Naval Facilities Engineering Systems Command Washington
Washington, D.C.

Final

Comprehensive Fourth Five-Year Review Report

Former Naval Surface Warfare Center White Oak
Silver Spring, Maryland

June 2022

Naval Facilities Engineering Systems Command Washington
Washington, D.C.

Final

Comprehensive Fourth Five-Year Review Report

Former Naval Surface Warfare Center White Oak
Silver Spring, Maryland

June 2022

Prepared for NAVFAC Washington
by CH2M HILL, Inc.
Contract N62470-21-D-0007
CTO N4008021F 4883

Comprehensive Fourth Five-Year Review
for
Former Naval Surface Warfare Center White Oak
Silver Spring, Maryland

June 2022

This report documents the Fourth Five-Year Review for the following operable units (OUs) and sites at Former Naval Surface Warfare Center (NSWC) White Oak in Silver Spring, Maryland with a Record of Decision for taking action, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan, Part 300.430(f)(4)(ii)) of the Code of Federal Regulations:

- OU2 (Soil, Waste, and Sediment at Site 1 [Parking Lot Landfill] and Site 2 [The Apple Orchard Landfill]) and OU3 (Groundwater underlying and surface water adjacent to Site 1 and Site 2)
- Site 4 – Chemical Burial Area
- Sites 5 and 13 – Open Burn Area and Oil Sludge Disposal Area
- Site 49 – Trichloroethene Groundwater Plume in the 400 Area
- Solid Waste Management Unit (SWMU) 87 – Building 611 Solid Waste Storage Area

The Five-Year Review evaluated the implementation and performance of the site remedy for each OU, site, and SWMU to determine if the remedy is, or will be, protective of human health and the environment in accordance with the requirements set forth in the Records of Decision. This evaluation was accomplished through a review of various reports and documents pertaining to post-remedy implementation activities, analytical data, and findings, as well as site visits and inspections.

As outlined in this Fourth Five-Year Review, the remedies for all five areas are protective of human health and the environment

United States Department of the Navy

By: KNIGHT.WYNETTE.R.1040800243 Digitally signed by KNIGHT.WYNETTE.R.1040800243 Date: 2022.06.13 10:07:35 -04'00' Date: 13 June 2022

W. Rachelle Knight
Base Realignment and Closure Environmental Coordinator
By direction of BRAC Program Management Office

Executive Summary

The Department of the Navy (Navy) conducted this Five-Year Review for Former Naval Surface Warfare Center (NSWC) White Oak in Silver Spring, Maryland, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan, Part 300.430(f)(4)(ii) of the Code of Federal Regulations. The Navy is the lead agency implementing the cleanup at Former NSWC White Oak. Former NSWC White Oak is not listed on the National Priorities List (NPL) and the United States Environmental Protection Agency (USEPA) has deferred environmental cleanup to Maryland Department of the Environment (MDE). The report has been prepared in accordance with the USEPA Comprehensive Five-Year Review Guidance (USEPA, 2001) and Navy Policy on Five-Year Reviews (Chief of Naval Operations, 2011). It summarizes the evaluation of remedies and remedial actions that resulted in hazardous substances, pollutants, or contaminants remaining at sites above levels that allow for unlimited use and unrestricted exposure, and for which there is a Record of Decision (ROD) or Decision Document in place. This document presents the Fourth Five-Year Review Report for Former NSWC White Oak, and has been conducted on remedial actions (RAs) completed at the following five sites:

- Operable Unit (OU) 2 (Soil, Waste, and Sediment (at Site 1 [Parking Lot Landfill] and Site 2 [The Apple Orchard Landfill]) and OU3 (Groundwater underlying and surface water adjacent to Site 1 and Site 2)
- Site 4 – Chemical Burial Area
- Sites 5 and 13 – Open Burn Area and Oil Sludge Disposal Area
- Site 49 – Trichloroethene Groundwater Plume in the 400 Area
- Solid Waste Management Unit (SWMU) 87 – Building 611 Solid Waste Storage Area

The review was conducted between October 1, 2016 and December 31, 2021. The First, Second, and Third Five-Year Review Reports were signed on April 23, 2007 (JM Waller Associates, 2007); June 13, 2012 (Tetra Tech, 2012b); and June 23, 2017 (CH2M, 2017e), respectively. The triggering action for this fourth statutory review was June 23, 2017, the Navy's signature date of the Third Five-Year Review Report.

The objective of the Five-Year Review is to evaluate the effectiveness of the remedies to determine whether they continue to be protective of human health and the environment in accordance with the requirements set forth in the RODs. This evaluation was accomplished through a review of various reports and documents pertaining to post-remedy implementation activities, analytical data, and through site visits and inspections. The community was notified of the review process through a fact sheet sent to various community members and organizations in April 2022. Additionally, a notice will be sent to members of the Remedial Advisory Board and other community organizations indicating the results and the final report will be made available to the public at the White Oak Public Library, 11701 New Hampshire Avenue, Silver Spring, Maryland and in the administrative record file at https://www.bracpmo.navy.mil/brac_bases/northeast/former_warfare_center_white_oak/documents.html. The Five-Year Review Report identifies any circumstance that may prevent a particular remedy from functioning as designed or providing sufficient protection of human health and the environment. The overall evaluation of the effectiveness of each remedy is presented as a protectiveness statement developed for each site.

A summary of the remedial actions completed for each site and the technical performance assessment, issues and recommendations, and protectiveness statements based on this Five-Year Review are provided in the following Five-Year Review Summary Form.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Former Naval Surface Warfare Center White Oak		
EPA ID: MD0170023444		
Region: 3	**State:** MD	**City/County:** Silver Spring/Montgomery County and Prince George's County
SITE STATUS		
NPL Status: Non-NPL The response does not address the question. Minimum requirements per the EPA guidance includes notification of		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** United States Navy		
Author name (Federal or State Project Manager): Naval Facilities Engineering Systems Command (NAVFAC)		
Author affiliation: Department of the Navy		
Review period: October 1, 2016 to December 31, 2021		
Date of site inspection: November 18, 2021		
Type of review: Statutory		
Review number: 4		
Triggering action date: June 23, 2017 (signature date of the Third Five-Year Review Report for the Former NSWC White Oak)		
Due date *(five years after triggering action date)*: June 23, 2022 (5 years after the signature date of the Third Five-Year Review Report for the Former NSWC White Oak)		
Issues/Recommendations		
OU(s) without Issues/Recommendations Identified in the Five-Year Review:		
OU2 and OU3; Site 4; Sites 5 and 13; Site 49, SWMU 87		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s)		
Operable Unit: OU2 and OU3	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy for OU2 and OU3, consisting of a multimedia cap, monitored natural attenuation, land use controls (LUCs) that incorporate institutional controls (ICs), and groundwater and surface water monitoring, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.		

Protectiveness Statement(s)		
Operable Unit: Site 4	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy for Site 4, consisting of enhanced reductive dechlorination, LUCs that incorporate ICs, and long-term monitoring (LTM), is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.		

Protectiveness Statement(s)		
Operable Unit: Site 5 and Site 13	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy for Site 5 and Site 13, consisting of in situ chemical reduction with zero-valent iron, groundwater LTM, and LUCs that incorporate ICs, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.		

Protectiveness Statement(s)		
Operable Unit: Site 49	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The selected remedy for Site 49, consisting of in situ chemical oxidation, LUCs that incorporate ICs, and groundwater LTM, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.		

Five-Year Review Summary Form (continued)

Protectiveness Statement(s)		
Operable Unit: SWMU 87	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The selected remedy for SWMU 87, consisting of enhanced in situ bioremediation, LUCs that incorporate ICs, and LTM, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.		
Sitewide Protectiveness Statement		
Protectiveness Determination: Protective		*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: Because the remedial actions at all OUs/sites are protective, the Basewide protectiveness determination is protective of human health and the environment.		

Contents

Appendixes

Tables

Figures

Acronyms and Abbreviations

µg/kg	microgram per kilogram
µg/L	microgram per liter
AEDC	Arnold Engineering Development Center
AGVIQ	AGVIQ Environmental Services
amsl	above mean sea level
AOC	area of concern
ARAR	Applicable or Relevant and Appropriate Requirements
Army	United States Army
BERA	baseline ecological risk assessment
bgs	below ground surface
BHHRA	baseline human health risk assessment
BRAC	Base Realignment and Closure Act
BTAG	Biological Technical Assistance Group
CAO	Corrective Action Objective
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH2M	CH2M HILL, Inc.
CMS	corrective measures study
COC	constituent of concern
COPC	constituent of potential concern
CVOC	chlorinated volatile organic compound
DCA	dichloroethane
DCE	dichloroethene
DNT	dinitrotoluene
EE/CA	Engineering Evaluation/Cost Analysis
EISB	enhanced in situ bioremediation
EOS	emulsified oil substrate
ERA	ecological risk assessment
ERD	enhanced reductive dechlorination
EVO	emulsified vegetable oil
FS	feasibility study
GSA	General Services Administration
HHRA	human health risk assessment
HI	hazard index
HMX	high melting explosive
IAS	Initial Assessment Study
IC	institutional control
ICR	incremental cancer risk
IR	Installation restoration
IRP	Installation Restoration Program
ISCO	in situ chemical oxidation
LTM	long-term monitoring
LUC	land use control

MCL	maximum contaminant level
MCS	media clean-up standard
MDE	Maryland Department of the Environment
MNA	monitored natural attenuation
MTBE	methyl-tert-butyl ether
NA	not applicable
NAVFAC	Naval Facilities Engineering Systems Command
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFA	no further action
NSWC	Naval Surface Warfare Center
O&M	operations and maintenance
ORP	Oxidation-reduction potential
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCA	tetrachloroethane
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PRG	Preliminary Remediation Goals
RA	remedial action
RAB	Remedial Advisory Board
RACR	Remedial Action Completion Report
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDX	cyclotrimethylenetrinitramine
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	remedial investigation
ROD	Record of Decision
ROI	radius of influence
Shaw	Shaw Environmental & Infrastructure, Inc.
SVE	soil vapor extraction
SWMU	solid waste management unit
SVOC	semivolatile organic compound
TAL	target analyte list
TCE	trichloroethene
TCL	Target Compound List
Tetra Tech NUS, Inc.	Tetra Tech
TOC	total organic carbon
UU/UE	unlimited use and unrestricted exposure
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound

WSSC	Washington Suburban Sanitation Commission
ZVI	zero-valent iron

SECTION 1

Introduction

This report presents the results of the fourth Five-Year Review under the Atlantic Division, Naval Facilities Engineering Systems Command (NAVFAC) Washington, Comprehensive Long-term Environmental Action—Navy Program, Contract Number N62470-21-D-0007, Contract Task Order N4008021F 4883, as required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) §121(c), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Part 300.430(f)(4)(ii) of the Code of Federal Regulations. Department of the Navy (Navy) has prepared this Five-Year Review Report for Former Naval Surface Warfare Center (NSWC) White Oak, Silver Spring, Maryland, in accordance with the United States Environmental Protection Agency (USEPA) *Comprehensive Five-Year Review Guidance* (USEPA, 2001), the amended Appendix E of the *Comprehensive Five-Year Review Guidance* (USEPA, 2016), and with Navy policy on Five-Year Reviews (Chief of Naval Operations, 2011). The Navy is the lead agency implementing the cleanup at Former NSWC White Oak. USEPA has deferred environmental cleanup oversight to Maryland Department of the Environment (MDE).

The purpose of a Five-Year Review 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 Five-Year Review reports such as this one. In addition, Five-Year Review reports identify issues found during the review, if any, and document recommendations to address them.

The Former NSWC White Oak follows Navy policy of conducting an installation-wide Five-Year Review that includes all sites with remedies in place based on the remedy initiation trigger date for the first site. In accordance with Navy policy, a Five-Year Review is required 5 years from the initiation of the first remedial action (RA) that leaves hazardous substances, pollutants, or contaminants at a site above levels that allow for unlimited use and unrestricted exposure. If a site contains multiple remedies, all are subject to a Five-Year Review when at least one remedy is initiated. The triggering action for the initial statutory review for the Former NSWC White Oak was initiation of RAs for Operable Unit (OU) 2 in April 2002 (Tetra Tech, 2012b).

NAVFAC Washington has conducted this Five-Year Review of the RAs implemented at the following five sites at Former NSWC White Oak:

- Operable Unit (OU) OU2 (soil, waste, and sediment at Site 1 [Parking Lot Landfill] and Site 2 [The Apple Orchard Landfill])
- OU3 (groundwater underlying and surface water adjacent to Site 1 and Site 2)1
- Site 4 – Chemical Burial Area
- Site 5/13 – Open Burn Area and Oil Sludge Disposal Area
- Site 49 – Trichloroethene Groundwater Plume in the 400 Area
- Solid Waste Management Unit (SWMU) 87 – Building 611 Solid Waste Storage Area

In addition, since the Third Five-Year Review was finalized in 2017, three sites (Site 7, Site 9, and Site 11) at Former NSWC White Oak were closed via a Remedial Action Completion Report (RACR). The history of these sites and discussion of the chronological events are presented in **Section 8** as part of the Five-Year

[1] Although there are separate RODs for OU2 and OU3, the OUs are environmentally managed as one OU OU2/OU3.

Review for completeness. Reviews of these sites will not warrant evaluation in subsequent Five-Year Review Reports.

As part of a Navy nationwide emerging contaminant initiative, a base-wide per- and polyfluoroalkyl substances preliminary assessment /site investigation is currently being conducted, which will be published in a separate report that was not available at the time of this Five-Year Review.

This is the fourth Five-Year Review for Former NSWC White Oak. The previous Five-Year Review was signed on June 23, 2017. Navy policy (Chief of Naval Operations, 2011) states that subsequent Five-Year Review reports shall be signed by the Navy no later than 5 years after the Navy signature date of the previous Five-Year Review Report consistent with Section 1.2.3 of the *Comprehensive Five-Year Review Guidance* (USEPA, 2001). The Five-Year Review has been prepared because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. The review began on September 1, 2021.

1.1 Background

In support of the Five-Year Review, presentation of background information for Former NSWC White Oak is necessary to identify for each OU/site/SWMU the potential threats posed to human health and the environment at the time of the Record of Decision (ROD). This allows for the remedy performance to be compared with the site conditions that the remedy was intended to address. Information presented in this section includes the facility description, physical characteristics of the facility, and other background information.

1.1.1 Facility Description

Former NSWC White Oak is located in Silver Spring, Maryland, approximately 4 miles northwest of Washington, DC. (**Figure 1-1**). The facility encompasses approximately 663 acres and is located in both Prince George's and Montgomery counties. Approximately 635 acres of the property is undeveloped. **Figure 1-2** shows the locations of Sites 4, 5/13, 49, SWMU 87, OU2, and OU3 at Former NSWC White Oak. The United States Army (Army) Adelphi Laboratory Center is located just south of Former NSWC White Oak.

The facility was established in 1946 as the Naval Ordnance Laboratory. The laboratory conducted research, development, and evaluations for surface warfare weapon systems, ordnance technologies, underwater weapons, and strategic systems. The Naval Ordnance Laboratory was closed in 1997 under the Base Realignment and Closure Act (BRAC). Approximately 662 acres were transferred to the General Services Administration (GSA) and became the GSA's Federal Research Center where the Federal Drug Administration campus is currently located. The remaining 48 acres were transferred to the Army.

1.1.2 Physical Characteristics

1.1.2.1 Climate

Available climate data from the National Oceanic and Atmospheric Administration for Washington, D.C., the city with available local data/records closest to the Former NSWC White Oak, indicate that summers are warm and humid with an average temperature of 78.9 degrees Fahrenheit; winters are cool to cold with an average temperature of 39.7 degrees Fahrenheit (http://www.weather.gov/media/lwx/climate/dcatemps.pdf), based on data available from 1991 through 2020. Average annual precipitation is approximately 41.82 inches with little seasonal variation, based on data available from 1991 through 2020 (http://www.weather.gov/media/lwx/climate/dcaprecip.pdf). Massive snowfall is not common, but

occasionally occurs; average snowfall is approximately 13.7 inches, based on data available from 1991 through 2020 (http://www.weather.gov/media/lwx/climate/dcasnow.pdf).

1.1.2.2 Topography

As described in the Background Investigation Report for Former NSWC White Oak (Tetra Tech, 1998b), Former NSWC White Oak is located near the boundary between the Piedmont and Coastal Plain Physiographic Provinces. The facility lies in gently rolling terrain. The topographic expression of the area represents the result of deeply incised, dendritic stream channel pattern. Local drainage patterns are dominated by the Paint Branch stream and its tributaries.

The highest elevation on the facility is approximately 395 feet above mean sea level (amsl). The lowest elevation is roughly 160 feet amsl. The terrain of the western portion of the Base slopes generally eastward toward Paint Branch, with an approximate 3.5 percent grade. Similar grades are encountered in the eastern portion of the facility, but slopes trend generally more southward or are locally influenced by proximity to Paint Branch and its tributary drainages. Near stream channels, the ground slopes increase to as much as 65 percent.

1.1.2.3 Surface Water Resources

Former NSWC White Oak lies entirely within the drainage basin of Paint Branch, a 12-mile-long tributary to the Northeast Branch of the Anacostia River. Like other streams in the region, Paint Branch is a gaining stream, which is perennially supported by shallow groundwater discharge from small springs and seeps along its length. Another perennial stream, West Farm Branch, flows through the eastern portion of the property. It originates approximately 1 mile to the north and joins Paint Branch just south of the property line.

In addition to perennial streams, the facility is traversed by eight intermittent streams, all of which discharge to Paint Branch either on the property or nearby. Several of these streams are very small and are not mapped by the United States Geological Survey (Tetra Tech, 1998b).

1.1.2.4 Geology and Hydrogeology

The regional geology is discussed in the *Master Project Plans for the former NSWC White Oak* (Brown & Root, 1998). In summary, the facility is located about 1 mile east of the boundary between the Piedmont and Coastal Plain physiographic provinces, known as the Fall Line or Fall Zone. This boundary runs southwest to northeast and is generally parallel to the Montgomery – Prince George's County line in the White Oak area. Physically, the Fall Line represents the contact where older Piedmont rocks, exposed to the northwest, dip beneath Coastal Plain deposits that increase in thickness to the southeast.

The Coastal Plain is characterized by unconsolidated sediments of the Potomac Group, deposited in the floodplains of rivers, and are of Cretaceous age and younger (Cloos et al., 1964). The sediments comprise primarily quartz, quartz sandstone, and quartzite grains ranging in size from sands to cobbles; however, traces of clay are present. The gravels at the base of the formation may be cemented with iron oxide (Volkes and Edwards, 1974). The sediments form a wedge that is thinnest at the Fall Line and thickens in a southeasterly direction. Underlying the Coastal Plain deposits are the crystalline rocks of the Piedmont.

The Piedmont is characterized by sequences of metamorphic rocks such as gneiss and schist that are of Precambrian age. The upper portion of the Piedmont rocks has been weathered to a saprolite and the saprolite has been removed in many stream valleys (including those of West Farm Branch and Paint Branch) where the streams have eroded into the bedrock.

Cloos et al. (1964) reports fractures and foliation in the Piedmont rocks. Specifically, Froelich (1975) reported foliations with a northeast-southwest strike and dipping to the southeast and joints with a north-south or northeast-southwest strike and a vertical orientation at outcrops in Paint Branch near

OU1[2], whose area encompasses installation restoration (IR) Sites 3, 4, 5, 6, 7, 9, 13, and 46 (CH2M, 2003).

Groundwater occurs in both unconfined and confined conditions under the facility. The sand and gravel units of the Coastal Plain Province and the upper most weathered zone of the saprolite of the Wissahickon Formation comprise the unconfined or water-table aquifer. The thickness of the saprolite varies with the degree of weathering. Where erosion has removed the overlying Cretaceous and Tertiary sediments, the saprolite is thicker due to greater exposure to weathering processes. Based on drill logs from field investigations, the saprolite may act as an aquitard in places where it has a high clay content and unfractured texture. Therefore, the saprolite can limit the water flow between the overlying water table and the underlying fractured Wissahickon Formation when there is a high clay content. Groundwater flow within the competent bedrock is limited to fractures and probably occurs under confined conditions at most sites (Tetra Tech, 1998b).

1.1.3 Surrounding Land and Resource Uses

Land use in the vicinity of the Former NSWC White Oak is varied. The facility is adjacent to residential properties on its west, south and east flanks. To the north lies park land, and commercial and light industrial areas which include retail businesses, office buildings, several apartment complexes, a hospital, and a former sand and gravel quarry (Former Percontee quarry) currently owned by Global LifeSci Development Corporation. The University of Maryland also has a research center to the north of the site.

To the east are a commercial/industrial park, apartment houses, a hospital and medical complex, and a single-family residential community. To the south are the Powder Mill Community Park, residential areas, and the Hillandale Company 12 Fire Department. To the west on New Hampshire Avenue are more single-family residences.

1.1.4 Regulatory and Environmental Investigation Summary

Currently, 14 sites and three OUs are defined under the Navy's Installation Restoration Program (IRP) and identified for CERCLA process activities (remedial investigation [RI], feasibility study [FS], and RA) at Former NSWC White Oak. These sites and OUs are presented in **Table 1-1**.

The primary focus of this Five-Year Review Report are the five sites undergoing RAs: OU2 and OU3; Site 4; Site 5/13; Site 49; and SWMU 87. These sites are discussed in further detail in **Sections 3** through **7**. In addition, three Former NSWC White Oak sites, Site 7, Site 9, and Site 11, have been identified as not requiring any action to ensure protection of human health and the environment for unlimited use and unrestricted exposure (UU/UE) since the Third Five-Year Review Report (CH2M, 2017e). These three sites are discussed in further detail in **Section 8**.

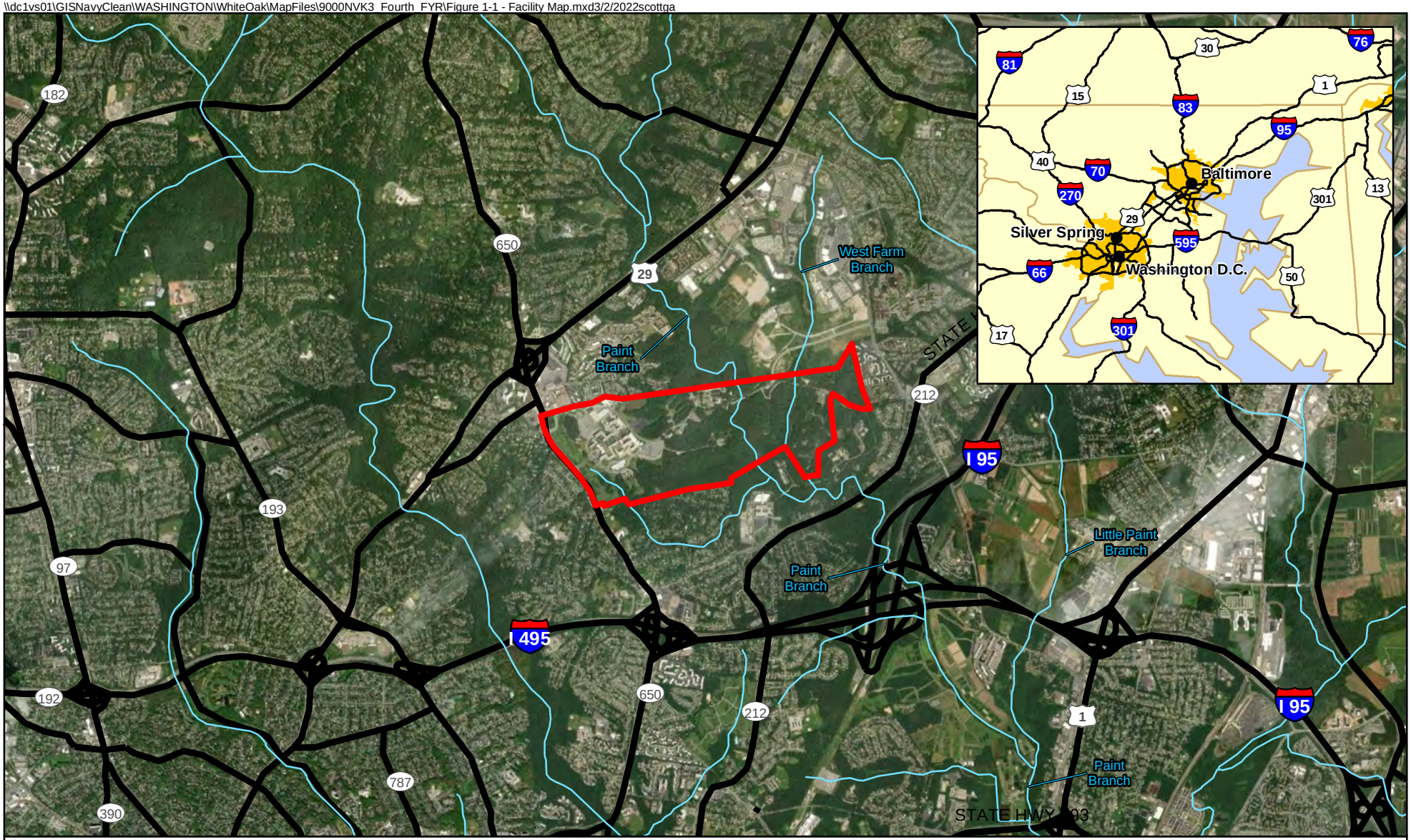
Finally, sites that do not require evaluation in this Five-Year Review Report are identified in **Table 1-1**. RODs requiring no further action (NFA) have been issued for five of these sites (Site 3, Site 8, Site 11 [soil], Site 18, and Site 47) at Former NSWC White Oak Five of these sites. Additionally, three sites (Site 7, Site 9, and Site 11 [groundwater]) have been closed with a RACR that allows for UU/UE, are identified in **Table 1-1**.

[2] OU1 originally represented a groundwater and surface water operable unit in the eastern half of the installation. Subsequent to an RI/FS for OU1, management of groundwater and surface water contamination was deferred to the individual site operable units associated with the contaminant release.

Table 1-1. Summary of Sites that do not Require Evaluation during the Fourth Five-Year Review

Site Number	Site Identification	OU Description	ROD Status
3	Pistol Range Landfill	Groundwater, Soil, and Sediment	NFA ROD signed March 2005
7	Ordnance Burn Area	Groundwater and Soil	ROD signed September 2004; RACR signed August 2017
8	Abandoned Chemical Disposal Pit	Soil	NFA ROD signed July 2002
9	Industrial Wastewater Disposal 300 Area	Groundwater and Soil	ROD signed September 2004; RACR signed September 2019
11	Industrial Wastewater Disposal 100 Area	Groundwater	ROD signed April 2004; RACR signed January 2020
		Soil	NFA ROD signed July 2002
28	Building T-14 Scrapyard	Soil	NFA ROD signed May 2003
47	Building 90 Drainage	Soil and Sediment	NFA ROD signed May 2003

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 1-1 - Facility Map.mxd3/2/2022scottga



Legend

- Former NSWC - White Oak Facility Boundary
- Rivers and Streams
- Highways

N

0 2,250 4,500 Feet

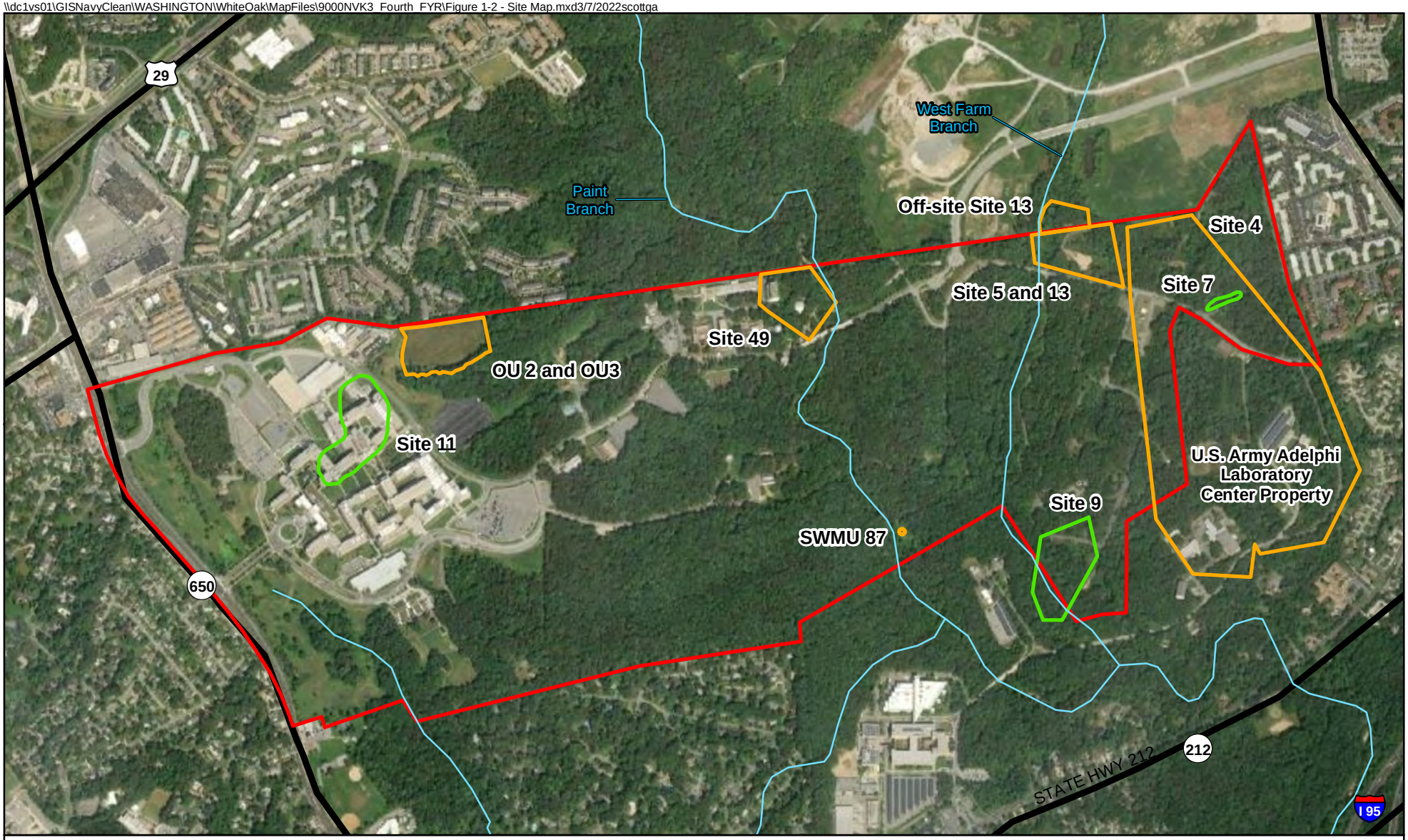
1 inch = 4,500 feet

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1-1
Facility Map
Fourth Five-Year Review Report
Former NSWC-White Oak Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 1-2 - Site Map.mxd3/7/2022scottga



Legend

- Site Boundary
- Closed IRP Site
- Former NSWC - White Oak Facility Boundary
- Rivers and Streams
- Highways

N

0 1,200 2,400 Feet

1 inch = 1,200 feet

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1-2
Site Map
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

SECTION 2

Five-Year Review Process

Former NSWC White Oak is a federal facility at which CERCLA activities are funded and implemented by the Navy under the Navy IRP. The Navy implements CERCLA at Former NSWC White Oak in partnership with MDE. Remedy protectiveness for the five sites at Former NSWC White Oak was evaluated through community involvement, document reviews, data review activities, and site inspections as described in the following subsections.

