FIFTH FIVE-YEAR REVIEW REPORT FOR THE MARATHON BATTERY COMPANY SUPERFUND SITE PUTNAM COUNTY, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AS/SVE	Air Sparge and Soil Vapor Extraction
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
ICs	Institutional Controls
MCL	Maximum Contaminant Level
Mg/kg	Milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OU	Operable Unit
PCE	Tetrachlorethylene
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RI/FS	Remedial Investigation/ Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
TBC	To be considered
TCE	Trichloroethane
UAO	Unilateral Administrative Order
µg/L	Micrograms per Liter
USACE	United States Army Corps of Engineers
UU/UE	Unrestricted Use/Unlimited exposure
VOC	Volatile Organic Compounds

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. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Marathon Battery Company Superfund Site (Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of three operable units (OUs). All three OUs will be addressed in this FYR. OU1 includes Constitution Marsh and East Foundry Cove Marsh, and is also known as "Area I." OU2 consists of East Foundry Cove, West foundry Cove, and the Hudson River in the vicinity of the Cold Spring pier, and is referred to as "Area III." OU3 contains the former Marathon Battery Company plant grounds and the surrounding residential neighborhood, and is known as "Area II." See Figure 1.

The Marathon Battery Company Superfund Site FYR was led by Pamela Tames, the EPA Remedial Project Manager. Participants included Michael Scorca, EPA hydrologist; Mindy Pensak, EPA biologist; Lora Smith, EPA risk assessor; Cecilia Echols, EPA community involvement coordinator; Wayne Mizerak, New York State Department of Environmental Conservation (NYSDEC) project manager; and Lisa Rosman, National Oceanic and Atmospheric Administration. The performing potentially responsible party (PRP) was notified of the initiation of the FYR. The FYR began on May 8, 2018.

Site Background

The Site is located in the Village of Cold Spring, Putnam County, New York. The Site includes the grounds of a 12-acre former nickel-cadmium battery manufacturing facility, the Hudson river in the vicinity of the Cold Spring pier and a series of river backwater areas known as East Foundry Cove, East Foundry Cove Marsh, Constitution Marsh and West Foundry Cove. Before the Site was remediated, a battery plant and an underground asphalt- and clay-lined vault containing spoils from dredging activities in East Foundry Cove were located on the facility's grounds. Twenty-nine houses, located on Constitution Drive, are in the vicinity of the Site.

The 12-acre former battery plant grounds parcel is zoned "light industrial" and is currently awaiting redevelopment. Since this portion of the Site is surrounded on three sides by residential properties and the access roads leading to it are very narrow, it is unlikely that its future use will mirror its historic industrial use. Potential redevelopment scenarios include single and/or multi-

family homes, senior housing and a municipal parking lot.

Scenic Hudson, a not-for-profit conservation organization, bought East Foundry Cove and East Foundry Cove Marsh, in addition to the adjacent 95-acre West Point Foundry Historic site. The area is open to the public for walking, hiking, bird watching, canoeing and kayaking. Hunting and camping are not allowed. The marsh and cove areas are managed by the Audubon Society, which also manages the adjacent Constitution Marsh.

Nickel-cadmium batteries were manufactured at the plant from 1952-1979. The plant's wastewater treatment system originally consisted of a lift station and piping for transfer of all process wastewater into the Cold Spring sewer system for discharge directly into the Hudson River at the Cold Spring pier. In addition, a bypass valve was installed so that when the lift station was shut down or overloaded, a direct gravity discharge could be made into the Kemble Avenue storm sewer for discharge into Foundry Cove. Samples of sediments, vegetation, various species of fish, muskrat, turtle eggs and green heron taken for studies conducted from 1976 to 1980 revealed high concentrations of cadmium.

Appendices A and B, attached, summarize the documents utilized to prepare this FYR and the site chronology, respectively.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Marathon Battery Company		
EPA ID: NYD010959757		
Region: 2	**State:** NY	**City/County:** Cold Spring/Putnam County
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? Yes	**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): Pamela Tames		
Author affiliation: EPA		
Review period: 6/11/2013 - 6/11/2018		
Date of site inspection: 5/22/2018		
Type of review: Statutory		
Review number: 5		

Triggering action date: 6/10/2013
Due date *(five years after triggering action date)*: 6/10/2018

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In August 1983, EPA and the State of New York signed a Cooperative Agreement to undertake a remedial investigation and feasibility study (RI/FS) at the Site. An RI report describing the nature and extent of the contamination at and emanating from the Site was completed in July 1985. The RI and risk assessment focused on contaminated sediments in the surrounding marshes, coves and the Hudson River. The results of the RI sediment sampling program indicated widespread heavy metal contamination of the sediments in Foundry Cove. The highest level of contamination occurred in East Foundry Cove Marsh in close proximity to the Kemble Avenue outfall. This area, characterized by a layer of greenish-white sediment spanning an approximately 50 by 100 foot area, showed concentrations as high as 171,000, 156,000, and 6,700 milligrams/kilogram (mg/kg) for cadmium, nickel, and cobalt, respectively. Cadmium levels as high as 2,200 mg/kg were found in the Hudson River in the vicinity of the Cold Spring pier.

Human health risks were driven by the high cadmium concentrations in East Foundry Cove Marsh; unacceptable risks were associated with ingestion of surface water and sediment during recreational activities. In addition, human health risks were present from the ingestion of fish and blue crabs in the vicinity of the Site. The ecological risk assessment found that cadmium contamination was evident in all trophic levels and was being bioaccumulated through the food chain.

An RI/FS for the plant area, existing buildings, adjacent residential homes and underlying groundwater was completed in 1988. Samples from the former battery facility indicated contamination as high as 120,000 mg/kg cadmium and 130,000 mg/kg nickel in the rafters, and up to 600 mg/kg cadmium on the surrounding grounds. Cadmium concentrations up to 67 mg/kg were found in soils in the adjacent residential yards. The risk assessment concluded that an unacceptable risk was associated with the ingestion of cadmium contaminated soils and building dust. The Agency for Toxic Substances and Disease Registry (ATSDR) conducted an evaluation of the health risks associated with the ingestion of garden vegetables grown in cadmium contaminated soils. It was determined that the cadmium levels in the soil posed an unacceptable risk for future residential use.

Volatile organic compounds (VOCs) and inorganics were detected in the groundwater underlying the plant grounds. Although the groundwater is not used as a potable water source, the Village of Cold Spring had expressed an interest in using this aquifer to supplement its fire hydrant water supply, which is connected to the municipal water supply. Therefore, the potential exists, if the aquifer is to be used as a water source, that residents may be exposed to the VOCs and inorganic contaminants present in the groundwater.

Response Actions

In 1972, the U.S. Department of Justice signed a Consent Agreement requiring the owners/operators to remove as much cadmium from the outfall area and channel leading into East Foundry Cove as was economically, technically and ecologically feasible. Dredging was performed between November 1972 and July 1973. The dredge spoils were entombed in the above-described vault.

The dredging that was performed by the owners/operators was not totally successful. Post-dredging monitoring continued to detect elevated cadmium concentrations in the cove's sediments, flora, and fauna. Tidal action slowly flushed some of the remaining cadmium deposits from the cove into the Hudson River and into Constitution Marsh, a National Audubon Society sanctuary. Based upon these findings, in 1981, the Site was included on the National Priorities List (NPL).

Remedy Selection

On September 30, 1986, a Record of Decision (ROD) was signed for Area I (OU1). The ROD established the following remedial action objectives (RAOs):

- Prevention of all biota from contacting East Foundry Cove Marsh and Constitutional Marsh contaminated sediments that would threaten them.
- Prevention of resuspension and redistribution of the contaminated sediments that would threaten the area flora and fauna.
- Minimization of the disturbance to Constitution Marsh, since this wetland is a delicate ecological habitat.

The selected remedy included:

- dredging of the cadmium-contaminated sediments within East Foundry Cove Marsh exceeding 100 mg/kg;[1]
- placement of a clay cap and soil cover on the excavated marsh areas;
- restoration of the marsh;
- chemical fixation and off-Site disposal of the excavated sediments; and
- long-term monitoring of Constitution Marsh.[2]

Supplemental RI activities for the former battery facility (Area II and OU3) were completed in April 1988. A ROD for OU3 was signed on September 30, 1988 which established the following

[1] In conjunction with the clay cap and soil cover, the 100 mg/kg action level, which was based upon an analysis of available information and discussions with state and federal fish and wildlife experts, was found to be protective of human health and the environment.

[2] Although cadmium-contaminated sediment hot spots were identified in Constitution Marsh, remediation of these sediments would have had a significant adverse impact on the marsh's sensitive ecosystem. In addition, the cadmium-contaminated sediments would eventually be covered with clean sediments following the remediation of the cadmium-contaminated sediments in East Foundry Cove Marsh. Therefore, long-term monitoring was selected for Constitution Marsh.

RAOs:

- Reduce cadmium in soils and building dust to protect human health and the environment.
- Reduce VOCs in the groundwater to protect human health and the environment.

. The selected remedy included:

- Decontamination of the inside surfaces and contents of the former battery facility to remove the heavy metal- contaminated dust;
- Excavation of the cadmium- contaminated soil to a level of 20 mg/kg[3] on the battery plant grounds and the residential yards impacted by the Site;
- Excavation of the on-Site dredge spoils vault;
- Fixation of the excavated soil, dust and vault sediments;
- Off-Site disposal of the cadmium-contaminated soils, sediments, and dust at a facility to be arranged for by NYSDEC;
- Excavation of the VOC-contaminated soil hotspots followed by enhanced volatilization and replacement of the clean residuals on-Site;
- Backfilling of the excavated areas with clean fill;
- Institutional controls to restrict development of the aquifer for potable or municipal use, until State or Federal applicable or relevant and appropriate requirements are reached;
- Long-term monitoring of the groundwater underlying the Site; and
- Evaluation and performance of minor repairs, if needed, to the inoperable sprinkler and heating systems inside the former battery facility.

