPs conducted an enhanced monitoring program in November 2014, which consisted of sediment and surface water chemistry as well as toxicity testing for the lower ponds. The surface water sampling results did not indicate any exceedances of the New York State Ambient Water Quality Standards, but the sediment sampling results revealed one location that exceeded the sediment remedial goal for cadmium. The sediment toxicity testing indicated that there was no statistically significant difference in survival of either the Hyalella Azteca or Chironomus dilutus. Although growth was significantly different in most of the Massapequa pond samples, some of the impacted samples were in locations with the lowest cadmium and chromium concentrations. Consequently, the toxicity may not be associated with the contaminants. While it has been determined that the remedy continues to be protective of ecological receptors downstream, because the sediment remedial goal was exceeded for cadmium at one location, the PRPs will implement another enhanced monitoring program event within the next five years of the entire Massapequa Creek and Preserve. It will consist of similar surface water and sediment sampling and bioassays that were conducted in November 2014.

Vapor Intrusion

As stated above, in January 2017, the most recent vapor sampling event was conducted at the Woodward Parkway Elementary School, and the results confirmed that indoor air and sub-slab air sampling results remained below the following screening levels: 0.48 micrograms/cubic meter ($\mu g/m^3$) indoor air and 16 $\mu g/m^3$ sub-slab air for TCE and 11 $\mu g/m^3$ indoor air and 360 $\mu g/m^3$ sub-slab air for PCE, which were established at a set cancer risk of 10^{-6} and hazard quotient of 1. Upon review of all vapor sampling results, EPA determined that further VI investigation was no longer warranted at the Site.

Site Inspection

A Site inspection was performed on November 18, 2021 by Lorenzo Thantu, Damian Duda, and Liana Agrios from EPA; John Swartwout from NYSDEC; Ralph Golia from AMO Environmental Decisions, Inc.; and Kaitlyn Crosby from PW Grosser Consulting. The GRS was inspected, as well as the area around the plant and associated monitoring wells. The team also walked around the Massapequa Preserve. No anomalies were identified.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

The main elements of the 2002 ROD include excavation and disposal of contaminated on-site soils, removal of contaminated materials from underground storage tanks and other subsurface features, excavation and disposal of contaminated sediments within Pond A, implementation of a monitoring program for the remainder of the ponds within Massapequa Preserve, construction and operation of pump-and-treat systems for Plume A, implementation of a groundwater monitoring program, and ICs

to prevent access to groundwater and restrict certain land uses. All of these remedial components have been implemented and groundwater operation, maintenance, and monitoring activities are ongoing.

The full pump and treat construction was completed in 2009/2010 to include off-site recovery wells; pulse pumping was initiated in 2012. Pulse pumping does not appear to be pulling a higher rate of mass from the aquifer except for two possible exceptions at RW-3A for cadmium and RW-7 for cadmium and total chromium where increasing trends are shown following the onset of pulse pumping.

On-site/property boundary monitoring wells show that VOCs have nearly reached remedial goals with the exception of one monitoring well (MW-7A) and two recovery wells in the UGA (RW-1 and RW-3A). Maximum Site-wide VOC concentrations are found downgradient of the property in an area known as the midfield in the MA (MW-11C and MW-11D). In this area, the maximum TCE concentration of 220 µg/l was detected in MW-11C during this FYR period. In MW-11C, TCE concentrations continue to fluctuate but are lower than historic concentrations. In MW-11D, TCE concentrations were below criteria from 2015-2019, but exceeded criteria during the September 2020 and July 2021 sampling events. However, as stated above, periodic monitoring of the six sentinel wells has not detected any site-related Plume A or Plume B contamination, indicating that the on-site GRS pumping and treatment is operating as intended and the plumes are stable. Groundwater monitoring is conducted annually at the Site and will continue to be performed to further evaluate these fluctuating trends.

Site-wide cadmium and chromium concentrations are lower than historic levels, but recent concentration trends have varied depending on the monitoring well sampled. Maximum cadmium and chromium concentrations are found underlying the property and in the midfield area, but the highest concentrations reside in the UGA rather than the MA. Monitoring wells showing maximum cadmium and chromium concentrations during this FYR period were boundary well MW-39A (512 µg/l) and midfield well MW-29B (1,080 µg/l), respectively. Since these monitoring wells are within the capture zones of either the on-site recovery wells or the midfield UGA recovery wells, the plumes should not migrate outside the current extent of contamination. Monitoring will continue to ensure this does not occur.

All ICs have been implemented at the Liberty site and the ESD, which was published by EPA in July 2012, notified the public of the change in the permitted use from commercial-industrial to recreational for the Central Parcel.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Although specific parameters may have changed since the time the risk assessment was completed, the process that was used remains valid. The exposure assumptions, toxicity data, cleanup levels, and RAOs identified for the Liberty site remain valid. There are no changes in the physical conditions of the site or site uses that would affect the protectiveness of the selected remedy.

Changes in land use requirements necessitated updates to the July 2000 BHHRA and March 2002 BHHRA Addendum, which were the basis for the remedy selected in the 2002 ROD. The Central Parcel was previously zoned for commercial/industrial use. The November 2011 updated Risk Assessment then evaluated the Central Parcel as an extension of the recreational Ellsworth Allen Park for protectiveness for recreational land use as requested by the Town. The November 2011 updated Risk Assessment

concluded that soil conditions in the Central Parcel, upon completion of the soils and subsurface features remedial action in September 2011, are protective of a recreational land use scenario for this area.

While a new toxicity value for TCE was released in September 2011, the toxicity value used in the human health risk assessment and addenda is still protective of human health. The groundwater MCL remains at 5 µg/l, and the selected cleanup level for soils (0.7 mg/kg) remains more stringent than the residential TCE soil levels currently utilized by NYSDEC (10 mg/kg). Therefore, the cleanup goals selected in the 2002 ROD are still valid.

The cleanup goal selected for chromium in groundwater is the state ARAR of 50 µg/l. Hexavalent chromium toxicity remains under review by EPA; therefore, this value could change in the future. Since the groundwater treatment system is currently capturing the chromium contamination, downgradient properties are connected to a public water supply, and institutional controls are in place to prevent any new potable well installation, there are no completed exposure pathways for the remaining contaminated groundwater and the remedy remains protective. However, future FYRs will need to consider changes in toxicity.

VI is evaluated when soils and/or groundwater are known or suspected to contain VOCs. Sampling of several residences and the Woodward Parkway Elementary School during the previous FYR period indicated that VI is not an exposure pathway of concern for the site. Indoor air and sub-slab air sampling results from the Woodward Parkway Elementary School were all below EPA's residential VI screening levels (set at a cancer risk of 10-6 and hazard of 1) in the most recent sampling event conducted in January 2017. Shallow groundwater results taken from the Upper Glacial Aquifer during the current FYR period were compared to EPA's residential VI screening levels (set at a cancer risk of 10-6 and hazard of 1). There were no screening level exceedances of VOCs, therefore it is unlikely that VI would be a concern in the future.

The remedy has eliminated exposure to ecological receptors through the excavation and off-site disposal of the contaminated sediment in Massapequa Creek. The surface water sampling data did not have any exceedances of the New York State Ambient Water Quality Standards, and sediment sampling and analysis did not show an impact to biota based on sediment toxicity testing. However, because the sediment sampling data indicated an exceedance of the sediment remedial goal for cadmium at one location, the enhanced monitoring program for the Massapequa Preserve should be repeated to reevaluate the protectiveness for the next FYR.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

OTHER FINDINGS

The suggestion below was identified under Other Findings in the second FYR as one that may improve management of O&M activities but would not affect protectiveness. The suggestion is repeated here since it was not implemented in time to be discussed in this FYR. EPA expects the enhanced monitoring will be implemented in the next five-year period.

- As stated, above, because the sediment monitoring data during this FYR period showed an exceedance of the sediment remedial goal for cadmium at one location, the enhanced monitoring program for the Massapequa Preserve will be repeated.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Protective	Click here to enter a date
Protectiveness Statement: The remedy at OU 1 is protective of human health and the environment		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	Click here to enter a date
Protectiveness Statement: The remedies implemented for the Site are protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Liberty Industrial Finishing Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

APPENDIX A – REFERENCE LIST

Documents, Data, and Information Reviewed in Completing the Five-Year Review:

1) Record of Decision for the Liberty Industrial Finishing Superfund Site *March 28, 2002*

2) Administrative Order on Consent for Removal Action for Phase I Demolition, *March 21, 2002*

3) Remedial Design & Remedial Action Consent Judgment *September 30, 2003*

4) Pond Sediments Remedial Action Report *December 2008*

5) Groundwater Remedial Action Report *September 2010*

6) Site-wide Groundwater Monitoring Program Report for 2005 Summer *November 2005*

7) Site-wide Groundwater Monitoring Program Report for Semiannual Period (July to December 2010) *June 2011*

8) Proposed On-Site GWTF Pulse Pumping Proposal to Improve Contaminant Recovery Efficiency Memorandum *August 2011*

9) Site-wide Groundwater Monitoring Program Report for Semiannual Period (January to June 2011) *December 2011*

10) Soils and Subsurface Features Remedial Action Report *September 2010*

11) Soils and Subsurface Features Remedial Action Report Addendum *September 2011*

12) Site Management Plan for the Western and Central Parcels *March 18, 2011*

13) Public Health Consultation Letter *September 16, 2009*

14) Update of Risk Assessment Addendum (Central Parcel) to the Baseline Human Health Risk Assessment *November 2011*

15) First Five-Year Review *June 2012*

16) Explanation of Significant Differences *July 2012*

17) Record of Decision Amendment for the Liberty Industrial Finishing Superfund Site *September 2012*

18) Preliminary Close-Out Report for the Liberty Industrial Finishing Superfund Site *September 2012*

19) 2012 Annual Site-wide Groundwater Monitoring Report (Jun & Nov 2012 Sampling Events) *July 2013*

20) 2013 Semi-Annual (Boundary & Annual Key MW) Sampling Letter Report *October 2013*

21) 2013 On-Site Groundwater Treatment Facility Pulse Pumping Program Summary Memorandum *January 2014*