2.1 Community Notification, Involvement, and Site Interviews

As part of the Five-Year Review process, it is required that the public be notified that a Five-Year Review is being conducted and when it is completed. A fact sheet (**Appendix A**) for the Fourth Five-Year Review for OU2/OU3, Sites 4, 5/13, 49, and SWMU 87 was distributed in April 2022. Remedial Advisory Board (RAB) members and various local community organizations were provided the fact sheet. The purpose of the fact sheet was to inform the public that the Five-Year Review was being conducted; provide information on the sites with RODs under review; provide information on how the community can contribute during the review process; and provide contact information for anyone seeking additional information on the sites. No comments or questions were received from the public related to the Five-Year Review. Upon completion of this Fourth Five-Year Review, the results will be made available to the RAB members at their next meeting. Additionally, a notice will be sent to RAB and other community organizations indicating the results and the final report will be made available to the public at the White Oak Public Library, 11701 New Hampshire Avenue, Silver Spring, Maryland and in the administrative record file at https://www.bracpmo.navy.mil/brac_bases/northeast/former_warfare_center_white_oak/documents.html.

2.2 Data Review

The Five-Year Review consisted of a review of site-specific documentation and data for each OU, site, and SWMU. First, the ROD for each OU was reviewed to identify the potential risks to human health and the environment, remedial action objectives (RAOs), selected remedy, and Applicable or Relevant and Appropriate Requirements (ARARs). Additional review of relevant documents, including operations and maintenance (O&M) records, monitoring data, and other pertinent documents and data, were also reviewed to assess remedy performance and continued protection of human health and the environment. A list of the documents reviewed is included in each specific OU, site, and SWMU section, and references are provided in **Section 10**.

2.3 Site Inspections

Site Inspections for the Five-Year Review were conducted on November 18, 2021. The site inspections were carried out by representatives of the Navy, GSA, and CH2M, and consisted of inspections of all Five-Year Review sites. Completed Five-Year Review inspections checklists and a photograph log of the sites are located in **Appendix B**. The purpose of the inspections was to assess the protectiveness of the remedy and are discussed in further detail in **Sections 4** through **7**.

SECTION 3

Site 2 – OU2 (Soil, Waste, and Sediment associated with Apple Orchard Landfill) and OU3 (Groundwater and Surface Water associated with Apple Orchard Landfill)

3.1 Site Chronology

A chronology of major events for OU2 and OU3 is provided in **Table 3-1**.

Table 3-1. Key Events and Milestones for OU2 and OU3

Date	Key Events and Milestones
1984	Sites 1 and 2 identified as IRP sites during the Navy's Initial Assessment Study (IAS) (Navy, 1984).
1985	Confirmation Study (Verification Phase) for seven NSWC White Oak sites, that included Site 2, to confirm the findings of the IAS and obtain additional information in characterizing site hazards (Malcolm Pirnie, Inc. [Malcolm Pirnie] 1987).
1990	A Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted at NSWC White Oak. The RFA identified 97 SWMUs and 19 areas of concern (AOCs). All 14 of the IRP sites identified in the IAS were identified as either SWMUs or AOCs in the RFA report. Forty SWMUs were recommended for further investigation in a RCRA Facility Investigation (RFI); SWMUs 3 and 1 are associated with Sites 1 and 2, respectively (Kearney/Centaur Division, 1990).
January 1989 - March 1992	An RI was conducted at NSWC White Oak in two phases and the RI results confirmed the presence of contamination at Site 2. Potential risks were calculated, and based on exposure to groundwater and surface water, the calculated risks were determined to be high enough to support the development of a FS for Site 2 (Malcolm Pirnie, 1992).
1993	FS prepared for NSWC White Oak that included Site 2 (Malcolm Pirnie, 1993).
1995	A Design Verification Study was conducted to prepare remedial designs for NSWC White Oak Sites 2, 3, 4, 8, 9, and 11; a draft remedial design plan report was issued for NSWC White Oak Sites 2, 3, 4, and 9 (Haliburton NUS Corporation, 1995).
June 1996	Land transfer of NSWC White Oak to GSA and Army agreed on the disposition of the Federal Research Center (formerly the Dahlgren Division, White Oak Detachment, Naval Surface Center) at White Oak in Silver Spring, Maryland, from the Navy to GSA (662 acres) and to the Army (48 acres) (Tetra Tech, 2012b).
June 1998	USEPA issued Administrative Order to the Navy requiring interim measures be taken at Former NSWC White Oak to mitigate threats to human health and the environment, and to perform a RCRA FS and corrective measures study (CMS).
October 2000	Final RFI report evaluating Site 2 soil, groundwater, surface water, and sediment data from sampling conducted between January 1995-February 1999 completed (Tetra Tech, 2000b).

Table 3-1. Key Events and Milestones for OU2 and OU3

Date	Key Events and Milestones
January 1999-October 1999	Additional groundwater sampling conducted during four rounds (January/February, April, July/August, October) in 1999 and presented in the RFI Addendum report (Tetra Tech, 2000a).
March 2001	Final CMS completed which offered remedial alternatives to address soil and sediment risks that were identified during the RI for Site 1 and Site 2, designated at OU2 (Tetra Tech, 2001b).
July 2001	ROD for OU2 (soil, solid waste, and sediment) was signed; the selected remedy included excavation, treatment and disposal of waste, restoration, multimedia cap, institutional controls (ICs), and surface water and groundwater monitoring (Navy Engineering Field Activity Chesapeake, 2001).
December 2001	OU2 RA consisting of excavation and consolidation of waste under landfill cap completed (Tetra Tech, 2002).
June 2002 – July 2004	Long-term monitoring (LTM) of surface water and groundwater at OU2.
February 2003	Final Post-Closure Long-Term Monitoring Plan for OU2 completed (Tetra Tech, 2003b)
September 2004	ROD for OU3 (groundwater/surface water) was signed; the selected remedy is natural attenuation, ICs, and LTM of surface water and groundwater (NAVFAC, 2004a).[3]
September 2005 – May 2014	LTM of surface water and groundwater at OU2 and OU3.
2007	Land Use Control Remedial Design for OU2 and OU3 finalized (NAVFAC, 2007a).
August 2015 – June 2020	LTM of OU2 and OU3 surface water and groundwater for fourth Five-Year Review period.

Note: References used when compiling site chronology prior to 2012 included *Record of Decision for Naval Surface Warfare Center – White Oak, Operable Unit 2* (Navy Engineering Field Activity Chesapeake, 2001) and *Second Five-Year Review Report for Naval Surface Warfare Center, White Oak, Maryland* (Tetra Tech, 2012b).

3.2 Background

3.2.1 Description and History

Site 2, known as the Apple Orchard Landfill, is located in the northwestern portion of Former NSWC White Oak (**Figure 1-2**). Soil, waste, and sediment associated with the landfill are referred to as OU2, while the groundwater and surface water associated with Site 2 are referred to as OU3. These current operable units formerly spanned two sites, Site 1 (Parking Lot Landfill) and Site 2 (Apple Orchard Landfill). The waste has since been consolidated, so that there is now only one landfill, the Apple Orchard Landfill at Site 2 (NAVFAC, 2004a).

The Parking Lot Landfill at Site 1 was used for waste disposal from 1948 to 1953. Material disposed of included trash, metal scrap, construction debris, lubricating oil, storage batteries, battery acid, metal plating wastes, and vehicle maintenance shop wastes. Other than reports that 60 automobile batteries were disposed, the IAS reports no information regarding the quantity of wastes disposed. It was

[3] The groundwater monitoring component of the OU3 remedy is conducted in accordance with the Final Post-Closure Monitoring Plan for OU2 (NAVFAC, 2004a and Tetra Tech, 2003b)

estimated that Site 1 contained a total of 10,000 cubic yards of fill and waste (Navy Engineering Field Activity Chesapeake, 2001).

The Apple Orchard Landfill at Site 2 operated between 1948 and 1982 and is approximately 5.5 acres. Waste reportedly disposed of at the landfill included construction rubble, various solvents (xylene, acetone, dry cleaning solvents, and lacquer thinner), polychlorinated biphenyls (PCBs), paint residue, phenols, acids, other waste chemicals, and ordnance shapes (metal vessels used during research at the former facility). Additionally, carbon tetrachloride and methyl ethyl ketone may have been disposed of in the landfill, and between 500 and 1,000 gallons of oil containing PCBs were deposited in the landfill in 1957 and 1958 (Tetra Tech, 2012b).

In 2001, the waste from the Parking Lot Landfill at Site 1 was excavated and consolidated into the Apple Orchard Landfill at Site 2, and a landfill cap was constructed over the combined waste, per the selected remedy outlined in the ROD for OU2 (Navy Engineering Field Activity Chesapeake, 2001). Additionally, the selected remedy in the OU2 and OU3 RODs included natural attenuation, ICs, and LTM of groundwater and surface water (NAVFAC, 2004a). Because the RA consolidated waste and did not clean up site media to levels that would allow for unlimited use and unrestricted exposure, a statutory review has been, and will continue to be, performed every 5 years to evaluate the protectiveness of the selected remedy (NAVFAC, 2004a).

3.2.2 Physical Characteristics

OU2 is approximately 5.5 acres in size; it is bordered on the north by Perimeter Road and private property, and on the south by an unnamed tributary (**Figure 3-1**). The geology underlying OU2 has been characterized based on the results of borings located around the perimeter of the landfill and test pits along its northern edge. The thickness of the landfill was estimated by comparing the topography prior to landfill activities to the present topography. The landfill thickness ranges from about 4 feet along Perimeter Road to about 36 feet near the edge of the landfill plateau. Test pits along the northern perimeter and northeastern corner of the landfill revealed sand with silt and gravel and concrete and asphalt as the fill material (Halliburton NUS Corporation, 1995). The native material surrounding OU2 consists of a thin mantle of soil resting on the saprolite of the Wissahickon gneiss. The shallow surface material is variable, ranging from clayey silt to sandy silt to gravel with a thickness of 2 to 6 feet. The saprolite ranges in thickness from 8 feet along the unnamed tributary to greater than 49 feet along the northern edge of the site. Bedrock was encountered along the southern perimeter of the landfill approximately 10 feet below ground surface (bgs), and 30 feet bgs in the northwestern corner of OU2. OU3 (the underlying groundwater) is unconfined and present in the saprolite, bedrock and, to a lesser extent, the surface soils along the surface drainage pathways. The depth to the water table for OU3 ranges from approximately 3 to 4 feet bgs along the toe of the landfill to 32.5 feet bgs along Perimeter Road. Based on a comparison of available groundwater elevations and predevelopment topographic maps of OU2, it is unlikely that groundwater is in contact with wastes within OU2. Groundwater flows from the northwestern corner of the site to the southeast, discharging at least in part to the unnamed tributary to the south (**Figure 3-2**). The mean hydraulic conductivity of the saprolite has been calculated to be 9.58 feet/day and 7.66×10^{-2} feet/day for the bedrock (Tetra Tech, 2012b).

3.2.3 Land and Resource Uses

Currently, the majority of property occupied by OU2 is open grass space with a small, paved parking area associated with buildings to the west side of the site. The property is owned by the GSA and future use of OU2 is to remain a landfill with use restrictions that do not disturb the landfill cap. The area surrounding OU2 is anticipated to remain as commercial/industrial use. Private property immediately north of the Former NSWC White Oak is used for residential purposes. An apartment complex is located on private property less than 100 feet to the north of OU2. Groundwater at OU2 is not used as a potable water

supply and controls are in place to restrict future use of the groundwater. In addition, water for occupants of the Former NSWC White Oak and the surrounding properties is, and is expected to continue to be, supplied by a local municipal water authority. Local ordinances prevent the installation of new private potable wells where a public supply is readily available.

3.2.4 History of Contamination

Site 1 (the Parking Lot Landfill) was used as an open disposal site and landfill between 1948 and 1953, Wastes reportedly disposed of at Site 1 included various wastes, including trash, metal scrap, construction debris, lubricating oil, storage batteries, battery acid, metal plating wastes and vehicle maintenance shop wastes. Site 2 (the Apple Orchard Landfill) operated as an open disposal area and landfill from 1948 until 1982. Wastes reportedly disposed of at Site 2 included municipal waste, construction rubble, PCBs, various solvents, paint residue, acids, other waste chemicals, and ordnance shapes (metal vessels used during research at the former facility). Waste within Sites 1 and 2 were consolidated and capped as OU2 in 2001. Constituents of concern (COCs) in OU2 soil include 1,2-dichloroethane (DCA), trichloroethene (TCE), PCBs, polycyclic aromatic hydrocarbons (PAHs), lead, manganese, mercury, and zinc (NAVFAC, 2001); COCs in OU2 sediment include Aroclor 1260, PAHs, and lead (NAVFAC, 2001). OU3 is defined as the groundwater underlying and surface water adjacent to Sites 1 and 2, and OU3 COCs include iron, lead, and manganese (NAVFAC, 2004a).

As documented in the OU2 Post-Closure LTM Plan (Tetra Tech, 2002), COCs identified in soil and sediment during the RFI and baseline ecological risk assessment (BERA) have been addressed through excavation and consolidation of contaminated soil and sediment and the construction of the landfill cap. A post-removal action report associated with the verification sampling performed during the completion of the OU 2 remedial action was developed to verify that no site risks associated with exposure to soil and sediment were present following completion of the remedial action. Monitoring of OU3 COCs is conducted to confirm that the corrective action performed at OU2 is protective of human health and environmental receptors.

Trend graphs showing concentrations of commonly detected constituents in groundwater and surface water are presented in **Appendix C-1.**

3.2.5 Site Risks

Various RI activities were undertaken at OU2 and OU3 in the 1980s and 1990s, and the data from these investigations were used to conduct a Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA). The following summary of human health risk is based on the HHRA presented in the OU2 and OU3 RODs (Navy Engineering Field Activity Chesapeake, 2001; NAVFAC, 2004a), and in the first and second Five-Year Reviews (JM Waller Associates, 2007; Tetra Tech, 2012b). The following summary of the ERA is based on the ERA presented in the Screening Level Ecological Risk Assessment (Tetra Tech, 1999b) and BERA (Tetra Tech, 2001a).

3.2.5.1 Human Health Risk Assessment

The HHRA for Site 1 soil was completed as part of the 1999 Engineering Evaluation and Cost Analysis and the HHRA for Site 2 soil, and sediment, surface water, and groundwater was completed as part of the RFI (Tetra Tech, 2000b) and are summarized in the 2001 CMS (Tetra Tech, 2001b). The HHRAs evaluated noncarcinogenic hazards and carcinogenic risks associated with exposure to surface soil and subsurface soil for Site 1, surface soil for Site 2, and sediment, surface water, and groundwater across Sites 1 and 2. Note that OU2 and OU3 no longer encompass Site 1, as wastes associated with Site 1 were addressed through removal and consolidation on Site 2. However, the HHRA discussion includes Site 1, as it was still part of OU2 and OU3 at the time of the HHRAs. Exposure to site media was evaluated for both a reasonably anticipated commercial/industrial site use scenario (including full-time worker,

maintenance/utility worker, construction worker, day care center child, adult recreational user, and/or adolescent trespasser) and a less likely future residential use scenario (including adult and child resident).

Lead was the only analyte identified as presenting a potential unacceptable risk to human health under the reasonably anticipated commercial/industrial use scenario for Site 1 for surface soil. Risks associated with exposure to Site 1 subsurface soil under the reasonably anticipated commercial/industrial site use scenario and the less likely future residential use scenario, were within acceptable levels. While residential use was not anticipated, PAHs, PCBs (specifically, Aroclor 1260, and to a lesser extent Aroclor 1254), dieldrin, and heptachlor epoxide were found to contribute to an unacceptable carcinogenic risk for Site 1 for this potential use.

Risks associated with exposure to surface soil (or surface and subsurface soil for the construction or maintenance worker) at Site 2 and sediment under the reasonably anticipated commercial/industrial site use scenario were within acceptable levels. While residential use of the Site 2 landfill (OU2) source area was not anticipated, PAHs and PCBs (Aroclor 1260) in surface soil were found to contribute to an unacceptable carcinogenic risk for Site 2 for potential future residential use. With regard to sediment, manganese was found to present an unacceptable noncarcinogenic hazard, and PAHs, PCBs, and arsenic were found to contribute to unacceptable carcinogenic risk, under potential residential use.

The HHRA determined that under current conditions, there was no unacceptable human health risk associated with contaminants in groundwater and surface water because groundwater and surface water at OU3 were not being used as a potable water source. Noncarcinogenic hazards associated with exposure to OU3 groundwater under a hypothetical future residential scenario exceeded the USEPA's target hazard level associated with arsenic and manganese. Carcinogenic risks associated with exposure to groundwater under a hypothetical future residential scenario exceeded USEPA’s target risk range associated with TCE and arsenic.

Based on these exceedances of target risk levels, it was determined that RA was necessary to reduce risk-driving concentrations of constituents at OU2 and OU3.

3.2.5.2 Ecological Risk Assessment

An ERA for OU2 (soil and sediment) was conducted over several years and through multiple sampling and analysis efforts. A Screening Level Ecological Risk Assessment (Tetra Tech, 1999b) was conducted for all sites at Former NSWC White Oak. This entailed comparison of soil and sediment data to ecological screening criteria to identify constituents of potential concern (COPCs). Subsequently, a quantitative BERA (Tetra Tech, 2001a) was conducted that evaluated those COPCs in conjunction with site-specific toxicity and bioaccumulation data. The BERA concluded that concentrations of PAHs and PCBs detected in soil and sediment posed potential risks to ecological receptors. Based on these exceedances of target risk levels, it was determined that RA was necessary to reduce risk-driving concentrations of constituents at OU2.

As groundwater exposure is not associated with ecological receptors, OU3 groundwater poses no ecological risks. No site-related potential chemicals of concern were retained in the BERA for surface water in the tributary adjacent to OU2; therefore, risk to ecological receptors was not evaluated for this medium relative to OU3.

3.3 Response Action Summary

3.3.1 Basis for Remedial Action

Based on the results of previous investigations and risk assessments, RA was warranted to protect public health, welfare, and the environment from actual or threatened releases of hazardous substances from OU2 soil and sediment to OU3 groundwater and surface water.

As documented in the OU2 ROD, the COCs in OU2 soil include total PCBs, total PAHs, TCE, 1,2-DCA, manganese, lead, zinc, and mercury. The COCs in OU2 sediment included total PCBs, low-molecular-weight PAHs, and high-molecular-weight PAHs. Remedial action levels for these constituents are identified in the OU2 ROD (Navy Engineering Field Activity Chesapeake, 2001).

The COCs identified in the ROD for OU3 groundwater underlying and surface water adjacent to Site 1 (the Parking Lot Landfill) and Site 2 (the Apple Orchard Landfill) include iron, lead, and manganese. However, no media clean-up standards (MCSs) were identified for these COCs because the OU3 groundwater is located beneath a landfill cap where cleanup is not required by USEPA policy regarding capped landfills; ICs can be applied to restrict its use; and because there is no evidence that these COCs are migrating offsite (NAVFAC, 2004a).

3.3.2 Response Actions

3.3.2.1 Selected Remedy for OU2

The ROD for OU2 was signed on July 18, 2001 (Navy Engineering Field Activity Chesapeake, 2001). The ROD summarized the risks to human health and the environment, established RAOs, and defined the selected remedy. The RAOs for OU2 as stated in the ROD are the following:

- Prevent direct contact with landfill contents/soil.
- Minimize infiltration and resulting contaminant migration to groundwater.
- Control surface water runoff and erosion.
- Eliminate exposure of ecological receptors to sediments of concern.

The remedy selected to achieve the RAOs, “Alternative 2: Containment of Landfills and Sediment with Multimedia Cap,” comprised the following components:

- Excavation, regrading, and consolidation of soil and waste of Sites 1 and 2 and associated sediment
- Treatment and disposal, as necessary, of any incompatible wastes encountered during excavation and regrading of soil and waste and of wastewater generated during excavation and regrading of waste, soil and sediment
- Restoration of areas of soil, waste and sediment excavation
- Construction of engineered multimedia cap components for Site 1 and Site 2
- Installation of surface water controls and vegetation of cap
- ICs preventing future use of the property that could result in unacceptable risks, and protecting the integrity of the landfill caps
- Surface water and groundwater monitoring

The primary goal for the remediation at OU2 was to make Sites 1 and 2 suitable for the planned commercial and industrial uses of the property. The following are performance standards for the implementation of the remedy (Navy Engineering Field Activity Chesapeake, 2001):

- Remove contaminated soil and contain it beneath landfill caps, such that constituent concentrations in remaining soil are below RA levels and do not pose a threat to human health or the environment.
- Appropriately manage any military waste encountered.
- Appropriately manage any wastewater developed or encountered during RA.
- Develop and implement a land use control (LUC) plan, to prevent human exposure to contaminated media.
- Design and implement a surface water and groundwater monitoring plan in order to monitor performance of the RA.
- Design and implement an O&M plan to ensure the continued integrity of the landfill caps.

The following conditions were among those set forth in the ROD to define compliance with ARARs:

- Meet requirements of landfill closure, including those specific to hazardous waste landfills.
- Reduce concentrations of contaminants in site media to a level that would not pose a potential risk to human health.
- Ensure the public could not come into contact with any unexploded ordnance recovered from the landfills.

The full list of ARAR considerations can be found in the ROD for OU2 (Navy Engineering Field Activity Chesapeake, 2001).

3.3.2.2 Selected Remedy for OU3

The ROD for OU3 was signed on September 30, 2004 (NAVFAC, 2004a). The ROD summarized the risks to human health and the environment, established objectives, and defined the selected remedy.

Corrective Action Objectives (CAOs) identify receptors, pathways, and action levels. The following CAOs were defined for OU3:

- Prevent human exposure (through ingestion, inhalation, and dermal contact) to groundwater having contaminants at concentrations in excess of MCSs.
- Comply with ARARs, and To Be Considered Criteria as appropriate.

Because it is not USEPA's policy to require an RA for groundwater beneath a landfill cap, no MCSs were developed and the following minimum CAOs were used instead:

- Prevent human exposure (ingestion, inhalation, and dermal contact) to groundwater with COC concentrations greater than screening criteria.
- Mitigate further migration of COCs.
- The remedy selected to achieve the RAOs, “Alternative 2: Monitored Natural Attenuation (MNA), ICs and Long-term Monitoring,” comprised the following components:
  - Allow the process of natural attenuation to proceed, including dispersion, dilution, adsorption, and biodegradation.
  - Implement LUCs to:
    - Ensure no withdrawal of groundwater for any purpose (including as drinking water) from within the restricted area (shown on **Figure 3-1**) until the Preliminary Remediation Goals

(PRGs)[4] are met and risks from groundwater use are shown to be reduced to acceptable levels.

  - Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.
  - Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.
  - Ensure adequate notification of pertinent use restrictions to current and future owners.

– Regularly collect and analyze groundwater and surface water samples to assess the progress of natural attenuation and warn of potential migration of contaminants.

The primary goal of LTM OU3 groundwater is to ensure that natural attenuation is occurring, and that migration of contamination in groundwater is not occurring.

The following conditions were among those set forth in the ROD to define compliance with ARARs:

- Adopt criteria and procedures to protect lands and water comprising a watershed of the State of Maryland during the development of corrective measures.
- Adhere to USEPA protocol regarding monitoring groundwater for natural attenuation.
- Adhere to Maryland regulation involving monitoring well installation and abandonment.
- The full list of ARAR considerations can be found in the ROD for OU3 (NAVFAC, 2004a).

3.3.3 Status of Remedy Implementation

3.3.3.1 Removal Action and Landfill Capping

The following information regarding remedy implementation comes from the Post-Closure Report for OU2 (Tetra Tech, 2002). The RA was performed by the NAVFAC Atlantic Division Remedial Action Contractor between June and December of 2001. Between August and September, after the excavation was complete, 13 soil samples and 15 sediment samples were collected from across the site, to confirm that the excavation had removed all contaminated soil and sediment to levels that allowed UU/UE. Following completion of excavation and verification sampling, OU2 was restored by placing clean backfill above the geosynthetic landfill cap materials. Excavation, waste consolidation, cap construction, and site restoration were completed by December 2001. No hazardous wastes were identified during the waste excavation and consolidation efforts; however, numerous ordnance shapes were removed from the landfill and disposed of offsite.

3.3.3.2 Long-Term Monitoring

Per the selected remedy outlined in the ROD for OU2 (Navy Engineering Field Activity Chesapeake, 2001), groundwater and surface water LTM was conducted in June, October, and December 2002; March 2003; and June and July 2004. Following these events and in accordance with the February 2003 OU2 Post-Closure LTM Plan (Tetra Tech, 2003b), groundwater and surface water sampling was conducted in approximate 15-month intervals from March 2003 through 2018, and in 30-month intervals starting in May 2020[5], to assess the progress of natural attenuation and identify potential migration of COCs. Specifically, the LTM groundwater and surface water sample analyses documented in

[4] Groundwater PRGs were not established in the OU2 and OU3 ROD

[5] Based on the 2018 LTM results, and in accordance with the OU2 ROD (Navy Engineering Field Activity Chesapeake, 2001) and LTM Plan (CH2M, 2005), the White Oak Partnering Team (consisting of the Navy, MDE, and GSA) agreed during the April 18, 2018, partnering meeting to decrease LTM sampling to every 30 months starting with the sampling event originally scheduled for May 2020

the OU2 Post-Closure LTM Plan (Tetra Tech, 2003b) included volatile organic compounds (VOCs), inorganics, perchlorates, total organic carbon (TOC), total organic halides, and explosives. However, based on optimization, LTM groundwater samples are currently analyzed for target analyte list (TAL) VOCs, TAL metals, mercury, explosives and perchlorate, and LTM surface water samples are analyzed for TCE, TAL metals, and mercury.

With regard to the monitoring well and surface water sample locations included in LTM, nine monitoring wells (02GW31, 02GW32, 02GW45, 02GW100, 02GW101, 02GW103, 02GW104, 02GW105, and 02GW76) were initially included in the Post-Closure Long-Term Monitoring Plan Operable Unit 2 (Tetra Tech, 2003b). However, three monitoring wells (02GW100, 02GW101, and 02GW105) were removed from LTM prior to the OU2 groundwater and surface water sampling event in October 2009 (Tetra Tech, 2010). Additionally, six surface water samples (OU2SW01 through OU2SW06) were initially included in the Post-Closure Long-Term Monitoring Plan Operable Unit 2 (Tetra Tech, 2003b). However, two surface water sampling locations (02SW02 and 02SW04) were removed from LTM following the OU2 groundwater and surface water sampling event in October 2011 (Tetra Tech, 2012a).

In addition to groundwater and surface water sampling, LTM also includes landfill gas monitoring at the gas vents and landfill gas monitoring wells located on and north of the capped landfill with a photo-ionization detector to measure the levels of volatile organics venting from the landfill.

The following is a summary of the most recent OU3 LTM groundwater and surface water sampling event conducted in June 2020.

Trichloroethene

TCE was only detected in the groundwater sample collected from monitoring well 02GW45 at a concentration of 2 micrograms per liter (µg/L). At this location, concentrations of TCE have ranged from 2 µg/L to 9.1 µg/L since monitoring began and have been declining since 2007.

TCE was the only organic constituent analyzed in the four surface water samples collected in June 2020 and concentrations were below laboratory detection limits.

Cis-1,2-Dichloroethene

Cis-1,2-dichloroethene (DCE) was only detected in the groundwater sample collected from monitoring well 02GW45 at a concentration of 1.55 µg/L. Cis-1,2-DCE has been declining since monitoring began with concentrations ranging from 1.55 µg/L to 3 µg/L from 2008 to 2020.

Methyl-tert-butyl ether

Methyl-tert-butyl ether (MTBE) was only detected in the groundwater sample collected from monitoring well 02GW45 at a concentration of 0.2 J[6] µg/L. Historically, MTBE has not been above laboratory detection limits at this well.

Freon-11

Freon-11 was detected in groundwater samples collected from two monitoring wells (02GW103 and 02GW45). In samples collected from monitoring well 02GW103, Freon-11 was detected at a concentration of 1.79 µg/L in 2020 and has fluctuated with concentrations ranging from 0.35 J µg/L and 8.4 J µg/L since monitoring began. At monitoring well 02GW45, Freon-11 was detected at a concentration of 0.453 J µg/L in 2020 and has decreased from a concentration of 32 µg/L in December 2006.