An August 1993 Explanation of Significant Differences (ESD) modified three of the components of the remedy for OU3 (Area II). First, the majority of the residential yard soils were not fixated prior to off-Site disposal, because the results of tests performed on each roll-off of excavated yard soils showed that the majority of yard soils passed Toxicity Characteristics Leaching Procedure (TCLP) testing without treatment. Second, the plant grounds' soils would not undergo enhanced volatilization as called for in the ROD, since the results of the soil gas testing showed that the levels of volatile organics present in the VOC-contaminated soils are now below action levels. Lastly, the sprinkler and heating systems would not be repaired since the removal of the two million decontaminated books previously stored within the facility eliminated the threat of fire.

A second ESD in June 1994 documented the incorporation of the demolition of the facility into the remedy for OU3 (Area II). Following the decontamination of the building it deteriorated and a portion of the roof experienced structural failure. Due to the threat of potential exposure of the public to contaminated dust from the building's foundation and the VOCs present in the soil underlying the foundation, the building would be demolished and the contaminated soil remediated.

[3] The 20 mg/kg action level was based upon a risk assessment performed by the Agency for Toxic Substances and Disease Registry. The risk assessment assumed that the risk pathway for humans was via ingestion of vegetables grown in cadmium contaminated soils.

The third ESD dated May 1995 documented a modification to the remedy in which cadmium-contaminated soils remaining within a 20 by 60 foot area at twenty-four feet below the ground surface would not be removed. Two feet of limestone would be added to stabilize it and an institutional control (IC) added to the deed to prevent excavations deeper than 15 feet in that area.

An RI/FS report for the East Foundry Cove, West Foundry Cove, and Hudson River in the vicinity of the Cold Spring pier portion of the Site (Area III and OU2) was completed in June 1989. The Area III ROD (OU2) was signed on September 26, 1989. The ROD established the following RAOs:

- Reduce cadmium in sediments to protect aquatic organisms and protect human health;
- Reduce the transport of suspended sediments from East to West Foundry Coves and the pier area.

The selected remedy called for:

- Dredging the contaminated sediments from East Foundry Cove to a depth of one foot, chemical fixation and off-Site disposal of those sediments, and restoration of the original contours, as necessary;[4]
- Continued monitoring for the West Foundry Cove;[5] and
- Sampling and analysis adjacent to and under Cold Spring pier with dredging of any contaminated sediments determined to be a threat to the environment, followed by chemical fixation, off-Site disposal, and restoration of the original contours, as necessary.

Status of Implementation

In June 1987, funds were provided to the U.S. Army Corps of Engineers (USACE) for the design of the selected remedy for Area I. Under a USACE contract, Malcolm Pirnie, Inc. (MPI) commenced the design of a containment dike around East Foundry Cove Marsh, a haul road, a railroad spur (the treated sediments and soils were to be transported off-Site via a nearby rail line), a marsh excavation and restoration plan, and the treatment process.

In September 1989, MPI began the Area III design. In September 1991, the portion of the Area II design associated with the excavation of the dredge spoils vault and the cadmium-contaminated soils on the former battery plant grounds and the enhanced volatilization of the VOC-contaminated

[4] Since most of the contamination was located in the top four inches of the sediment, removal of one foot of sediment would achieve the 95% removal rate and the cleanup goal of about 10 mg/kg which was sought in the 1989 ROD.

[5] Although West Foundry Cove sediments are contaminated with cadmium, since they would eventually be covered with clean sediments following the remediation of the cadmium-contaminated sediments in the other portions of the Site, long-term monitoring was selected for West Foundry Cove.

soils[6] commenced. A consolidated design for Areas I, II (the dredge spoils vault and the plant grounds), and III was completed in May 1992.

Since the proposed treatment area, the proposed location for the haul road, East Foundry Cove Marsh, and East Foundry Cove were located within the West Point Foundry National Historic District, a cultural resources survey was conducted. The cultural resources survey indicated that five archaeologically-sensitive areas would be impacted as a result of construction activities. Accordingly, a Data Recovery Plan was developed to recover, remove, stabilize, conserve, and curate artifacts from these areas and thereby document these archeological resources. Through these efforts, over 145,000 prehistoric and Civil War era artifacts were analyzed, documented, and recovered. The artifacts were temporarily transferred to the Orange County Historical Society for display and research. Some of the artifacts are now located at the Putnam County Historical Society and the remainder are in storage in the Village of Cold Spring.

On March 26, 1989, EPA issued a Unilateral Administrative Order (UAO) to the PRPs, Marathon Battery Company, Gould Inc., and Merchandise Dynamics (the property owner), requiring them to decontaminate the interior of the 114,000-square foot former battery plant (which at the time was an abandoned book repository) and its contents, recycle the decontaminated books and properly dispose of contaminated materials. Following a pilot-scale study conducted by ENSR Consulting and Engineering, Marathon Battery Company and Gould Inc.'s contractor,[7] to evaluate decontamination techniques, the facility, as well as 4,170 pallets containing approximately 2.5 million books, was decontaminated. Based on the results of the sampling of 76 rolloffs which were filled with debris from the building and HEPA vacuum filters from the decontamination work, 12 were determined to contain hazardous debris and were disposed of at Chemical Waste Management's hazardous landfill in Model City, New York. The remaining rolloffs were sent to Waste Management's Modern Landfill in York, Pennsylvania. While the book and building decontamination work was completed in December 1991, due to the limited production rate of available book recycling companies, the recycling of the books continued until March 1993.

Following the completion of field investigations to more fully delineate the areas of the adjacent properties that required remediation, in May 1992, this portion of the Area II remediation effort commenced. When the remedial action was completed in March 1993, approximately 1,600 cubic yards of contaminated soil had been excavated, stabilized, and removed from the Site.

After the completion of the comprehensive remedial design for Areas I, II (the dredge spoils vault and the plant grounds), and III, bids for the implementation of the remedial action were solicited by the USACE. EPA and the PRPs, however, negotiated a settlement the week prior to the bid opening and the bidding process was halted. A Consent Decree, in which Gould Inc. agreed to perform the remedial action, and the remaining PRPs, Marathon Battery Company and the U.S. Army, agreed to a cash settlement, was entered with the Southern District Court on April 1, 1993.

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[6] A search for VOC-contaminated soils on the plant grounds during the design failed to find any hot spots and the enhanced volatilization aspect of the remedial design was eliminated. This was documented in an August 1993 Explanation of Significant Differences (ESD). The subsequent demolition of the former battery plant revealed elevated levels of VOCs in some sections of the sealed process trenches and an ejector pit, which were removed and disposed of off-Site.

[7] The bankrupt Merchandise Dynamics did not comply with the UAO.

Gould Inc., as the settling work defendant, took over the solicitation of the contract and chose Sevenson Environmental Services as its contractor. The USACE performed oversight of the work.

Full-scale dredging of East Foundry Cove Marsh and East Foundry Cove and the excavation of the plant grounds began in September 1993. The treated sediments and soils were stockpiled on the treatment area for curing and post-treatment testing prior to off-Site disposal. All treated materials were subjected to the TCLP.

Dredging in the Hudson River in the vicinity of the Cold Spring pier was completed in July 1994 and dredging of East Foundry Cove continued until February 1994. All dredged areas underwent post-remediation sampling. The dredged areas in the Hudson River and East Foundry Cove were surveyed to determine whether the proper dredging depth was achieved. In East Foundry Cove Marsh, post-dredging cadmium levels in the sediments did not exceed the 100 mg/kg action level, averaging 11.75 mg/kg. In the Hudson River and East Foundry Cove, an average of 10 mg/kg cadmium remained, which was consistent with the ROD requirement that at least one foot of sediment and 95% of the contamination be removed.

The collection of ice and snow on the former battery facility's roof during the winter of 1994 resulted in the collapse of a 10,000 square foot section of the roof, thereby exposing a portion of the concrete foundation to the outside elements. This particular portion of the foundation contained numerous trenches that were used for waste disposal during the manufacture of nickel-cadmium batteries. Sample analyses revealed that elevated levels of cadmium and nickel remained encased in the rubble-filled and cemented-over trenches. Due to the concern that continued exposure to the elements and freeze/thaw cycles may cause the concrete floor and/or trenches' cement caps to heave and crack, possibly resulting in a release of contaminated dust, the PRPs agreed to demolish the building and remove the foundation and process trenches. Demolition of the former battery facility began in September 1994 and was completed in January 1995.

Following the demolition of the former battery facility, it was discovered that a cadmium nitrate tank located on a pedestal immediately adjacent to the plant had leaked onto the underlying soil prior to the closing of the plant in 1979. In an attempt to remove this cadmium-contaminated soil, a 20 by 60-foot area was excavated to a depth of approximately 22 feet (approximately two feet above the groundwater table). While post-excavation sampling of this area showed that some cadmium contamination remained in the saturated soils at levels above the 20 mg/kg action level, and that cadmium was present in the groundwater, it was determined that excavating an additional four feet of contaminated soil to a depth of 26 feet (two feet below the water table), placing two feet of limestone at the bottom of the excavation (to raise pH levels and keep the cadmium insoluble), and backfilling the excavation with clean fill would be protective of public health and the environment.[8]

At the completion of the marsh remediation and restoration activities in April 1995, the marsh was planted with cattails, bull rush, arrow arrum and upland shrubs in specified areas. Growth of these plants was interrupted by significant ice scour and an invasion of geese, which destroyed approximately 40% of the newly-planted marsh areas. A geese control plan was devised and

[8] The noted modification to the remedy was documented in a May 1995 ESD.

denuded areas were replanted during molting season, when the geese would not be able to fly in. The plantings are being monitored on a regular basis by the warden of the adjacent National Audubon sanctuary, Constitution Marsh.