22) 2014 Annual Site-wide Groundwater Monitoring Report *April 2015*

23) 2015 Post-Remedial Action Enhanced Pond Sampling Report *April 2015*

24) 2015 Annual Site-wide Groundwater Monitoring Report *July 2016*

25) 2016 Annual Site-wide Groundwater Monitoring Report *June 2017*

26) Second Five-Year Review *July 2017*

27) 2017 Annual Site-wide Groundwater Monitoring Report *February 2018*

28) 2018 Annual Site-wide Groundwater Monitoring Report *February 2019*

29) 2019 Annual Site-wide Groundwater Monitoring Report *September 2020*

30) 2020 Annual Site-wide Groundwater Monitoring Report *August 2021*

31) 2021 Annual Site-wide Validated Groundwater Monitoring Data *November 2021*

APPENDIX B – TABLES

Table 1: Chronology of Events

DATE	EVENT
June 1986	Listing of Liberty Industrial Finishing Superfund Site on NPL
January 1994	EPA Completion of Initial RI Report
April 1996	PRP Completion of PCB Removal Action
July 1997	EPA Completion of Initial FS Report
April 2001	PRP Completion of Supplemental RI/FS Reports
March 2002	EPA ROD for Comprehensive Remedy
December 2002	NYSDEC's Listing of Farmingdale Plaza Cleaners Site on its Registry of Inactive Hazardous Waste Disposal Sites
December 2008	PRP Completion of Subsurface Features Removal Action Report
December 2008	PRP Completion of Pond Sediments RAR Report
June 2009	NYSDEC Completion of Farmingdale Plaza Cleaners Site Immediate Investigation Report
September 2010	PRP Completion of Groundwater RAR Report
September 2010	PRP Completion of Soils and Subsurface Features RAR Report
September 2011	PRP Completion of Soils and Subsurface Features RAR Addendum Report
March 2012	NYSDEC OU 1 ROD for Farmingdale Plaza Cleaners Site
June 2012	First Five-Year Review
September 2012	EPA Plume B ROD Amendment
September 2012	Liberty Preliminary Close-Out Report
February 2013	NYSDEC Completion of Plume B RI Report for Farmingdale Plaza Cleaners Site
April 2013	NYSDEC Completion of Plume B FS Report for Farmingdale Plaza Cleaners Site
March 2014	NYSDEC OU 2 Plume B ROD for Farmingdale Plaza Cleaners Site
July 2017	Second Five-Year Review

Table 2 - Chronology of Major Groundwater Remediation System Construction Events

Si. No.	Event	Date	Task Description
1	Notice to Proceed (NTP) Issued	5/29/2009	The EPA conditional approval of the Remedial Action Work Plan (RAWP) received; NTP issued to Prime Contractors
2	Moretrench Site Mobilization	6/8/2009	Moretrench American Corporation (Moretrench) began mobilizing to the site for treatment system and recovery well work
3	Preconstruction Meeting	6/11/2009	Discussed project expectations, lines of communication, record keeping, health and safety, and project schedule, among other things. Supervising Contractor, Engineer, and Prime Contractors present.
4	Selective Demolition	6/12/2009	Moretrench began demolition and removal of existing treatment system components
5	Well Installation, Main Site	6/24/2009	Moretrench began drilling wells and piezometers at the Site
6	Temporary Interim Treatment System Completed	6/29/2009	Interim treatment system completed for operation during construction activities
7	Recovery Well Installation, School Property	6/30/2009	Moretrench began drilling wells and piezometers at the School Property
8	Treatment System Construction	7/8/2009	Begin construction of new treatment system, including process equipment, piping, fittings, and valves.
9	Bove Site Mobilization and Preparation	8/3/2009	Bove began digging test pits for utilities; equipment and materials delivered to Site
10	Pipeline Installation, Main Site and School Property	8/26/2009	Bove began installing pipelines at the Site and School Property by open trenching; Piping connections to recovery wells installed
11	Pipeline Installation, Residential Neighborhoods Rights-of-Way (ROWs)	9/8/2009	Bove began installing pipe through the residential neighborhoods by horizontal directional drilling (HDD)
11	Massapequa Preserve Permits Approved	9/25/2009	Received utility easement and work permit for construction in the Preserve; NTP issued to contractors upon receipt of signed permits
12	Preserve Mobilization and Preparation	9/30/2009	Bove began preparation in the Preserve including limited clearing and trimming, installation of silt fence at Massapequa Creek crossing
13	Pipeline Installation, Massapequa Preserve	10/1/2009	Began pipelines installation in the Preserve by HDD
14	Well Installation, Massapequa Preserve	10/5/2009	Moretrench began drilling PZ-14 and RW-7 in the Preserve
15	Control Panel Installations	10/23/2009	Moretrench and Elemco transferred the Electrical Control Panels from the Motor Ave. building to 1st Ave. extraction wells location and secured the panels to the concrete pad. Elemco began pulling wire from the well chambers to the Electrical Control Panel.
16	Treatment System Startup and Testing	2/3/2010	Five-day test of treatment system begins
17	Complete System Testing	2/9/2010	Five-day test of treatment system ends

Table 2 - Chronology of Major Groundwater Remediation System Construction Events (Continued)

Si. No.	Event	Date	Task Description
18	Contractor Demobilization	2/10/2010	Moretrench demobilizes off site
19	Substantial Completion Inspection	2/12/2010	Moretrench contract substantially completed in accordance with Remedial Design documents
20	United States Environmental Protection Agency Pre-Certification Inspection	9/7/2010	

Note: This table does not include events for Remedial Element III prior to 5/29/2009.

Table 3 - Groundwater Recovery System Design Flow Rate

Well Identification	Flow Rate
On-Site Upper Glacial Aquifer Wells	
RW-1	60 GPM
RW-2	20 GPM
RW-3	0 GPM (standby only)
RW-3A	30 GPM
Total Flow	**110 GPM**
Off-Site Upper Glacial Aquifer Wells	
RW-4 (mid-field)	45 GPM
RW-5 (mid-field)	45 GPM
RW-6 (mid-field)	70 GPM
RW-7 (far-field)	65 GPM
Total Flow	**225 GPM**
Off-Site Magothy Aquifer Wells	
RW-8 (mid-field)	30 GPM
RW-9 (mid-field)	20 GPM
RW-10 (mid-field)	35 GPM
Total Flow	**85 GPM**

Explanation:
GPM - gallons per minute

q

Table 4 - Chronology of Major Pond Sediments Remedial Action Construction Events

Si. No.	Event	Date	Task Description
1	Pre Construction Meeting	5/15/2008	ENTACT's site supervisor, health & safety officer, PRP representative, EEEPC project manager, and construction oversight were present at the meeting
3	Clearing/Grubbing	5/21/2008	Removed small trees, shrubs, vegetation
4	Support Facilities	5/28/2008	Received office trailers, furniture, file cabinets
5	Site Preparation	6/13/20008	Install by-pass systems, installed perimeter fences, silt fencing, sediment trap, decontamination pad, water treatment systems, post-excavation survey
6	Pond Sediment Excavation	6/27/2008	Remove contaminated sediment from pond and transport off-site
7	Demobilization	8/21/2008	Demobilization of Equipment and Supplies
8	Begin Site Restoration	9/3/2008	Planting, Grading
9	End Site Restoration	9/25/2008	--
10	Substantial Completion Inspection	10/3/2008	--
11	USEPA Pre-Certification Inspection	11/18/2008	--

Note: The table does not include events at Pond A before May 15, 2008.

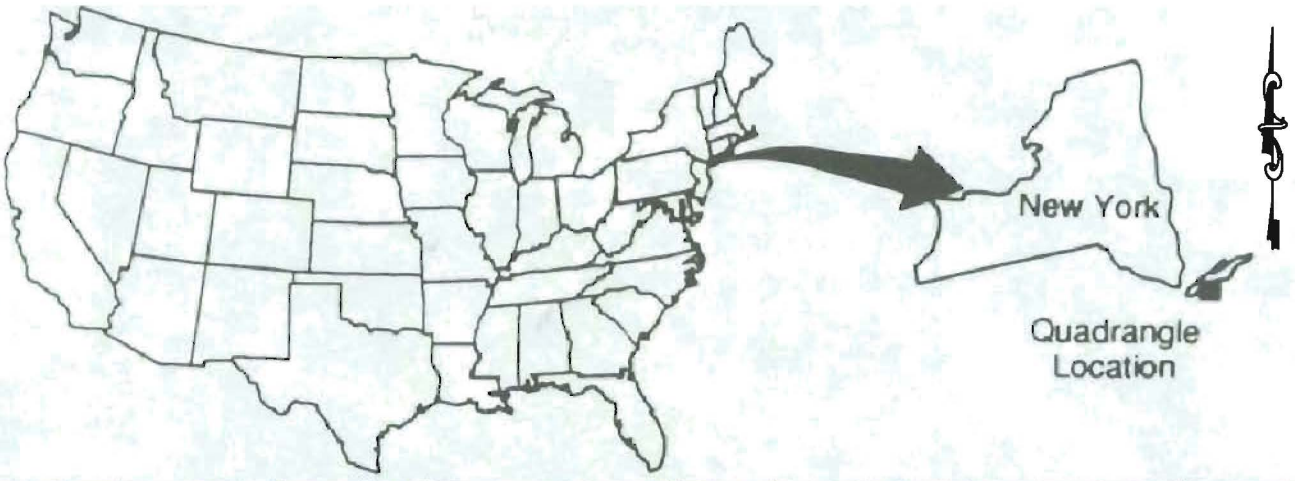
Table 5 - PFAS and 1,4-Dioxane Groundwater Sampling Results