[6] J - Analyte present, value may or may not be accurate or precise

High Melting Explosive

High melting explosive (HMX) was detected in samples collected from two monitoring wells (02GW103 and 02GW45). In samples collected from monitoring well 02GW103, HMX was detected at a concentration of 2.13 µg/L and historically has remained relatively stable between 1.1 µg/L and 6 J µg/L. At monitoring well 02GW45, HMX was detected at a concentration of 0.622 J µg/L. Concentrations have decreased at this well since a maximum concentration of 44.4 µg/L in 2004.

Perchlorate

Perchlorate was detected in samples from three monitoring wells (02GW103, 02GW32, and 02GW76). In samples collected from monitoring well 02GW103, perchlorate was detected at a concentration of 0.588 µg/L and has been stable ranging from below laboratory detection to 1.2 µg/L since monitoring began. At monitoring well 02GW32, perchlorate was detected at 0.273 J µg/L and concentrations have been stable ranging from below laboratory detection and 0.27 J µg/L since December 2006. In samples collected from monitoring well 02GW76, perchlorate was detected at a concentration of 0.322 J µg/L. Perchlorate concentrations have been declining since a maximum concentration of 0.847 in 2014.

Total Metals

Nineteen metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, and sodium) were detected in the groundwater samples collected in June 2020.

Fourteen metals (aluminum, arsenic, barium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc) were detected in surface water samples collected in June 2020.

Metals concentrations in both groundwater and surface water have remained relatively consistent over the last several monitoring events and this suggests that further optimization of LTM and monitoring parameters is warranted.

3.3.3.3 Operation and Maintenance

A LUC remedial design (RD) was developed to outline O&M responsibilities following installation of the multi-layer geosynthetic cap (NAVFAC, 2007a) requiring the site to be inspected twice a year to evaluate the condition of the landfill cap, vegetation and maintenance of monitoring wells in accordance with a LUC Remedial Design. Since 2013, site inspections have been conducted annually. In general, the results of the site inspections indicated the cap is in good condition and there have been no disturbances or damage to the monitoring wells. During the January 2021 annual site inspection, part of the liner was observed exposed on the northwest side of the landfill by the rip-rap channel; however, this minor damage did not affect site protectiveness.

3.3.3.4 Institutional Controls Summary

ICs documented in the LUC Remedial Design (NAVFAC, 2007a) include land use restrictions, a survey plat describing the land area where the LUCs are implemented and deed notification requirements to prohibit residential use of the property and site inspections to ensure the integrity of the cap is maintained. In addition, access to the area of OU2 outside of the cap is restricted unless a post-excavation risk assessment demonstrates that there is no unacceptable risk for this use.

In accordance with the OU3 ROD (NAVFAC, 2004a), ICs will be implemented to meet the following LUC objectives:

- Ensure no withdrawal of groundwater for any purpose (including as drinking water) from within the restricted area shown on **Figure 3-1** until the PRGs[7] are met and risks from groundwater use are shown to be reduced to acceptable levels.
- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.
- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.
- Ensure adequate notification of pertinent use restrictions to current and future owners.

LUCs will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure.

In addition to groundwater and surface water sampling, the landfill has been inspected during each sampling event to ensure the continued integrity and effectiveness of the cap.

3.4 Progress Since Last Review

Tables 3-2 and **3-3** provide the protectiveness determinations and statements from the last Five-Year Review, and the recommendations from the last Five-Year Review and the current status of those recommendations.

Table 3-2. Protectiveness Determination/Statement from the Third Five-Year Review – OU2 and OU3

Protectiveness Determination	Protectiveness Statement
Protective	The remedy at OU2 and OU3, consisting of a multimedia cap, MNA, ICs, and groundwater and surface water monitoring, is currently protective of human health and the environment over the long term. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

Table 3-3. Status of Recommendations from the Third Five-Year Review – OU2 and OU3

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Site inspections not documented	Site inspections should be conducted at least once a year, documented in accordance with the OU2 and OU3 LUC RD, and summarized during the next Five-Year Review.	Ongoing	Annual site inspections are being conducted to confirm continued compliance with the LUC RD objectives at OU2 and OU3 and were completed in October/November 2016, November 2017, December 2018, January 2020, and January 2021. Site inspection checklists are included in **Appendix D**.	November 2016 November 2017 February 2018 January 2020 January 2021

[7] While this objective was stated in the OU3 ROD on page 2-21 (NAVFAC, 2004a), groundwater PRGs were not established nor identified in this document.

3.5 Five-Year Review Process

3.5.1 Document Review

Table 3-4 summarizes the main documents reviewed in the preparation of this section of the Five-Year Review. A complete list of documents cited in the preparation of this Fourth Five-Year Review Report is included in **Section 10**.

Table 3-4. Summary of OU2 and OU3 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
ROD for OU2	Navy Engineering Field Activity Chesapeake	2001
Post-Closure Report for OU2	Tetra Tech	2002
ROD for OU3	NAVFAC	2004
First Five-Year Review Report	JM Waller Associates	2007
OU2 Surface Water and Groundwater Sampling Memorandum	Tetra Tech	2009
OU2 Surface Water and Groundwater Sampling Memorandum	Tetra Tech	2011
Second Five-Year Review Report	Tetra Tech	2012
Third Five-Year Review Report	CH2M	2017
Basewide Long-term Monitoring Report 2015	CH2M	2017
Basewide Long-term Monitoring Report 2016	CH2M	2017
Basewide Long-term Monitoring Report 2017-2018	CH2M	2019
Basewide Long-term Monitoring Report 2020	CH2M	2021

3.5.2 Site Inspections

During the site inspection conducted annually and for this Five-Year Review at OU2 and OU3, no issues were identified affecting the protectiveness of the sites. Site inspection checklists are included in **Appendix B** and **Appendix D**.

3.5.3 Data Review and Evaluation

Groundwater and surface water monitoring is conducted as part of the post-closure activities at OU2 and OU3 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. Surface water and groundwater quality at OU2 and OU3 have generally remained the same since the landfill cap was emplaced in 2001. While VOCs, explosives, and metals continue to be consistently detected in groundwater, they are generally present at low concentrations (CH2M, 2021a). Based on a history of low to non-detect concentrations, two surface water sampling locations have been removed from the sampling program, and explosives and most VOCs have been removed from the analyte list[8]. Only TCE and metals continue to be analyzed in surface water.

[8] OU2 and OU3 groundwater and surface water optimization is currently summarized in the Basewide Long-term Monitoring Report (CH2M, 2021a)

3.6 Technical Assessment

This section presents the answers to the three questions defined for the Technical Assessment for OU2 and OU3.

3.6.1 Question A – Is the Remedy Functioning as Designed?

A review of site inspections findings and LTM data demonstrate the remedy is still functioning as intended.

3.6.1.1 Remedial Action Performance

Based on inspections conducted during LTM since its construction in 2001 through 2020, the landfill cap at OU2 is in good condition. LTM of groundwater and surface water associated with the OU2 landfill has not indicated a release from the landfill.

3.6.1.2 Implementation of Institutional Controls and Other Measures

LUCs at OU2 and OU3 include ICs to prohibit residential development, disturbance of the landfill cap, and potable use of groundwater or surface water. The Navy and GSA are obligated to ensure the implementation of these restrictions, including ensuring that current and future property owners are aware of the restrictions. These LUCs remain in place, and no signs of LUC violations have been observed.

3.6.1.3 Opportunities for Optimization

Since the last Five-Year Review, as agreed by the White Oak Partnering Team during the April 18, 2018 partnering meeting, the LTM sampling frequency was decreased to every 30 months starting with the sampling event originally scheduled for May 2020.

3.6.2 Question B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Selection Still Valid?

Land use has not changed; therefore, the exposure assumptions and RAOs developed at the time of remedy selection are still valid. Soil and sediment contamination was adequately addressed through the 2001 RA, as established in the Post-Closure Report (Tetra Tech, 2002).

Although toxicity values have changed since the HHRA was performed and the ROD was signed, the LUCs meet the requirement of the CAOs to prevent human exposure to soil and groundwater. No PRGs or cleanup levels were established for OU3; therefore, changes to toxicity values would not result in any changes to PRGs, and there have been no changes to groundwater maximum contaminant levels (MCLs) since the previous Five-Year Review.

3.6.3 Question C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

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

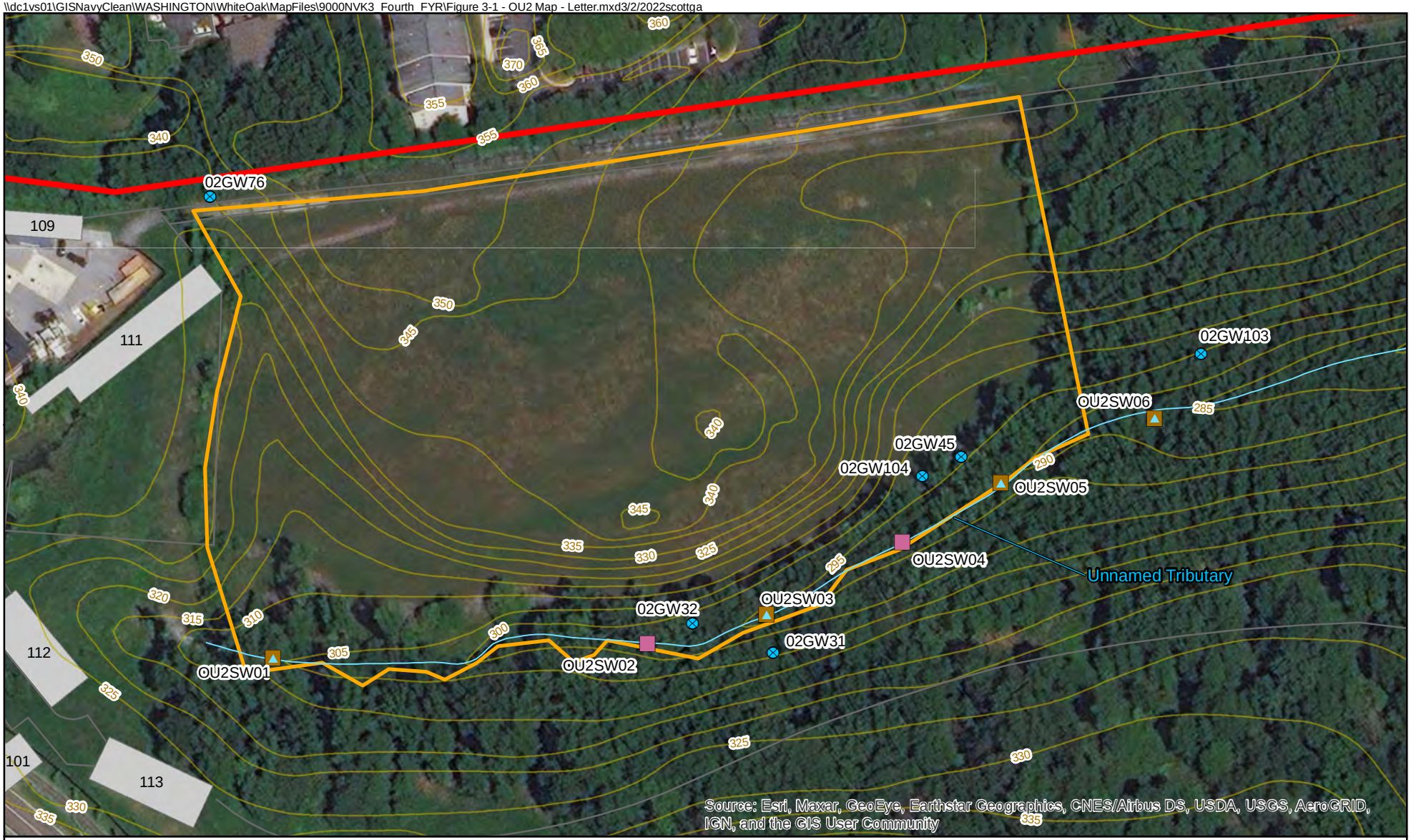
3.7 Issues, Recommendations, and Follow-up Actions

Based on this Five-Year Review, there are no issues or recommendations for OU2 and OU3 that affect current or future protectiveness.

3.8 Protectiveness Statement

The remedy at OU2 and OU3, consisting of a multimedia cap, MNA, LUCs that incorporate ICs, and groundwater and surface water monitoring, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 3-1 - OU2 Map - Letter.mxd3/2/2022scottga



Legend

- 2020 Long Term Monitoring Well
- 2020 Long Term Monitoring Surface Water Location
- Surface Water Location
- Topographic Contours (ft msl)
- Site Boundary
- Former NSWC - White Oak Facility Boundary
- Unnamed Tributary
- Roads
- Abandoned Building and Other Structures

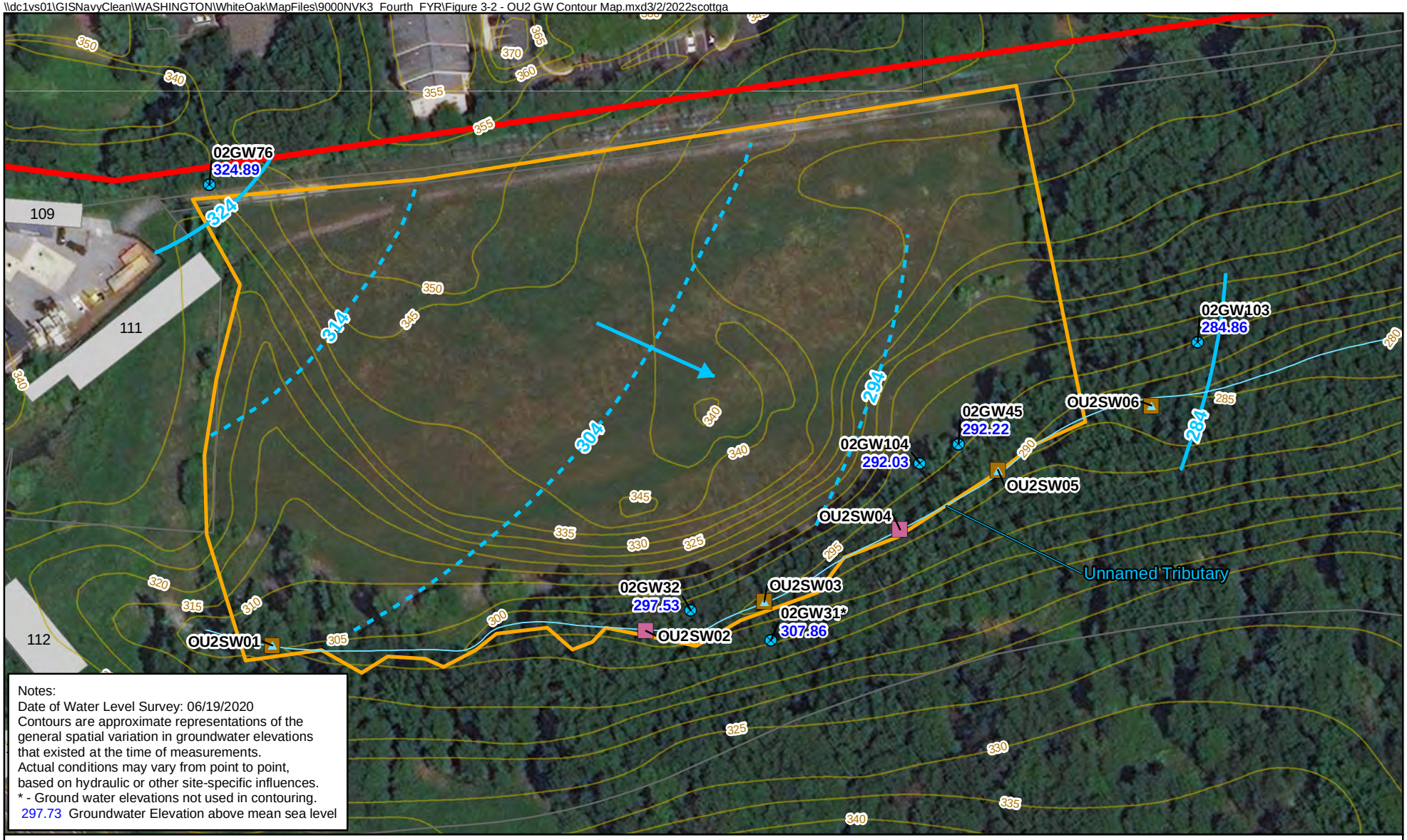
N

0 60 120 Feet

Figure 3-1
OU2 and OU3 Map
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 3-2 - OU2 GW Contour Map.mxd3/2/2022scottga



Legend

- 2020 Long Term Monitoring Well
- 2020 Long Term Monitoring Surface Water Location
- Surface Water Location
- Topographic Contours (ft msl)
- Site/LUC Boundary
- Former NSWC - White Oak Facility Boundary
- Unnamed Tributary
- Roads
- Abandoned Building and Other Structures
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

N

0 60 120 Feet

Figure 3-2
OU2 and OU3 Groundwater Contour Map and LTM Locations – June 19, 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

SECTION 4

Site 4 – Chemical Burial Area

4.1 Site Chronology

A chronology of major events for Site 4 is provided in **Table 4-1**.

Table 4-1. Key Events and Milestones for Site 4

Date	Key Events and Milestones
1984	Site 4 identified as an IRP site during the Navy's IAS (Navy, 1984).
1985	Confirmation Study (Verification Phase) for seven NSWC White Oak sites, that included Site 4, to confirm the findings of the IAS and obtain additional information in characterizing site hazards (Malcolm Pirnie, 1987).
1990	An RFA was conducted at NSWC White Oak. The RFA identified 97 SWMUs and 19 AOCs. All 14 of the IRP sites identified in the IAS were identified as either SWMUs or AOCs in the RFA report. Forty SWMUs were recommended for further investigation in an RFI; SWMU 4 in the RFA is the same as IRP Site 4 identified in the IAS (Kearney/Centaur Division, 1990).
January 1989 - March 1992	An RI was conducted at NSWC White Oak in two phases and the RI results confirmed the presence of contamination at Site 4. Potential risks were calculated, and based on exposure to groundwater, the calculated risks were determined to be high enough to support the development of a FS for Site 4 (Malcolm Pirnie, 1992).
1993	An FS was completed for NSWC White Oak that included Site 4 (Malcolm Pirnie, 1993).
1995	A Design Verification Study was conducted to prepare remedial designs for NSWC White Oak Sites 2, 3, 4, 8, 9, and 11; a draft remedial design plan report was issued for NSWC White Oak Sites 2, 3, 4, and 9 (Haliburton NUS Corporation, 1995).
1995 - 1996	The Former NSWC White Oak was selected for closure on the BRAC IV list, and a Phase I Environmental Baseline Survey was conducted (EA, 1996).
1997	A site investigation was conducted at Site 46 to identify and characterize the source of chlorinated VOCs (CVOCs)detected in this area, which is situated immediately downgradient of Site 4 (Tetra Tech, 1998a).
1998-1999	An RFI that included the immediate area around Site 4 was conducted to further characterize the nature and extent of contamination in soil and groundwater at Site 4. The RFI concluded that elevated risks were present from exposure to Site 4 soil contaminated with CVOCs, most notably TCE (Tetra Tech, 2000b).
January 1999	An Engineering Evaluation/Cost Analysis (EE/CA) is completed for Site 4 (Brown & Root, 1999) which recommended a removal action.
June-September 1999	A soil removal action was conducted at the Site 4 source area to address contamination from historical chemical disposal activities at Burial Areas 1 and 2. During the removal action, approximately 23,000 tons (18,000 cubic yards) of contaminated soil and solid waste were removed and transported to a municipal solid waste landfill for disposal. The cleanup goals, which were based on industrial use standards, were met (Tetra Tech, 1999a).

Table 4-1. Key Events and Milestones for Site 4

Date	Key Events and Milestones
2002	The RI report for OU1 (the groundwater and surface water OU for the eastern portion of Former NSWC White Oak, including Site 4) was completed (CH2M, 2002).
2003	The FS report for OU1 was completed (CH2M, 2003).
September 28, 2005	The ROD for Site 4 soil and groundwater was signed by the USEPA and Navy with concurrence by MDE. The selected remedy for soil is soil vapor extraction. The selected groundwater remedy is enhanced reductive dechlorination (ERD), with ICs, and LTM until groundwater remediation goals are met (NAVFAC, 2005a).
September-October 2007	The initial implementation of ERD was performed by with emulsified oil substrate (EOS) injected at the Source Area, 50 Series Area, and 100 Series Area (Shaw, 2008b).
October 2008	LTM sampling at the Site 4 Source Area and 100 Series monitoring wells 1 year after the 2007 ERD injection. (CH2M, 2009b)
February 2009	A baseline groundwater sampling event was conducted for the 200 Series Area (AGVIQ-CH2M, 2010a).
September 2009	A baseline groundwater sampling event for the 300 Series was conducted (AGVIQ-CH2M, 2010b).
September-November 2009	A second ERD injection was completed at the following three areas: Source Area, 200 Series Area, and 300 Series Area. Reinjection did not occur in the 50 Series and 100 Series areas (CH2M, 2009d).
February 2010 – June 2020	Post-injection groundwater sampling events completed (CH2M, 2021a).

Site chronology from the first White Oak Five-Year Review Report (JM Waller Associates, 2007), the Site 4 ROD (NAVFAC, 2005a), and the Basewide Long-Term Monitoring Report 2015 (CH2M, 2017a)

4.2 Background

4.2.1 Description and History

Site 4 (Chemical Burial Area) consists of a former chemical disposal/burial area and is located in the northeastern corner of the Former NSWC White Oak (**Figure 1-2**). Chemicals and other wastes reportedly were buried here, beginning in the mid-1950s until the early 1970s.

Site 4 was first identified as a Navy IRP site in the IAS conducted by Naval Energy and Environmental Support Activity (NEESA) in 1984. Investigation activities have been conducted at Site 4 since 1985 to meet the requirements of both a CERCLA RI and an RFI. The investigative activities focused on characterizing surface and subsurface soil and groundwater and are listed in **Table 4-1**.

It was initially believed that wastes were disposed of in four discrete burial trenches within the 1.1-acre site. However, information from test pits collected in 1998 in support of the EE/CA for the non-time critical removal action, determined that disposal of material was not confined to discrete trenches, but rather to two larger burial areas (Burial Area 1 and Burial Area 2). Wastes reportedly disposed of at Site 4 included acids, energetic compounds, kerosene, chlorinated solvents, fuel tank sludges, and chemical powder, including white phosphorus (CH2M, 2002).

Odors consistent with fuel-type compounds were noted during the EE/CA investigation (Brown & Root, 1999). The source of such odors could not be determined with certainty, but it appeared from the

results of the investigation that petroleum products, or debris containing residual fuel, had been disposed of at Site 4. For the purpose of the removal action, the BRAC Cleanup Team decided that confirmatory samples would also be analyzed for total petroleum hydrocarbons (TPH) and a PRG for TPH would be applied to the removal action.

Waste and contaminated soil at Site 4 were excavated as part of a non-time critical removal action conducted June through August 1999. The objectives of the removal action were to remove soil and solid waste to eliminate human health risk to future land users based on an industrial land use scenario. The removal action goals used for the excavation were based on risk from direct contact with soil and were not necessarily protective of groundwater. Therefore, there was a potential that soil contamination was still present at concentrations that represented a potential continuing source to groundwater contamination through leaching. Confirmation soil samples collected from the bottom and sidewalls of the removal action excavation indicated that levels of PAHs, total petroleum hydrocarbons (TPH), and VOCs remained at levels that exceeded the PRGs. After collecting verification samples, the excavation area was backfilled with up to 20 feet of clean soil and regraded to an elevation approximately 10 feet lower than its pre-removal-action topography; complete results are provided in the Site 4 Post-Removal Action Report (Tetra Tech, 1999a).

Because the soil at Site 4 contained TCE and 1,1,2,2-tetrachloroethane (PCA), and the wells located on the upgradient side of Site 4 were relatively free from contamination, Site 4 was identified as the likely source of the TCE, PCA, and several other VOCs found in the groundwater in this area. The Site 4 LUC boundary is defined by the groundwater contaminant plume (consisting primarily of CVOCs) containing TCE at concentrations greater than 5 µg/L originating at the former chemical burial area (Site 4) and extending south and southeast toward Paint Branch and the stream flowing along the east side of Floral Drive.

OU1 is defined as the groundwater underlying the eastern half of Former NSWC White Oak, and groundwater underlying Site 4 is a subset of OU1. An RI for OU1 was completed in 2002 which identified Site 4 as a source zone of VOC contamination in groundwater. In 2003, an FS for OU1 was conducted and included additional sampling of the deep subsurface soil remaining at Site 4 following the 1999 removal action to determine if soil represented source of contamination to groundwater via leaching. The FS concluded that soil approximately 17 to 30 feet bgs across an area of 8,000 square feet (that is, approximately 3,800 cubic yards of soil) contained concentrations of TCE and 1,1,2,2-PCA representing potential continuing sources of groundwater contamination (CH2M, 2003).

The Site 4 ROD was signed in 2005 and stated that in situ ERD with ICs and LTM to address groundwater contamination, and soil vapor extraction (SVE) to address soil contamination, were necessary to protect human health and the environment. The selected remedy also included the continued operation of the existing interim groundwater extraction and treatment system at Site 4, initially installed in 1998, to maintain plume containment while treatment was ongoing and specific criteria were met (NAVFAC, 2005a).

As stated in the Site 4 ROD, Site 4 includes the groundwater beneath the area previously identified as Site 46 because the Navy determined that Site 4 is the source of contaminated groundwater in the Site 46 area. Site 4 does overlap with Site 7, which is now closed and allows for unlimited use and unrestricted exposure. The Site 4 groundwater plume extends from the property currently owned by GSA onto the Army property. Although, the leading edge of the plume had migrated onto private residential property located between the federal property and the Paint Branch stream and stream along Floral Drive in 2016, concentrations in the closest downgradient monitoring well to the private residential property (46GW127) were below the PRGs that allow for UU/UE (CH2M, 2017h).

The PRGs developed for groundwater and presented in the Sites 4 ROD (NAVFAC, 2005a)**.** The PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs (CH2M, 2010).

4.2.2 Physical Characteristics

The Site 4 former source area is a depression surrounded by a rising slope to the east, south, and west. There are no surface water features near the former burial pits. Surface water runoff from Site 4 and the immediate vicinity flows toward the center of the site, infiltrates the soil overlying the area of the former burial pits, and migrates into the subsurface soils. The three primary stratigraphic units underlying Former NSWC White Oak in the Site 4 area are the Coastal Plain sediments, saprolite, and bedrock. The Coastal Plain deposits are silty sand, sand, and gravel underlain by clayey sand with gravel or silt, and then underlain with saprolite (a layer of disintegrating rock above the bedrock). During the June 2020 LTM event, groundwater level measurements were obtained from 33 monitoring wells at Site 4 prior to groundwater sampling (**Figure 4-1**). Groundwater elevations ranged from 220.26 to 252.12 feet amsl and were used to create a map of the potentiometric surface (**Figure 4-2**). Groundwater flow is generally to the south-southeast, which is consistent with previous LTM events.

The depth to water at the Site 4 source area is approximately 27 feet bgs because much of the overburden in this area was removed as part of the soil removal action (refer to **Section 4.2.1**). The saturated thickness within the Coastal Plain sediments in this area is estimated to be 27 feet under current water table conditions (CH2M, 2011b).

The depth to groundwater within the Site 4 LUC boundary varies from about 50 feet (just south of the Site 4 source area) to 40 feet (just north of the extraction wells at the centrifuge). The Site 4 groundwater contamination occurs primarily in the Coastal Plain deposits, which range in thickness from roughly 55 feet in the vicinity of Site 4 source to 80 feet immediately downgradient (south) of the source area, and gradually thins to 70 feet in the area north of the centrifuge extraction wells. The saturated thickness of the Coastal Plain deposits throughout the Site 4 LUC boundary is approximately 30 feet.

The hydraulic gradient at the Site 4 source area is estimated to be 0.008, sloping to the south-southeast, and the geometric-mean hydraulic conductivity is estimated to be 1.8 feet per day based on data from past aquifer pumping tests performed in Site 4 wells. Using an assumed effective porosity of 0.25, the average groundwater velocity is calculated to be 21 feet per year. The groundwater flow field does not appear to be uniform in the vicinity of Site 4 because of localized variations in the transmissive properties of the Coastal Plain sediments.

Overall groundwater flow is to the south-southeast (**Figure 4-2)**. The hydraulic gradient between the Site 4 source area and the centrifuge area extraction wells averages approximately 0.013, but varies to some degree. The gradient near Site 4 is slightly flatter (approximately 0.008, mentioned above), while the gradient at the midpoint of the plume is estimated at 0.017. The overall geometric mean of hydraulic conductivity for the Coastal Plain deposits is 5.25 feet per day based on recent aquifer pumping tests. Using these parameters and assuming a porosity of 0.25, the average groundwater flow velocity is estimated at 100 feet per year across plume.

4.2.3 Land and Resource Uses

The Site 4 source area is approximately 1.1 acres and consists of an open bowl-shaped field surrounded to the east, west, and south by wooded property owned by GSA. The property bounding the site to the north is an industrial property formerly operated as a sand and gravel quarry, currently owned by Global LifeSci Development Corporation. The land overlying the groundwater plume originating at Site 4, and extending south to Paint Branch, consists of federal land owned by GSA and the Army, and several private properties along Paint Branch and the Floral Drive streams. The anticipated future use of the area within the Site 4 LUC boundary (preventing residential use) is commercial/industrial use, and the Army property is currently being used for industrial purposes.

There are no drinking water supply wells located on private property at the southern edge of the plume and all of the properties are provided with water from a public source. Groundwater at Site 4, and

throughout the Former NSWC White Oak, is not used as a potable water source and is unlikely to be used for such purposes in the future. As noted in the Site 4 ROD, local ordinances prevent the installation of new private potable supply wells without a permit (NAVFAC, 2005a).