The plant grounds were regraded and reseeded in July 1995.

In all, 189,265 tons of treated soils and sediments were transported off-Site (via 1,979 railcars) to City Management Landfill in Michigan. Chemical Waste Management's hazardous waste landfill in Model City, New York received 906 tons of hazardous materials.

A remedial action report associated with the remediation of the adjacent properties was approved on September 28, 1993. A remedial action report associated with the East Foundry Cove, East Foundry Cove Marsh, Hudson River in the vicinity of the Cold Spring pier, former battery facility, and plant grounds portions of the Site was approved on September 18, 1995. A Superfund Site close-out report was approved on September 28, 1995. The Site was deleted from the NPL on October 18, 1996.

Institutional Control Summary

Table 1: Summary of Planned and/or Implemented Institutional Controls

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)
Groundwater	Yes	No	Area II (former factory grounds)	Bar the construction of on-Site groundwater wells without the approval of EPA and excavation deeper than 15 feet within the "pedestal area."	Deed Restriction dated November 14, 2003
Sediment	Yes	No	East Foundry Cove Marsh	Limit disturbances to the marsh and not to expose or puncture the protective clay cap covering it	Prospective Purchaser Agreement between EPA and Scenic Hudson dated October 10, 1996.

In addition, the New York Department of Health continues to issue a fish advisory against the consumption of fish and blue claw crabs from East Foundry Cove, West Foundry Cove and the Hudson River in the vicinity of the Cold Spring Pier (Area III). Although the main objective of this institutional control is to prevent human consumption of fish and blue claw crabs contaminated with PCBs, previous studies have shown that the fish and crabs were also contaminated with cadmium in this area.

Systems Operations/Operation & Maintenance

Annual Site inspections are conducted to examine the restored marsh for invasive vegetative species, determine the percentage of vegetative cover on the cap in East Foundry Cove Marsh, identify irregular settlement, bubbles, erosion or other disturbances which might affect the integrity of the cap and vegetative cover, check the integrity of the fencing surrounding the plant grounds, and check the integrity of the monitoring wells. Maintenance is performed, as necessary.

In accordance with the Site monitoring plan, monitoring originally included the collection of groundwater, surface water, sediment and wildlife tissue samples and the performance of marsh vegetation inventories annually. Laboratory analyses included metals for sediments, VOCs and metals for groundwater, metals for surface water, and metals for wildlife analyses. Since during the second FYR period, there had not been a change in the wetland surface water and soil sample results and since the levels of contaminants present in the surface water and East Foundry Cove Marsh soil concentrations do not pose a significant threat to the environment, sampling and analysis of surface water, wildlife tissue samples and East Foundry Cove Marsh soils are no longer performed.

Thirteen monitoring wells on the plant grounds were used for the long-term monitoring of the groundwater for VOCs and cadmium until 2003, when 11 of the wells were decommissioned due to the absence of contamination. In 2005, an additional groundwater monitoring well was installed to better delineate the groundwater plume. Five temporary wells were also installed to assist in the groundwater plume delineation. In May 2013, three additional air sparge (AS) wells and three additional vapor monitoring point wells were installed as part of the AS/ Soil Vapor Extraction (SVE) Pilot.

A vegetation survey performed in September 2013 indicated that the transect locations located within large planted areas had become more established and had a denser vegetative cover. The stations in relatively open areas or areas adjacent to the marsh channels continued to show little or no change in vegetative cover. A review of photographs from several annual Site visits showed that the bare areas persisted and more of the marsh was underwater at low tide. Given the sensitivity of marsh plants to changes in water elevation, it was requested that the PRPs investigate settlement within the marsh. In 2016, an analysis of the rate of settlement was performed in addition to a physical inspection of the geosynthetic clay liner (GCL) seams near the area of greatest settlement. Test trenches indicated that the seams at all exposed locations were still intact and in good condition.

During the 2015 annual Site visit, a “bubble” caused by an exposed portion of the GCL adjacent to the channel in the southern half of the marsh with localized spring activity in the underlying marsh soils was found to be increasing in size. Samples of sediment were collected beneath the GCL and it was determined that the GCL could safely be removed from this area to allow the underlying water to escape. A 30- by 10-foot section of the GCL was removed in spring 2016.

Another “bubble” also caused by localized spring activity in the underlying marsh soils was found during the 2018 Site visit. This bubble will be removed in fall 2018 to allow the underlying water to escape.

Potential Site impacts from climate change have been assessed, and the performance of the remedy may be impacted by the following expected effects of climate change in the region and near the Site: sea level rise. Marsh plants are sensitive to the amount of time they spend submerged during the tidal cycle. Since the water in the marsh will continue to deepen as the sea level slowly rises, a review of the marsh should be performed to identify ways to evaluate how best to keep the marsh stable and healthy.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR (see Table 2, below), as well as the recommendations from the last FYR and the current status of those recommendations (see Table 3, below).

Table 2: Protectiveness Determinations/Statements from the 2013 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The implemented actions at OU1 protect human health and the environment.
2	Protective	The implemented actions at OU2 protect human health and the environment.
3	Short-term Protective	The implemented actions at OU3 protect human health and the environment in the short term. In order to be protective in the long term, methods of addressing the groundwater contamination should continue to be assessed and implemented as appropriate.
Sitewide	Short-term Protective	The implemented actions at the Site protect human health and the environment in the short term. In order to be protective in the long term, methods of addressing the groundwater contamination should continue to be assessed and implemented as appropriate.

Table 3: Status of Recommendations from the 2013 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
3	The levels of VOCs in the groundwater plume continue to be stable. Attempts to enhance the natural degradation process have not been successful. It is suspected that source material remains in the vicinity of the shed area.	Methods of addressing the residual source and groundwater contamination should continue to be assessed and implemented.	Addressed in Next FYR	The AS/SVE system ran from June 2013 to May 2014 and removed 30 pounds of VOCs. Monitoring of the plume indicated continued rebound in a portion of the plume. Continuous sparging of the groundwater with ozone	6/28/2019

				took place from June 2017 to June 2018. A one-year groundwater monitoring study began in June 2018. The data will then be evaluated to determine its success.	

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement and Site Interviews

On October 2, 2017, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 38 Superfund sites in New York and New Jersey, including the Site. The announcement can be found at the following web address: https://wcms.epa.gov/sites/production/files/2017-10/documents/five_year_reviews_fy2018_final.pdf. The results of the Site's FYR and the report will be made available on EPA's Site webpage at: https://www.epa.gov/superfund/marathon-battery and at the Site information repositories located at EPA, 290 Broadway, 18th floor, New York, NY and the Cold Spring Village Hall, 87 Main Street, Cold Spring, NY.

A joint letter dated August 9, 2018 was received from Scenic Hudson Land Trust and Constitution Marsh Audubon Center and Sanctuary which expressed disappointment in the marsh restoration effort and concern about "erosion, increasing areas of open water, exposure of the fabric barrier, colonization by invasive exotic species, and overtopping of berm." The letter also acknowledged attempts to improve the restoration of the marsh over the years, but urged the Agency to perform additional studies to examine the issues they raised, develop new restoration goals, and take actions needed to achieve these goals. As is noted in the "Other Findings" section, below, in fall 2018, an EPA contractor will perform an independent review of the marsh to identify ways to improve vegetation coverage and reduce settlement and erosion.

Data Review

During the 2012-2018 operation of the natural attenuation enhancement pilot, groundwater sampling has included wells from the long-term monitoring network and system-performance wells. The most recent comprehensive groundwater sampling round was conducted in December 2017 and included 19 wells. Two sampling rounds of five selected wells were conducted in 2018. The results and concentration trends from several selected wells are discussed below.

Concentrations of trichloroethylene (TCE) at on-property long-term monitoring wells MB-3 and MW-7S(A)[9] generally have exhibited declining trends since the 1990's, but remain above the New

[9] The original well MW-7S was replaced by MW-7S(A) in 1987.

York State standard of 5 micrograms per liter (µg/L). Both monitoring wells are located nearby, but outside the natural attenuation enhancement treatment area. Monitoring well MW-7S(A) is about 50 feet to the west of the treatment area and is screened from 29 to 39 feet below ground surface (bgs). The TCE concentration was 100 µg/L in 1998 and decreased to 58 in 2011. During the natural attenuation enhancement phases, TCE concentrations have been somewhat variable and ranged from 44 to 66 µg/L. Monitoring well MB-3 is about 40 feet to the east of the treatment area and is screened 30 to 40 feet bgs. The TCE concentration decreased to 23 µg/L in December 2017.

Monitoring wells IW-6, IW-8, and ASMP-1 are all located within the natural attenuation enhancement treatment area. Monitoring well IW-6 (screened 25 to 35 feet bgs) showed a sharp reduction in TCE from 110 to 42 µg/L during the first part of the ozone treatment phase, but rebounded recently to 73 µg/L in December 2018.

Monitoring well IW-8 (screened 25 to 35 feet bgs) had a TCE concentration of 180 µg/L in 2009. Its TCE concentration decreased significantly during operation of the AS/SVE and ozone treatment systems and was 10 µg/L in 2018.

Monitoring well ASMP-1 (screened 22 to 32 feet bgs) had a TCE concentration of 160 µg/L during the early phase of the enhancement systems. Concentrations dropped significantly to 7 µg/L during Phase IV of the AS/SVE pilot, but TCE concentrations rebounded to 67 µg/L in 2018.