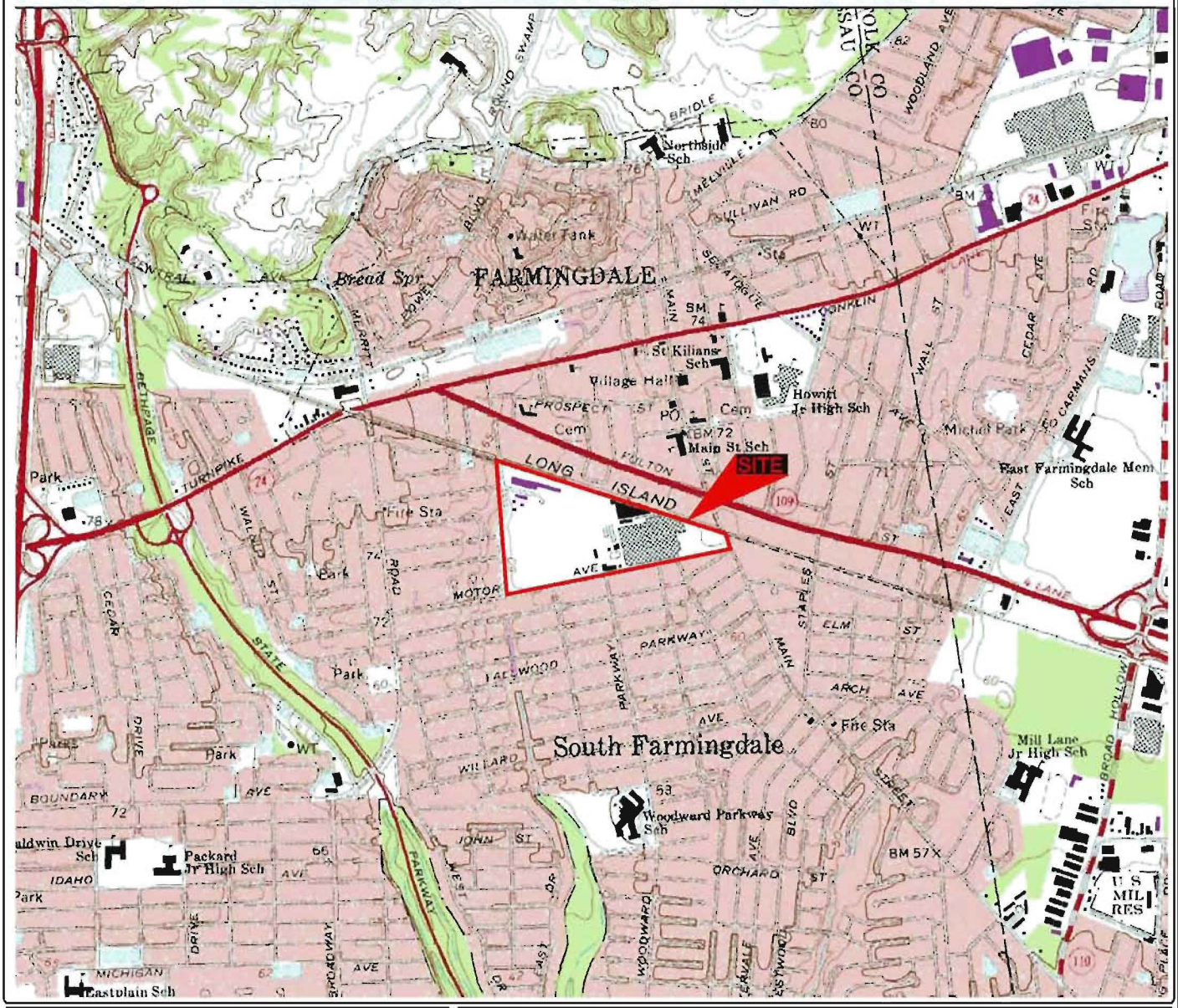
	Well# & (Location)	MW-4A(Upgradient)			MW-7A(ON-SITE)			MW-7A (DUPL)			MW-11C(Downgradient)			MW-9A(Downgradient)		
	CLP#	BEC23			BEC24			BEC24 (BEC25)			BEC26			BEC27		
	Sample Name	BEC23-TAG:LF-2-P			BEC24-TAG:LF-3-P			BEC25-TAG:LF-4-P			BEC26-TAG:LF-5-P			BEC27-TAG:LF-6-P		
	Sample Date	14-Nov-18			14-Nov-18			14-Nov-18			14-Nov-18			14-Nov-18		
	Start Depth	0			0			0			0			0		
	End Depth	37			26			26			120			13.5		
	Depth Unit	ft			ft			ft			ft			ft		
CAS RN	Chemical Name	Result	Qual	Unit	Result	Qual	Unit	Result	Qual	Unit	Result	Qual	Unit	Result	Qual	Unit
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	42.7		ng/l	22.3		ng/l	20.9		ng/l	4.56		ng/l	14		ng/l
335-67-1	Perfluorooctanoic acid (PFOA)	20.7		ng/l	3.8		ng/l	3.93		ng/l	20.2		ng/l	10		ng/l

Liberty Industrial Finishing

Statistic	Conc.	Units	Max non PFOS/PFOA
Maximum 1,4-Dioxane	0.16	µg/l	
Maximum PFOA	20.7	ng/L	
Maximum PFOS	42.7	ng/L	

APPENDIX C – FIGURES





LEGEND:

GRAPHIC SCALE

1000 0 1000 2000

1 inch = 2000 ft.

SOURCE: UNITED STATES GEOLOGICAL SURVEY 7.5 MINUTE SERIES AMITYVILLE, NY QUADRANGLE 1979

TITLE: SITE LOCATION MAP

PROJECT: LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NEW YORK

CLIENT NAME: USEPA

WESTON MANAGERS DESIGNERS/CONSULTANTS

DATE: MARCH 2002

FIGURE #: 1

00561TopomapFig1

FIGURE 1 - SITE LOCATION MAP

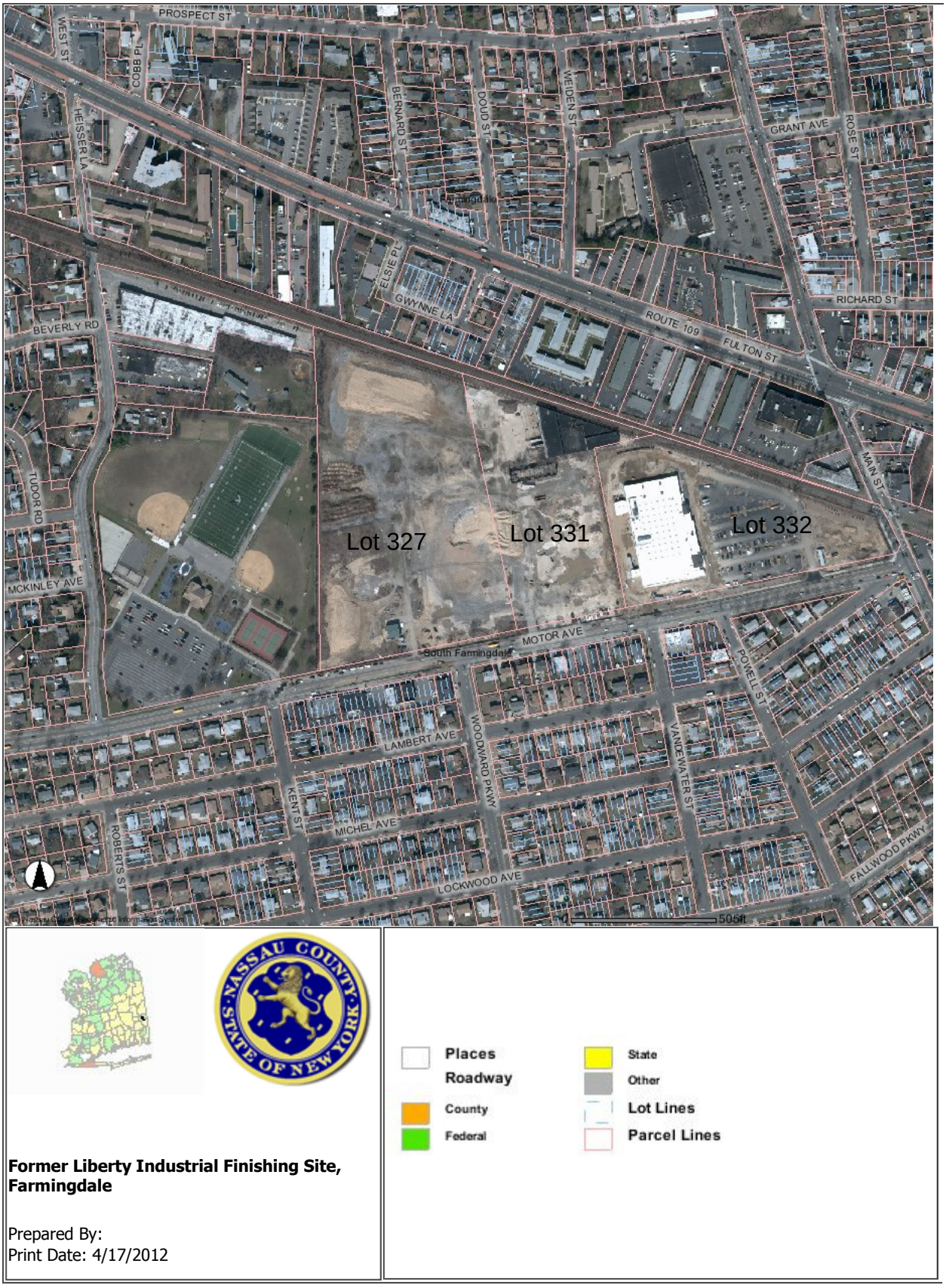


Figure 2 – Current Map of Liberty Tax Lots 327, 331, and 332



Figure 3 - Plume A/Plume B Map

ecology and environment P.C.