4.2.4 History of Contamination

Contaminants have been detected in Site 4 soil and groundwater during numerous investigations conducted at the Former NSWC White Oak since 1999. The primary contaminants detected in these media at Site 4 are VOCs, with TCE and 1,1,2,2-PCA being the most prevalent and detected at the highest concentrations. As summarized in the ROD (NAVFAC, 2005a), the source of TCE and 1,1,2,2-PCA contamination was identified as the waste and contaminated soil in the Site 4 chemical disposal area. The vast majority of this waste was excavated in 1999, but confirmation soil samples collected from the bottom and side walls of the excavation indicated that PAHs, total petroleum hydrocarbons, and VOCs, namely TCE and 1,1,2,2-PCA, remain in the soil at depths of approximately 14 feet below the ground surface extending to the water table at approximately 32 feet bgs. TCE and 1,1,2,2-PCA concentrations in this subsurface soil do not present an unacceptable risk to receptors from contact with the soil because human receptors would not be exposed to soil at these depths during any likely exposure scenarios including typical excavation activities, but do represent a potential continuing source of groundwater contamination through leaching.

Historically, the contaminated soil and waste has resulted in a plume of contaminated groundwater that extends from Site 4 to approximately 3,300 feet southeast where the groundwater discharges into several surface water streams. The thickness of the plume is estimated to be the entire saturated zone within the Coastal Plain deposits, approximately 25 feet. The plume is generally defined by groundwater containing TCE at concentrations greater than 5 µg/L. At the time of the 2005 Site 4 ROD, 13 COCs were identified in Site 4 groundwater, and the maximum detected concentrations of 10 of these COCs[9] within the Site 4 plume was (in order of prevalence):

- TCE: 4,300 µg/L
- 1,1,2,2-PCA: 317 µg/L
- Vinyl chloride (VC): 73 µg/L
- cis-1,2-DCE: 402 µg/L
- 1,2-DCA: 285 µg/L
- 2-amino-4,6-DNT: 0.8 µg/L
- 4-amino-2,6-DNT: 1.0 µg/L
- Iron: 38,500 µg/L
- Benzene: 1,710 µg/L (detected in one well)
- Toluene: 2,490 µg/L (detected in one well)
- Perchlorate: 76 µg/L

Contamination is limited to the Coastal Plain hydrogeologic unit within the majority of the Site 4 plume. This conclusion is based on the lower hydraulic conductivity of the saprolite compared to the Coastal Plain deposits, the absence of contamination in wells screened in the saprolite downgradient of Site 4, and the absence of contamination in bedrock wells in the vicinity of Site 4, Building 500, and well nest 46GW213S. While other contaminants (benzene, toluene, explosives, perchlorate) have been detected in discrete areas of the TCE and 1,1,2,2-PCA groundwater plume, these contaminants appear to have

[9] At the time the Site 4 ROD was signed in 2005, there was no established ARAR for perchlorate, and the human health risk-based screening level identified by USEPA Region 3 was strictly associated with drinking water. Because of these considerations and given the fact that the OU1 groundwater is not currently used as a source of drinking water, and its use is and will continue to be prohibited through existing local regulations and proposed ICs, perchlorate was not considered a COC.

originated from other known sources (Site 7 and a former gasoline underground storage tank at the centrifuge area).

During the most recent round of groundwater sampling in June 2020, selected monitoring wells were sampled for select VOCs (1,1,2,2- PCA, 1,2-DCA, TCE, cis-1,2-DCE, and VC), dissolved iron, and geochemistry parameters including alkalinity, TOC, dissolved gases (methane, ethane, and ethene), carbon dioxide, metabolic acids, sulfide, sulfate, chloride, nitrate, and nitrite.

4.2.5 Site Risks

Both ecological and human health baseline risk assessments were conducted to evaluate risks from Site 4 contaminants. Baseline Human Health Risk Assessments (BHHRAs) were conducted for Site 4 soil following the soil removal action (Tetra Tech, 2003a) as well as for Site 4 groundwater, surface water, and sediment as part of the OU1 RI (CH2M, 2002). The BERA was conducted on a facility-wide basis and consisted of screening all soil, surface water, and sediment data collected at Former NSWC White Oak against applicable ecological risk-based screening criteria (Tetra Tech, 2001a). This data included soil data from Site 4 as well as sediment and surface water data from the surrounding streams that would receive groundwater impacted by Site 4.

4.2.5.1 Human Health Risk Assessment

Based on the HHRA included in the OU1 RI (CH2M, 2002), site-related contaminants were not detected in Site 4 surface water and sediment at concentrations exceeding risk-based screening criteria, and therefore, exposure to surface water and sediment pose no unacceptable human health risks at Site 4 (CH2M, 2002). The OU1 RI (CH2M, 2002) evaluated exposure to groundwater for current and future construction workers, and potential future child and adult residents. The soil BHHRA (Tetra Tech, 2003a) evaluated exposure to soil by current and future industrial workers, maintenance workers, construction workers, adult recreational users, adolescent trespassers, potential future daycare-center children, and potential future child and adult residents.

As detailed in the Site 4 ROD (NAVFAC, 2005a), prior to implementation of the Site 4 remedy, the human health risk was summarized as follows:

> *Under current conditions, there is no significant human health risk associated with contaminants in groundwater because groundwater at Site 4 is not being used as a potable source.*
>
> *Non-carcinogenic hazard indices (HIs) associated with exposure to Site 4 groundwater, both in the coastal plain/saprolite, and in the bedrock, under a hypothetical future residential scenario (adult or child) exceed the EPA's acceptable target hazard of unity. The incremental lifetime cancer risks (ILCRs) associated with exposure to groundwater under a hypothetical future residential scenario exceed the EPA's acceptable carcinogenic risk range.*
>
> *Exposure to site 4 soil remaining after the 1999 removal action does not present an unacceptable risk for human receptors (i.e., the HI was below unity for all receptors and the incremental lifetime cancer risk was below the upper risk range of 1 x 10^{-4}) based on concentrations in soil at depths a human receptor would be assumed to contact. However, concentrations of TCE and PCA in the soil represent a continuing source of groundwater contamination. Site-specific modeling indicates that site soil concentrations of these two chemicals may result in groundwater contamination at levels that would exceed Maximum Contaminant Levels (MCLs) and result in an unacceptable risk to potential future residents that might use the groundwater for a primary drinking water source.*

Groundwater COCs identified in the Site 4 ROD (NAVFAC, 2005a) included TCE, 1,1,2,2-PCA, cis-1,2-DCE, 1,2-DCA, VC, 1-1-DCE, benzene, toluene, 2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4,6-TNT, cyclotrimethylenetrinitramine (RDX), and iron. Additionally, although perchlorate was detected in

several of the attainment areas, it was not considered a COC and no PRG was established. As stated in the Site 4 ROD (NAVFAC, 2005a):

> *At this time there is no established ARAR for perchlorate, and the human health risk-based screening level identified by EPA Region 3 is strictly associated with drinking water. Because of these considerations and given the fact that the OU1 groundwater is not currently used as a source of drinking water, and its use is and will continue to be prohibited through existing local regulations and proposed institutional controls, perchlorate is not considered a COC. However, the monitoring of perchlorate concentrations in groundwater and in the influent and effluent of any ex-situ treatment system will be performed during the course of the remedial action and every five years the remedy will be revised to ensure it remains protective of human health and the environment. The maximum concentration of perchlorate found with the Site 4 groundwater area is 76 µg/L.*

Based on unacceptable carcinogenic and noncarcinogenic risks associated with exposure to Site 4 groundwater, it was determined that RA was necessary for soil and groundwater to prevent unacceptable risks to human receptors.

4.2.5.2 Ecological Risk Assessment

As summarized in the Site 4 ROD (NAVFAC, 2005a), a facility-wide BERA was conducted by the Navy and presented in the Basewide Ecological Risk Assessment for Former NSWC White Oak (Tetra Tech, 2001a). The BERA included screening of soil, surface water, and sediment collected at the facility against applicable ecological risk-based screening criteria. Soil data from Site 4, as well as sediment and surface water data from surrounding streams that would receive groundwater impacted by Site 4, were evaluated. Based on the results of the BERA, there was no unacceptable risk from Site 4 soil based on post-removal action conditions and sediment and surface water in the streams do not pose unacceptable ecological risks. Additionally, since groundwater exposure is not associated with ecological receptors, groundwater from Site 4 poses no unacceptable ecological risks.

4.3 Response Action Summary

4.3.1 Basis for Remedial Action

Based on the results of previous investigations, RA is warranted to protect human health from actual or threatened releases of VOCs, explosives, and metals in groundwater, and prevent leaching of VOCs in soil to groundwater that would result in concentrations in groundwater that are not protective of human health at Site 4.

4.3.2 Response Actions

4.3.2.1 Selected Remedy for Site 4

The ROD for Site 4 soil and groundwater was signed on September 28, 2005 (NAVFAC, 2005a). The ROD summarized the risks to human health and the environment, established RAOs, and defined the selected remedy. The RAO for Site 4 soil as stated in the ROD is:

- Prevent leaching of contaminants from soil to groundwater at concentrations that would result in unacceptable risks to human receptors.

The RAOs for Site 4 groundwater as stated in the ROD are as follows:

- Prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.
- Where practicable, to restore contaminated groundwater to a quality amenable to beneficial use (that is, meet the PRGs identified).

To achieve the RAOs for soil, the selected remedy for Site 4 soil included Soil Vapor Extraction, which comprised of the following components:

- Installation of soil vapor extraction wells and blower system.
- Baseline and verification soil and vapor sampling to monitor treatment efficiency.
- Preparation of a remediation completion report.

To achieve the RAOs for groundwater, the selected remedy for groundwater included in-situ enhanced reductive dichlorination, ICs and LTM combined with the continued operation of the existing groundwater extraction and treatment system, which comprised of the following components:

- Installation of injection wells and injection of electron donor at the former Site 4 disposal pits.
- Installation of injection wells and injection of electron donor in the areas of higher concentrations of TCE in the downgradient portion of the Site 4 plume between the former Site 4 disposal pits and the centrifuge extraction wells.
- Continued operation of existing groundwater extraction wells and trench and associated treatment system.
- LTM of the in situ reductive dechlorination area, existing extraction system areas and downgradient portions of the plume.
- Preparation of annual technical memoranda and Five-Year Reports.
- Implementation of ICs until PRGs are met.

4.3.3 Status of Implementation

4.3.3.1 SVE Extraction System

The SVE system was designed in tandem with the in situ ERD treatment of groundwater to remove contaminants from soil above the water table located in the vadose zone. Meanwhile, the in situ ERD treatment would remediate contamination that was located below the groundwater table. The intent of the SVE system was to remediate concentrations of COCs (TCE and 1,1,2,2-PCA) so that they would not result in an exceedance of groundwater PRGs through the process of partitioning (leaching) into rainfall as it infiltrates through the contaminated soil. The SVE system was installed by Shaw Environmental & Infrastructure, Inc. (Shaw) in 2007 and O&M were completed by Page Technologies.

Evaluation of the SVE monitoring data collected in 2007 and 2008 suggested that the lack of detections was consistent with the concept that the vadose zone had been adequately remediated such that it no longer posed a potential threat to human health or the environment, from either a direct contact or leaching- to- groundwater pathway, and the SVE system was shut down in November 2009 (CH2M, 2009c). However, it was theorized that the significant variance in the water table levels at the Site 4 source area (variations as great as 13 feet have been observed) may contribute to the lack of VOC detections at the SVE system. Since, during times of high water levels, contaminants present in the soil would not be available for treatment by the SVE system as they would be saturated and treated through the ERD injections. It was recommended that the SVE system remain shut down for a period of 2 years to allow contamination to be treated through ERD without hindrance of the SVE system. In the interim, groundwater levels would be gauged and performance monitoring would be conducted at the Site 4 source area to determine if a remaining source was present in the soil in the lower portions of the vadose zone (soil that is exposed when the water table is low). This evaluation would be based upon a comparison of groundwater elevations and the concentrations of TCE and 1,1,2,2-PCA in monitoring wells located within the Site 4 source area.

Based on the analysis of the data collected in 2010 and 2011 from the Site 4 monitoring wells located within the source area, the SVE system met one of the shutdown conditions listed in the Site 4 ROD; groundwater concentrations of TCE and 1,1,2,2-PCA within the source area are reduced to groundwater PRGs with acceptable rebound (Section 2.12.2.6 of the Site 4 ROD; NAVFAC, 2005a). It was recommended that operation of the SVE system not be reinstated and that the SVE system could be demobilized from the Site 4 source area. While a small area represented by 04GW413, remains above the groundwater PRGs, the results of the ERD performance monitoring indicate that the remaining VOC concentrations are expected to be adequately treated through ERD and therefore the costs associated with bringing the SVE system back into operational condition would exceed any marginal remedial benefit that the SVE system would provide (CH2M, 2013a). The extraction well and above ground piping associated with the SVE system were decommissioned in September 2013 according to the Site 4 SVE Extraction System Decommissioning Work Plan (CH2M, 2013a); however, the former SVE has not been removed from the site.

4.3.3.2 ERD Injections

Five groundwater remediation monitoring areas of Site 4 are spatially identified based on their progressive distance from the Site 4 Source Area, as presented on **Figure 4-1** and described as follows:

- Source Area – Consists of a depression surrounded by a rising slope to the east, south, and west
- 50 Series Area – Located in a wooded area approximately 150 feet south-southeast (downgradient) of the Source Area
- 100 Series Area – Located in a wooded area approximately 250 feet south-southeast of the Source Area
- 200 Series Area – Located in a wooded area approximately 500 feet south-southeast of the Source Area, just north of Coffman Road
- 300 Series Area – Located in a grassy field and partially wooded area approximately 1,000 feet south-southeast of the Source Area

The areas are located on the part of the Former NSWC White Oak property now owned by GSA, with the exception of the 300 Series Area, which is primarily located on the Army Adelphi Laboratory Center property (south of Coffman Road).

Two rounds of ERD injections have been completed to treat the dissolved phase CVOC groundwater plume associated with Site 4. The first round of ERD injections, located within the source area, 50 Series well area and 100 Series well area, was performed by Shaw in 2007. Following the 2007 injection, a significant decrease in concentrations of COCs was observed; however, concentrations were not below PRGs in all monitoring wells, and an ERD reinjection was proposed and completed in November 2009 by AGVIQ-CH2M. At the time of the 2009 reinjection the SVE system had been shut down (CH2M, 2013a).

4.3.3.3 Existing Interim Groundwater Extraction and Treatment System

The groundwater component of the remedy for Site 4 included the operation of three interim groundwater extraction and treatment systems including the Centrifuge Extraction System, Site W Swale, and the Building 502 Treatment Systems. These systems were inspected monthly and repaired or replaced as necessary. The first of these systems was put into operation in 1997. These interim measures ceased operation in 2007 since they were no longer deemed to be cost effective in reducing contaminant mass at the site and as potential risks to human health associated with exposure to downgradient surface water discharges were evaluated and found to be acceptable (NAVFAC, 2007b, 2007c).

4.3.3.4 Long-Term Monitoring

In accordance with the LTM Plan for Site 4 Groundwater (CH2M, 2011b), groundwater sampling was performed in approximate 12-month intervals from 2010 until 2018 in order to assess the effectiveness of the RA, and includes assessing the effectiveness of the ERD and the achievement of PRGs, as well as evaluating the need to optimize the LTM approach or to discontinue LTM. Based on the 2018 LTM results, and in accordance with the Site 4 ROD (NAVFAC, 2005a) and LTM Plan (CH2M, 2011b), the White Oak Partnering Team[10] agreed during the April 18, 2018, Partnering Team meeting to decrease LTM sampling to every 30 months starting with the sampling event originally scheduled for May 2020.

The following is a summary of the most recent Site 4 LTM groundwater sampling event conducted in June 2020.

4.3.3.5 Source Area, 50 Series Area, and 100 Series Area Performance Data

Five monitoring wells from the Source Area, 50 Series, and 100 Series Areas (04GW402, 04GW403, 04GW405, 04GW407, and 04GW413) were sampled for select VOC constituents. The analytical results are presented on the trend graphs for select wells (**Appendix C-2.1**) and summarized as follows:

- 1,1,2,2-PCA and 1,2-DCA were reported at concentrations less than laboratory detection limits in all groundwater samples collected, which is consistent over the past five years.
- Monitoring well 04GW413 was the only location where groundwater concentrations exceeded the PRG for TCE and cis-1,2-DCE (**Figures 4-3** and **4-4**). Concentrations of TCE and cis-1,2-DCE have decreased over the last five years in the Source Area, 50 Series, and 100 Series Areas.
- Four monitoring well locations (04GW402, 04GW403, 04GW407, and 04GW413) had groundwater concentrations that exceeded the PRG for VC. VC concentrations decreased in groundwater over the last five years.

During the June 2020 Site 4 LTM groundwater sampling event, dissolved iron was analyzed in the groundwater samples collected from seven monitoring wells at the Source Area, 50 Series, and 100 Series Areas (04GW301, 04GW402, 04GW403, 04GW405, 04GW412, 04GW413, and 04GW414). Dissolved iron was detected at concentrations exceeding the PRG of 11,000 µg/L at all seven wells, which has been consistent over the last five years.

4.3.3.6 200 Series Wells

Three 200 Series monitoring wells (04GW502D, 04GW503D, and 04GW504D) were sampled for select VOC constituents. The analytical results are presented on the trend graphs for select wells (**Appendix C-2.2**) and summarized as follows:

- Groundwater concentrations at monitoring well 04GW504D exceeded the PRG for 1,1,2,2-PCA and have been relatively stable within the last five years.
- 1,2-DCA was detected at concentrations less than the PRG in groundwater samples collected from all three monitoring wells, which has been consistent over the last five years.
- TCE concentrations at all three monitoring wells exceeded the PRG (**Figure 4-3**). TCE concentrations have decreased over the last five years at monitoring well 04GW502D and have been fluctuating at monitoring wells 04GW503D and 04GW504D.

[10] The White Oak Partnering Team consists of the Navy, MDE, and GSA.

- Detected groundwater concentrations at monitoring wells 04GW503D and 04GW504D exceeded the PRG for cis-1,2-DCE (**Figure 4-4**). Cis-1,2-DCE concentrations have been decreasing over the last five years at monitoring well 04GW504D and increasing at monitoring well 04GW504D.
- VC was detected and exceeded the PRG in groundwater samples collected from all three monitoring wells. Over the last five years, VC concentrations have decreased at 04GW504D, increased at 04GW503D, and remained stable at 04GW502D.

During the June 2020 Site 4 LTM groundwater sampling event, groundwater samples from three monitoring wells at the 200 Series Area (04GW502D, 04GW503D, and 04GW504D) were analyzed for dissolved iron. Dissolved iron was detected at concentrations exceeding the PRG at all three wells.

4.3.3.7 300 Series Wells

Four 300 Series monitoring wells (04GW601D, 04GW602S, 04GW604S, and 04GW604D) were sampled for select VOC constituents. The analytical results are presented on the trend graphs for select wells (**Appendix C-2.3**) and summarized as follows:

- 1,1,2,2-PCA was reported at concentrations less than laboratory detection limits in all groundwater samples collected, which has been consistent over the last five years.
- 1,2-DCA was detected in groundwater samples collected from two monitoring wells; however, concentrations were less than the PRG, which has been consistent over the last five years.
- TCE was detected in groundwater samples collected from two monitoring wells (**Figure 4-3**). Concentrations at one monitoring well (04GW601D) exceeded the PRG. Over the last five years, TCE at 04GW601D has decreased.
- Cis-1,2-DCE was detected at concentrations less than the PRG in groundwater samples collected from all four monitoring wells (**Figure 4-4**), which has been consistent over the last five years.
- VC was detected below the PRG in groundwater samples collected from one monitoring well, 04GW601D. VC concentrations in monitoring well 04GW601D have been increasing over the last five years.

During the June 2020 Site 4 LTM groundwater sampling event, groundwater from monitoring wells at the 300 Series Area (04GW502D, 04GW503D, and 04GW504D) were analyzed for dissolved iron. Dissolved iron was detected at concentrations exceeding the PRG of 11,000 µg/L at all three wells.

4.3.3.8 Site 46 Wells

Three performance monitoring wells (46GW123D, 46GW134, and 046GW219) were added to the Site 4 LTM sampling in December 2012 to evaluate groundwater conditions downgradient of the 300 Series Area. Groundwater was sampled for select VOC constituents. The analytical results are summarized as follows:

- 1,1,2,2-PCA was detected in groundwater samples collected from one monitoring well (46GW219), which exceeded the PRG. Concentrations of 1,1,2,2-PCA at monitoring well 46GW219 have been relatively stable over the last five years.
- 1,2-DCA was detected in groundwater samples collected from one monitoring well (46GW219) at a concentration less than the PRG, which has been consistent over the last five years.
- TCE was detected in groundwater samples collected from all three monitoring wells (**Figure 4-3**). TCE at all monitoring wells exceeded the PRG. Over the last five years, TCE concentrations have been decreasing in monitoring wells 46GW123D and 46GW134 and fluctuating in monitoring well 46GW219.

- Cis-1,2-DCE was detected in groundwater samples collected from all three monitoring wells but were less than the PRG (**Figure 4-4**), which has been consistent over the last five years.
- VC was detected in groundwater samples collected from two monitoring wells (46GW134 and 46GW219). VC at 46GW219 slightly exceeded the PRG. VC concentrations in groundwater at 46GW219 have been fluctuating over the last five years.

4.3.3.9 Operation and Maintenance

The only O&M activities currently associated with Site 4 are inspection and maintenance of the monitoring wells.

4.3.3.10 IC Summary

ICs at Site 4 include LUCs to:

- Prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA), including drinking water, from within the restricted area, until the PRGs are met and the risks from groundwater use are determined to be reduced to level acceptable for unrestricted use.
- Provide adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells or vent pipes, or remedial operations within the restricted area.
- Provide adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.
- Provide adequate notification of the LUCs to current and future property owners.

The Final LUC RD for Site 4 Groundwater was documented in 2013 (CH2M, 2013b).

4.4 Progress Since Last Review

This section includes the protectiveness determinations and statements from the last Five-Year Review (**Table 4-2**) as well as the recommendations from the last Five-Year Review and the current status of those recommendations (**Table 4-3**).

Table 4-2. Protectiveness Determination/Statement from the Third Five-Year Review – Site 4

Protectiveness Determination	Protectiveness Statement
Protective	The remedy for Site 4, consisting of enhanced in situ bioremediation (EISB), groundwater treatment, LUCs, and groundwater LTM, is currently protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

Table 4-3. Status of Recommendations from the Third Five-Year Review – Site 4

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Additional injection should be considered	An additional injection should be considered. Such reinjection will provide another several years of treatment, which will help move the site further toward the cleanup goals.	Ongoing	Continuing Evaluation in Progress	Will be completed by 2027.
Site inspections not documented	LUC inspections should be conducted at least once a year, documented in accordance with the Site 4/46 LUC RD, and summarized during the next Five-Year Review.	Ongoing	Annual site inspections are being conducted to confirm continued compliance with the LUC RD objectives at Site 4/46 and were completed in October/November 2016, November 2017, December 2018, January 2020, and January 2021. Site inspection checklists are included in **Appendix D**.	November 2016 November 2017 December 2018 January 2020 January 2021

4.5 Five-Year Review Process

4.5.1 Document Review

Table 4-4 summarizes the main documents reviewed in the preparation of this section of the Five-Year Review. A complete list of documents cited in the preparation of this Fourth Five-Year Review Report is included in **Section 10**.

Table 4-4. Summary of the Site 4 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
ROD for Site 4 Soil and Groundwater	NAVFAC	2005
Long-Term Monitoring Plan for Site 4 Groundwater	CH2M	2011
Land Use Control Remedial Design for Sites 4/46 Groundwater	CH2M	2013
Third Five-Year Review Report	CH2M	2017
Basewide Long-term Monitoring Report 2015	CH2M	2017
Basewide Long-term Monitoring Report 2016	CH2M	2017
Basewide Long-term Monitoring Report 2017-2018	CH2M	2019
Basewide Long-term Monitoring Report 2020	CH2M	2021

4.5.2 Site Inspections

During the site inspections conducted annually and for this Five-Year Review, no issues were identified affecting the protectiveness of the sites. Site inspection checklists are included in **Appendix B** and **Appendix D**.

4.5.3 Data Review and Evaluation

LTM is being conducted for groundwater at Site 4 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. Trend graphs presenting VOC COC results for select monitoring wells located in the Source Area, 50 Series, 100 Series; 200 Series; and 300 Series Areas at Site 4 are provided in **Appendix C-2.1, Appendix C-2.2, and Appendix C-2.3**. Conclusions based on evaluations of the analytical data from the Source and Series Areas, as well as Site 46, are summarized below.

4.5.3.1 Source Area, 50 Series, and 100 Series Conclusion

Overall, the changes in VOC concentrations in groundwater at the Source Area, 50 Series Area, and 100 Series Area wells are consistent with those expected during the reductive dechlorination process indicating that the system has performed as expected. Significant declines in TCE and 1,2-DCE have been observed in each well since baseline and remain relatively stable. Daughter products of TCE have been produced and are being converted to ethene. At 04GW413, persistent elevated concentrations of cis-1,2-DCE and VC in groundwater have been noted at this well (**Appendix C-2.1**), which suggests that a residual source zone may remain in the Source Area near this well. Consideration of the recent oxidation-reduction potential (ORP) and TOC results and length of time that has passed since the last emulsified vegetable oil (EVO) injection suggest that an additional substrate injection in select injection wells could be beneficial in sustaining optimal ERD conditions and would further stimulate the degradation of remaining VOCs in the vicinity of this well.

4.5.3.2 200 Series Conclusion

Some VOC concentrations in groundwater from the deep monitoring wells continue to exceed PRGs. Overall, the VOC, TOC, and geochemistry data indicate that ERD of VOCs was successfully achieved and to some degree, continues to occur within the 200 Series Area. The low TOC, slight increases in ORP, and the presence of TCE at concentrations of 358 µg/L at well 04GW504D suggest that optimal conditions for ERD are no longer present in the 200 Series Area. The data indicate additional substrate injection in select injection wells in the 200 Series Area, particularly in the vicinity of well 04GW504D, would be beneficial in sustaining optimal ERD conditions.

4.5.3.3 300 Series Conclusion

In general, VOC concentrations in the 300 Series Area appear to be somewhat lower than in the upgradient areas of the site. As with the 200 Series Area wells, the TCE and cis-1,2-DCE groundwater concentrations are greater in the deep wells than they are in the shallow wells. Overall, the VOC, TOC, and geochemistry data indicate that ERD of VOCs was successfully achieved after substrate injection in 2009. Groundwater conditions remain reducing at some wells in the 300 Series Area. However, rebounding TCE at several wells, such as 04GW601D, along with higher ORP values during recent years compared to low ORP values shortly after substrate injection indicate that optimal conditions for ERD are no longer present. The data suggest that additional substrate injection in select injection wells in the 300 Series Area wells would be beneficial in restoring and sustaining optimal ERD conditions.

4.5.3.4 Site 46 Conclusions

TCE exceeded the PRGs at Site 46 in three monitoring wells (46GW123D, 46GW134, and 46GW219). Monitoring well 46GW219 had the highest detections of COCs compared to the other two monitoring wells. VOC concentrations have decreased between November 2011 and June 2020 at 46GW134, and

from December 2012 to June 2020 at 46GW123D. These results suggest that the reductions in VOCs achieved by the upgradient biobarriers are successfully reducing downgradient VOC concentrations as well.

4.5.3.5 Site 46 Source Area and Releases of Contamination

From multiple investigations at Site 4/46, groundwater is primarily impacted by TCE, limited to the shallow aquifer (Coastal Plain), and the centrifuge area appears to be the primary source for TCE contamination encountered near the Army's Building 500 (Tetra Tech, 1998a).

Site 4 300 Series monitoring wells and three Site 46 monitoring wells (46GW123D, 46GW134, and 46GW219) have been routinely sampled as part of LTM. Concentrations of TCE from the 2020 LTM event at the three Site 46 monitoring wells ranged from 7.66 µg/L (46GW134) to 389 µg/L (46GW219) (CH2M, 2021a). Based on these previous investigations and the latest groundwater monitoring results from the June 2020 LTM, a data gap has been identified where groundwater near the centrifuge might still have residual impacts from past Site 4 TCE migration, or that a small residual source zone is present upgradient of the centrifuge area (CH2M, 2021b).

4.6 Technical Assessment

This section presents the answers to the three questions defined for the Technical Assessment for Site 4.

4.6.1 Question A - Is the Remedy Functioning as Designed?

The Site 4 remedy of ERD, ICs, and LTM has been implemented and is functioning as intended by reducing contaminant mass and restricting exposure to contaminants by human receptors.

4.6.1.1 Remedial Action Performance

The EVO injection activities completed as a component of the ERD groundwater RA for Site 4 appear to have been effective with the overall reduction in the extent of the groundwater contaminant plume and an overall decrease in groundwater contaminant concentrations. Trend analysis of TCE and cis-1,2-DCE concentrations in wells at each of the Site 4 areas indicate TCE and cis-1,2-DCE concentrations are declining (**Figures 4-3** and **4-4**). ERD of VOCs was successfully achieved, and to some degree, the process continues to occur at Site 4 based on an evaluation of the VOCs and supporting geochemical data.

4.6.1.2 Implementation of Institutional Controls and Other Measures

LUCs at Site 4 include ICs to prohibit withdrawal of groundwater, minimize physical disruption of any remedial equipment, and minimize potentially adverse health and environmental effects of work or development in the restricted area (CH2M, 2013b). These LUC objectives will remain in force until the Navy determines and the USEPA and the MDE concur in writing, that the groundwater within the restricted area or any part thereof, are suitable for unrestricted use. These LUCs remain in place, and no signs of LUC violations have been observed.