One off-property monitoring well (OSMW-3 screened 48 to 58 feet bgs) that was installed along Constitution Drive in 2009 continues to have levels of TCE above the New York State standard, ranging between 7.7 to 17 µg/L (see Figure 2). The other two off-property wells (OSMW-1 screened 47 to 57 feet bgs and OSMW-2 screened 49 to 59 feet bgs), which are downgradient from OSMW-3, have had VOC concentrations below 1 µg/L (less than EPA's 5 µg/L Maximum Contaminant Level (MCL)).

During this FYR period, concentrations of tetrachloroethylene (PCE) in groundwater were also reviewed for the monitoring wells in the network. Nine monitoring wells have PCE concentrations that have remained less than EPA's 5 µg/L MCL during their full period of record. The maximum PCE concentration observed in the monitoring well network was 34 µg/L at monitoring well IW-8 in 2009, but PCE has subsequently declined at that monitoring well to less than 5 µg/L since 2013. Five other monitoring wells within the VOC plume have remained above 5 µg/L during the last five years.

Overall, the VOC (TCE and PCE) concentration levels in the groundwater plume on the property generally have decreased over time, but remain above the MCL in several wells, as shown in Figures 3a-f. The maximum observed TCE concentrations in the groundwater samples during the six-year natural attenuation enhancement pilot have decreased from 160 µg/L in 2012 to 73 µg/L in 2018. The performing PRP continues to evaluate technologies to address residual TCE contamination present on-Site.

The sediment in East Foundry Cove is sampled at five locations every year. Due to the tidal nature of the Cove, the sample results show some variation but have been generally less than 10 mg/kg for the last five years.

In the Spring of 2013, just over four hundred quart-sized wetland plants of various species were planted throughout the marsh. The plant locations were determined based on water depths and the location of the same or similar species currently thriving in the marsh. Perimeter fencing was installed along with small metallic flags to deter geese predation. In September 2013, a vegetation survey was performed and the results compared to previous surveys performed in 2010 and 2012. The 2013 results indicated that the percentage of total cover at the transect locations increased by more than 10% from 2012. Subsequent site visits do not indicate that these plantings have thrived. A review of the marsh to identify ways to improve vegetation coverage and reduce settlement and erosion should be performed.

Site Inspection

The inspection of the Site was conducted on May 22, 2018. In attendance were Pamela Tames, Wayne Mizerak, Lisa Rosman, Eric Lind of the Audubon Society, and Paul Marano of Advanced GeoServices, representing the PRP. The purpose of the inspection was to assess the protectiveness of the remedy.

During the inspection, it was noted that large areas of East Foundry Cove Marsh are still devoid of vegetation and areas of the marsh remain underwater during low tide, indicating settlement of the marsh. It was also noted that a previously identified "bubble" in the GCL on the eastern side of the marsh had grown in size. The monitoring wells located on the former factory grounds are intact, as is the fence surrounding the property.

V. TECHNICAL ASSESSMENT

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

The three RODs for the Site addressed unacceptable risks through the excavation of contaminated soils on the former plant grounds and adjacent properties, dredging of the contaminated sediments in East Foundry Cove Marsh, East Foundry Cove, and the Hudson River in the vicinity of the Cold Spring pier, placement of a clay cap and soil cover on the excavated marsh areas in East Foundry Cove Marsh, and natural attenuation of groundwater. In addition, although not documented in a ROD, the application of institutional controls to prevent perforation of the cap, human consumption of contaminated blue claw crabs, and the potable use of on-Site groundwater also contributes to the reduction of unacceptable risks.

While the remedies to address the contaminated soils and sediments are functioning as intended by the decision documents, the contamination levels in the groundwater have not declined as quickly as expected and have remained relatively stable since the remediation was completed. Institutional controls are effectively in place to prevent unacceptable groundwater use and a pilot study is underway to enhance the degradation of the VOCs in the groundwater. Monitoring and pilot studies should continue to best inform strategies to facilitate the continued degradation of the contamination in the groundwater. In addition, an inspection of the marsh is performed annually to ascertain that the cap is secure and bubbles and/or exposed cap areas are remediated/fixed

promptly. Concerns about bare areas and the risk of future erosion which could expose additional cap areas should be investigated.

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?

Because the land uses at the Site have not changed the exposed populations evaluated as part of the three RODs for the Site remain appropriate currently and for the next five years. These include recreational users of and consumers of fish and blue crab (uptake from sediment) from the water bodies, persons entering the property (trespassers) and nearby residents. Exposure pathways also remain valid and include direct contact and ingestion of suspended contaminated sediments during recreational use of the surface waters, ingestion of cadmium-contaminated sediments in the surface water during water sports, ingestion of fish and/or blue crabs from Site surface water bodies, direct contact exposure with the plant building, Site soils, the dredge spoils vault, and adjacent residential soils, ingestion of groundwater and inhalation of organics during domestic groundwater use.

The OU1 and OU2 RODs, dealing with water bodies, were signed prior to the implementation of the Risk Assessment Guidance for Superfund used currently by EPA. However, the process that was used remains valid. In the absence of standards or criteria for contaminant levels of cadmium, nickel and cobalt in sediments, to evaluate remedial alternatives for East Foundry Cove Marsh and Constitution Marsh (Area I), it was necessary to establish an acceptable cadmium contaminant level for the Site. Nickel and cobalt were determined to be less toxic to humans than cadmium and because they were co-located with the cadmium, they were dredged with the cadmium contamination. Based upon a probabilistic human health impact assessment, 900 mg/kg cadmium in sediment was found to be acceptable to protect public health. A sediment cadmium remediation goal of 100 mg/kg was selected to be protective of ecological health.

The average post-excavation cadmium concentration in East Foundry Cove was approximately 12 mg/kg, well below the current EPA residential Regional Screening Level (RSL) for cadmium in residential soil of 71 mg/kg.

While a no action remedy was selected for Constitution Marsh to minimize disturbance, it was anticipated that the cadmium-contaminated sediments would eventually be covered with clean sediments following the remediation of the cadmium-contaminated sediments in East Foundry Cove Marsh. Sediment cadmium concentrations in Constitution Marsh are following a general decreasing trend. Current concentrations of cadmium and nickel in Area III (East Foundry Cove, West Foundry Cove and the Hudson River in the vicinity of the Cold Spring pier) sediments are close to background concentrations and are below current EPA residential RSLs for soil (which is a conservative screen for sediment). Sediment toxicity data and cleanup levels remain valid and the remedy remains protective of human health, and direct contact pathways have been interrupted.

The most recent data from East Foundry Cove (November 2017) indicate that the maximum sediment cadmium concentration was 57.8 mg/kg, which is below the remediation goal and EPA RSL; however, it has increased from "not detected" just a few years ago. Sediment monitoring will continue.

As was noted above, the following RAOs were established for sediment--prevention of resuspension and redistribution of the contaminated sediments that would threaten the area flora and fauna and minimization of the disturbance to Constitution Marsh, since this wetland is a delicate ecological habitat. These RAOs remain valid. The careful dredging of contaminated sediment from East Foundry Cove Marsh, as well as East Foundry Cove and the Hudson River in the vicinity of the Cold Spring pier, has resulted in the achievement of the cleanup goals and, thus, the first RAO. Constitution Marsh was not disturbed, but left to recover naturally. Data indicate that sediment is currently approaching background levels; therefore, achieving the second RAO.

As was noted above, the following RAO was established for biota--prevention of all biota from contacting East Foundry Cove Marsh and Constitution Marsh contaminated sediments that would threaten them. This RAO remains valid and, as a result of the aforementioned remedial actions in these water bodies (*e.g.*, dredging/natural recovery of sediment), has been met. Additionally, a state fishing advisory remains in effect for blue crabs in this area of the Hudson River.

The highest total cadmium concentration in surface water was 1.12 µg/L. The current New York State Part 703 Surface Water Standard for cadmium based on health (water source) is 5 µg/L. The current EPA RSL for cadmium in tapwater is 9.2 µg/L. The tapwater RSL is far more conservative than necessary to evaluate a recreational direct contact scenario. Therefore, the highest detected concentration of cadmium is below this screening level and the State standard. Because cadmium concentrations in dissolved surface water samples were below drinking water standards, no remediation goal was selected for surface water.

In the OU3 ROD inhalation of cadmium-contaminated dust (soils) was identified as the pathway of greatest risk to nearby residents and persons entering the property. A back-calculation was performed to determine a Site-specific cadmium soil cleanup goal. To achieve an acceptable risk level of 10^{-6}, cadmium in soils would need to be less than 56 mg/kg. The selected cleanup goal for the plant grounds and residential soils was 20 mg/kg, based on an ATSDR risk estimate for residents consuming home-grown vegetables. The selected cleanup goal is more conservative than the current EPA residential RSL for cadmium in soil of 71 mg/kg. As a result, cleanup levels remain valid.

With the exception of cadmium-contaminated soils exceeding the 20 mg/kg cleanup level in a twenty- by sixty-foot area of saturated soils at a depth of 26 feet (two feet below the water table), all the soils on the former battery facility grounds and residential yards have been remediated to 20 mg/kg. As a result of the placement of two feet of limestone at the bottom of the excavation (to raise pH levels and keep the cadmium insoluble), the backfilling of the excavation with clean fill, and the placement of institutional controls to restrict excavation within the former pedestal area on the former battery plant grounds, there is no route of exposure to the contaminated soils. Therefore, the soil remedy remains protective of human health.

As was noted above, the RAO for soil is to protect human health and the environment from exposure to contaminated soils. This RAO remains valid. Since the contaminated soils on the former Marathon Battery property have been excavated and/or remain inaccessible and an institutional control is in place to prohibit excavating in the former pedestal area, this RAO has been achieved.