EXTENT OF PLUME A (METALS) AND PLUME B (PCE) IN GROUNDWATER
LIBERTY INDUSTRIAL FINISHING SITE
FARMINGDALE, NEW YORK



Legend

- Site
- Transect
- Roads

Figure 4

Farmingdale Plaza Cleaners Site Location Map

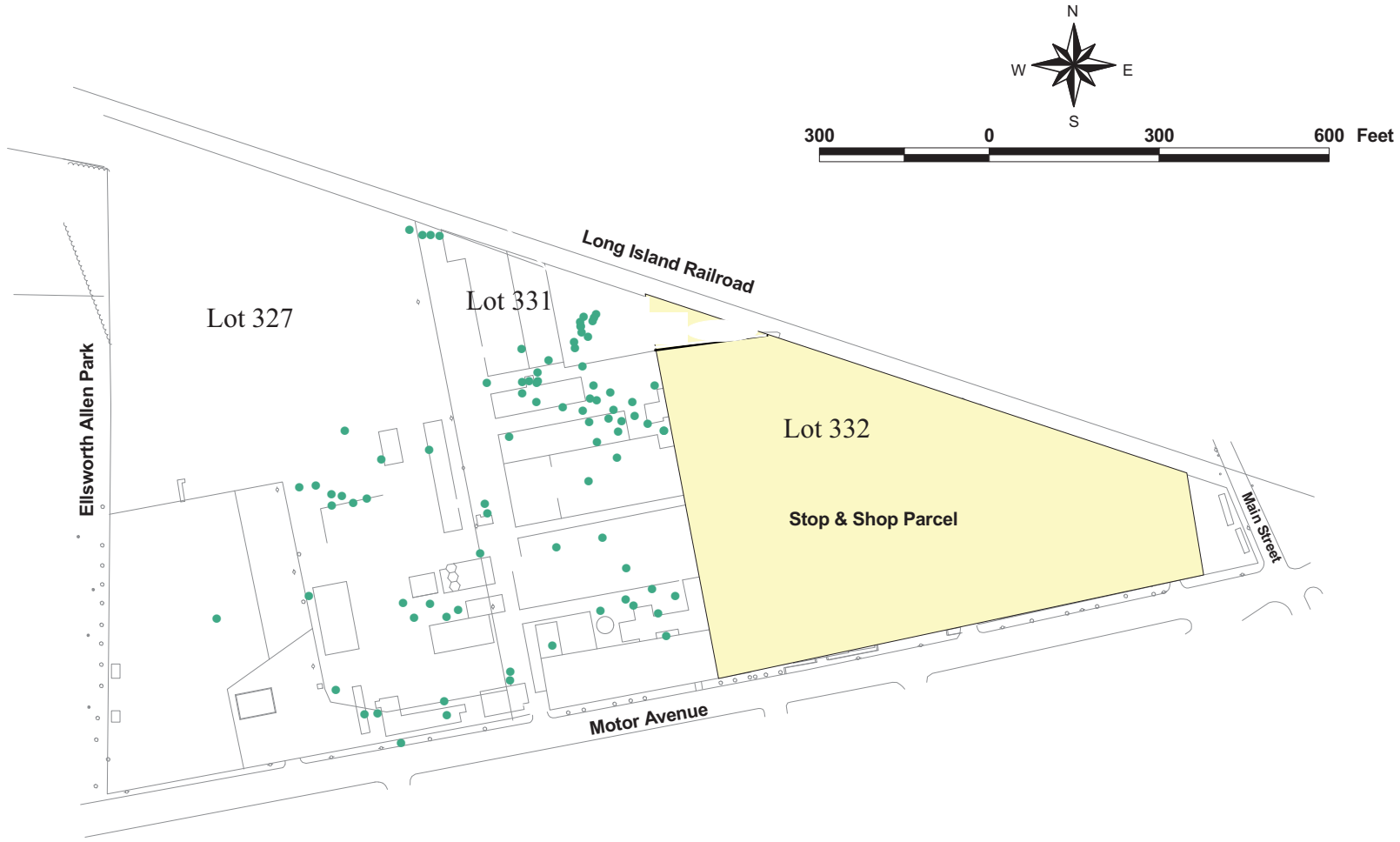
N

0 100 200 400 Feet

PREPARED FOR:
New York State Department of Environmental Conservation
Farmingdale Plaza Cleaners
Nassau County, New York

PREPARED BY:
YU & Associates, Inc.

DATE:	PROJECT NO.:
02/25/2009	08021
DRAWN BY:	CHECKED BY:
YZ	MG



Explanation:

- Western Subsurface Feature Locations
- Phase I Demolition Area/Stop & Shop Parcel
- Former Building Slabs, Property Lines, Roads

Figure 5 - Phase I Demolition Area & Western Parcel and Central Parcel
Subsurface Features Location Map

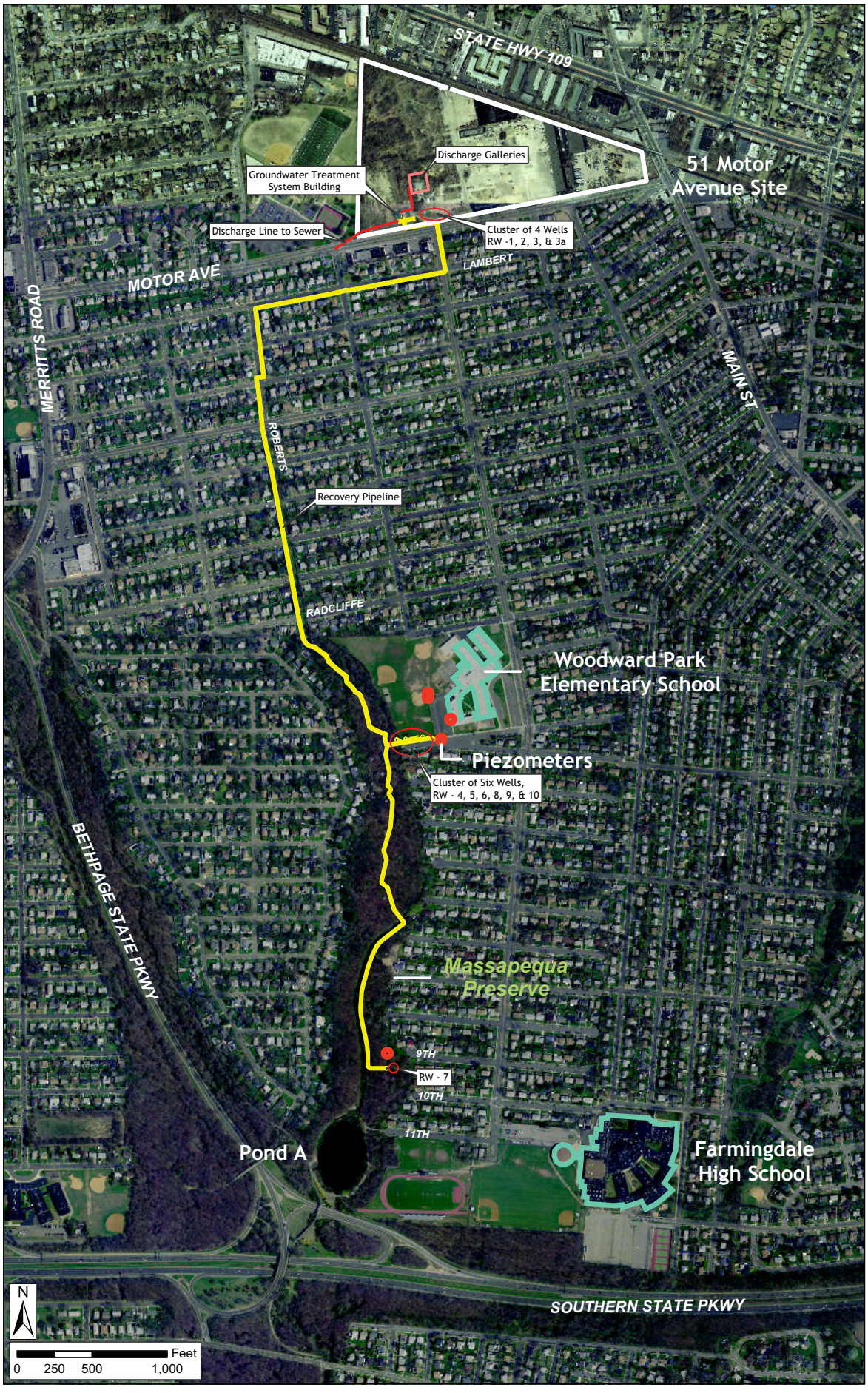


Figure 6 - Groundwater Remediation System's On-Site and Off-Site Construction Activities Layout