As described in the ROD for Site 4 soil, the selected remedy for Site 4 soil is SVE; ICs are not required for this medium (NAVFAC, 2005a).

4.6.1.3 Opportunities for Optimization

After the last Five-Year Review, the Navy recommended and implemented several changes to the LTM program for Site 4. These changes are summarized in **Table 4-5**.

Table 4-5. Site 4 Groundwater Optimization

Sampling Event	Groundwater Optimization
October 2016	Based on Decision Rule 2B: • Eliminate VOCs analysis from monitoring wells 04GW301 and 04GW414 (CH2M, 2017f).
November 2017	Based on Decision Rule 2B: • Eliminate VOCs analysis from monitoring wells 04GW412 and 04GW602D (CH2M, 2019b). • Perform LTM at 30-month intervals.
June 2020	• Eliminate chloride, carbon dioxide, nitrate/nitrite, alkalinity, dissolved oxygen, and ferrous iron test kits

Notes:
[1]Decision rules for determining effectiveness of in situ bioremediation are documented in the Long-Term Monitoring Plan for Site 4 Groundwater (CH2M, 2011b). Decision Rule 2B states *"If contaminant concentrations of a particular set of compounds in a monitoring well in the LTM program are reduced below PRGs and remain below PRGs for 2 sampling rounds, then that analyte should be considered for elimination from further monitoring."*

4.6.2 Question B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Selection Still Valid?

Land use has not changed; therefore, the exposure assumptions and RAOs developed at the time of remedy selection are still valid. Direct exposure to surface and shallow subsurface soil (to depths of at least 14 feet) was adequately addressed through the 1999 removal action, as established in the Site 4 Post-Removal Action Report (Tetra Tech, 1999a). Leaching of VOC contamination in deeper soil to the underlying groundwater has been addressed by treating the deeper soil via SVE and ERD, and is being monitored by groundwater sampling. PRGs established for groundwater at Site 4 in the 2005 ROD were revised in 2010 in accordance with Technical Memorandum: *Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (2010 PRG Technical Memorandum) (CH2M, 2010). Changes in toxicity data and exposure assumptions would not change the cleanup levels that are based on MCLs, and the MCLs presented in the 2010 PRG Technical Memorandum (CH2M, 2010) are still current. Typical values for exposure factors (that is, groundwater ingestion rate, skin surface in contact with groundwater, body weight) and some toxicity values have been updated since the revised PRGs, and these changes would result in slight increases to the cleanup levels for those COCs without MCLs (1,1,2,2-tetrachloroethene [PCE] and iron). However, LUCs prevent exposure to groundwater, and therefore, the remedy is still protective by eliminating potential exposure.

4.6.3 Question C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

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

4.7 Issues, Recommendations, and Follow-up Actions

Based on this Five-Year Review, there are no issues affecting protectiveness for Site 4.

4.7.1 Other Findings

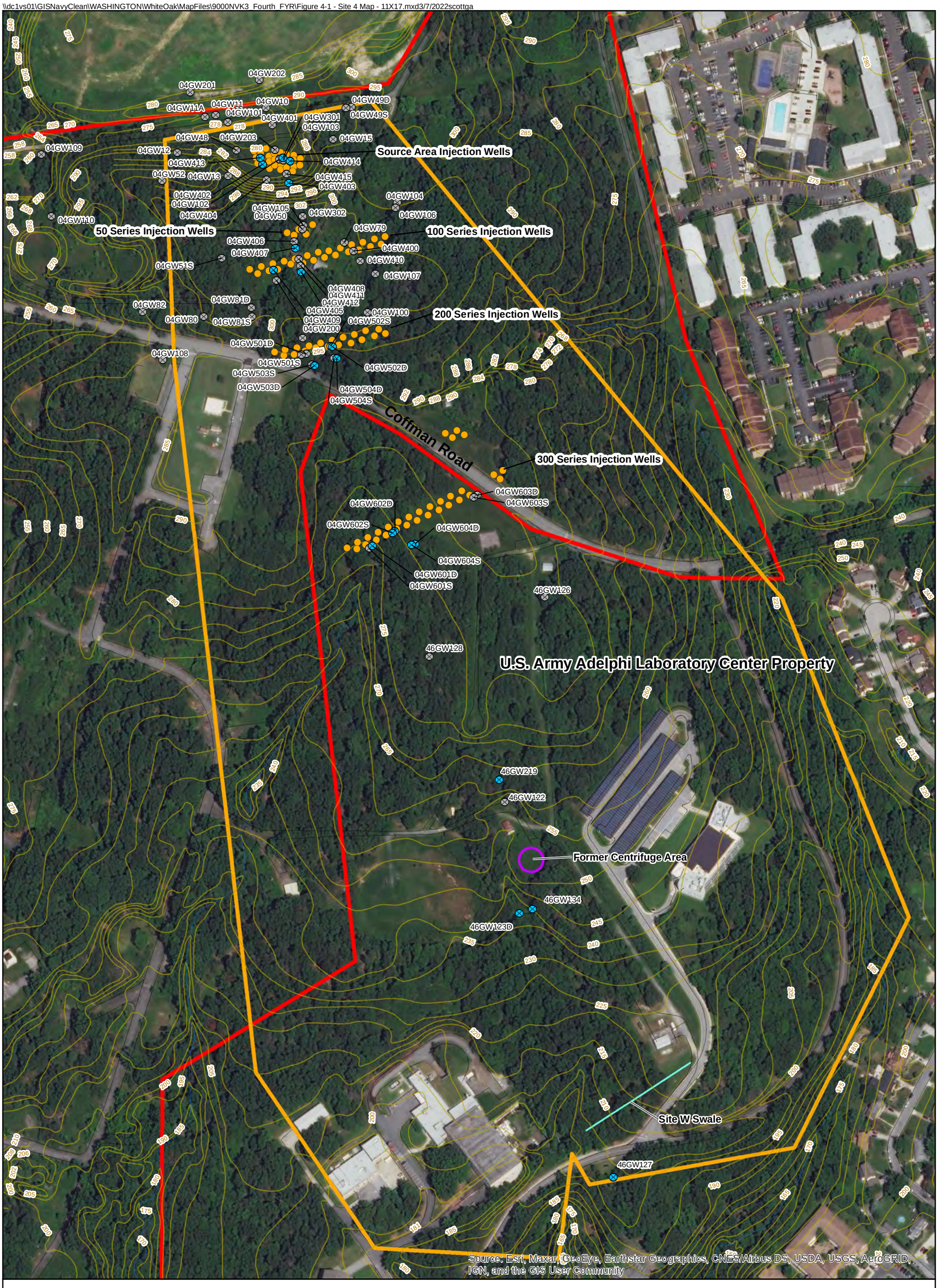
The following are recommendations that were identified during the Five-Year Review and may improve performance of the remedy, reduce costs, and/or accelerate site closeout, but do not affect current and/or future protectiveness:

- The Navy plans to sample groundwater from existing wells and grab sample locations in the downgradient portion of Site 4 to evaluate the VOC plume and explosives compounds by the end of calendar year 2022.
- Additional Injection – The White Oak Partnering Team has reviewed the most recent data and based on Decision Rule 1B of the Site 4 LTM Plan (CH2M, 2011b) suggests reinjection of EVO into select wells in the Source Area, 200 Series and 300 Series areas, and the downgradient portion of Site 4 to accelerate the reduction of contaminant concentrations and decrease the time necessary to meet cleanup goals. In the Source Area, reinjection in wells near well 04GW413 is anticipated. For the 200 Series Area and 300 Series Area wells, reinjection is anticipated in the center of the plume where it appears to be continuing to migrate. This reinjection is anticipated to be completed by 2027.

4.8 Protectiveness Statement

The remedy for Site 4, consisting of ERD, LUCs that incorporate ICs, and LTM, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 4-1 - Site 4 Map - 11X17.mxd3/7/2022scottga



Legend

- 2020 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- LUC Boundary
- Former NSWC - White Oak Facility Boundary

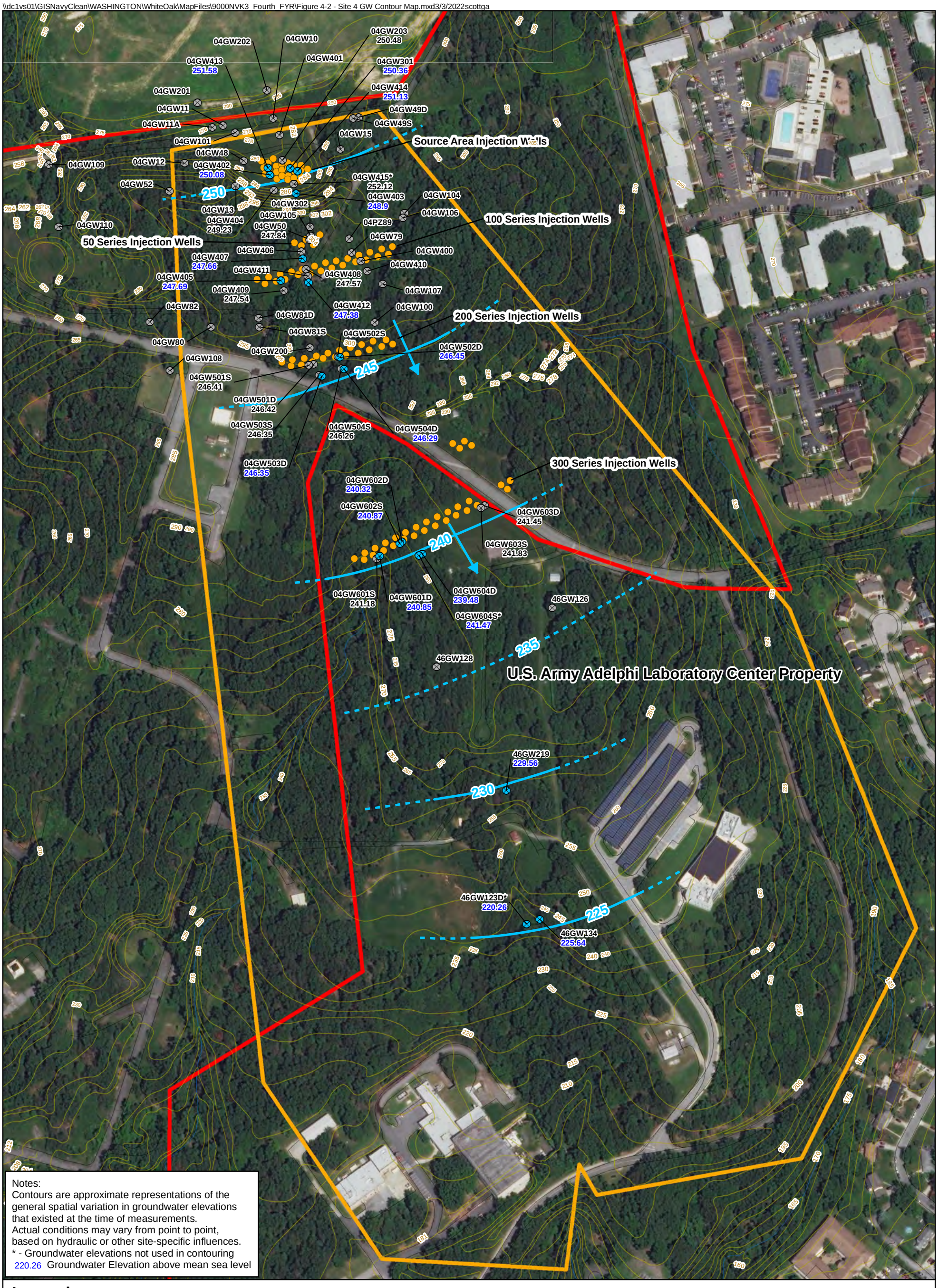
N

0 100 200 400 Feet

Figure 4-1
Site 4 Map
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 4-2 - Site 4 GW Contour Map.mxd3/3/2022scottga



Notes:
Contours are approximate representations of the general spatial variation in groundwater elevations that existed at the time of measurements.
Actual conditions may vary from point to point, based on hydraulic or other site-specific influences.
* - Groundwater elevations not used in contouring
220.26 Groundwater Elevation above mean sea level

Legend

- 2020 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction
- Topographic Contours (ft msl)
- LUC Boundary
- Former NSWC - White Oak Facility Boundary

N

0 100 200 400 Feet

Figure 4-2
Site 4 Groundwater Contour Map and LTM Locations – June 15, 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 4-3 - Site 4 TCE Plume Map.mxd3/3/2022scottga

TCE (ug/L)		
Well	Baseline	2020 LTM
04GW50	11 B	NS
04GW203	ND	NS
04GW301	33	NA
04GW400	1.8 B	NS
04GW402	1.8 B	ND
04GW403	2.5 J	0.268 J
04GW404	2.3 B	NS
04GW405	1.8 J	1.17
04GW407	2,600	1.9
04GW408	5.7 B	NS
04GW409	16	NS
04GW412	430	NA
04GW413	19,000	9.63 J
04GW414	12	NA
04GW415	NS	NS
04GW501D	27	NS
04GW501S	5.8	NS
04GW502D	1,100	10.8
04GW502S	ND	NS
04GW503D	630	35.7
04GW503S	15	NS
04GW504D	570	358 J
04GW504S	180	NS
04GW601D	ND	13.5
04GW601S	47 J	NS
04GW602D	250	NA
04GW602S	71	ND
04GW603D	9.3 J	NS
04GW603S	ND	NS
04GW604D	320	3.37
04GW604S	63 J	ND
46GW123D	NA	23.1
46GW134	NA	7.66
46GW219	NA	389

Notes:
NA - Not Analyzed
ND - Not Detected
NS - Not Sampled

Contours are approximate representations of the general spatial variation in groundwater concentrations that existed at the time of the measurements. Actual conditions may vary from point to point, based on hydraulic or other site-specific influences.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- 2020 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- LUC Boundary
- Former NSWC - White Oak Facility Boundary

TCE Plume Boundaries

- 2020 above PRG (5 µg/L)
- Baseline above PRG (5 µg/L)

N

0 100 200 400 Feet

Figure 4-3
Site 4 TCE Plume Boundaries - June 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 4-4 - Site 4 cis-1,2-DCE Plume Map.mxd3/3/2022scottga

Cis 1,2-DCE (ug/L)		
Well	Baseline	2020 LTM
04GW50	1.4 J	NS
04GW203	1.6 J	NS
04GW301	5,200	NA
04GW400	ND	NS
04GW402	20B	2.01
04GW403	130	2.80
04GW404	65 B	NS
04GW405	220	1.16
04GW407	460	6.08
04GW408	1200	NS
04GW409	270	NS
04GW412	280	NA
04GW413	53,000	2,660
04GW414	35	NA
04GW415	NS	NS
04GW501D	43	NS
04GW501S	57	NS
04GW502D	420	5.73
04GW502S	42	NS
04GW503D	78	73
04GW503S	30	NS
04GW504D	460	89.9 J
04GW504S	190	NS
04GW601D	ND	28
04GW601S	65 J	NS
04GW602D	29 J	NA
04GW602S	46	1.47
04GW603D	2.3 J	NS
04GW603S	ND	NS
04GW604D	40 J	1.43
04GW604S	29 J	0.291 J
46GW123D	NA	3.94
46GW134	NA	2.35
46GW219	NA	68.40

Notes:
NA - Not Analyzed
ND - Not Detected
NS - Not Sampled

Value below each monitoring well ID refers to the concentration of cis-1,2-DCE in µg/L

Contours are approximate representations of the general spatial variation in groundwater concentrations that existed at the time of the measurements. Actual conditions may vary from point to point, based on hydraulic or other site-specific influences.

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- 2020 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- LUC Boundary
- Former NSWC - White Oak Facility Boundary

cis-1,2-DCE Plume Boundaries

- 2020 above PRG (70 µg/L)
- Baseline above PRG (70 µg/L)

N

0 100 200 400 Feet

Figure 4-4
Site 4 cis-1,2-DCE Plume Boundaries - June 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

SECTION 5

Sites 5 and 13 – Open Burn Area and Oil Sludge Disposal Area

5.1 Site Chronology

A chronology of major events for Sites 5 and 13 is provided in **Table 5-1**.

Table 5-1. Key Events and Milestones at Sites 5 and 13

Date	Key Events and Milestones
1984	Both Sites 5 and 13 were identified as IRP sites during NEESA IAS (NAVFAC, 2004b).
1990	An RFA was conducted at NSWC White Oak. The RFA identified 97 SWMUs and 19 AOCs. Forty SWMUs were recommended for further investigation in an RFI; SWMU 32 is associated with Site 5 and SWMU 7 is associated with Site 13. Both sites were recommended for investigation in an RFI (Kearney/Centaur Division, 1990).
1992	An RFA review was completed for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual SWMU. Sites 5 and 13 were identified as sites of low to moderate priority based upon potential risk (NAVFAC, 2004b).
1997	A site screening investigation for Sites 1, 5, 6, 12, 13, 28, 29, 31, 32, and 33 and AOC 100 was completed. The site screening investigation consisted of collecting a number of surface and subsurface soil samples at Sites 5 and 13 and installing and sampling 6 monitoring wells (Tetra Tech, 1998c).
2000	A soil removal action was conducted in 2000, during which the circular soil berms were removed and used as clean backfill at nearby Site 3 and the top 3 feet of contaminated soil that made up the floor of the three burn rings was excavated and disposed of in an offsite landfill (NAVFAC, 2004b).
2003	An RFI was conducted on the soil at Sites 5 and 13 in 2003. The RFI concluded that there were no unacceptable risks presented by the Sites 5 and 13 soil to either human or environmental receptors and that the soil did not represent a continuing source of contamination to the underlying groundwater.
2003	An FS was conducted for OU1 in 2003 (CH2M, 2003). The FS included the evaluation of remedial alternatives for Site 13 groundwater (Tetra Tech, 2003c).
August 2004	CH2M conducted a baseline groundwater sampling event was conducted prior to the RA (CH2M, 2019b).
September 2004	The Site 5 and 13 ROD for soil and groundwater was signed by the USEPA and Navy with concurrence by MDE with the selected remedy for groundwater being in situ chemical reduction with zero-valent iron (ZVI) and MNA with ICs; the selected remedy for Sites 5 and 13 soil is NFA (NAVFAC, 2004b).
November 2004-February 2005	15 injection wells were installed (IW-1 through IW-15). Pneumatic fracturing of saprolite and liquid atomized injection of ZVI was completed (Shaw, 2005a).
February 2005-August 2009	Post-injection groundwater sampling events completed (CH2M, 2019b).

Table 5-1. Key Events and Milestones at Sites 5 and 13

Date	Key Events and Milestones
October 2006	Monitoring wells 13GW300 and 13GW301 were installed within the target remediation zone.
May 2010	20 injection boreholes were drilled to support the additional ZVI injections. Three additional permanent monitoring wells (13GW302 through 13GW304) were also installed as part of the LTM network for Site 13 (CH2M, 2011a).
June 2010	Supplemental ZVI injections into groundwater at Off-Site 13 were conducted to expedite remediation of offsite contamination and remaining Site 13 Source Area contamination (CH2M, 2011a).
October 2010-October 2017	Post-injection groundwater sampling events completed (CH2M, 2019b).
September-October 2016	An MNA assessment for Off-Site 13 was conducted. Groundwater grab samples from 12 locations and low-flow groundwater samples from 6 existing monitoring wells (13GW02, 13GW200, 13GW202, 13GW302, 13GW303, and 13GW304) were collected within Site 13 and Off Site 13 (CH2M, 2017g).
March-May 2018	A groundwater delineation assessment for Site 13 and Off-Site 13. Three new permanent bedrock monitoring wells (13GW305, 13GW306, and 13GW307) were installed and low-flow groundwater samples were collected from the three new and two existing bedrock monitoring wells. Additionally, groundwater grab samples from eight locations were collected as part of the delineation (CH2M, 2019a).
February 2020	Three monitoring wells (13GW308, 13GW309, and 13GW310) were installed at Site 13 to support the additional ZVI injections (CH2M, 2020).
March 2020	A baseline groundwater sampling event was conducted prior to the Supplemental RA (CH2M, 2022).
March 2020	Supplemental ZVI injections into groundwater at Site 13 were conducted to expedite remediation of onsite contamination (CH2M, 2020).
June 2020 – March 2021	Post-injection groundwater sampling events completed (CH2M, 2022).

5.2 Background

5.2.1 Description and History

Site 5 consists of three adjacent open burn areas that were used from the late 1940s until 1970 as a burn site for paper, cardboard, wood, and other bulky ignitable materials, as well as small quantities of hazardous materials. One or more of the areas may have also been used as a fire training area and for testing explosives and other pyrotechnic devices. Site 13 occupies approximately 0.7 acre and between 1970 and 1978, reportedly was used as a disposal area for approximately 6,000 to 10,000 gallons of oily sludge from storage tanks containing No. 6 fuel oil.

Sites 5 and 13 are located in the northeastern portion of Former NSWC White Oak (**Figure 1-2**), between the northern property line and Coffman Road (**Figure 5-1**). The area occupied by Sites 5 and 13 is entirely within property currently owned by GSA; however, the groundwater plume originating from the Site 13 Source Area extends off GSA property to the northwest onto private property formerly owned by

Percontee, Inc., (Percontee). Percontee historically used its site as a sand and gravel quarry; however, the property is currently owned by Global LifeSci Development Corporation and is referred to as Off-Site 13.

Both Sites 5 and 13 were identified as Navy IRP sites in an IAS conducted by NEESA in 1984 (Navy, 1984). An RFA was conducted by Kearney/Centaur Division in November 1990 which identified 97 SWMUs and 19 AOCs at Former NSWC White Oak, including Site 5 (SWMU 32) and Site 13 (SWMU 7). Both Sites were recommended for investigation in an RFI (Kearney/Centaur Division, 1990). In September 1992, Malcolm-Pirnie completed an RFA review for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual SWMU. Sites 5 and 13 were identified as sites of low to moderate priority based upon potential risk. Investigation activities specific to Sites 5 and 13 are listed in **Table 5-1**.

During the Site Screening Investigation conducted in 1997 and 1998, miscellaneous fill material, discolored soil, and soil contaminated with petroleum hydrocarbons and semivolatile organic compounds (SVOCs) were identified in the area of Burn Ring 1 at Site 5. The majority of the discoloration, odors, and elevated SVOC concentrations in the soil were in the top 2 to 3 feet (NAVFAC, 2004b). Based on the results from the Site Screening Investigation, the primary COPCs at Site 5 in soil were PAHs and inorganics (copper, lead, and selenium). The COPCs found in groundwater included VOCs, explosives, and inorganics; however, the VOC contamination in groundwater did not appear to be related to Site 5 practices and is likely related to Site 13. A removal action was recommended and implemented in 2000 at Site 5 to address the soil contamination. The top 3 feet of contaminated soil that made up the floor of the three burn rings was excavated and disposed of offsite as nonhazardous waste. The soil that made up the perimeter berms was sampled and was found to contain no contamination above screening levels or background concentrations and was removed and used as clean fill to regrade a neighboring site. The remaining surface and subsurface soil were investigated during the RFI that was conducted in 2002. The results of this investigation and risk assessment indicated that the soil at Site 5 did not pose a risk to potential receptors for UU/UE.

The 1997 Site Screening Investigation found PAHs in the surface and subsurface soils. A 2003 RFI at Site 13 confirmed the presence of elevated concentrations of a few PAHs and metals in soil; however, the RFI was unable to locate a source of the observed VOC groundwater contamination. The results of the RFI indicated that the Site 13 soil did not pose a risk to potential receptors for UU/UE, nor did it represent a source of groundwater contamination.

Groundwater at Site 13 was impacted by VOCs (1,1,2,2-PCA, cis-1,2- DCE, PCE, TCE, and VC). The OU1 RI showed that Site 13 groundwater contamination was a separate plume from Sites 4 and 46 plume; and documented the extent of contamination migrating northwestward from Site 13 onto the property currently owned by Global LifeSci Development Corporation.

The ROD for soil and groundwater at Sites 5 and 13 was signed in September 2004 (NAVFAC, 2004b). The remedy for groundwater included in situ chemical reduction with ZVI and MNA with ICs. Site 5 and 13 soils were addressed as part of a removal action in 2000 and the resulting risk assessment concluded that the remaining Site 5 soils and the soils at Site 13 do not represent unacceptable risks nor do they represent a possible source of groundwater contamination; therefore, NFA was the selected remedy for soil at Sites 5 and 13 with UU/UE.

Groundwater at Sites 5 and 13 is still subject to LTM and Five-Year Reviews. The requirements for groundwater LTM are specified in the ROD for Sites 5 and 13. The PRGs developed for groundwater and presented in the ROD (NAVFAC, 2004b). The PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs (CH2M, 2010).

5.2.2 Physical Characteristics

As summarized in the Sites 5 and 13 ROD (NAVFAC, 2004b), Sites 5 and 13 are adjacent sites located in the northeastern portion of Former NSWC White Oak, along the northern property line. The ground surface at Site 5 slopes generally to the south and southwest toward Coffman Road, and the maximum difference in elevation is approximately 30 feet. There are no surface water bodies within Site 5. The closest surface water body is a small, southward-flowing tributary (West Farm Branch) of Paint Branch located approximately 420 feet west of Site 5. During rain events, surface water infiltrates into the surface soil or drains offsite toward drainage ditches along Coffman Road and ultimately to West Farm Branch. **Figure 5-1** shows the layout of the Site 5 and 13 features.

The ground surface at Site 13 slopes gently to the west and consists of a relatively flat area. The maximum elevation relief across the site is approximately 5 feet, and the elevation of the site is approximately 260 feet. The topography to the northwest, west and southwest drops steeply at a grade of approximately 33 percent to an elevation of approximately 220 feet into the valley formed by West Farm Branch approximately 300 feet west of the site.

The soil underlying Sites 5 and 13 consists of a layer of silty sand and gravel (Coastal Plain deposits) ranging in thickness from 40 feet at the higher elevations on the east side of Site 5, to 10 feet on the west side of Site 13. The Coastal Plain is underlain by a 10- to 20-foot layer of decayed rock (saprolite). It grades from a micaceous silt or silty sand with varying amounts of clay and schist fragments to severely weathered schist with relief texture. Fractured rock underlies the saprolite, the competent bedrock is primarily a garnet schist; however, in the borings for the deep wells at Former NSWC White Oak, interbedded quartzites were observed.

The depth to the groundwater table varies from 25 feet on the east side of Site 5 to 12 feet at Site 13. While the upper portion of the water table aquifer resides in the relatively permeable Coastal Plain deposits on the east side of Site 5, the water table at Site 13 is present in the much-less permeable saprolitic soil. Groundwater flow beneath Site 5 is primarily to the south and southwest, while the flow beneath Site 13 is primarily to the west-northwest, toward and into West Farm Branch, except for the apparent groundwater divide in the southeast (**Figure 5-2**).

5.2.3 Land and Resource Uses

Currently, the combined area of Sites 5 and 13 consists of open field and woodlands approximately 3.5 acres in size. The area occupied by Sites 5 and 13 is within property currently owned by GSA; however, the groundwater plume originating from the Site 13 Source Area extends off GSA property to the northwest onto private property owned by Global LifeSci Development Corporation (Off-Site 13). The Navy has a Grant of Restrictive Easement for the Off-Site 13 property with Global LifeSci Development Corporation through 2029.

GSA, which owns the property overlying the groundwater containing the highest concentrations of contaminants, has no immediate plans to use this area. The affected portion of the adjoining private property amounts to less than 1 acre and consists of an undeveloped and steeply sloped wooded hillside and floodplain of West Farm Branch; however, there are plans to develop this area in the future with commercial and residential development (http://vivawhiteoak.com/).

There are no water supply wells located on the property in the area within or downgradient of the plume. Groundwater at and downgradient of Sites 5 and 13, and throughout the Former NSWC White Oak, is not used as a potable water source and is unlikely to be used for such purposes in the future. Water for the Former NSWC White Oak and the surrounding properties is (and is expected to continue to be) supplied by a local municipal water authority. Local ordinances and Maryland state regulations prevent the installation of new private potable supply wells without a permit.

5.2.4 History of Contamination

The practices that led to Sites 5 and 13 groundwater contamination and the exact location of the source are unknown. Based on groundwater screening data collected in 2001, the contaminants consist primarily of VOCs, which are 1,1,2,2-PCA, TCE, and cis-1,2-DCE, with lesser concentrations of PCE, trans-1,2-DCE[11] and VC. Historically, the well that consistently contained the highest VOC concentrations was well 13GW02, located on the north side of Site 13. At the time of the ROD, the COCs in the plume and the maximum concentrations of each are shown below.

- 1,1,2,2-PCA: 1,100 µg/L
- cis-1,2-DCE: 581 µg/L
- TCE: 420 µg/L
- PCE: 150 µg/L
- VC: 20 µg/L
- RDX: 110 µg/L
- Iron (dissolved): 18,900 µg/L

VOCs (1,1,2,2-PCA, PCE, TCE, cis-1,2-DCE, and VC) and dissolved iron concentrations remain above PRGs at Site 13 and Off-Site 13. The current horizontal and vertical extent of VOC contaminant plumes in groundwater are delineated. During the performance monitoring following the 2020 ZVI injection, selected monitoring wells were sampled for select VOCs, dissolved iron, and geochemistry parameters including TOC, dissolved gases (methane, ethane, ethene), carbon dioxide, sulfide, sulfate, chloride, nitrate, and nitrite.

5.2.5 Site Risks

Both human health and ecological baseline risk assessments were conducted to evaluate risks from Sites 5 and 13 contaminants. BHHRAs were conducted separately for soil at Sites 5 and Site 13 following the soil removal action as part of the RFI (Tetra Tech, 2003c), as well as for Sites 5 and 13 groundwater, surface water, and sediment as part of the OU1 RI (CH2M, 2002). The BERA was conducted on a facility-wide basis and consisted of screening all soil, surface water, and sediment data collected at Former NSWC White Oak against applicable ecological risk-based screening criteria (Tetra Tech, 2001a). This included soil data from Sites 5 and 13 as well as sediment and surface water data from the surrounding streams that would receive groundwater impacted by Sites 5 and 13.