Groundwater was also evaluated as part of the OU3 ROD. The drinking water model that was used assumed the same default ingestion rate used currently. Maximum contaminant concentrations were used to maintain conservatism. The excavation and treatment of soils contaminated with VOCs beneath the former battery plant was expected to remove much of the source of contamination to groundwater. Groundwater monitoring samples, however, indicate that while the levels of TCE and PCE in groundwater have slowly decreased since the implementation of the remedial action, the concentrations continue to be above the MCL of 5 µg/L in several monitoring wells. As was noted above, the RAO for groundwater was to restore it to drinking water standards. This RAO remains valid. While the remedial goal for TCE and PCE in groundwater has not been met, because area residents receive public water and an institutional control is in place to prohibit the installation of groundwater wells on the plant grounds, the remedy remains protective of human health.

Based on a recommendation from the third FYR, a vapor intrusion investigation was performed at the adjacent residences on Constitution Drive. In January 2009, sub-slab soil gas samples were collected from nine residences. The sample results showed elevated VOC concentrations beneath the slab of two residences. In March 2009, these two residences underwent indoor air sampling and a second round of sub-slab sampling. In addition, a residence located across Constitution Drive also underwent sub-slab vapor intrusion sampling. The sub-slab VOC concentrations for all of these residences were below EPA's action levels, indicating that there was no vapor intrusion issue at the Site. However, because low levels of VOCs were found in the indoor air of one home in the living space, but not the basement, in response to EPA's request, the performing PRP installed a vapor intrusion mitigation system at this residence in September 2009. The other residence had recently installed a radon mitigation system similar to the VOC mitigation system. In February 2012, both of these houses had their sub-slab and indoor air retested to confirm that their mitigation system were operating properly. With functioning sub-slab depressurization systems, EPA requires no further follow-up sampling.

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

No

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations	
OU(s) without Issues/Recommendations Identified in the Five-Year Review:	
1, 2	
Issues and Recommendations Identified in the Five-Year Review:	
OU(s): 3	**Issue Category: Remedy Performance**
	Issue: The levels of VOCs in the groundwater remain above MCLs.

	Recommendation: Meth**o**ds of addressing the residual source and groundwater contamination should continue to be assessed and implemented.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2019

OTHER FINDINGS

In addition, the following suggestion was identified during the FYR and may improve management of operation and maintenance, but do not affect current and/or future protectiveness:

- An independent review of the marsh to identify ways to improve vegetation coverage and reduce settlement and erosion should be performed. This review will be performed by an EPA contractor in fall 2018.

VII. PROTECTIVNESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: 01	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The implemented actions at OU1 protect human health and the environment.		

Protectiveness Statement(s)		
Operable Unit: 02	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The implemented actions at OU2 protect human health and the environment.		

Protectiveness Statement(s)		
Operable Unit: 03	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The implemented actions at OU3 protect human health and the environment in the short term. For the remedy to be protective in the long term, methods of addressing the groundwater contamination should continue to be assessed and implemented, as appropriate.		

Sitewide Protectiveness Statement

Protectiveness Determination:	*Planned Addendum Completion Date:*
Short-term Protective	Click here to enter a date
Protectiveness Statement: The implemented actions at the Site protect human health and the environment in the short term. For the remedy to be protective in the long term, methods of addressing the groundwater should continue to be assessed and implemented, as appropriate.	

VIII. NEXT REVIEW

The next FYR report for the Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Documents, Data, and Information Reviewed in Completing the Five-Year Review	
Document Title, Author	**Date**
Record of Decision, EPA	September 1986
Record of Decision, EPA	September 1988
Record of Decision, EPA	September 1989
RD/RA Report, Malcolm Pirnie, Inc.	1992
ESDs, EPA	August 1993, June 1994, and May 1995
Close-Out Report, EPA,	1995
Long Term Monitoring Plan, Advanced GeoServices Corp.,	December 1995
EPA guidance for conducting five-year reviews and other guidance and regulations to determine if any new applicable or relevant and appropriate requirements relating to the protectiveness of the remedy have been developed since EPA issued the RODs, 2001	
Groundwater Natural Attenuation Enhancement Pilot-Test Completion Report, Advanced GeoServices Engineering P.C.	January 2013
Fourth Five -Year Review, EPA	June 2013
2013 Vegetation Survey East Foundry Cove Marsh, Advanced GeoServices Engineering P.C.	May 2014
Groundwater Natural Attenuation Enhancement Phase IV & V Completion Report, Advanced GeoServices Engineering P.C.	January 2015
Long Term Monitoring Sampling Event Report Year 19 – May/August 2014, Advanced GeoServices Engineering P.C.	January 2015

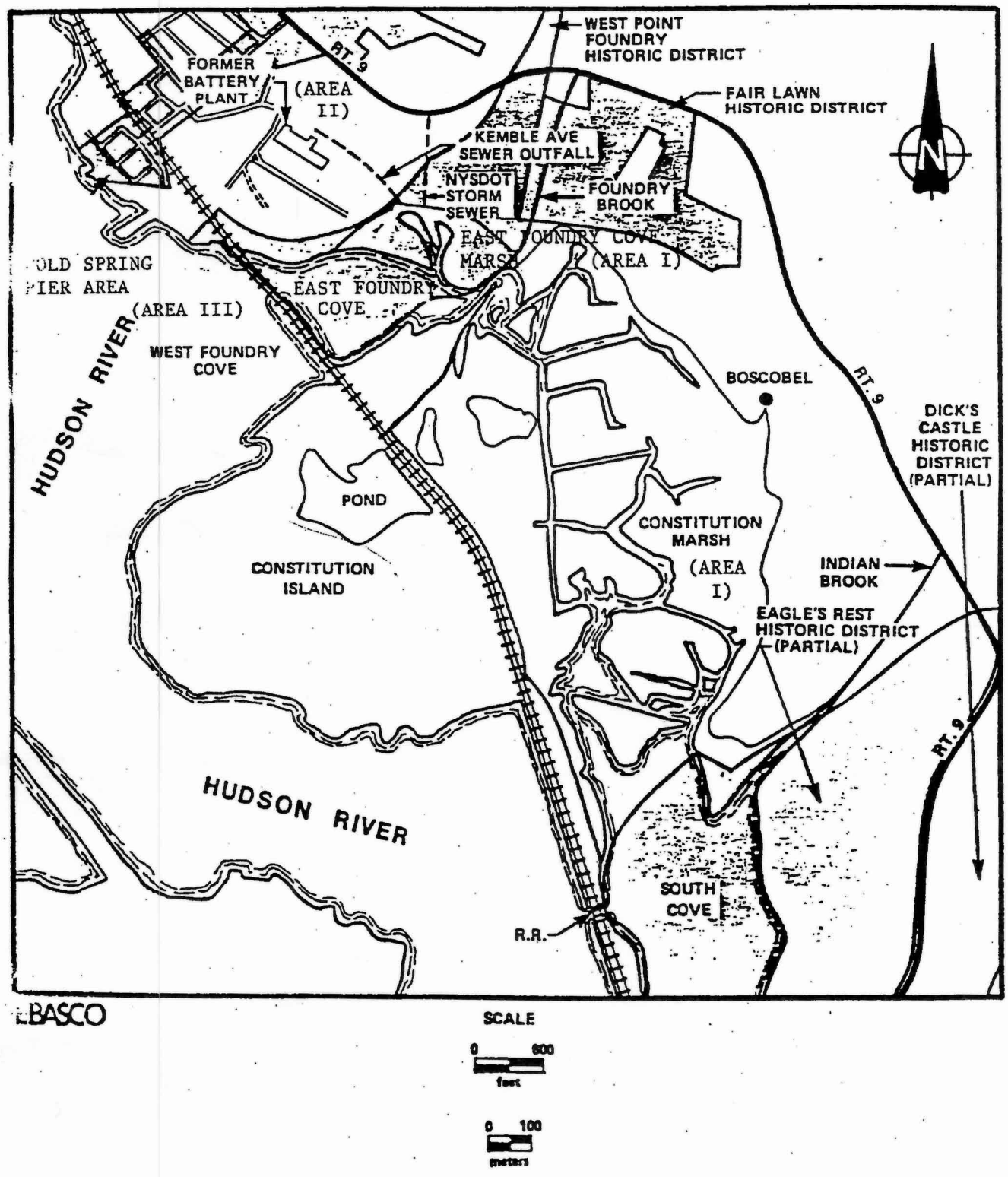
Long Term Monitoring Sampling Event Repot Year 21 – August/November 2016, Advanced GeoServices Engineering P.C.	January 2017
Memorandum – Marathon Battery Groundwater Remediation Ozone Sparging	April 2017
Progress Update Groundwater Treatment Report, Advanced GeoServices Engineering P.C.	May 2018