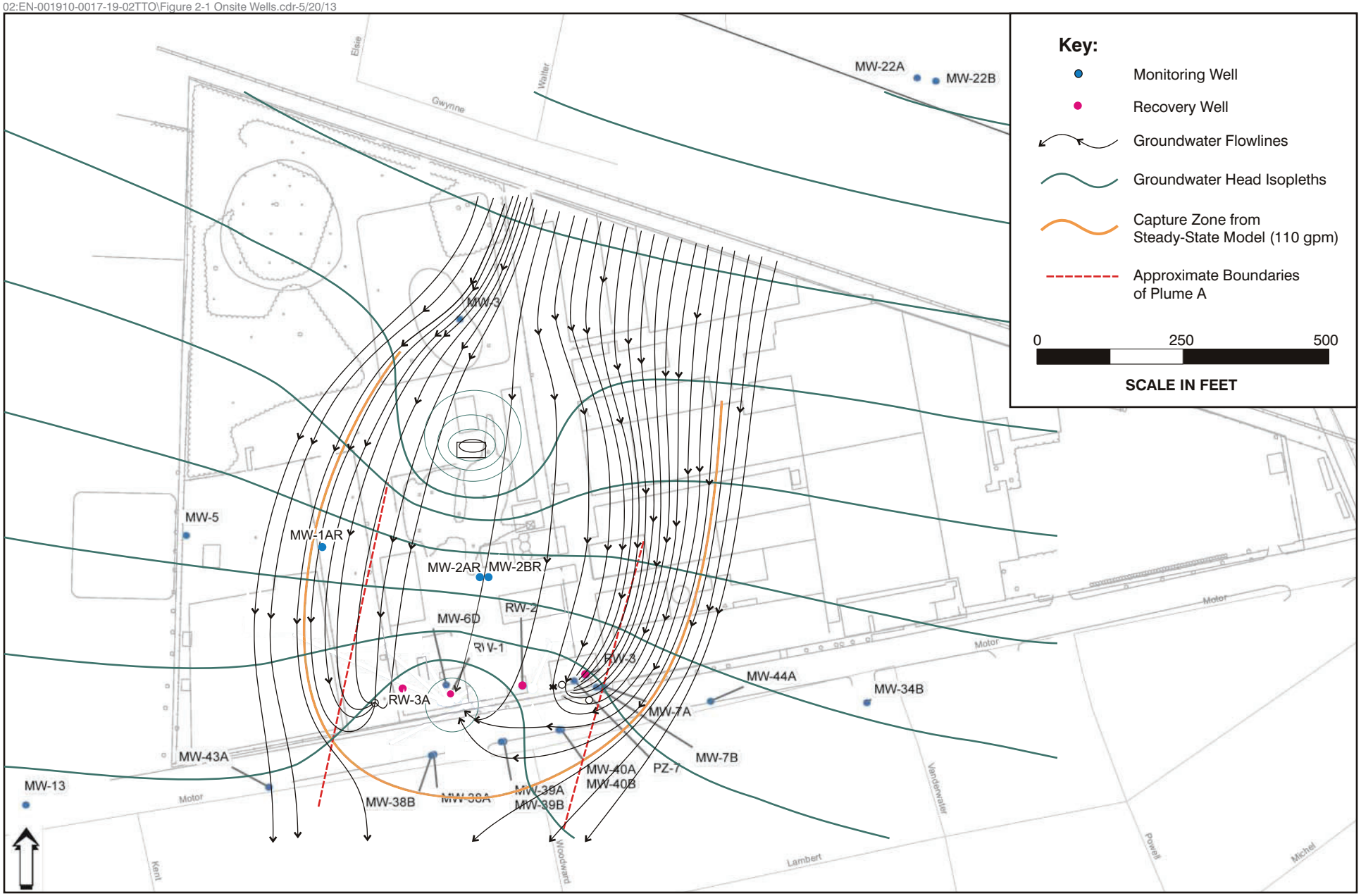


Figure 7 - Modeled Horizontal Capture Zone for On-site Recovery Wells

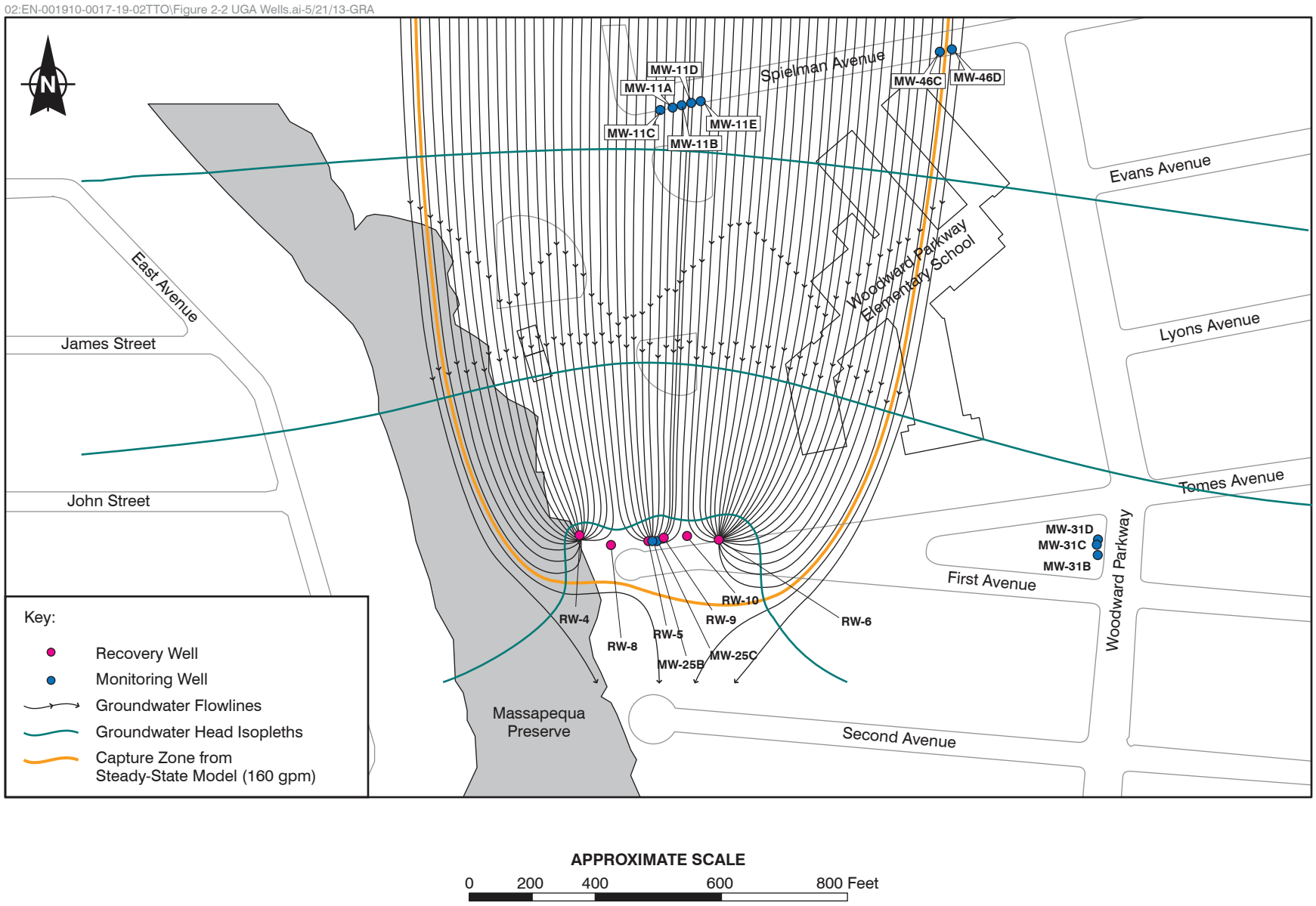
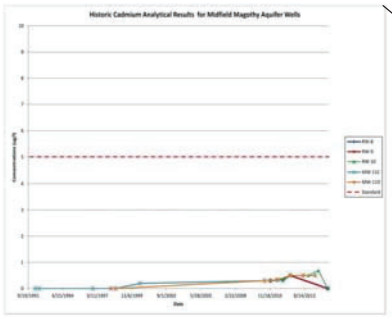
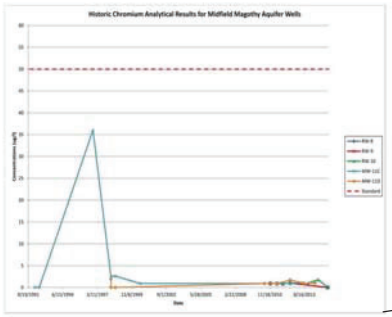


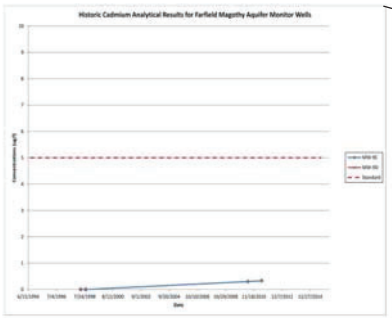
Figure 8 - Modeled Horizontal Capture Zone for Off-site UGA Recovery Wells, Liberty Industrial Finishing Site

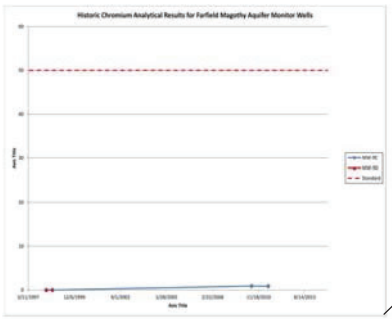
Figure 9
Magothy Aquifer Groundwater Elevation Contours with Historic Cadmium and Chromium Concentrations, October 2015

- Shallow Magothy Aquifer Monitor Well Location
- Middle Magothy Aquifer Monitor Well Location
- Deep Magothy Aquifer Monitor Well Location
- Magothy Aquifer Groundwater Elevation Contours
- Recovery Well Capture Zone
- Site Boundary









MW-6D 45.49
EPA-MW-14B NM
MW-30C 44.10
MW-30D
MW-27C 43.56
MW-29B
MW-29D
MW-37C
MW-37D
MW-43C 42.59
MW-26C 39.96
MW-46C 40.35
MW-46D
MW-28C 40.91
MW-28D
MW-45D
MW-11C 39.26
MW-11D
MW-11E
PZ-11A
PZ-11B
RW-8 33.99
RW-10
RW-9 31.00
MW-25C 37.31
MW-47C 38.89
MW-31C 38.01
MW-31D
MW-9C 36.87
MW-9D
MW-32C 35.05
MW-24C 35.46
MW-10C NM
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
MASSAPEQUA PRESERVE
FARMINGDALE HIGH SCHOOL
SOUTHERN STATE PKWY
MOTOR AVE
LAMBERT AVE
MICHEL AVE
LOCKWOOD AVE
FALLWOOD PKY
YORK MAVE
SULLIVAN AVE
PLITT AVE
WILLARD AVE
RADCLIFFE AVE
SPIELMAN
EVANS AVE
LYONS AVE
NORTH DR
JAMES ST
JOHN ST
HENRY ST
TOMES AVE
1ST AVE
2ND AVE
3RD AVE
4TH AVE
5TH AVE
6TH AVE
7TH AVE
8TH AVE
9TH AVE
10TH AVE
11TH AVE
MERRITT ROAD
ROBERTS ST
DAVIS ST
WOODWARD PARKWAY
JONES ST
CYPRESS ST
WOODWARD PKY
SUNSET AVE
WINDSOR DR
DOGWOOD DR
MEADOW LN
LEROY PL
SYLVAN PL
PARKDALE DR
0
500
1,000
2,000
Feet
N
S
E
W