5.2.5.1 Human Health Risk Summary

Based on the BHHRAs for soil included in the RFI for Sites 5 and 13 (Tetra Tech, 2003c), soil at both Sites 5 and 13 do not present an unacceptable risk for any receptors for unlimited use and unrestricted exposure; no unacceptable risks were identified for either Site 5 or Site 13 soil under post-removal action conditions based on direct exposure to combined surface and subsurface soil. Additionally, no chemicals pose a concern through the leaching-to-groundwater. Furthermore, no site-related chemicals were detected in the surface water or sediment in West Farm Branch; therefore, risks to receptors were not evaluated for this media relative to Sites 5 and 13. Neither sediment nor surface water are considered media of concern for Sites 5 and 13 (NAVFAC, 2004b).

As summarized in the ROD for Sites 5 and 13, the BHHRA for groundwater presented in the OU1 RI report evaluated risks related to the entire OU1 groundwater operable unit, of which Sites 5 and 13 are a part. Site specific risks were estimated for combined Site 5 and 13 using the results of the OU1 wide risk assessment. Because the Sites 5 and 13 area is a subarea of OU1 and many of the 41 COPCs identified for OU1 are not found in Sites 5 and 13 groundwater, it was assumed the risks from Sites 5

[11] Trans-1,2-DCE was not retained as a COC.

and 13 will be less than those from the entire OU1 area. Also, it was assumed that the only exposure scenarios that might experience unacceptable risks from groundwater at Sites 5 and 13 are those where unacceptable risks are present for OU1 (residential child, adult, and age-adjusted) (NAVFAC, 2004b).

A separate attainment area was established for Sites 5 and 13 (referred to as the Site 13 PRG attainment area) because of the unique set of contaminants found in the groundwater above risk-based screening levels in this area of OU1, and seven constituents were retained as COPCs for the Site 13 attainment area. The COPCs for Sites 5 and 13 were selected by identifying those OU1 COPCs that are present at concentrations corresponding to a cancer risk of 5.0×10^{-6} or above, or a hazard index (HI) of 0.1 or above, and were detected in monitoring wells within the Site 13 source area and plume. These levels were selected to ensure that the overall risk from COCs across OU1 does not exceed a carcinogenic risk of 5.0×10^{-5} or noncancer HI of 1. Inorganic compound concentrations found in the groundwater at Sites 5 and 13 do not exceed Basewide background levels and were excluded as COPCs for Sites 5 and 13. The following COCs were identified in the Sites 5 and 13 ROD: 1,1,2,2-PCA, PCE, TCE, cis-1,2-DCE, VC, RDX, and iron (NAVFAC, 2004b).

5.2.5.2 Ecological Risk Assessment

A facility-wide BERA was conducted by the Navy and presented in the Basewide Ecological Risk Assessment for the Former NSWC White Oak (Tetra Tech, 2001a). The BERA included screening of soil, surface water, and sediment collected at the facility against applicable ecological risk-based screening criteria. Based on the results of the BERA, all chemical concentrations in surface soil samples collected at Site 13 were below the risk-based levels developed during the BERA so risks to ecological receptors at Site 13 are expected to be negligible. Additionally, since groundwater exposure is not associated with ecological receptors, Sites 5 and 13 groundwater poses no ecological risks. No site-related chemicals were detected in the surface water or sediment in West Farm Branch and therefore, risks to ecological receptors were not evaluated for this media relative to Sites 5 and 13 (NAVFAC, 2004b).

5.3 Response Action Summary

5.3.1 Basis for Remedial Action

Based on the results of previous investigations, RA was warranted to protect human health from actual or threatened releases of VOCs, explosives, and metals in the groundwater at Sites 5 and 13.

5.3.2 Response Actions

5.3.2.1 Selected Remedy for Sites 5 and 13

The Sites 5 and 13 RAOs for groundwater, as presented in the ROD (NAVFAC, 2004b), include:

- Prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.
- Where practicable, restore contaminated groundwater to a quality amenable to beneficial use (that is, meet the PRGs identified).

Meeting these objectives for Sites 5 and 13 is based primarily upon achieving the PRGs. These PRGs were recalculated in 2010 for each of the COCs identified for the Site 13 groundwater, based on updated toxicity values, updated risk assessment methodology, and combined risks from the COCs in the Site 13 area groundwater (CH2M, 2010). The PRGs established were the MCL (for those compounds that have MCLs) and calculated risk-based PRG for chemicals that do not have MCLs.

The remedy selected to achieve the RAOs for Sites 5 and 13 groundwater, "Alternative 9: In situ Chemical Reduction with ZVI with MNA and Institutional Controls," comprised the following components:

- Installation of additional wells to define treatment area and establish a groundwater monitoring network
- Performance of a source area pilot test (if necessary)
- Installation of injection wells
- Pneumatic fracturing of the saprolite to enhance ZVI distribution
- Injection of ZVI in the Site 13 target remediation zone
- Groundwater monitoring of baseline and post-injection conditions
- Preparation of annual technical memorandums and Five-Year Review
- Monitoring for natural attenuation of the plume outside of the Target Remediation Zone
- Implementation of ICs until PRGs are met

5.3.3 Status of Implementation

5.3.3.1 Installation of Injection Wells, Pneumatic Fracturing, and Injection of ZVI

In November 2004, 15 injections wells were installed to support the remediation. In January and February 2005, pneumatic fracturing of saprolite and liquid atomized injection of 74,040 pounds of ZVI (that is, Ferox) using high-velocity nitrogen gas was completed by Shaw and ARS Technologies, Inc. Two additional permanent monitoring wells (13GW300 and 13GW301) were also installed (**Figure 5-1**).

Supplemental in situ remediation of groundwater at Off-Site 13 was conducted to expedite remediation of offsite contamination and remaining Site 13 source area contamination. In May 2010, 20 injections wells were installed to support the remediation. Three additional permanent monitoring wells (13GW302, 13GW303, and 13GW304) were also installed as part of the remedial decision process for Site 13. In June 2010, pneumatic fracturing of saprolite and liquid atomized injection of 139,265 pounds of ZVI using high-velocity nitrogen gas was completed by ARS Technologies, Inc. (AGVIQ-CH2M, 2010c).

In March 2020, additional supplemental in situ remediation of groundwater at Site 13 was conducted to act as a treatment zone to minimize offsite migration of groundwater impacted by VOCs. Three additional permanent monitoring wells (13GW308, 13GW309, and 13GW310) were installed as part of the remedial decision process for Site 13. Pneumatic fracturing of saprolite and injections of 67,353 pounds of ZVI at 11 locations using high-velocity nitrogen gas was completed by Redox Tech, LLC. (CH2M, 2020).

5.3.3.2 Long-Term Monitoring

In accordance with the LTM Plan for Sites 5 and 13 Groundwater (AGVIQ-CH2M, 2010c), groundwater sampling was performed in approximate 12-month intervals to assess the effectiveness of the ZVI injections and the achievement of PRGs, as well as evaluate the need to optimize the LTM approach or to discontinue LTM. Annual monitoring was conducted in 2016 and 2017. The Basewide Long-Term Monitoring Report, 2017-2018 (CH2M, 2019b) contained the following recommendation:

- Discontinue LTM at Site 13 and Off-Site 13 until the RA is complete and the LTM Plan has been revised.

Four rounds of quarterly performance groundwater sampling were performed at eight monitoring wells at Site 13 and Off-Site 13 to provide sufficient data to evaluate the technology performance after the

March 2020 supplemental injections were completed. The results of the four rounds of quarterly performance groundwater sampling following the 2020 injections are summarized as follows.

Off-Site/Site Boundary

Groundwater samples were collected from three monitoring wells (13GW02, 13GW202, and 13GW309) near the site boundary. Monitoring wells 13GW02 and 13GW202 were not targeted by the 2020 supplemental injections; however, after the injections, VOC concentrations at both wells were below PRGs. At monitoring well 13GW309, the TCE concentrations remained relatively stable above the PRG. Dissolved iron concentrations in all three monitoring wells were below the PRG during the final post-injection monitoring event.

Upgradient from Site Boundary

Groundwater samples were collected from five monitoring wells (13GW300, 13GW301, 13GW308, 13GW310, and 04GW109) within the site boundary. Following the injection, VOC concentrations at monitoring wells 04GW109 and 13GW301 were below PRGs. At monitoring well 13GW300, VOC concentrations decreased following the injection, but the TCE and VC concentrations still exceeded the PRGs during the final post-injection monitoring event. At monitoring well 13GW308, VOC concentrations initially decreased following the injection; however, VOC concentrations rebounded to levels similar to the baseline sampling event and concentrations of 1,1,2,2-PCA, TCE, and VC remain above the PRGs. At monitoring well 13GW310, groundwater concentrations remain above the PRGs for 1,1,2,2-PCA, cis-1,2-DCE, PCE, TCE, and VC. Dissolved iron concentrations were below the PRG in four of the monitoring wells, only monitoring well 04GW109 had iron concentrations above the PRG during the final post-injection monitoring event.

5.3.3.3 Operation and Maintenance

The O&M activities currently associated with Sites 5 and 13 are inspection and maintenance of the injection and monitoring wells.

5.3.3.4 Institutional Control Summary

Separate LUC RDs were prepared for Sites 5 and 13 and Off-Site. The LUC RD for Sites 5 and 13 (offsite) was finalized in 2008 (CH2M, 2008), and the LUC RD for Sites 5 and 13 (onsite) was finalized in 2017 (CH2M, 2017c).

The LUC RD for Sites 5 and 13 (offsite) is appended to the Grant of Restrictive Easement for the Off-Site 13 property. The LUC performance objectives from the LUC RD for Groundwater in the Offsite Portion of Site 13 (CH2M, 2008) are:

a. Prohibit residential use within the restricted area.

b. Prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to the CERCLA, the National Contingency Plan, and/or RCRA), including drinking water, from within the restricted area until the PRGs are met and risks from groundwater use are determined to be reduced to levels acceptable for unrestricted use.

c. Ensure adequate protection to minimize potentially adverse health and environmental effects of work in the restricted area.

d. Ensure protection to minimize physical destruction of any remedial equipment such as monitoring wells, or remedial operations in the restricted area.

e. Ensure adequate notification of land use restrictions to current and future property owners.

The LUC performance objectives from the Land Use Control Remedial Design for Site 5 and Site 13 Groundwater (CH2M, 2017c) are:

a. Prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA), including drinking water, from within the restricted area, until the PRGs are met or the risks from groundwater use are determined to be reduced to levels acceptable for unrestricted use.

b. Provide adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells or vent pipes, or remedial operations within the restricted area.

c. Provide adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.

d. Provide adequate notification of the LUCs to current and future property owners.

5.4 Progress Since the Last Five-Year Review

This section includes the protectiveness determinations and statements from the last Five-Year Review as well as the recommendations from the last Five-Year Review and the current status of those recommendations (**Tables 5-2 and 5-3**).

Table 5-2. Protectiveness Determination/Statement from the Third Five-Year Review – Sites 5 and 13

Protectiveness Determination	Protectiveness Statement
Protective	The remedy for Site 5 and Site 13, consisting of in situ chemical reduction with ZVI, groundwater LTM, and ICs is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

Table 5-3. Status of Recommendations from the Third Five-Year Review – Sites 5 and 13

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Additional groundwater characterization should be considered (Off-Site 13 and On-Site 13)	Further characterization and evaluation of Site 13 and Off-Site 13 groundwater should be conducted to optimize additional remedial activities.	Complete	Additional groundwater characterization events were completed in 2016, 2018.	October 2016 May 2018
LUCs inspections not documented (Off-Site 13 and On-Site 13)	Off-site and onsite inspections of Site 13 should be conducted at least once a year, documented in accordance with the Off-Site 13 and On-Site 13 LUC RDs, and summarized during the next Five-Year Review.	Complete	Annual LUC inspections were completed in October/November 2016, November 2017, December 2018, January 2020, and January 2021. Site inspection checklists are included in **Appendix D.**	October/November 2016 November 2017 December 2018 January 2020 January 2021

5.5 Five-Year Review Process

5.5.1 Document Review

Table 5-4 summarizes the main documents reviewed in the preparation of this section of the Five-Year Review. A complete list of documents cited in the preparation of this Fourth Five-Year Review Report is included in **Section 10**.

Table 5-4. Summary of the Sites 5 and 13 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
Remedial Investigation of Operable Unit 1	CH2M	2002
RCRA Facility Investigation for Sites 5 and 13	Tetra Tech	2003c
ROD for Sites 5 and 13 Soil and Groundwater	NAVFAC	2004b
LUC RD for Groundwater in the Offsite Portion of Site 13	CH2M	2008
Long-Term Monitoring Plan for Site 13 Groundwater	AGVIQ-CH2M	2010c
Land Use Control Remedial Design for Site 5 and 13 Groundwater (onsite)	CH2M	2017g
Comprehensive Third Five-Year Review	CH2M	2017b
Basewide Long-Term Monitoring Report – 2016, Former NSWC White Oak	CH2M	2017c
Off-Site 13 Natural Attenuation Assessment, Former NSWC White Oak	CH2M	2017d
Basewide Long-Term Monitoring Report, 2017 – 2018, Former NSWC White Oak	CH2M	2019a
Basis of Design, Site 13	CH2M	2019b
Completion of Monitoring Well Installation and Zero-Valent Iron Injection Activities at Site 13, Former NSWC White Oak	CH2M	2020
Final Long-term Monitoring for Site 13 and Off-Site 13 Groundwater	CH2M	2022

5.5.2 Site Inspections

During the site inspections conducted annually and for this Five-Year Review, no issues were identified affecting the protectiveness of the sites. Site inspection checklists are included in **Appendix B** and **Appendix D**.

5.5.3 Data Review and Evaluation

LTM has been conducted for groundwater at Site 13 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. Trend graphs presenting VOC COC and dissolved iron results for select LTM wells at Site 13 and Off-Site 13 are provided in **Appendix C-3.1** and **C-3.2**, respectively.

The current horizontal and vertical extent of VOC contaminant plumes in groundwater are delineated. Groundwater plume maps for 1,1,2,2-PCA, PCE, TCE, cis-1,2-DCE, and VC impacts in groundwater are presented on **Figures 5-3** through **Figure 5-8**, respectively. RDX has not been detected in groundwater from monitoring well 05GW01 (the only monitoring well where this constituent is being sampled) above

the PRG for three consecutive sampling events and was recommended for removal from LTM in 2016 (CH2M, 2017d).

5.6 Technical Assessment

This section presents the answers to the three questions defined for the Technical Assessment for Sites 5 and 13.

5.6.1 Question A – Is the Remedy Functioning as Designed?

The remedy for Sites 5 and 13 groundwater, consisting of ZVI injection, MNA and ICs, has been implemented and is functioning as intended by reducing contaminant concentrations and restricting exposure to contaminants by human and ecological receptors. The current horizontal and vertical extent of VOC contaminant plumes in groundwater has been fully delineated.

5.6.1.1 Remedial Action Performance

VOCs (1,1,2,2-PCA, PCE, TCE, cis-1,2-DCE, and VC) and dissolved iron concentrations remain above PRGs at five of the eight Site 13 and Off-Site 13 post-injection sampling locations. The 2020 supplemental ZVI injections activities completed as a component of the RA for Site 13 appear to have been effective with the overall reduction in the extent of the groundwater contaminant plume and an overall decrease in groundwater contaminant concentrations. However, some monitoring wells within Site 13 areas indicate stable or increasing VOC concentrations. The reduction of VOCs near the off-site boundary was successfully achieved, and to some degree, the process continues to occur at Site 13 based on an evaluation of the VOCs and supporting geochemical data.

5.6.1.2 Implementation of Institutional Controls and Other Measures

ICs at Sites 5 and 13 include offsite and onsite LUCs to ensure no withdrawal of groundwater, minimize potentially adverse health and environmental effects of work or development in the restricted area, and to minimize physical disruption of any remedial equipment. The offsite and onsite ICs have been effectively implemented to date and will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure.

5.6.1.3 Opportunities for Optimization

A revised Site 13 LTM Plan was prepared which identifies opportunities for optimization (CH2M, 2022).

5.6.2 Question B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Selection Still Valid?

Land use has not changed; therefore, the exposure assumptions and RAOs developed at the time of remedy selection are still valid. PRGs established for Sites 5 and 13 groundwater in the 2004 ROD were revised in 2010 as in accordance with the 2010 PRG Technical Memorandum (CH2M, 2010). Changes in toxicity data and exposure assumptions would not change the cleanup levels that are based on MCLs, and the MCLs presented in the 2010 PRG Technical Memorandum (CH2M, 2010) are still current. Typical values for exposure factors (i.e., groundwater ingestion rate, skin surface in contact with groundwater, body weight) have been updated since the revised PRGs, and these changes would result in slight increases to the cleanup levels for the three COCs without an MCL (1,1,2,2-PCA, RDX, and iron). Additionally, toxicity values have been updated for 1,1,2,2-PCA and RDX since the 2010 Technical Memorandum, which would also result in slight increases to the PRGs. However, LUCs prevent exposure to groundwater, and therefore, the remedy is still protective by eliminating potential exposure.

5.6.3 Question C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

No additional information has surfaced to question the protectiveness of the selected remedy.

5.7 Issues, Recommendations, and Follow-up Actions

Based on this Five-Year Review, there are no issues affecting protectiveness for Sites 5 and 13.

5.7.1 Other Findings

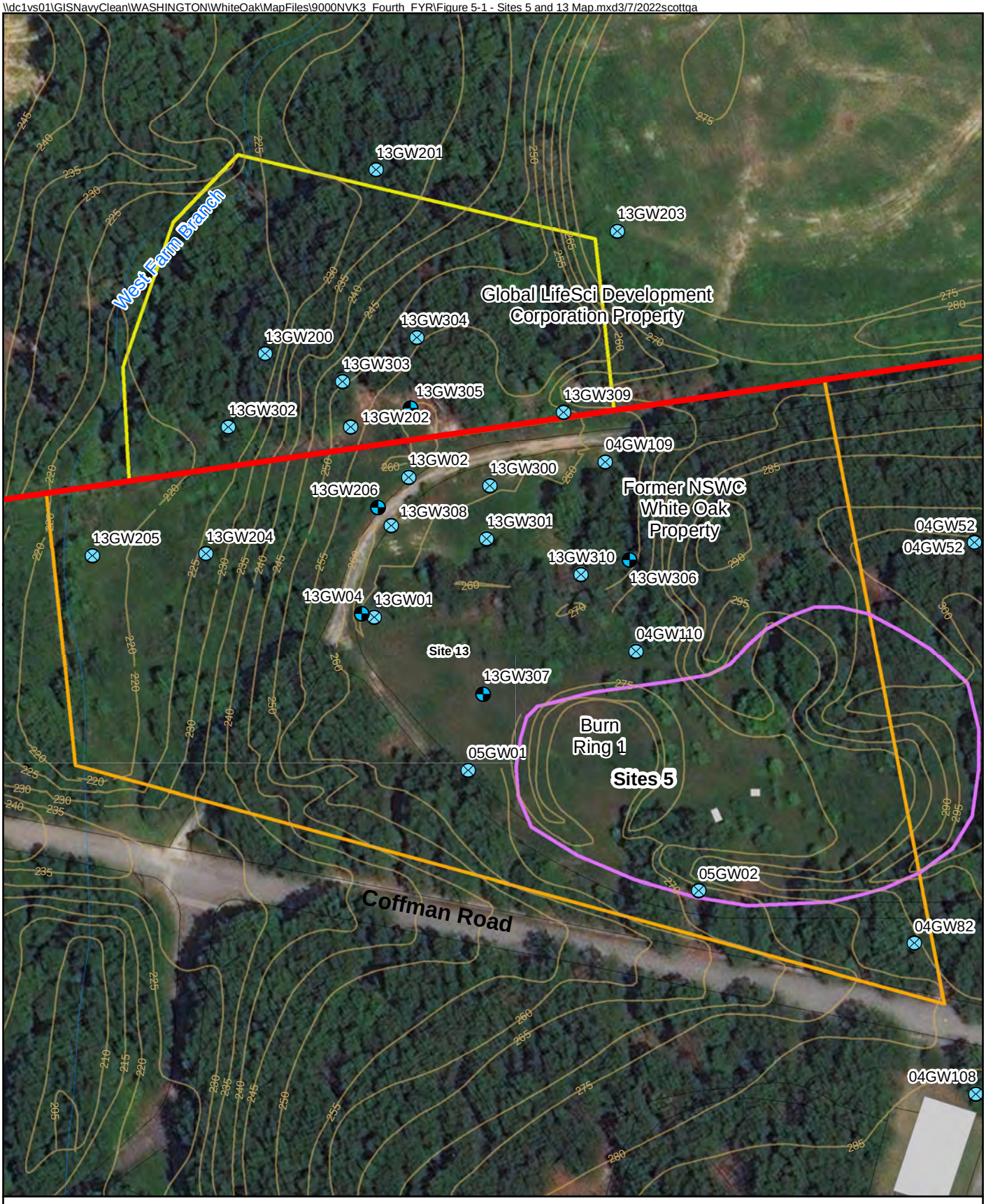
The following are recommendations that were identified during the Five-Year Review and may optimize performance of the remedy, reduce costs, and/or accelerate site closeout, but do not affect current and/or future protectiveness:

- The Navy intends to revise the Site 13 LTM Plan to include the recently installed monitoring wells and decision rules for groundwater optimization and site closeout. Following the finalization of the LTM Plan, LTM will resume.

5.8 Protectiveness Statement

The remedy for Site 5 and Site 13, consisting of in situ chemical reduction with ZVI, groundwater LTM, and LUCs that incorporate ICs, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 5-1 - Sites 5 and 13 Map.mxd3/7/2022scottga



Legend

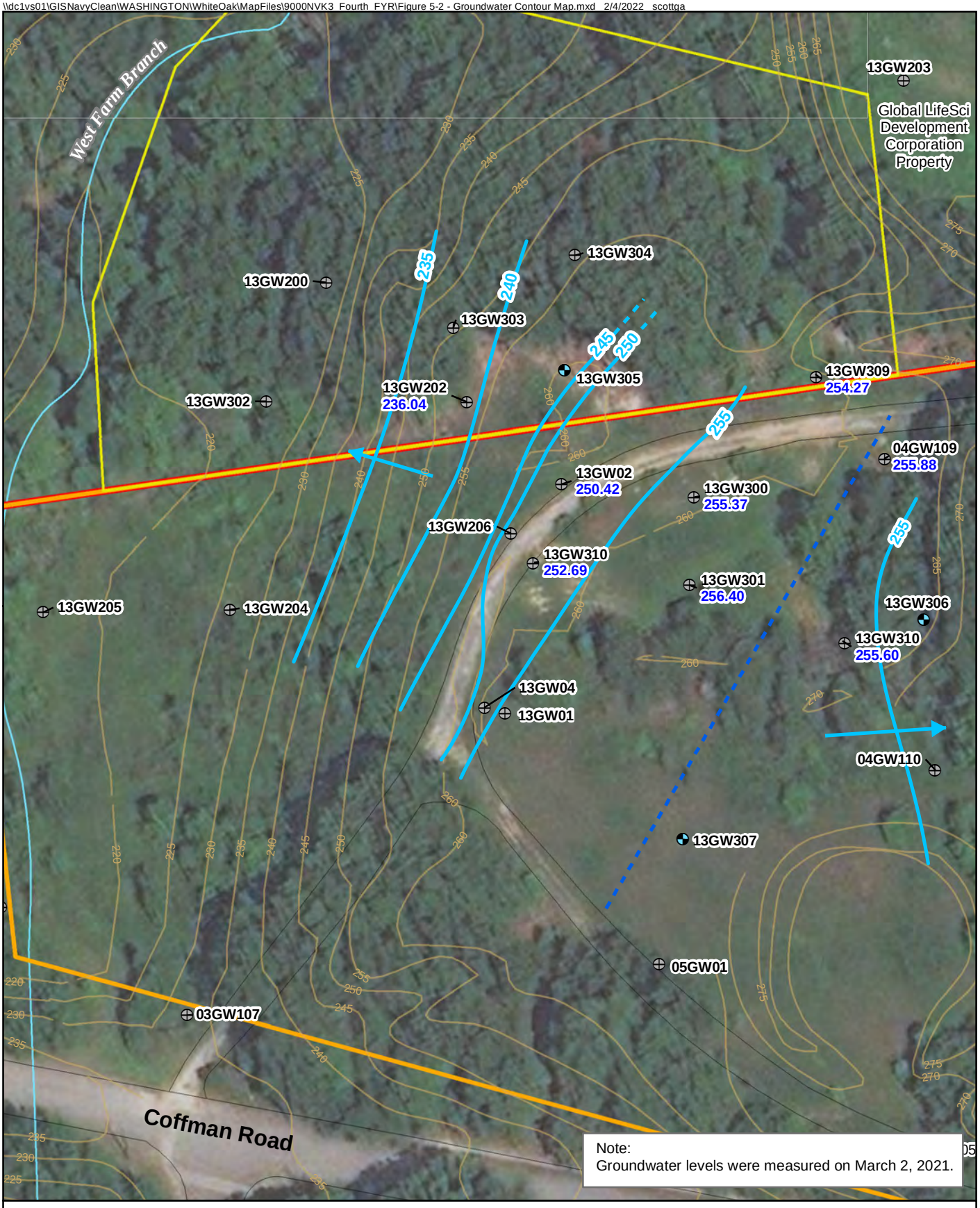
- Bedrock Monitoring Well
- Alluvial Monitoring Well
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Topography (5 ft intervals)
- Site 5/13 LUC Boundary
- Site 5 Boundary
- Off-Site 13 LUC Boundary

N

0 30 60 120 Feet

Figure 5-1
Sites 5 and 13 Map
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:



Legend

- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Former NSWC-White Oak Facility Boundary
- Water Bodies
- Potentiometric Surface Contour (dashed where inferred)
- Groundwater Flow Direction
- Apparent Groundwater Divide
- Roads
- Topography (5ft Intervals)
- Buildings and Other Structure
- Site 5/13 LUC Boundary
- Off-Site 13 LUC Boundary

250 - Groundwater Elevation in feet above mean sea level (ft amsl)

255.60 - Potentiometric surface elevation ft amsl

N

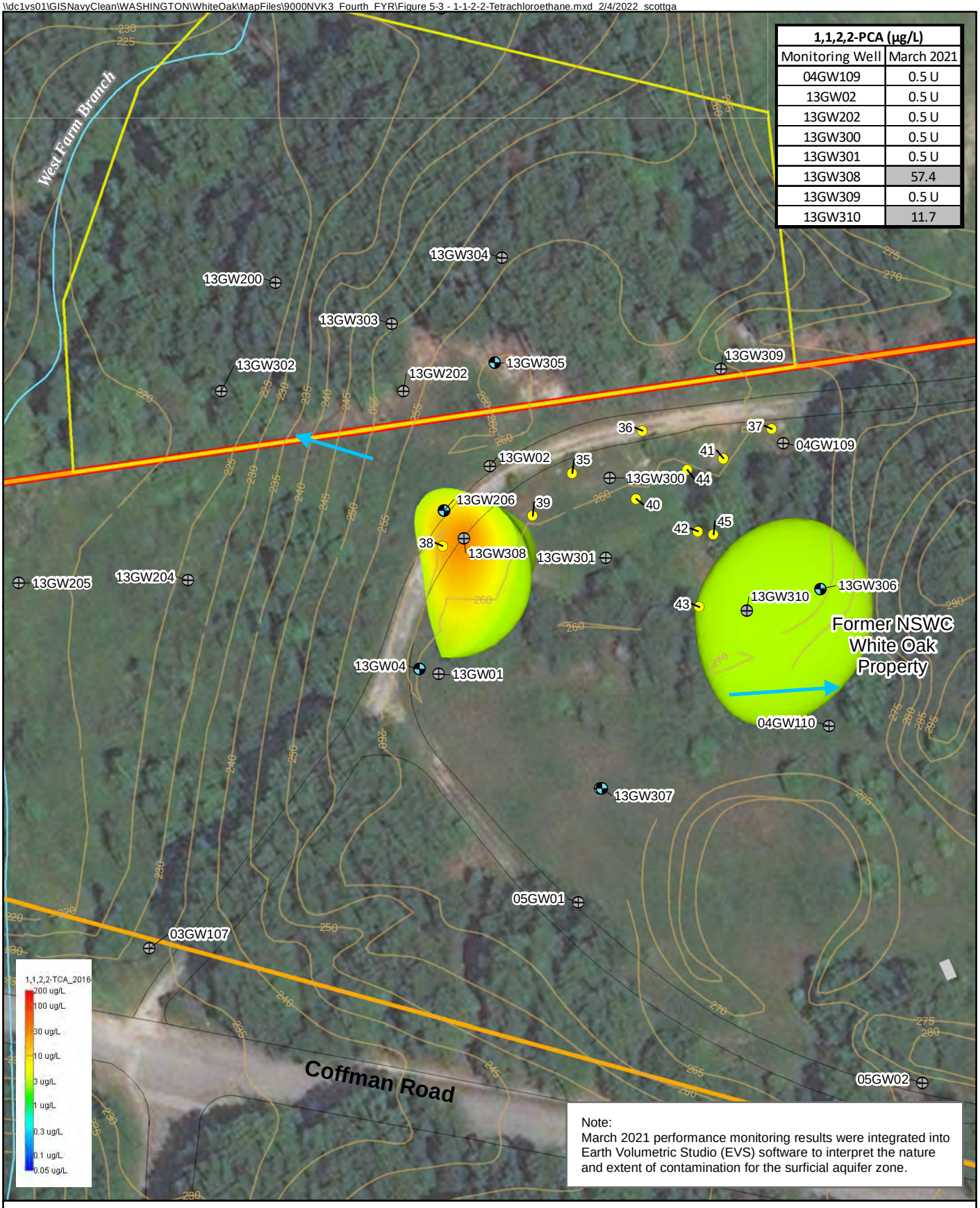
0 30 60

Feet

Figure 5-2
Site 13 Groundwater Contour Map - March 2, 2021
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 5-3 - 1-1-2-2-Tetrachloroethane.mxd 2/4/2022 scottga



1,1,2,2-PCA (µg/L)	
Monitoring Well	March 2021
04GW109	0.5 U
13GW02	0.5 U
13GW202	0.5 U
13GW300	0.5 U
13GW301	0.5 U
13GW308	57.4
13GW309	0.5 U
13GW310	11.7

Note:
March 2021 performance monitoring results were integrated into Earth Volumetric Studio (EVS) software to interpret the nature and extent of contamination for the surficial aquifer zone.