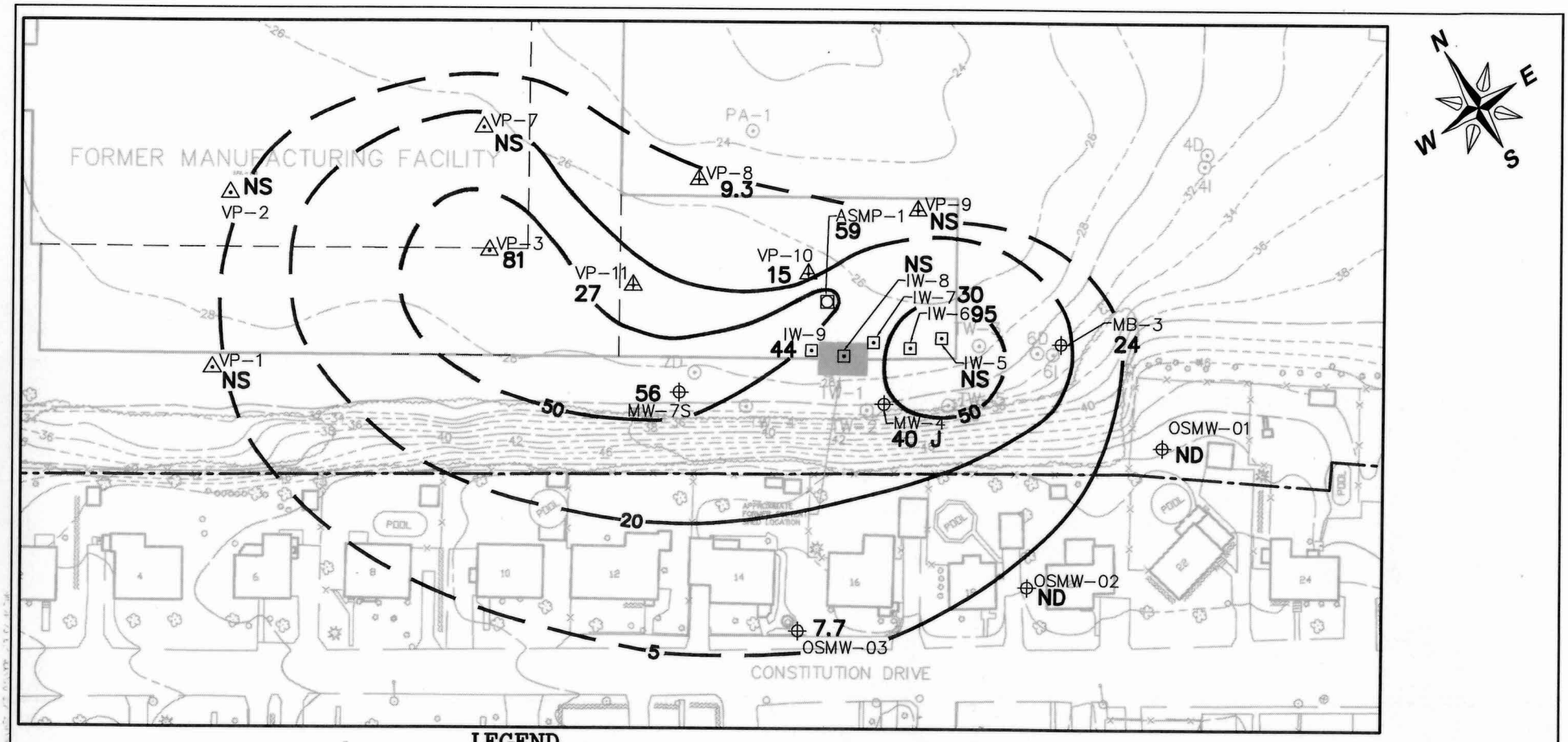
APPENDIX B – Site Chronology

Chronology of Site Events	
Event	**Date(s)**
High levels of cadmium contamination were discovered in Foundry Cove sediments by New York University, EPA, and the New York State Department of Environmental Conservation.	Early 1970s
U.S. Department of Justice required owners/operators to remove cadmium from the outfall area and channel leading into the Cove and place in an on-Site vault	1972
Dredging of Foundry Cove conducted	1972-1973
Marathon Battery Company site included on the Interim National Priorities List	1981
NYSDEC undertakes RI/FS	1983
EPA's contractor, Ebasco Services, Inc., conducts a Supplemental RI/FS	1986-1989
ROD issued selecting remedy for Area I (OU1)	1986
ROD issued selecting remedy for Area II (OU3)	1988
Unilateral Administrative Order required owners to decontaminate the former battery plant and its contents	1989
ROD issued selecting remedy for Area III (OU2)	1989
Consent Decree entered by the Southern District of New York with the PRPs to undertake the construction of the selected remedy for the Site	1993
Site remedy implemented by Sevenson Environmental Services, Inc.	1993-1995
ESD Issued	1993
ESD Issued	1994
ESD Issued	1995
Final Close-Out Report approved	1995
Marathon Battery Company Site deleted from the NPL	1996
First Five-Year Review	1998
Second Five-Year Review	2003
Third Five-Year Review	2008
Third Five-Year Review addendum	2011

Chronology of Site Events	
Fourth Five-Year Review	2013

Marathon Battery Company Site
Figure 1





LEGEND

- Existing Contour
- Existing Building
- Existing Edge of Paving
- Existing Right of Way
- Existing Tree Line
- Existing Lot Line
- Approximate Property Line

OSMW-03 — Existing Monitoring Well

IW-8 — Existing Injection Well Converted to Monitoring Well

VP-1 — Vertical Profiling Location Converted to Piezometer

20 — Groundwater Isoconcentration Line (µg/L) – Dashed Where Inferred

VP-8 — Existing Piezometer

NS — Not Sampled

PA-1 — Abandoned Historic Groundwater Monitoring Well

60 0 60 120
SCALE IN FEET

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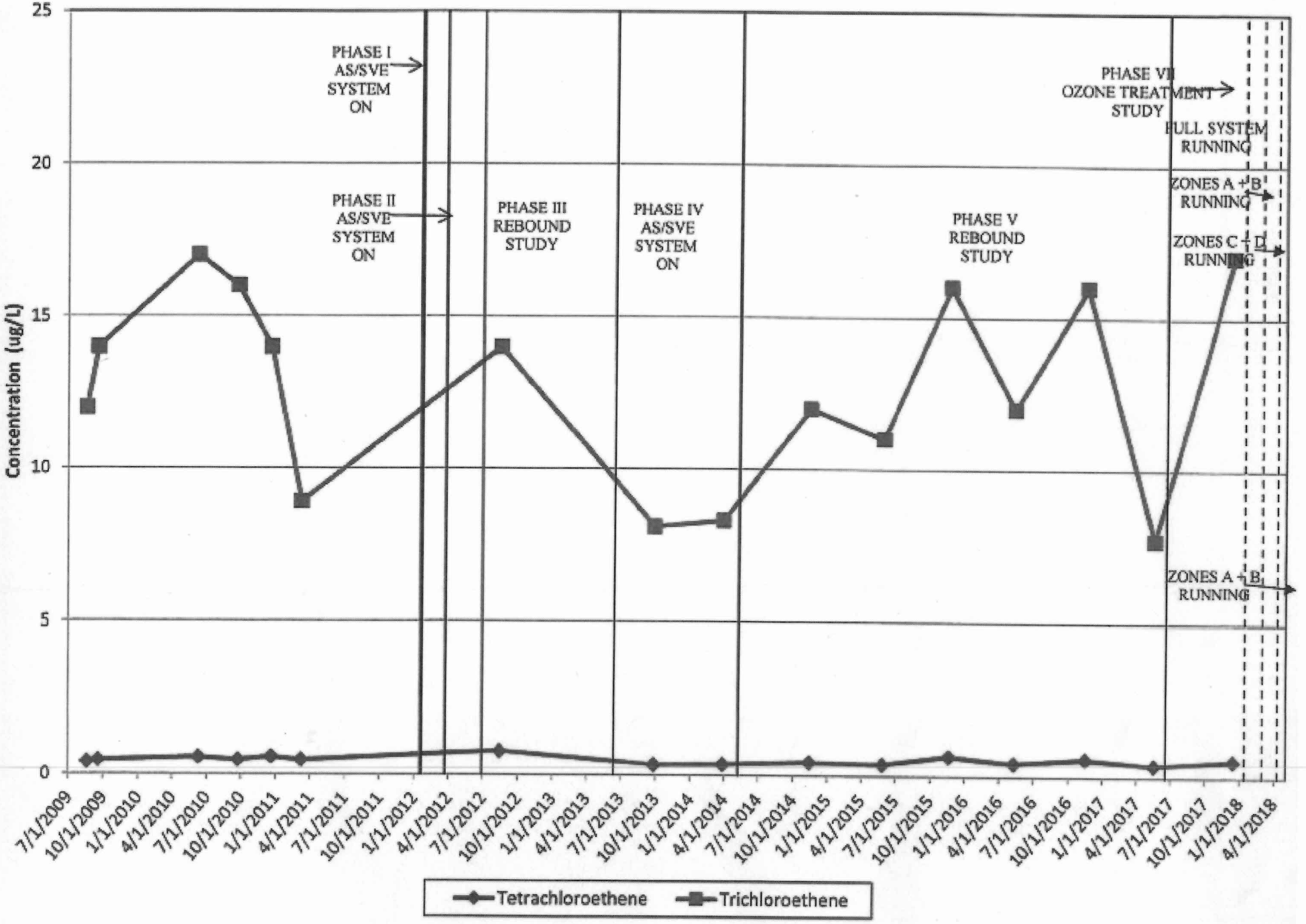
GROUNDWATER TCE ISOCONCENTRATION
MAY 2017
MARATHON REMEDIATION SITE
Cold Spring, New York

SCALE:	1" = 60'
PROJECT NUMBER:	NY95-219
DATE:	8/2/18

2

VOC CONCENTRATION TRENDS IN OSMW-3
Marathon Remediation Site
Cold Spring, New York