Figure 10 - Historic Cadmium Analytical Results for On-site Recovery Wells

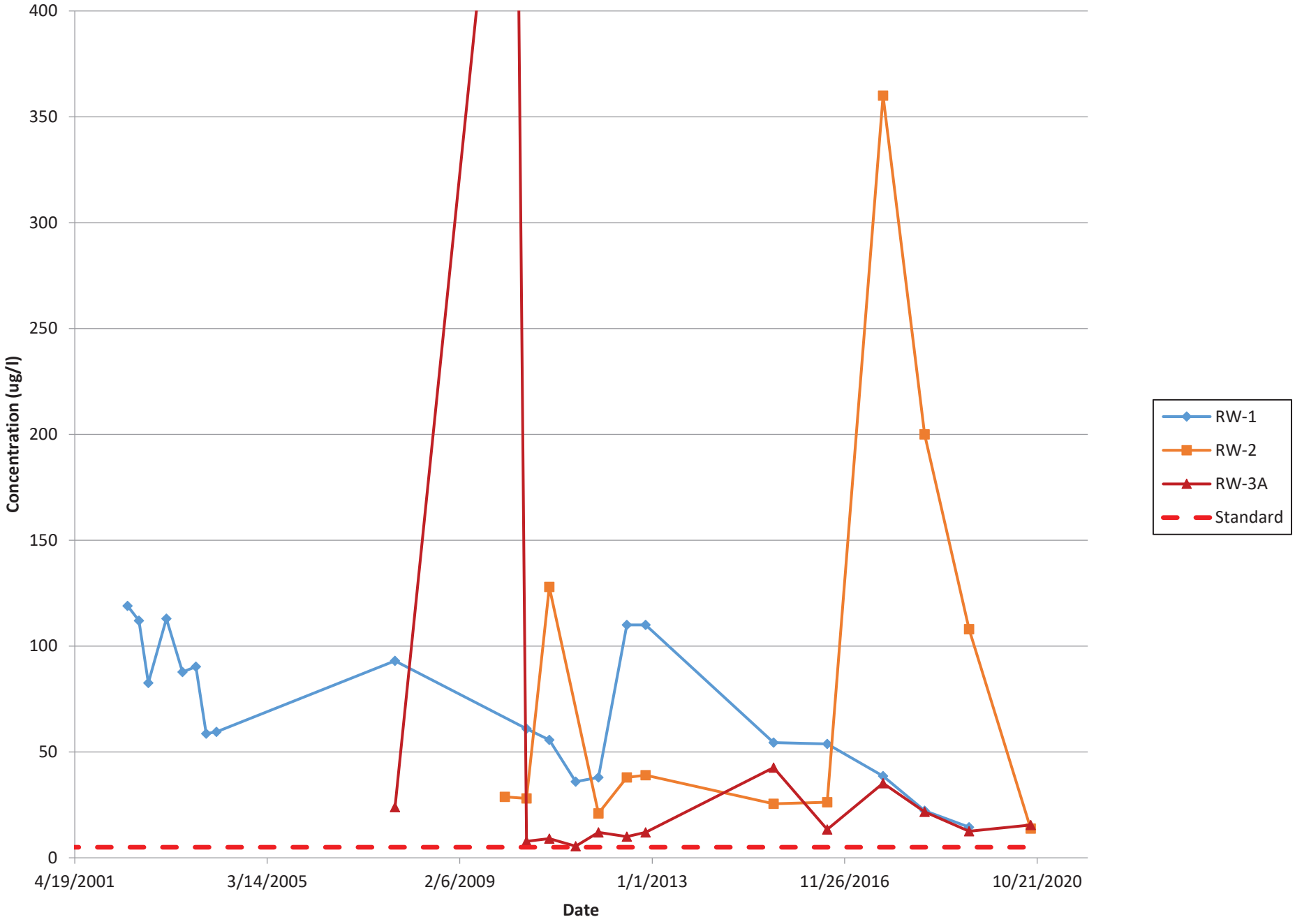


Figure 11 - Historic Cadmium Analytical Results for Farfield Wells

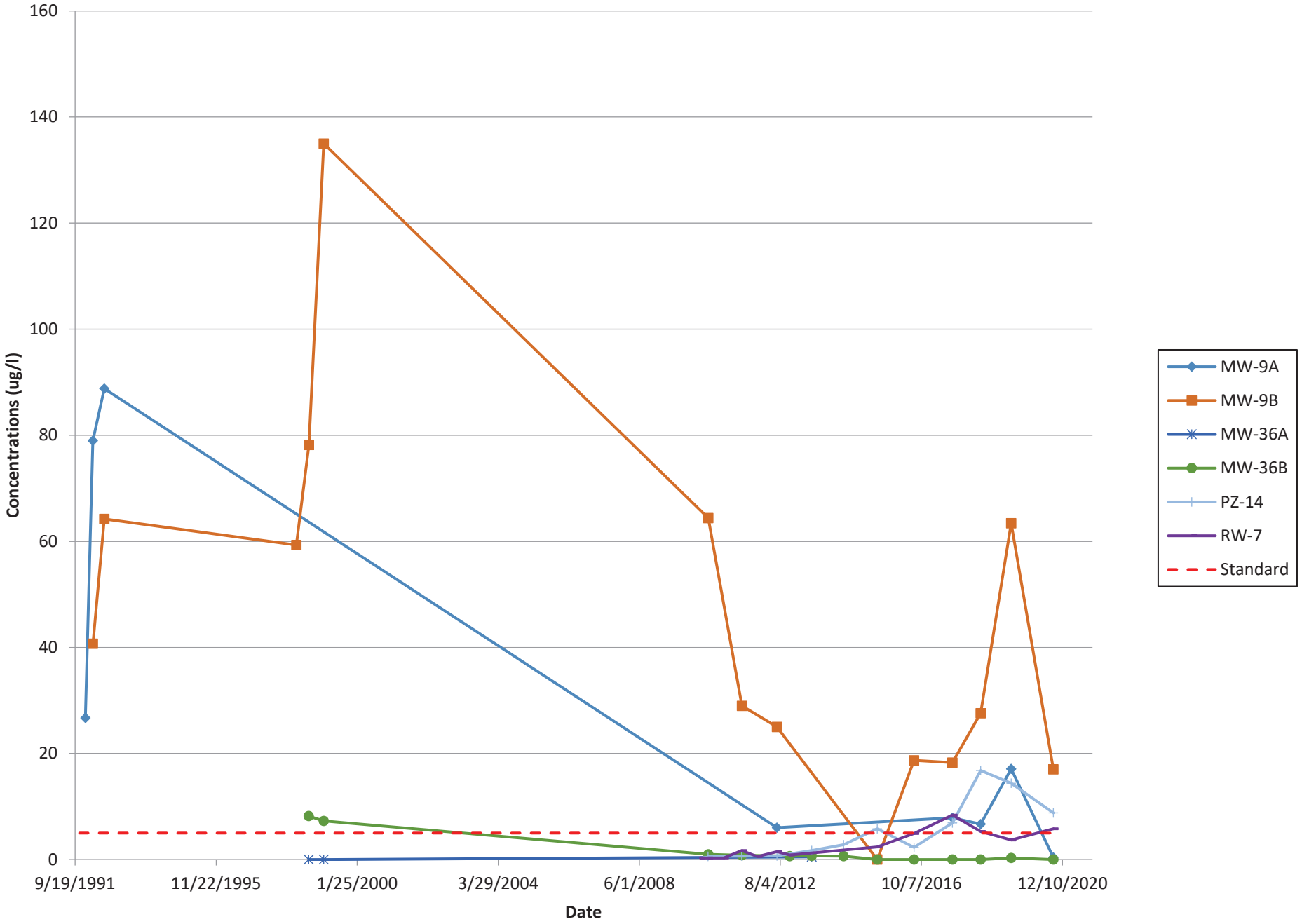


Figure 12 - Historic Chromium Analytical Results for Farfield Wells

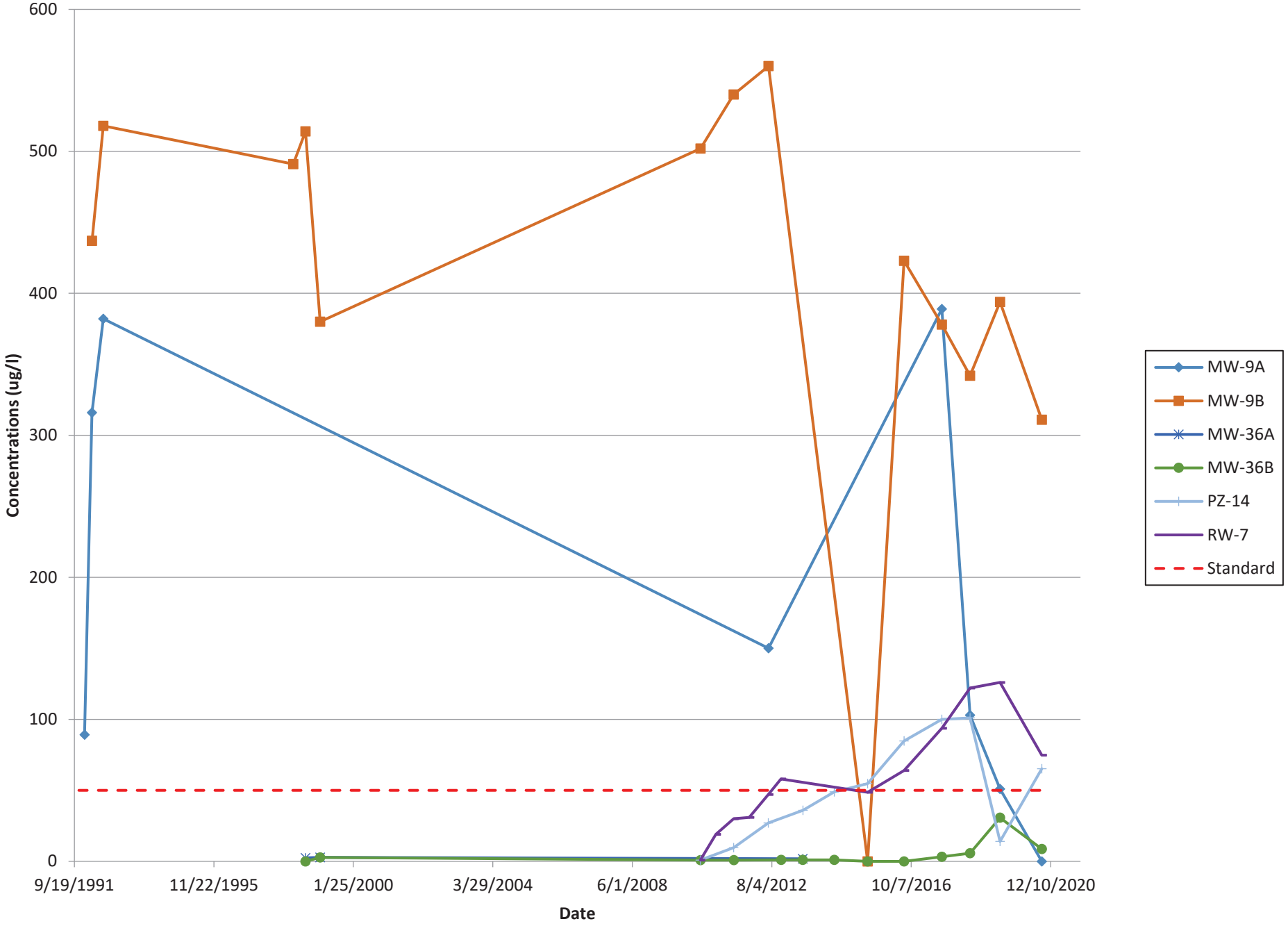