Legend

- 2020 ZVI Injection Location
- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Groundwater Flow Direction
- Former NSWC-White Oak Facility Boundary
- Water Bodies
- Roads
- Topography (5ft Intervals)
- Buildings and Other Structure
- Site 5/13 LUC Boundary
- Off-Site 13 LUC Boundary

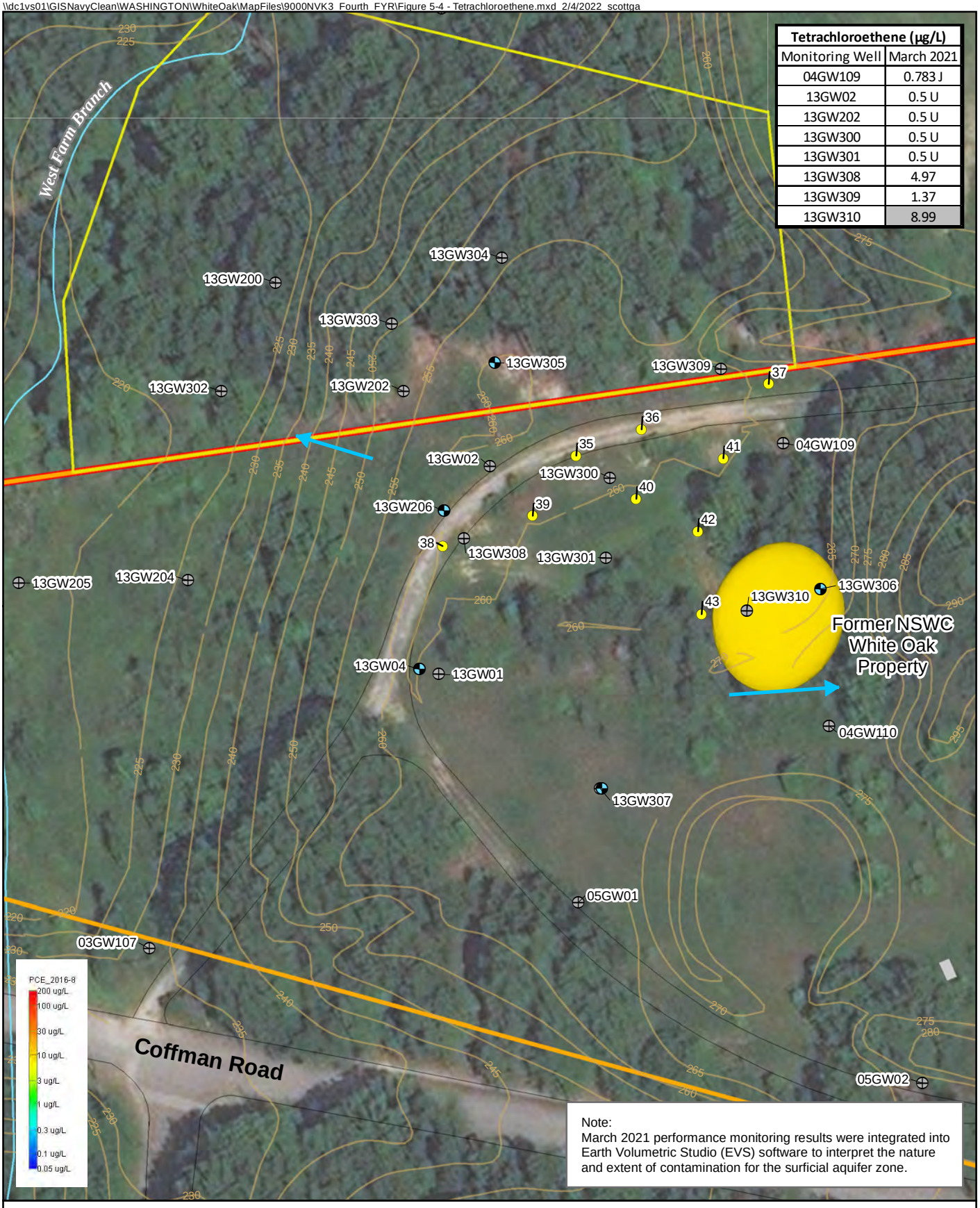
N

0 40 80 Feet

Figure 5-3
Sites 5 and 13 Performance Monitoring Results
March 2021 - 1,1,2,2-Tetrachloroethane
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 5-4 - Tetrachloroethene.mxd 2/4/2022 scottga



Tetrachloroethene (µg/L)	
Monitoring Well	March 2021
04GW109	0.783 J
13GW02	0.5 U
13GW202	0.5 U
13GW300	0.5 U
13GW301	0.5 U
13GW308	4.97
13GW309	1.37
13GW310	8.99

Note:
March 2021 performance monitoring results were integrated into Earth Volumetric Studio (EVS) software to interpret the nature and extent of contamination for the surficial aquifer zone.

Legend

- 2020 ZVI Injection Location
- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Former NSWC-White Oak Facility Boundary
- Groundwater Flow Direction
- Water Bodies
- Roads
- Topography (5 ft intervals)
- Buildings and Other Structure
- Site 5/13 LUC Boundary
- Off-Site 13 LUC Boundary

Notes:
J - Estimated Value
U - The material was analyzed for, but not detected

N

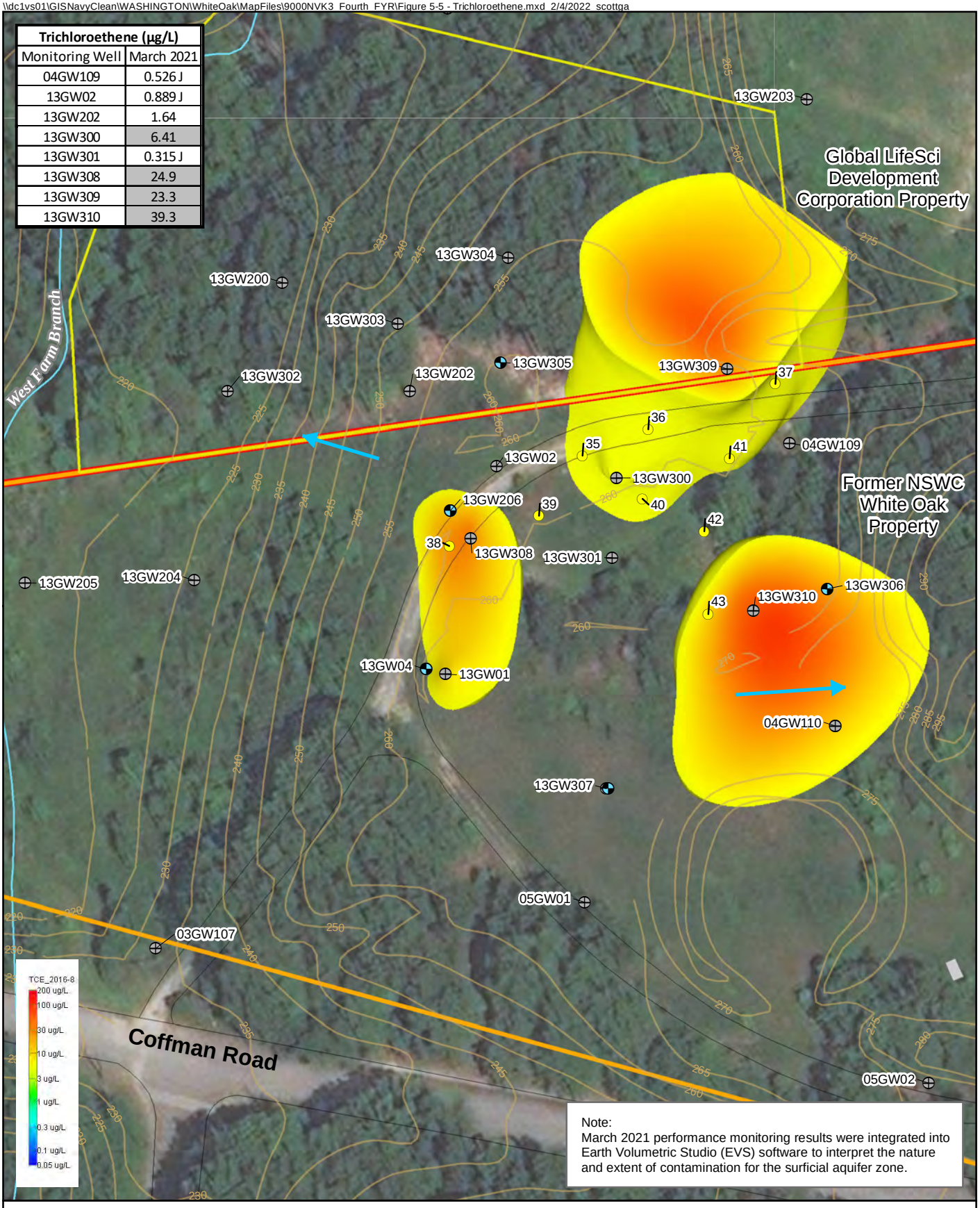
0 40 80 Feet

Figure 5-4
Sites 5 and 13 Performance Monitoring Results
March 2021 - Tetrachloroethane
Fourth Five-Year Review
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 5-5 - Trichloroethene.mxd 2/4/2022 scottga

Trichloroethene (µg/L)	
Monitoring Well	March 2021
04GW109	0.526 J
13GW02	0.889 J
13GW202	1.64
13GW300	6.41
13GW301	0.315 J
13GW308	24.9
13GW309	23.3
13GW310	39.3



Legend

- 2020 ZVI Injection Location
- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Former NSWC-White Oak Facility Boundary
- Groundwater Flow Direction
- Water Bodies
- Roads
- Topography (5ft Intervals)
- Buildings and Other Structure
- Site 5/13 LUC Boundary
- Off-Site 13 LUC Boundary

Note:
J - Estimated Value

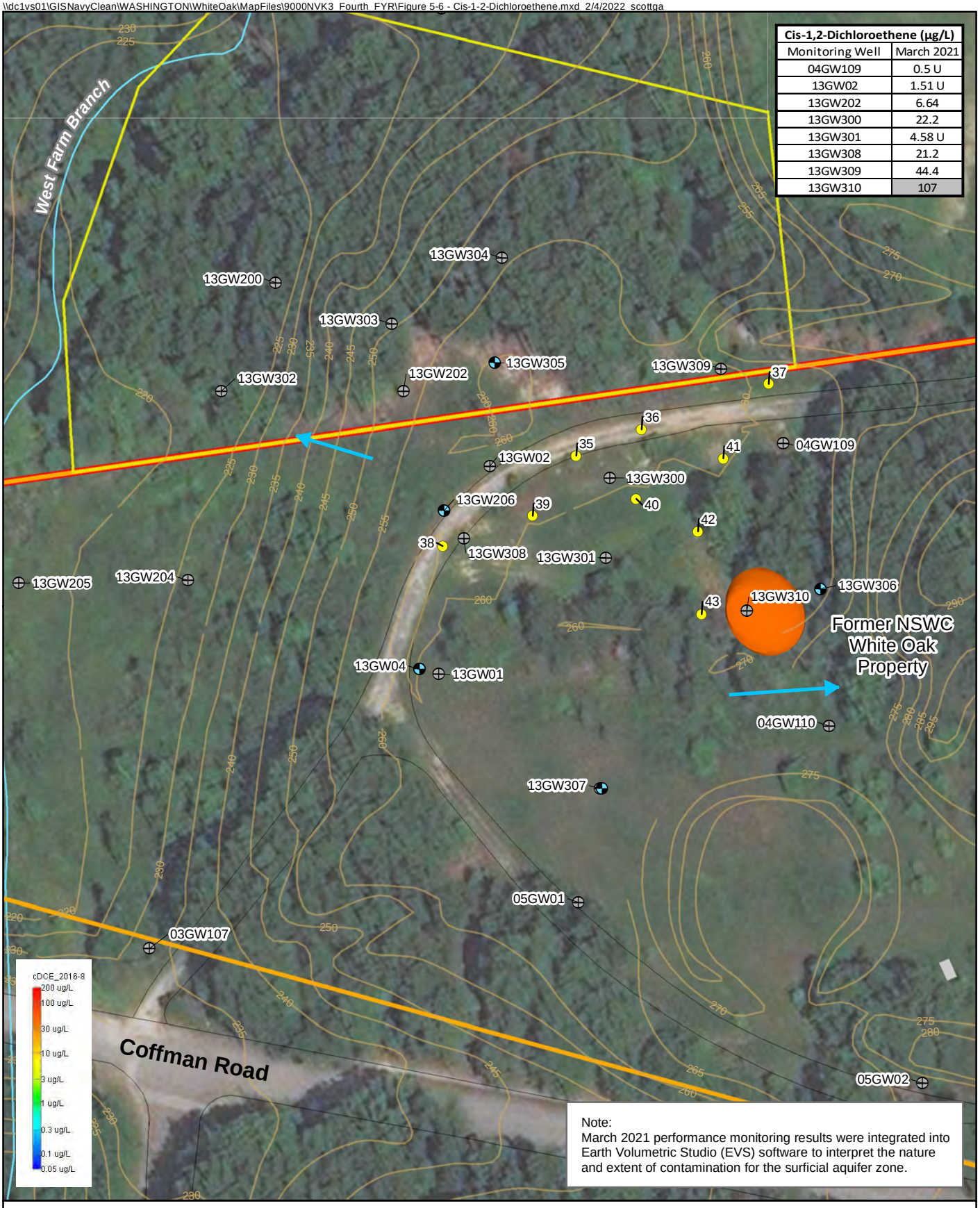
N

0 40 80 Feet

Figure 5-5
Sites 5 and 13 Performance Monitoring Results
March 2021 - Trichloroethene
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 5-6 - Cis-1-2-Dichloroethene.mxd 2/4/2022 scottga



Cis-1,2-Dichloroethene (µg/L)	
Monitoring Well	March 2021
04GW109	0.5 U
13GW02	1.51 U
13GW202	6.64
13GW300	22.2
13GW301	4.58 U
13GW308	21.2
13GW309	44.4
13GW310	107

Note:
March 2021 performance monitoring results were integrated into Earth Volumetric Studio (EVS) software to interpret the nature and extent of contamination for the surficial aquifer zone.

Legend

- 2020 ZVI Injection Location
- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Former NSWC-White Oak Facility Boundary
- Groundwater Flow Direction
- Water Bodies
- Roads
- Topography (5ft Intervals)
- Buildings and Other Structure
- Site 5/13 LUC Boundary
- Off-Site 13 LUC Boundary

Note:
U - The material was analyzed for, but not detected

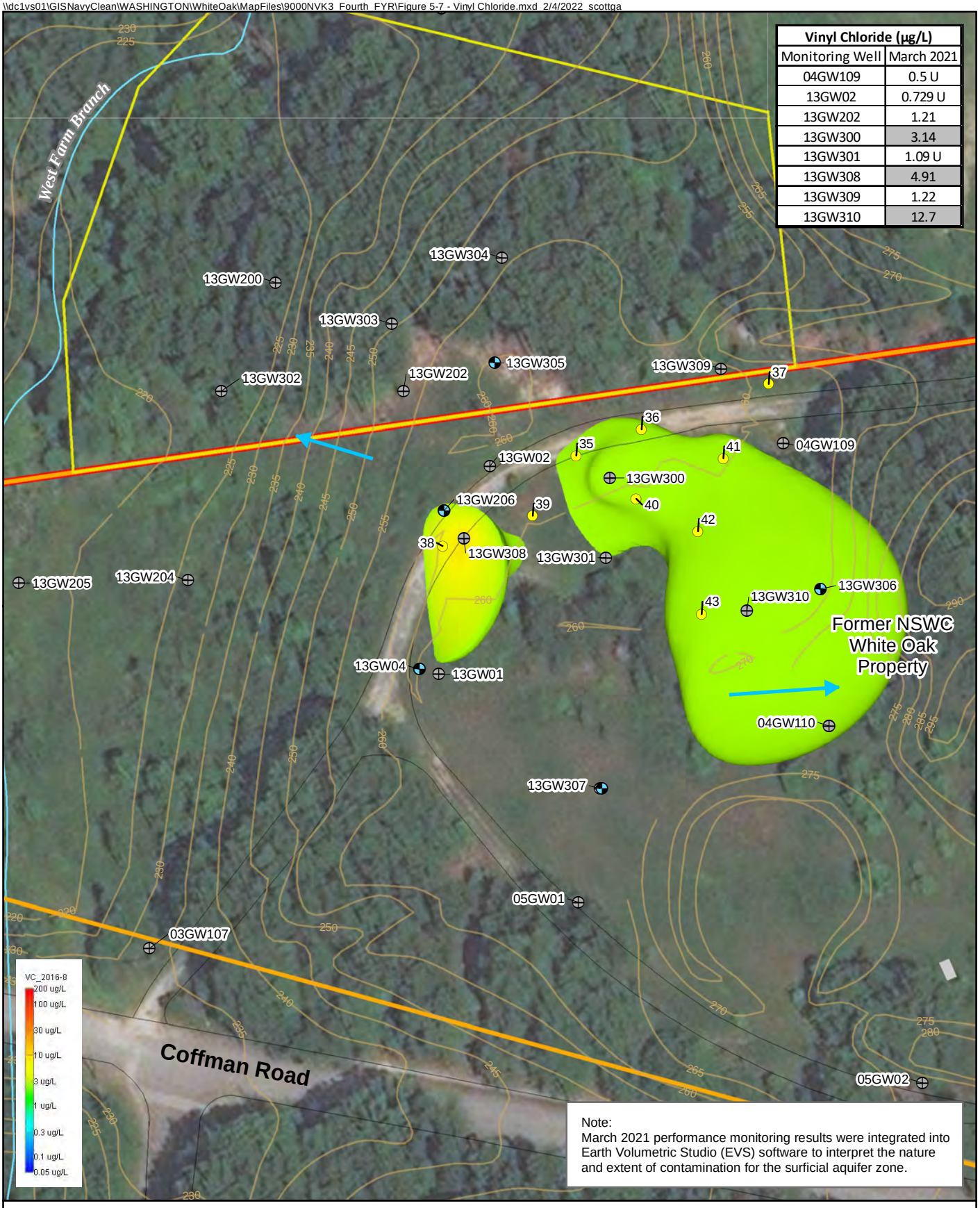
N

0 40 80 Feet

Figure 5-6
Sites 5 and 13 Performance Monitoring Results
March 2021 - Cis-1,2-Dichloroethene
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Fourth_FYR\Figure 5-7 - Vinyl Chloride.mxd 2/4/2022 scottga



Vinyl Chloride (µg/L)	
Monitoring Well	March 2021
04GW109	0.5 U
13GW02	0.729 U
13GW202	1.21
13GW300	3.14
13GW301	1.09 U
13GW308	4.91
13GW309	1.22
13GW310	12.7

Note:
March 2021 performance monitoring results were integrated into Earth Volumetric Studio (EVS) software to interpret the nature and extent of contamination for the surficial aquifer zone.

Legend

- 2020 ZVI Injection Location
- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Former NSWC-White Oak Facility Boundary
- Groundwater Flow Direction
- Water Bodies
- Roads
- Topography (5ft Intervals)
- Buildings and Other Structure
- Site 5/13 LUC Boundary
- Off-Site 13 LUC Boundary

Note:
U - The material was analyzed for, but not detected

N

0 40 80 Feet

Figure 5-7
Sites 5 and 13 Performance Monitoring Results
March 2021 – Vinyl Chloride
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\9000NVK3_Site13_LTM\Figure 3-7 - PlumeExtent - Ste 13 .mxd 2/21/2022 scottga

Legend

- Bedrock Monitoring Well
- Surficial Aquifer Monitoring Well
- Groundwater Flow Direction
- 2017 and 2021 Plume Extent Above PRGs for All Aquifers
- Former NSWC-White Oak Facility Boundary
- Water Bodies
- Roads
- Topography (5ft Intervals)
- Buildings and Other Structure
- Site 13 LUC Boundary
- Off-Site 13 LUC Boundary

Notes:
* Historical sampling results included at least one COC with an exceedance of the PRG, these wells were not part of performance monitoring after the 2020 ZVI injection.

N

0 40 80 Feet

Figure 5-8
Sites 5 and 13 Overall Plume Extent for All Aquifers
Fourth Five Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

SECTION 6

Site 49 – Trichloroethene Groundwater Plume in the 400 Area

6.1 Site Chronology

A chronology of major events for Site 49 is provided in **Table 6-1.**

Table 6-1. Key Events and Milestones for Site 49

Date	Key Events and Milestones
1999	Contamination at Site 49 (TCE in groundwater) was initially identified during the Washington Suburban Sanitation Commission (WSSC) and White Oak sanitary sewer lines investigation (CH2M, 1999).
June 2002	The former leaching well (also referred to on architectural drawings as the limestone pit) located on the western site of Building 427 was excavated by Shaw as a house keeping measure and a presumptive remedy (Shaw, 2008a).
2002-2003	An RI was conducted for Site 49 that included soil, groundwater, and surface water sampling (CH2M, 2004a).
2004	An FS was conducted for Site 49 to identify and evaluate groundwater remedial alternatives (CH2M, 2004b).
November 2004	ROD issued for Site 49 (NAVFAC, 2004e).
December 2005	Baseline groundwater sampling conducted prior to the sodium permanganate injection (CH2M, 2017d).
July-August, 2007	15 injection wells were installed and sodium permanganate injections were completed into these injection wells (Shaw, 2008a).
October 2007 – June 2020	Post-injection groundwater sampling events completed (CH2M, 2021a).

6.2 Background

6.2.1 Description and History

Site 49 is adjacent to the eastern end of the Arnold Engineering Development Center (AEDC) in the north-central portion of the facility (**Figure 1-2**). The western portion of the site is on the AEDC property. Site 49 begins west of Building 427 and extends to the east toward Paint Branch Creek (**Figure 6-1**). As summarized in the Site 49 ROD (NAVFAC, 2004e), Site 49 was initially identified during an unrelated investigation that the Navy conducted in 1999 through 2002 at the request of the WSSC to identify potential impacts from the Former NSWC White Oak property to the WSSC sanitary sewer line that traverses the property through the Paint Branch valley (CH2M, 2004a). During this investigation, TCE was detected in groundwater samples collected along the bedding of the WSSC sewer that runs along Paint Branch hydraulically downgradient of Building 427 (Site 49). Follow-up sampling identified that the TCE originated on the former Navy property in the area of Building 427; this area was designated as Site 49 in 2001 (CH2M, 2006).

Building 427 is a nine-story former hydrostatic testing facility that includes a 35-foot by 100-foot by 75-foot deep interior water tank. This tank was fed by an exterior aboveground storage tank located immediately southeast of Building 427; the Navy used the tank and building for hydrostatic testing of underwater weapons (CH2M, 2006). Much of Building 427 (three floors) is below ground. Building 427 was built in the mid-1960s and used by the Navy through the mid-1990s. It has since been abandoned.

An RI was conducted between 2001 and 2004 and the origin of the TCE and the nature and extent of the contamination in groundwater, surface water and soil at Site 49 was fully characterized. The RI found that groundwater has carcinogenic risks and noncarcinogenic hazards greater than the USEPA target levels associated with a future residential adult and child and a future construction worker exposed to groundwater. The majority of the risk from the groundwater is associated with TCE, cis-1,2-DCE, 1,2-dibromoethane (which was detected in only 1 of 16 groundwater samples), and VC. PCE, chromium, iron, and manganese also contribute to the risks and hazards, but to a much lesser extent (CH2M, 2004a).

Soil was not evaluated in the RI risk assessment because Site 49 was initially identified as a groundwater contamination site (that is, not as a disposal site related to known practices) and during subsequent sampling as part of the RI, none of the chemicals found in groundwater could be found in the soil and no discernible area of waste disposal has been identified in the soil at the site (based on site data and historic records searches) that can be attributed as the source of the VOCs found in groundwater. With the concurrence of the BRAC Cleanup Team for Former NSWC White Oak, potential risks associated with naturally occurring and anthropogenic compounds (metals and trace organic compounds) found in the soil samples that were collected were not quantified. Furthermore, sediment in Paint Branch was not sampled in the RI or evaluated in the risk assessment for Site 49 because a separate RFI and HHRA was already conducted specifically on Paint Branch (Tetra Tech, 2000b). The 2000 RFI did not detect any VOCs (the Site 49-related contaminants) in the sediment or surface water at, or immediately downgradient of, Site 49, and the accompanying HHRA indicated no unacceptable risks from exposure to Paint Branch sediment from any chemicals (NAVFAC, 2004a). During the Site 49 RI, surface water quality data from Paint Branch adjacent to Site 49 were consistent with the background data set discussed in the Background Investigation Report (Tetra Tech, 1998b) and show no anthropogenic influences from Site 49. In addition, no COPCs were retained for surface water; therefore, no unacceptable risks are associated with this medium (CH2M, 2004a).

The RI also included a visual inspection of Building 427 and sampling of the Building 427 perimeter drain and basement sumps for VOCs. Based on discussions with personnel who worked in the building or had knowledge of the activities that took place in the building, there was no known use of TCE. During visual inspection of the interior of the abandoned Building 427 in 2002, two empty 5-gallon cans labeled “solvent, dry-cleaning type” were found in a storage room on the 100-level floor (CH2M, 2004a).

A limestone pit, or leaching well, was present on the western side of the building that, according to construction drawings, was to be used for disposal of acidic wastewater from the water treatment system that pretreated water before filling the testing tank. Former building personnel stated that the leaching well was never used for its designed purpose and that the wastewater lines leading to the leaching well were reportedly connected to sinks in rooms that were initially designed to be laboratories but were actually used as offices (CH2M, 2004a). In 2002, the former leaching well was excavated and removed as part of a housekeeping measure and presumptive remedy (NAVFAC, 2004e).

As summarized in the Site 49 RI Report, risks to ecological receptors were not evaluated as part of the RI (CH2M, 2004a). The media affected at Site 49 is groundwater, for which there are no ecological receptors. The pathway for contaminant CVOC migration to the groundwater likely was through a leaching well or building sump, and therefore would not involve impacts to soil near the ground surface where risks to ecological receptors would be an issue.

An FS was prepared and submitted in June 2004 (CH2M, 2004b) and the ROD was signed in November 2004. The groundwater RA selected in the ROD included in situ chemical oxidation (ISCO) accompanied by LTM and ICs to address groundwater contamination and protect human health and the environment.

Groundwater at Site 49 is still subject to LTM and Five-Year Reviews. The requirements for groundwater LTM are specified in the ROD for Site 49 signed by USEPA Region 3 and the Navy, with concurrence by MDE (NAVFAC, 2004e). The PRGs developed for groundwater and presented in the Site 49 ROD (NAVFAC, 2004e). The groundwater PRGs were updated in 2010 based on May 2009 toxicity values for iron (CH2M, 2010).

6.2.2 Physical Characteristics

As summarized in the Site 49 RI Report (CH2M, 2004a), Site 49 is located at the eastern edge of the AEDC. The topography in this portion of the Former NSWC White Oak contains considerable relief. The western portions of Site 49, associated with AEDC, including Building 427, are relatively flat. The central and eastern portions of Site 49 include a steep-sided ravine formed by Paint Branch. Elevations at Site 49 range from approximately 275 feet amsl around Building 427 to approximately 180 feet amsl, at Paint Branch; the total elevation drop from west to east across Site 49 is approximately 100 feet.

Site 49 is underlain by a very thin veneer of Potomac Group coastal plain sand, gravel, silt and clay unconformably overlying bedrock. The uppermost zone underlying Potomac Group sediments consists of saprolite which is thoroughly weathered material that retains the appearance of bedrock. The saprolite zone varies in thickness from approximately 5 feet in the north to 25 feet in the south of the site. The saprolite grades downward into progressively less weathered bedrock composed of Cambrian-Precambrian metamorphic rock locally composed of garnet, mica schist (Shaw, 2008a).

The only surface water body in the vicinity of Site 49 is Paint Branch, which forms its eastern boundary. Paint Branch flows generally southeast from headwaters north of Former NSWC White Oak to its discharge into the upper reaches of the Anacostia River approximately 5 miles downstream of Former NSWC White Oak, draining an area of 17.5 square miles. In the immediate vicinity of Site 49, Paint Branch flows south. The Paint Branch channel likely is fracture-controlled and its channel is incised into bedrock throughout much of its channel in the vicinity of Former NSWC White Oak.

The hydrogeology of Site 49 is dominated by the saprolite-bedrock units. The Atlantic Coastal Plain sediments are present as a relatively thin veneer that is either unsaturated or has only a small, saturated thickness. Depth to groundwater increases westward across the site from approximately 45 to 30 feet bgs. Rainwater falling on the site infiltrates the ground surrounding Building 427 and percolates downward to the unconfined groundwater table. In the saturated zone, groundwater flows from west to east discharging into Paint Branch Creek on the eastern side of Site 49. Groundwater migration in the higher elevations beneath the western side of Site 49 occurs exclusively along bedrock fractures. Groundwater flow occurs in both bedrock and saprolite, beneath the lower elevations on eastern side of Site 49, near Paint Branch Creek (Shaw, 2008a).