VOC CONCENTRATION TRENDS IN MB-3
Marathon Remediation Site
Cold Spring, New York

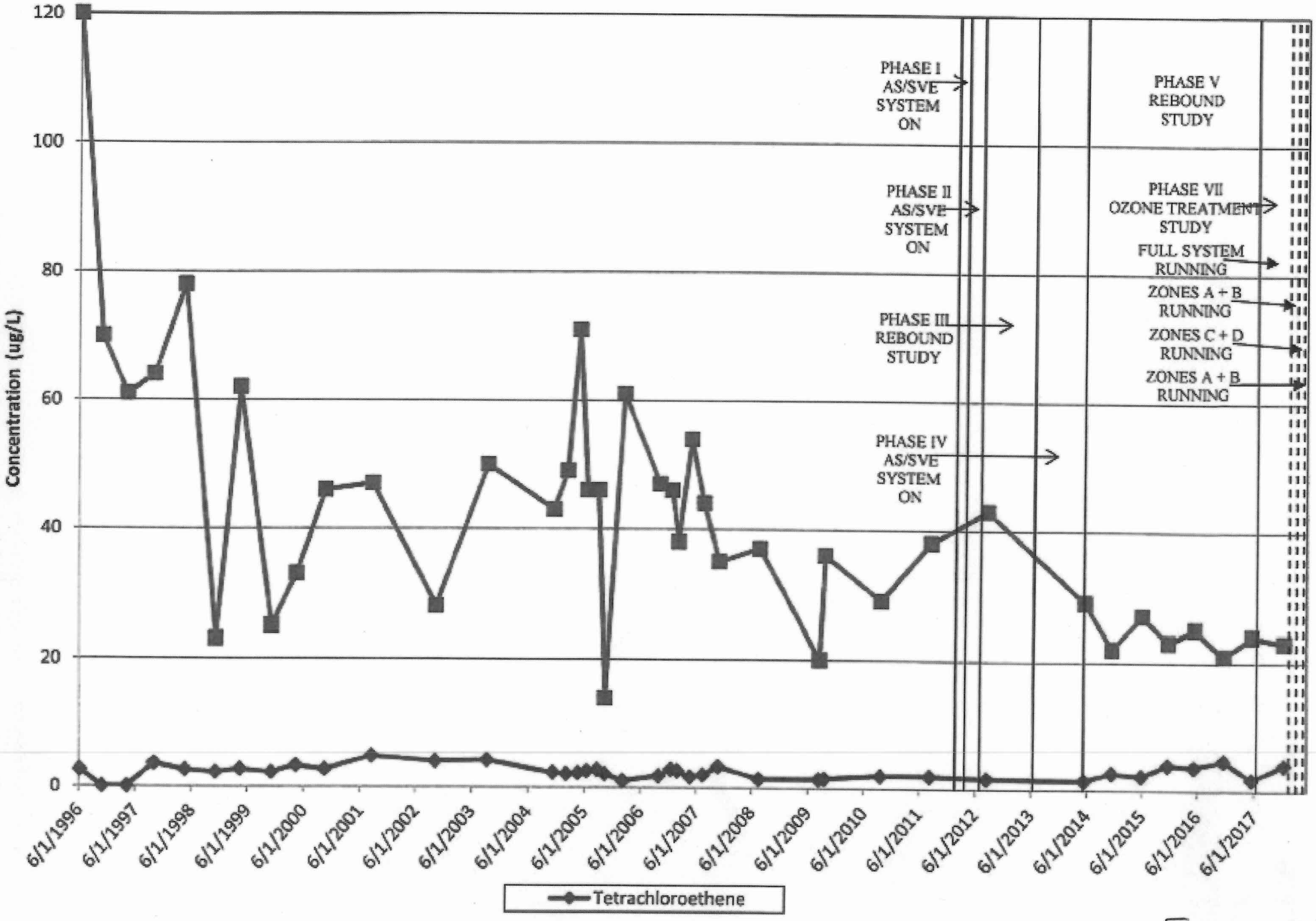


FIGURE 3B

VOC CONCENTRATION TRENDS IN ASMP-1
Marathon Remediation Site
Cold Spring, New York