Figure 13 - Historic TCE Analytical Results for On-site Recovery Wells

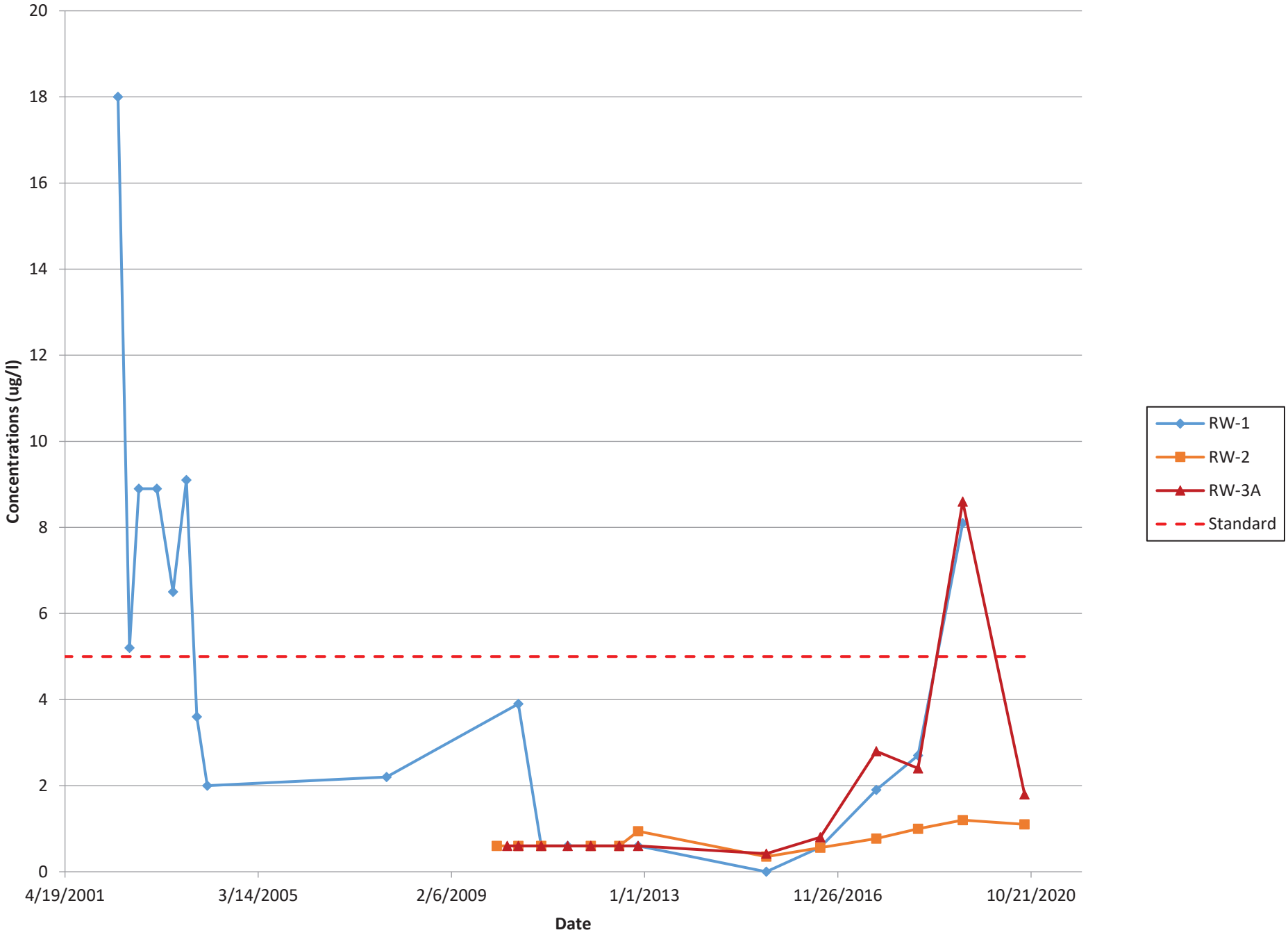


Figure 14 - Historic TCE Analytical Results for Motor Avenue Wells

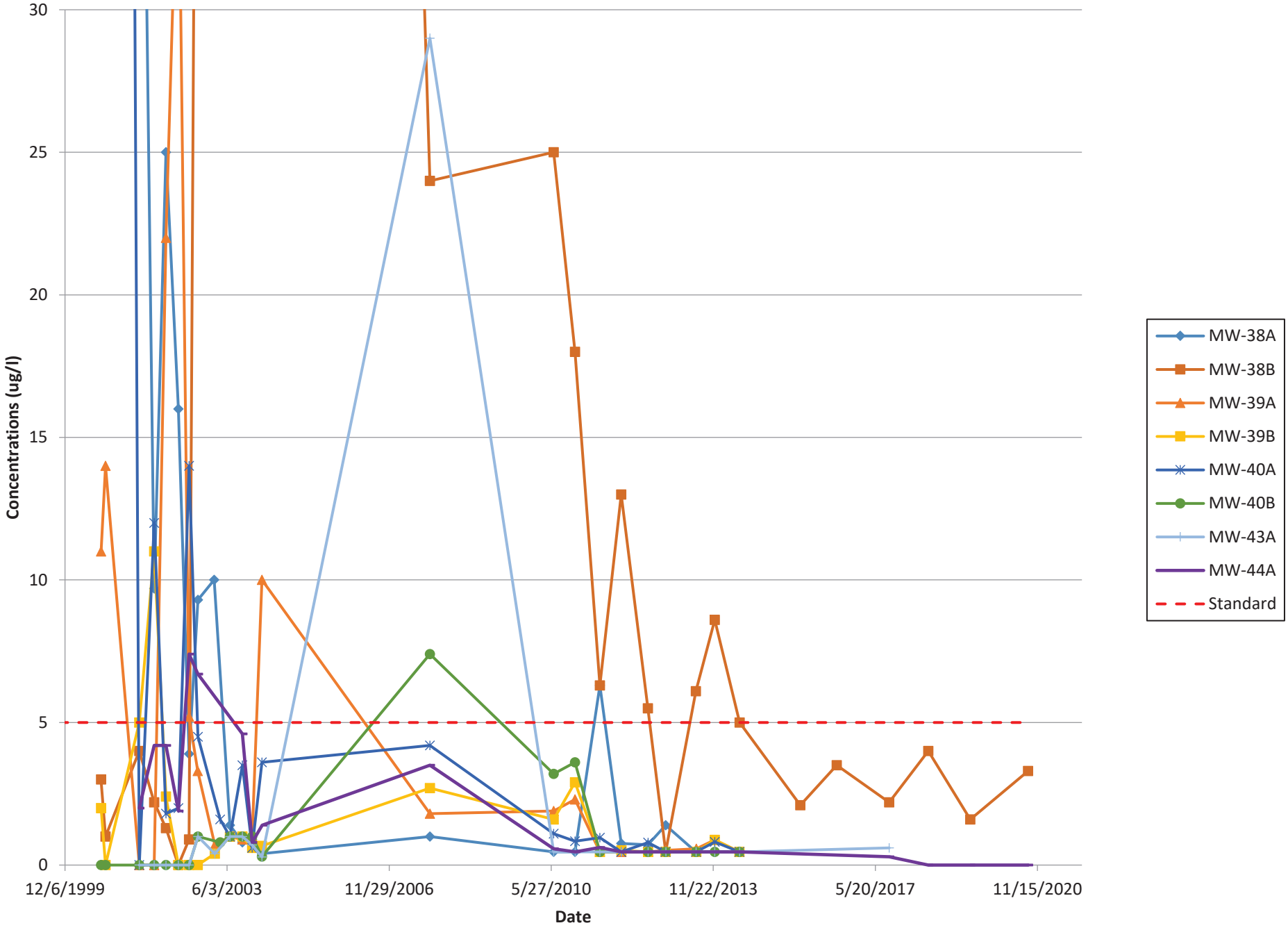


Figure 15 - Historic Cadmium Analytical Results for Motor Avenue Wells

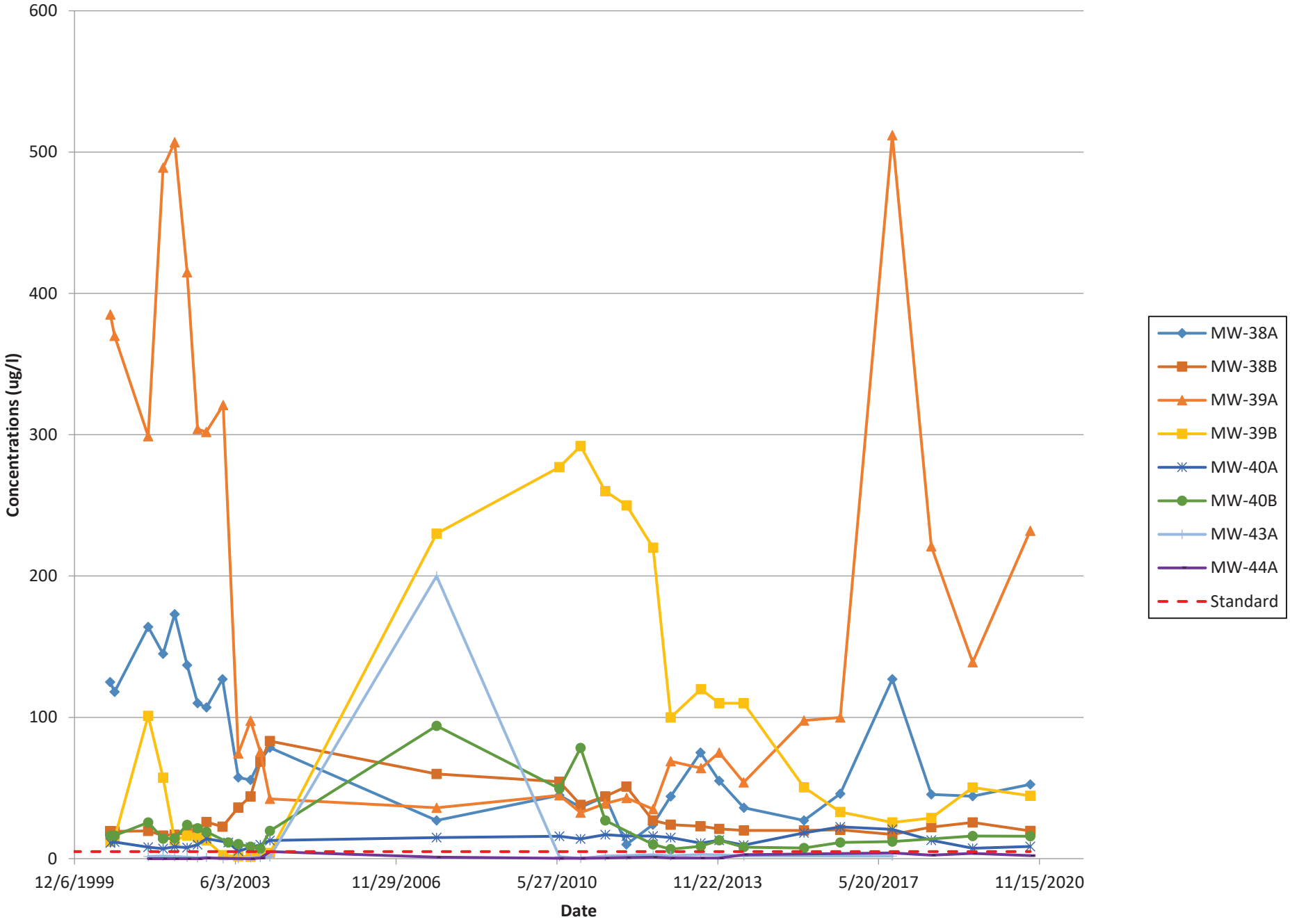


Figure 16 - Historic Chromium Analytical Results for Motor Avenue Wells

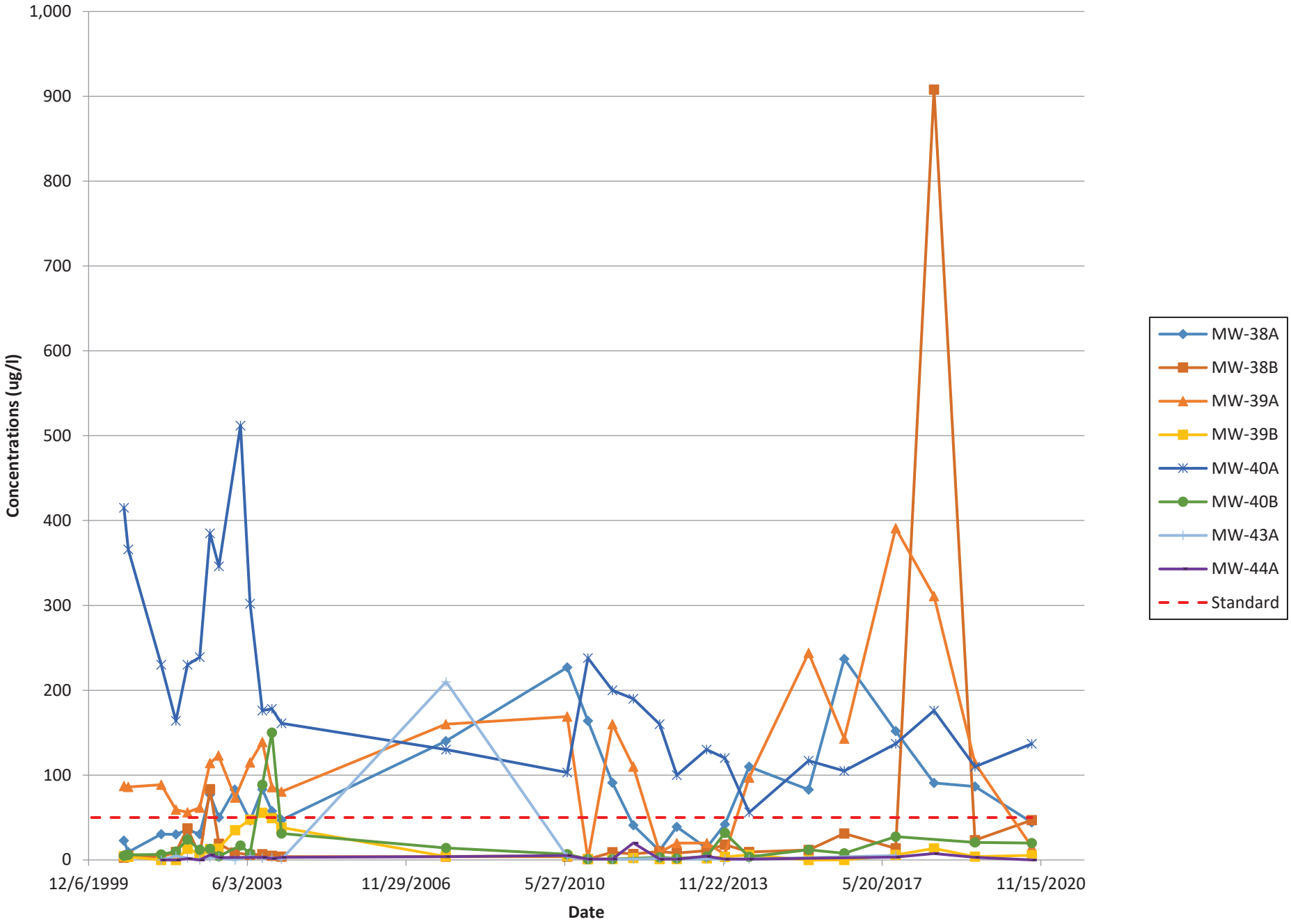


Figure 17 - Historic TCE Analytical Results for Midfield Magothy Aquifer Wells

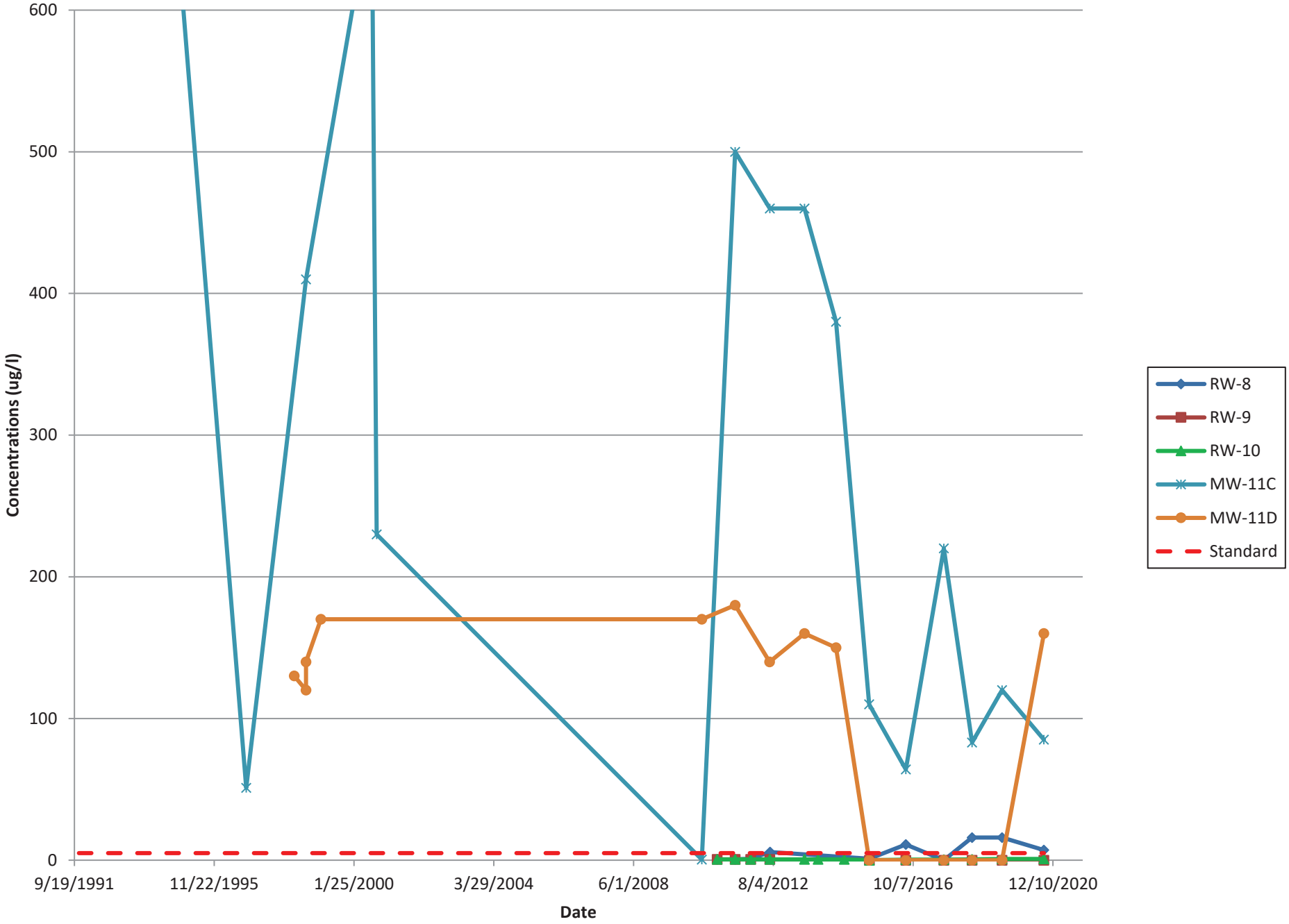


Figure 18 - Historic Cadmium Analytical Results for Midfield UGA Wells

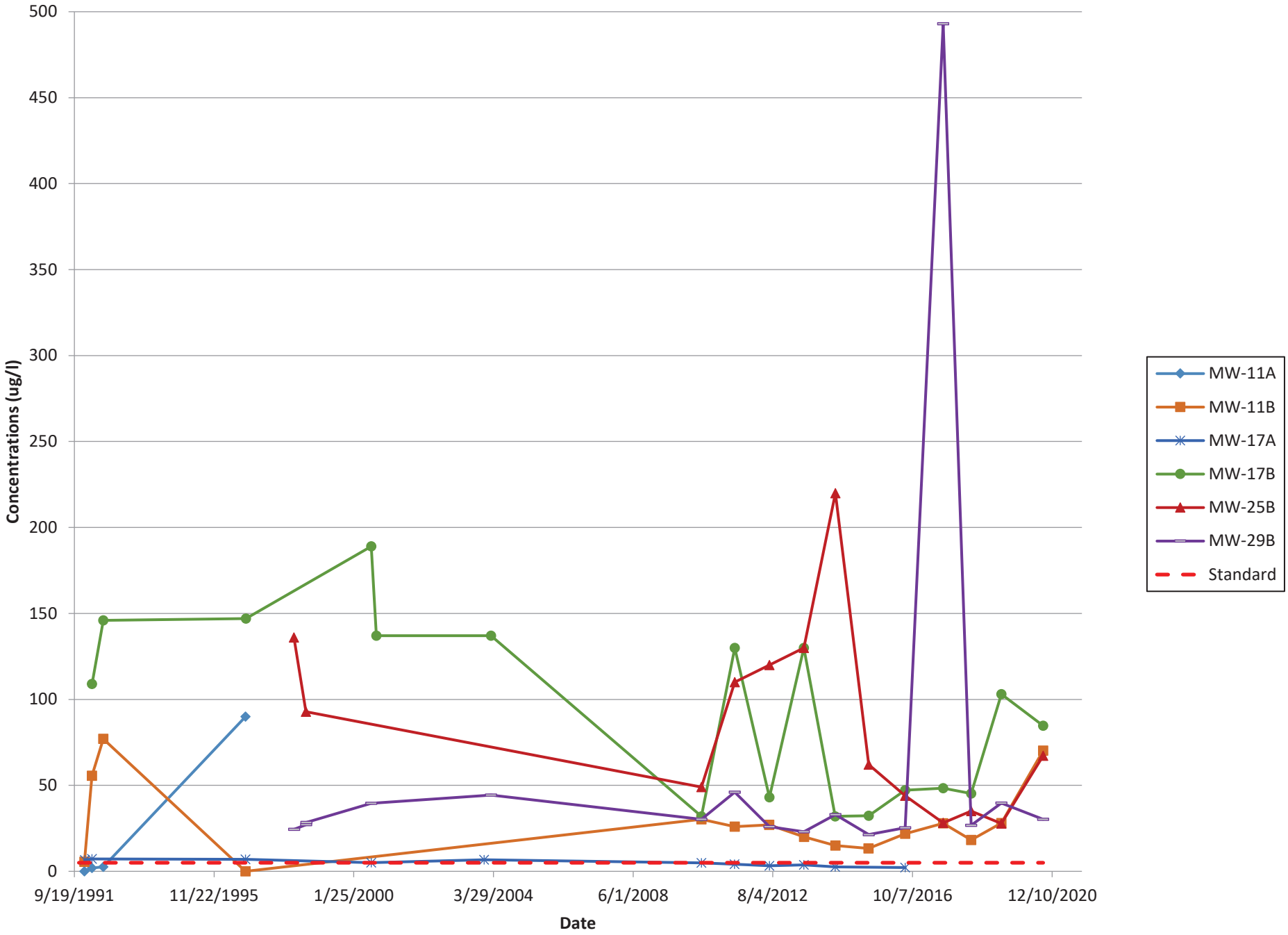


Figure 19 - Historic Chromium Analytical Results for Midfield UGA Wells