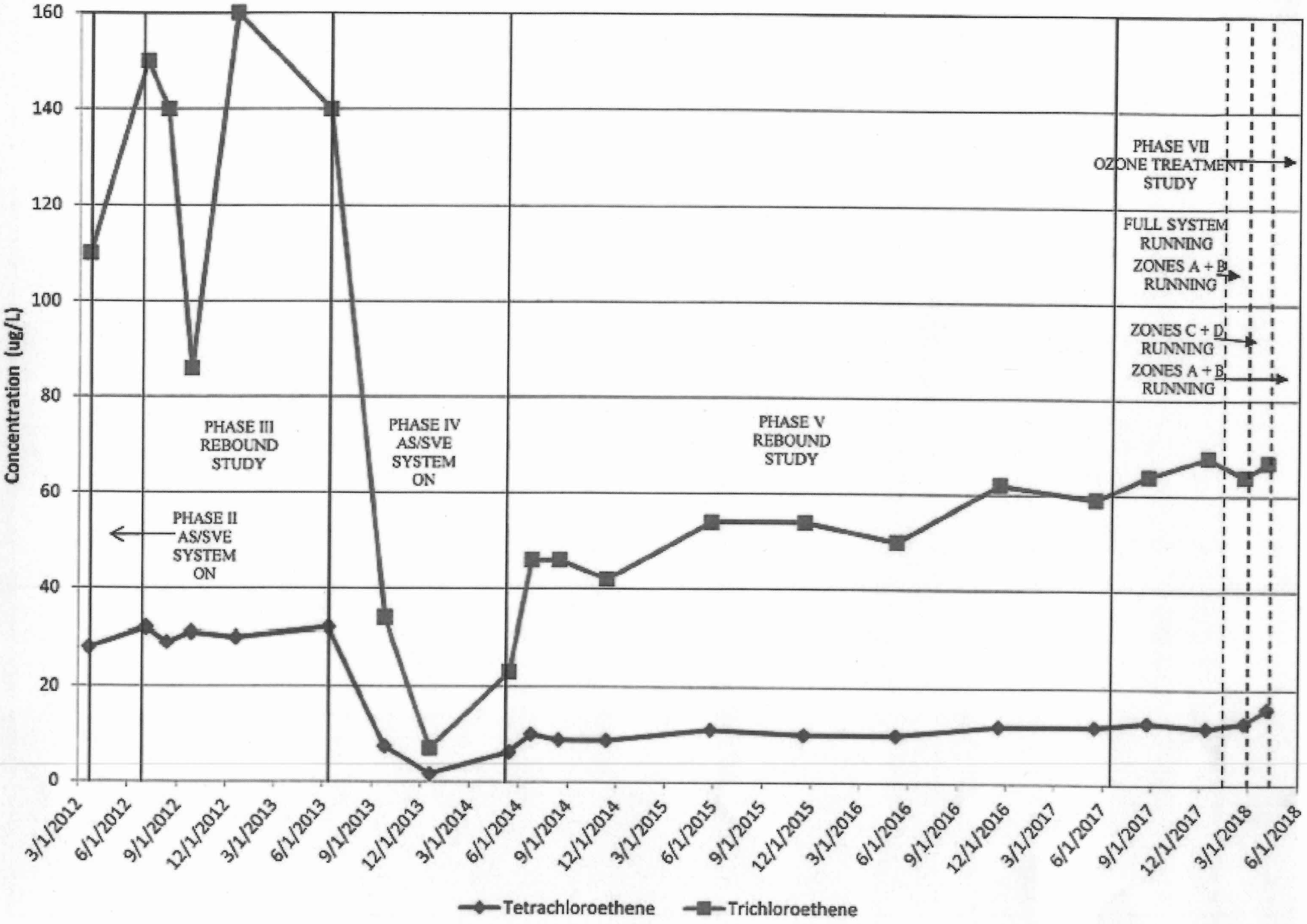


FIGURE 3C

VOC CONCENTRATION TRENDS IN IW-8
Marathon Remediation Site
Cold Spring, New York

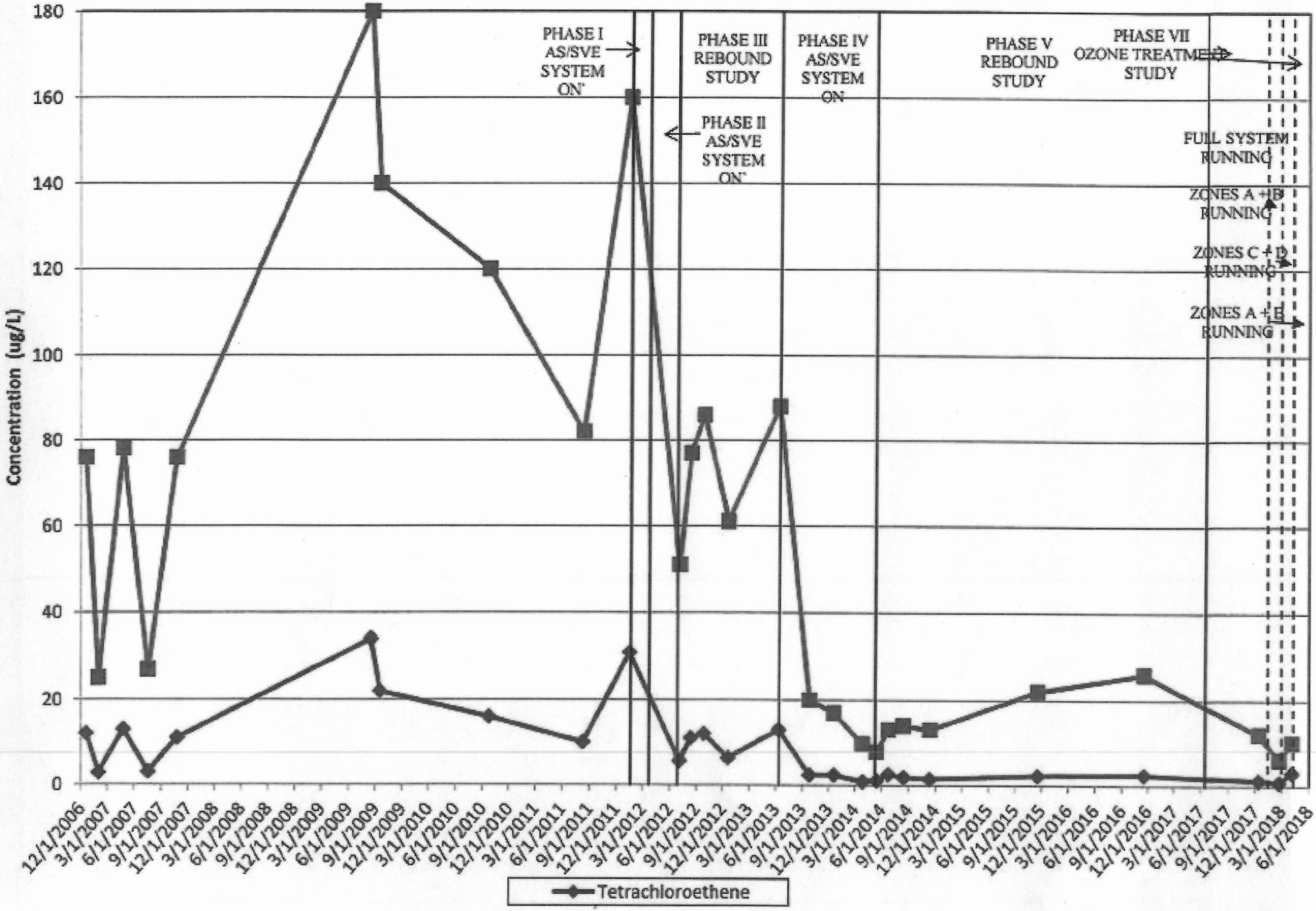


FIGURE 3D

VOC CONCENTRATION TRENDS IN IW-6
Marathon Remediation Site
Cold Spring, New York

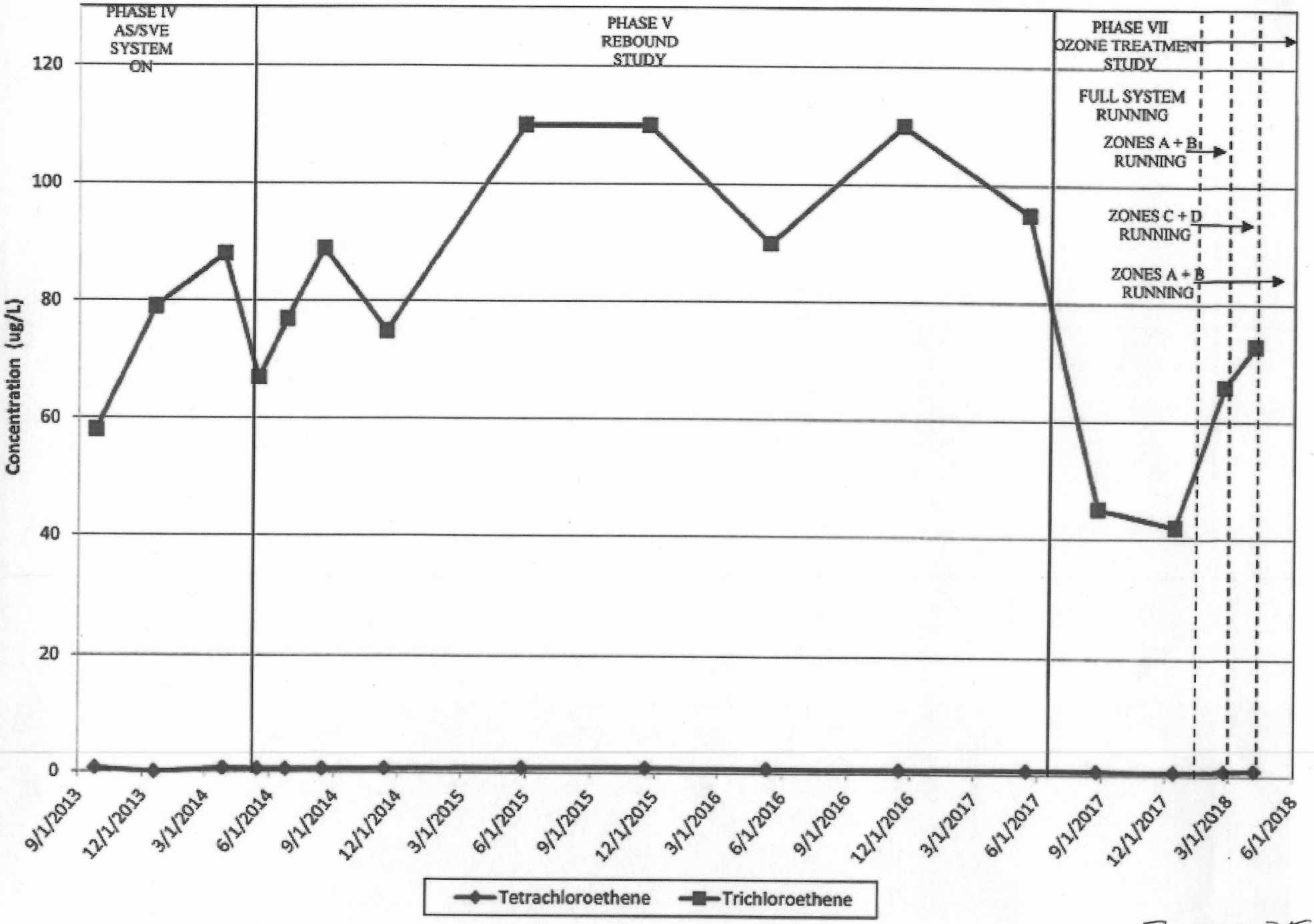


FIGURE 3E

VOC CONCENTRATION TRENDS IN MW-7S
Marathon Remediation Site
Cold Spring, New York

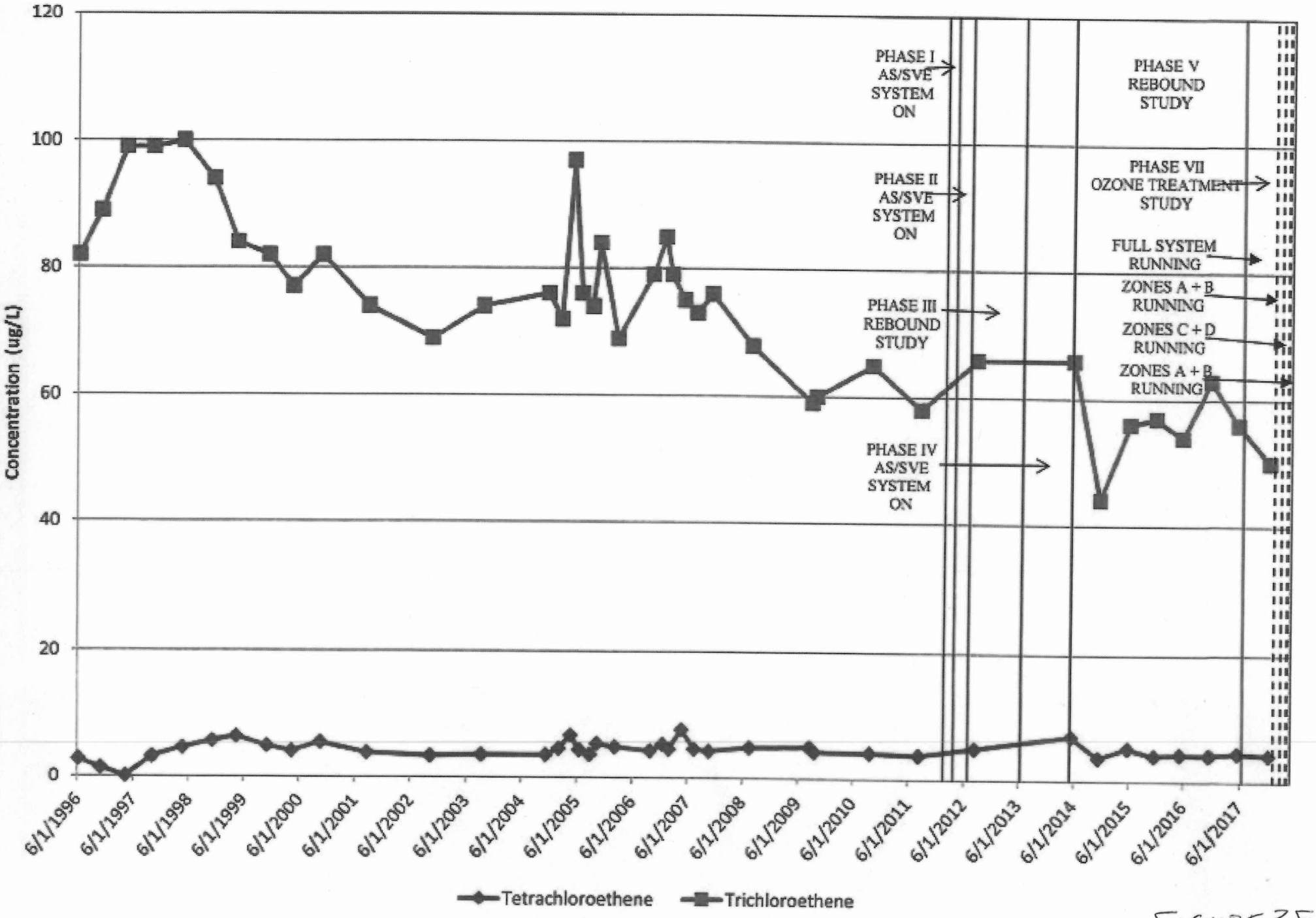


FIGURE 3F