No hydraulic testing of Site 49 was included in the scope of the RI. However, Site 49 is similar to, and in close proximity to, OU1, located to the east across Paint Branch, at Former NSWC White Oak. Because of their proximity, it is reasonably assumed that the hydraulic conductivity of the saprolite and bedrock at Site 49 is similar to that found in these same units at OU1. The hydraulic conductivity of the saprolite unit was estimated to be in the range of 6.9×10^{-6} and 1.0×10^{-4} feet per minute. The hydraulic conductivity of the bedrock units was estimated to be in the range of 2.3×10^{-6} and 2.8×10^{-6} feet per minute (CH2M, 2004a).

6.2.3 Land and Resource Uses

Site 49 is approximately 5 acres and is considered the area of groundwater contamination with TCE that originates in the vicinity of Building 427 at the eastern end of the AEDC in the north-central portion of the Former NSWC White Oak. Groundwater is not currently used as a potable water supply on government property at the site and is unlikely to be used for such purposes in the future. Water for occupants of the Former NSWC White Oak and the surrounding properties is (and is expected to continue to be) supplied by a local municipal water authority. Local ordinances and Maryland state regulations prevent the installation of new private potable supply wells without a permit. Additionally, the rock aquifer matrix within the site is incapable of providing a supply in excess of 1 gallon per minute (NAVFAC, 2004e).

Three private residential supply wells had operated downgradient of government property, approximately 1.2 miles downstream of Site 49 along Paint Branch. Two of these wells were closed and the residents were hooked up to the public water supply for reasons unrelated to the groundwater contamination found at Site 49. The third well is still active and it is located outside the area impacted by Site 49, 1.2 miles from the site.

6.2.4 History of Contamination

Contamination at Site 49 initially was identified during the 1999 sanitary sewer investigation (CH2M, 1999). TCE was detected in groundwater samples collected using direct-push technology on two occasions from one location (Manhole 32142) within the backfill of WSSC sewers that run along Paint Branch hydraulically downgradient of AEDC. Groundwater samples collected from sewer bedding up- and down-pipe of AEDC did not contain TCE. A subsequent investigation using four temporary monitoring wells indicated that TCE was present in shallow groundwater at concentrations as great as 1,000 µg/L (CH2M, 2004a).

The primary contaminants detected in groundwater are TCE and its breakdown products, cis-1,2-dichloroethene (cis-1,2-DCE) and VC. Maximum concentrations for each these contaminants through 2006 as listed in the LTM Plan for Site 49 groundwater (CH2M, 2006), as well as iron, are as follows:

- TCE – 4,400 µg/L
- cis-1,2-DCE – 1,100 µg/L
- VC – 5.7 µg/L
- Total Iron – 51,100 µg/L
- Dissolved Iron – 27,500 J µg/L

As summarized in the LTM Plan (CH2M, 2006), the contaminant plume extends 450 feet from the west side of Building 427 to Paint Branch (eastern boundary). Concentrations of TCE along the centerline of the plume were similar throughout the length of the plume prior to remediation. The open borehole well at the source area (49TW209 during the RI; now completed as 49W209) contained 2,800 µg/L of TCE, the open borehole well midway between the source and Paint Branch (49TW208 during the RI; now completed as 49GW208S) contained 2,800 µg/L, and one of the wells along Paint Branch (49GW201D) contained 4,400 µg/L (CH2M, 2006). This suggested that at the time of the RI, the source was in the vicinity of the former leaching well, that the plume was fairly well established, and that little attenuation of contamination occurred in the groundwater until it was intercepted by Paint Branch. The northern side of the TCE plume extended 100 feet to 200 feet onto property owned by the Maryland National Capital Park and Planning Commission and is defined by well 49GW205.

The vertical delineation indicates that TCE concentrations increase somewhat with depth near the source area and decrease with depth near Paint Branch. This is likely due to the complex vertical upward gradients and groundwater flow patterns near Paint Branch.

6.2.5 Site Risks

Both human health and ecological baseline risk assessments were conducted to evaluate risks from Site 49 contaminants. A BHHRA was conducted for Site 49 surface water and groundwater as part of the Site 49 RI (CH2M, 2004a). The BERA was conducted on a facility-wide basis and consisted of screening all surface water and sediment in the section of Paint Branch potentially affected by Site 49 against applicable ecological risk-based screening criteria (Tetra Tech, 2001a).

6.2.5.1 Human Health Risk Assessment

There were no constituents retained as COPCs for Paint Branch surface water in the HHRA included in the Site 49 RI (CH2M, 2004a), and therefore, no unacceptable risks were identified for surface water. The HHRA included in the Site 49 RI evaluated exposure to groundwater for future construction workers and residents (including future adult residents, child residents, and lifetime residents).

As detailed in the Site 49 ROD (NAVFAC, 2004e), based on the BHHRA conducted as part of the Site 49 RI, 12 COPCs were identified as contributing to potential unacceptable risk for the Site 49 groundwater. A subset of these COPCs were identified in the Site 49 ROD as the COCs requiring RA. The groundwater COCs identified in the Site 49 ROD (NAVFAC, 2004e) included TCE, cis-1,2-DCE, VC, and iron associated with a future residential adult and child exposed to potable use of groundwater and a future construction worker exposed to groundwater. At the time the Site 49 ROD was signed in 2004, there was no established ARAR for perchlorate, and the human health risk-based screening level identified by USEPA Region 3 was strictly associated with drinking water. Perchlorate was not detected at significant concentrations in groundwater during the Site 49 RI (CH2M, 2002) and this constituent was not added to the LTM for Site 49 when NAVFAC issued the Perchlorate Remediation Goal Memorandum dated December 15, 2006 (NAVFAC, 2006).

6.2.5.2 Ecological Risk Assessment

There is no ecological exposure pathway for groundwater with the exception of groundwater discharge to surface water and sediment. The ERA determined that surface water and sediment adjacent to Site 49 did not pose unacceptable risks to ecological receptors (CH2M, 2004a).

6.3 Remedial Actions

6.3.1 Basis for Remedial Action

Based on the results of previous investigations, RA is warranted to protect human health from actual or threatened releases of VOCs and iron in groundwater at Site 49.

6.3.2 Response Actions

6.3.2.1 Selected Remedy for Site 49

The ROD for Site 49 groundwater was signed on November 16, 2004 (NAVFAC, 2004e). The ROD summarized the risks to human health and the environment, established RAOs, and defined the selected remedy.

The RAOs for Site 49 groundwater as stated in the ROD are as follows:

- To prevent unacceptable risks to human receptors from exposure to contaminants in the groundwater.

- Where practicable, to restore contaminated groundwater to a quality amenable to beneficial use (i.e., meet the PRGs identified).
- Prevent further migration of contaminants.

The remedy selected to achieve the RAOs for Site 49 groundwater, "Alternative 4A: In Situ Chemical Oxidation with Pneumatic Fracturing," comprised the following components:

- lnstallation of additional wells to define treatment area, collect oxidant demand samples, and to establish an optimum groundwater monitoring network
- Performance of a source area pilot test or bench-scale test
- lnstallation of injection wells and pneumatic fracturing
- lnjection of oxidizing reagent
- Groundwater monitoring of baseline and post-injection conditions
- Preparation of a remediation completion report and Five-Year Reviews
- LTM of the plume until PRGs are met
- Implementation of ICs until PRGs are met

6.3.3 Status of lmplementation

6.3.3.1 In Situ Chemical Oxidation

Fifteen injection wells were installed and developed at Site 49 from July 19 through August 18, 2007. The injection wells penetrated the Coastal Plain sediments, saprolite zone, and slightly into the underlying bedrock and were located primarily in two north-south oriented rows. With the exception of injection wells 49INJ13 and 49INJ1S, the injection wells were installed to depths of 150 feet bgs with surface casing installed to depths ranging from 13 to 20 feet bgs and the remaining borehole left open. Injection well 49INJ13 was installed to a depth of 148 feet bgs with surface casing installed to a depth of 18 feet bgs and the remaining borehole left open. Injection well 49INJ1S was installed in unconsolidated Coastal Plain sediment overlying bedrock to a depth of approximately 18 feet bgs with a screened interval from eight to 18 feet bgs. After the injection wells were developed, borehole evaluations using a caliper and optical televiewer were conducted to help determine the locations of fractures. The results indicated that the majority of the observed fractures are small and partially open (Shaw, 2008a).

From August 21 to 29, 2007, Shaw injected a sodium permanganate solution into injection wells 49INJ1S, 49INJ1D and 49INJ2-49INJ14 via gravity feed. This was followed on August 23 through September 10, 2007, by an injection of chase water via gravity feed.

6.3.3.2 Long-Term Monitoring

Prior to the sodium permanganate injection at Site 49, baseline groundwater monitoring was conducted at nine monitoring wells from November 10 through 12, 2005 and the samples were analyzed for select VOCs and dissolved iron. In accordance with the LTM Plan for Site 49 Groundwater (CH2M, 2006), post-ISCO injection sampling was then conducted at 1-month, 3-months, and 6-months, and then in approximate 12-month intervals from 2008 to 2017 in order to assess the effectiveness of the ISCO injection. After the 2017 sampling event, the sampling interval for LTM was changed to every 2.5 years with the last sampling event in June 2020. Each sampling event is intended to evaluate progress of COC decreases toward their PRGs, as well as evaluating the need to optimize the LTM approach or to discontinue LTM.

During the most recent round of groundwater sampling in June 2020, eight monitoring wells (of 10 usually sampled) were sampled for select VOCs and dissolved iron. Monitoring well 49GW202D could not be located due to vegetation and well 49GW203 was inaccessible because it is inside the restricted portion of the Air Force property that was not open to contractors due to health concerns from the COVID-19 pandemic. The analytical results for groundwater samples collected from the 10 LTM wells are summarized below.

Volatile Organic Compound Results

Select VOCs (cis-1,2-DCE, TCE, and VC) were analyzed in the groundwater samples collected from eight monitoring wells (49GW200, 49GW206D, 49GW206M, 49GW206S, 49GW207D, 49GW207S, 49GW208D, and 49GW208S).

- TCE was detected in groundwater collected from all eight monitoring wells sampled, with concentrations ranging from 0.294 J µg/L (49GW206D) to 380 µg/L (49GW207D). It exceeded its PRG (5 µg/L) at seven of the eight locations (49GW200 [42.3 µg/L], 49GW206S [29.1 J µg/L], 49GW206M [130 µg/L], 49GW207S [30.4 µg/L], 49GW207D [380 µg/L], 49GW208S [5.99 µg/L], and 49GW208D [113 µg/L]).
- Cis-1,2-DCE was detected in groundwater collected from all eight monitoring wells sampled. Concentrations ranged from 3.02 µg/L (49GW206D) to 1,250 µg/L (49GW200), with results from three monitoring wells 49GW200 (1,250 µg/L), 49GW206M (243 µg/L), and 49GW207D (1,010 µg/L) exceeding the PRG (70 µg/L).
- VC was detected in groundwater samples collected from four of the eight monitoring wells analyzed for VOCs. VC concentrations ranged from 0.214 J µg/L (49GW208D) to 59 µg/L (49GW200), with results from three monitoring wells (49GW200 [59 µg/L], 49GW206M [5.8 µg/L], and 49GW207S [30.7 µg/L]), exceeding the PRG (2 µg/L).

Dissolved Iron Results

Dissolved iron was analyzed and detected above the PRG (11,000 µg/L) in groundwater samples from two monitoring wells, 49GW203 and 49GW207S, at concentrations of 17,800 µg/L in 2017 and 30,500 µg/L in 2020, respectively. Monitoring well 49GW203 was not sampled in 2020; therefore, the last sampling event concentration was used. Dissolved iron in 49GW206M was initially elevated but decreased to below its PRG for the first time in 2020.

6.3.3.3 Operation and Maintenance

The O&M currently associated with Site 49 are inspection and maintenance of the monitoring wells.

6.3.3.4 Institutional Control Summary

ICs at Site 49 include LUCs to:

- Ensure no withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA) from within the LUC boundary (CH2M, 2017b)) until the PRGs are met and risks from groundwater use are shown to be reduced to acceptable levels.
- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.
- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.
- Ensure adequate notification of pertinent use restrictions to current and future owners.

These LUC objectives shall remain in force until the Navy determines and the MDE concur in writing, that the groundwater within the restricted area or any part thereof, are suitable for unlimited use and unrestricted exposure. The LUC RD for On-site 49 Groundwater was made final in 2017 (CH2M, 2017b).

6.4 Progress Since Last Review

This section includes the protectiveness determinations and statements from the last Five-Year Review as well as the recommendations from the last Five-Year Review and the current status of those recommendations (**Tables 6-2 and 6-3**).

Table 6-2. Protectiveness Determination/Statement from the Third Five-Year Review – Site 49

Protectiveness Determination	Protectiveness Statement
Protective	Based on the activities that have been implemented, the selected remedy is protective of human health and the environment. In particular, ICs which prevent usage of groundwater as a potable water supply are functioning as intended and are protecting human receptors from exposure to groundwater contamination while the application of ISCO to site groundwater has reduced the contaminant mass. Groundwater monitoring and Five-Year Reviews will help ensure that the RAs are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

Table 6-3. Status of Recommendations from the Third Five-Year Review – Site 49

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to address the areas of highest concentrations of remaining CVOCs	The injection of additional sodium permanganate to promote the continued destruction of CVOCs in groundwater at Site 49 should be evaluated. A design should be developed to address the areas of highest remaining CVOCs, potentially including additional injection wells near Building 427.	Ongoing	The Navy is evaluating the feasibility of additional injections to enhance progress of decreasing VOC concentrations.	The feasibility evaluation will be completed by 2027.

Table 6-3. Status of Recommendations from the Third Five-Year Review – Site 49

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to assess whether oxidant/ catalyst solution continues to destroy dissolved and adsorbed CVOCs at Site 49 and whether additional treatment at Site 49 may be warranted.	Continue LTM for CVOCs at Site 49 following the second injection of sodium permanganate and a performance monitoring event.	Ongoing	LTM is ongoing and the Navy is considering additional injections.	NA
Need to address possible data gaps from locations near Paint Branch for the remedy to be protective.	The LTM Plan should be evaluated to determine whether groundwater data should continue to be collected from the locations of former monitoring wells 49GW201S, 49GW201D, and 49GW201DD.	Ongoing.	The Navy is considering optimizing the LTM plan near Paint Branch.	Will be completed by 2027.

6.5 Five-Year Review Process

6.5.1 Document Review

Table 6-4 summarizes the main documents reviewed in the preparation of this section of the Five-Year Review. A complete list of documents cited in the preparation of this Fourth Five-Year Review Report is included in **Section 10**.

Table 6-4. Summary of the Site 49 Documents Reviewed Preparing this Section of the Five-Year Review

Document	Author	Year
RI Report for Site 49	CH2M	2004a
FS for Site 49	CH2M	2004b
ROD for Site 49	NAVFAC	2004e
Long-Term Monitoring Plan for Site 49 Groundwater	CH2M	2006
Land Use Control Remedial Design for On-site 49 Groundwater	CH2M	2017f
Former NSWC White Oak Third Five-Year Review	CH2M	2017b
Basewide Long-Term Monitoring Report – 2017-2018, Former NSWC White Oak	CH2M	2019a
Basewide Long-Term Monitoring Report – 2020, Former NSWC White Oak	CH2M	2021a

6.5.2 Site Inspections

The area surrounding former monitoring wells 49GW201S, 49GW201D, and 49GW201DD (abandoned in 2015) has continued to erode, with two injection wells (49INJ13 and 49INJ14) discovered sticking up out of the ground by several feet during the 2020 Site Inspection. Also, during the 2020 inspection, 49GW205 was discovered to have been compromised, and had settled below the original installation grade.

During the site inspections conducted at Site 49 on November 18, 2021, no issues were identified affecting the protectiveness of the site. However, the following observations were noted:

- Monitoring well 49GW205 and injection wells 49INJ13 and 49INJ14 were abandoned in December 2020.
- Monitoring well 49GW202S was not found and is presumed destroyed.
- The washed-out bridge observed in June 2016 was removed from the stream.
- Stream restoration, to include rip-rap, was observed.

These observations do not affect current or future protectiveness. Site inspection checklists are included in **Appendix B** and **Appendix D**.

6.5.3 Data Review and Evaluation

LTM is being conducted for groundwater at Site 49 to evaluate the long-term effectiveness of the RA and the natural attenuation of COCs in groundwater. Trend graphs presenting VOC COC results for select monitoring wells at Site 49 are provided in **Appendix C-4**.

The concentration of one or more of the VOCs exceeded the PRGs in the eight monitoring wells sampled during the June 2020 sampling event. The VOC concentrations, although decreasing following the ISCO application, have generally stabilized with the exception of monitoring wells 49GW207D, 49GW206D, and 49GW202D, screened in the deeper portion of the aquifer. The TCE and cis-1,2-DCE concentrations in 49GW207D continue to fluctuate and increase. The permanganate oxidant was successful in treating the VOC mass it contacted in the bedrock fractures and saprolite; however, the slow kinetics of back-diffusion (from bedrock matrix and fine-grained portions of the saprolite) are likely contributing to the newly equilibrated VOC values measured in groundwater. Some localized anaerobic biodegradation may be occurring in well 49GW207S based on low ORP readings, TCE decreases, and fluctuating cis-1-2 DCE and VC concentrations (CH2M, 2021a). Fluctuating cis-1,2-DCE, TCE, and VC and low ORP readings in 49GW206D also suggest some anaerobic biodegradation is taking place in the vicinity of that well. In addition, concentrations of dissolved iron exceeded the PRG in one monitoring well (49GW207S) sampled during the June 2020 sampling event. Note, dissolved iron was above its PRG in well 49GW203 when it was sampled in 2017 and it could not be sampled in 2020. Dissolved iron was detected in 49GW206M but decreased to below the PRG (11,000 µg/L) for the first time since monitoring began in 2005.

6.6 Technical Assessment

This section presents the answers to the three questions defined for the Technical Assessment for Site 49.

6.6.1 Question A – Is the Remedy Functioning as Designed?

The Site 49 remedy of ISCO injection, ICs, and LTM have been implemented and are functioning as intended by reducing contaminant mass and restricting exposure to contaminants by human and ecological receptors.

6.6.1.1 Remedial Action Performance

The concentration of one or more of the VOCs exceeded the PRGs in the eight monitoring wells sampled during the June 2020 sampling event (**Figure 6-2**). Overall, VOC concentrations have generally stabilized or decreased in the last 5 years (**Appendix C-4**). The VOC concentrations from June 2020 are shown on **Figure 6-3**. The permanganate oxidant was successful in treating the VOC mass it contacted in the bedrock fractures and saprolite; however, the slow kinetics of back-diffusion (from bedrock matrix and fine-grained portions of the saprolite) are likely contributing to the newly equilibrated VOC values measured in groundwater.

6.6.1.2 Implementation of Institutional Controls and Other Measures

LUCs at Site 49 include onsite ICs to prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA) from within the restricted area until PRGs are met or the risks from groundwater use are determined to be reduced to levels acceptable to unrestricted use, minimize physical disruption of any remedial equipment or remedial operations within the restricted area, and minimize potentially adverse health and environmental effects of work or development in the restricted area.

6.6.1.3 Opportunities for Optimization

After the last Five-Year Review, the Navy implemented changes to the LTM program for Site 49. These changes are summarized in **Table 6-5**.

Table 6-5. Site 49 Groundwater Optimization

Sampling Event	Groundwater Optimization
November 2017	Perform LTM at 30-month intervals.

6.6.2 Question B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Selection Still Valid?

Since land use has not changed, the exposure assumptions and RAOs developed at the time of remedy selection are still valid. PRGs established for Site 49 groundwater in the 2005 ROD were revised in 2010 as described in the 2010 PRG Technical Memorandum (CH2M, 2010). Changes in toxicity data and exposure assumptions would not change the cleanup levels that are based on MCLs, and the MCLs presented in the 2010 PRG Technical Memorandum (CH2M, 2010) are still current. Typical values for exposure factors (i.e., groundwater ingestion rate, skin surface in contact with groundwater, body weight) have been updated since the revised PRGs, and these changes would result in a slight increase to the cleanup level for the one COC without an MCL (iron). However, LUCs prevent exposure to groundwater, and therefore, the remedy is still protective by eliminating potential exposure.

6.6.3 Question C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

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

6.7 Issues, Recommendations, and Follow-up Actions

Based on this Five-Year Review, there are no issues affecting protectiveness for Site 49.

6.7.1 Other Findings

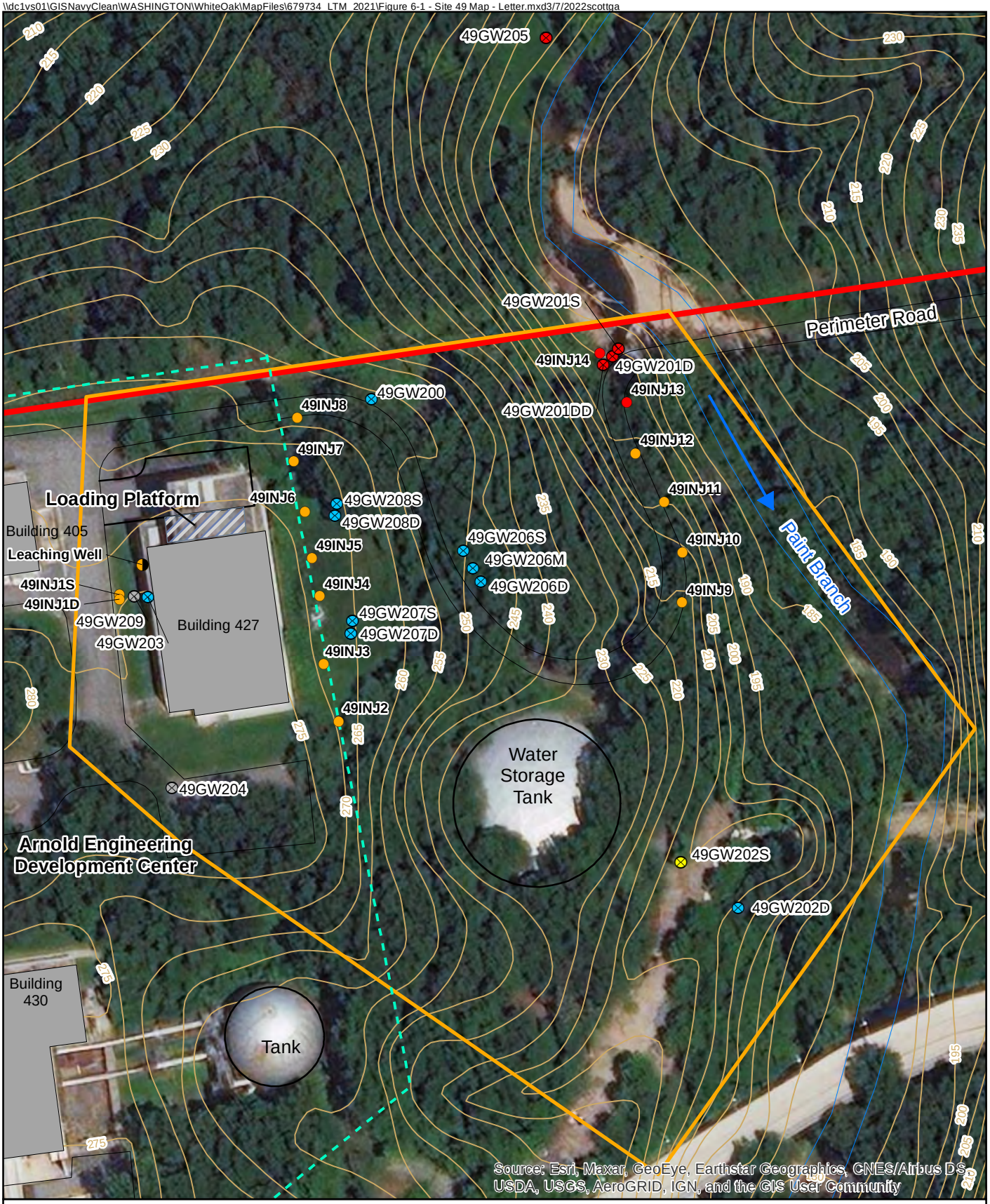
The following are recommendations that were identified during the Five-Year Review and may optimize performance of the remedy, reduce costs, and/or accelerate site closeout, but do not affect current and/or future protectiveness:

- The Navy is considering an additional injection to reduce contaminant concentrations. Because of the nature of the contamination at Site 49 (present in fractured bedrock), the additional injection is not expected to reduce concentrations to PRGs; however, it is expected that PRGs would eventually be met with natural attenuation in an overall shorter timeframe.
- The Navy is evaluating the LTM Plan to determine whether groundwater data should be collected from the locations of former monitoring wells 49GW201S, 49GW201D, 49GW201DD, and 49GW205 to refine the groundwater conceptual site model.

6.8 Protectiveness Statement

The selected remedy for Site 49, consisting of ISCO, LUCs that incorporate ICs, and groundwater LTM, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\679734_LTM_2021\Figure 6-1 - Site 49 Map - Letter.mxd3/7/2022scottga



Legend

- Destroyed Monitoring Well
- Abandoned Monitoring Well
- 2020 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Abandoned Injection Well
- Leaching Well Location
- Topographic Contours (feet above mean sea level)
- Former NSWC - White Oak Facility Boundary
- Site 49 LUC Boundary
- Fence
- Buildings and Other Structures
- Direction of Stream Flow

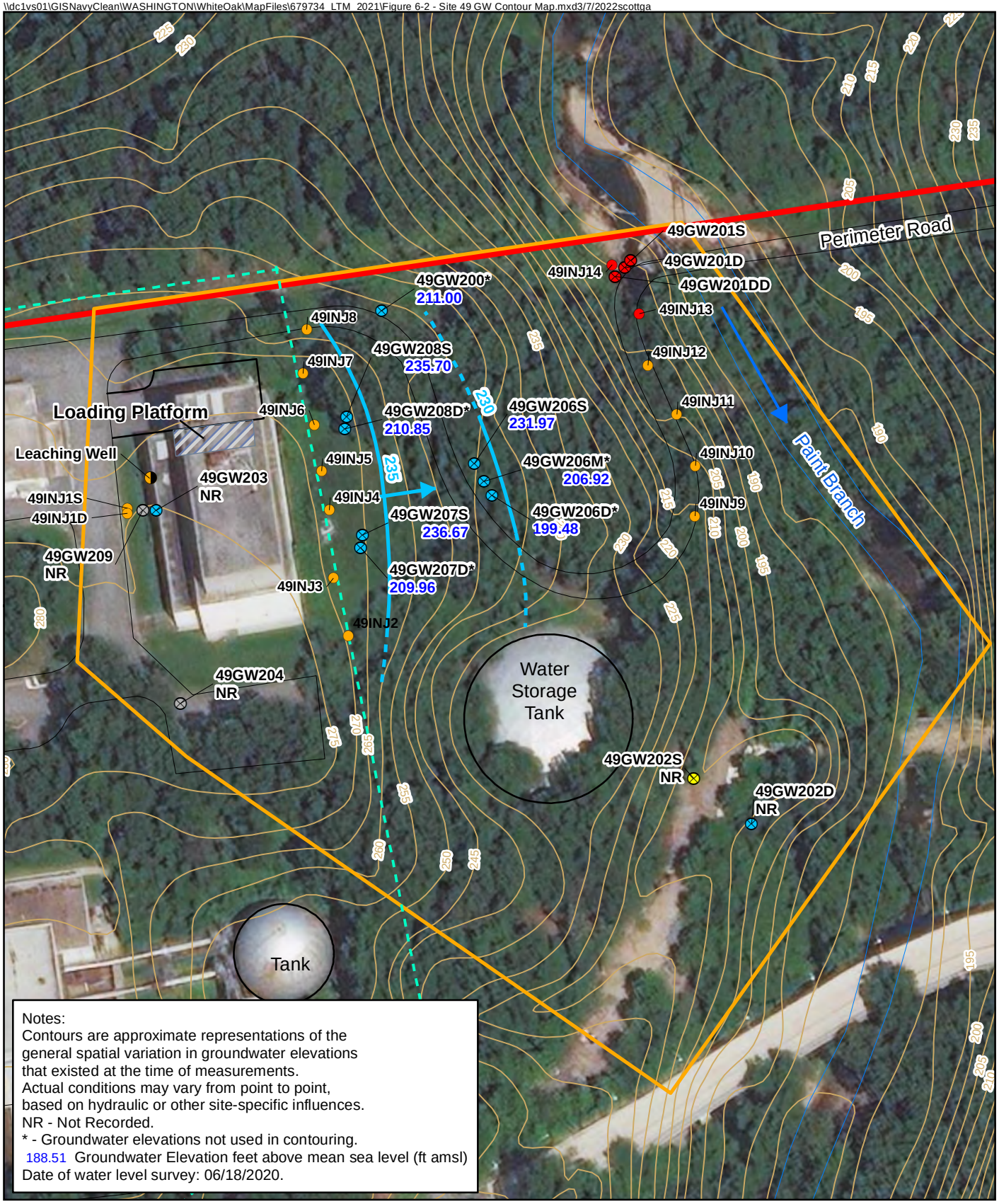
N

0 50 100 Feet

Figure 6-1
Site 49 Map
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\679734_LTM_2021\Figure 6-2 - Site 49 GW Contour Map.mxd3/7/2022scottga



Notes:
Contours are approximate representations of the general spatial variation in groundwater elevations that existed at the time of measurements.
Actual conditions may vary from point to point, based on hydraulic or other site-specific influences.
NR - Not Recorded.
* - Groundwater elevations not used in contouring.
188.51 Groundwater Elevation feet above mean sea level (ft amsl)
Date of water level survey: 06/18/2020.

Legend

- Destroyed Monitoring Well
- Monitoring Well
- Abandoned Monitoring Well
- 2020 Long Term Monitoring Well
- Injection Well
- Abandoned Injection Well
- Leaching Well Location
- Topographic Contours (ft amsl)
- Site 49 LUC Boundary
- Former NSWC - White Oak Facility Boundary
- Fence
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction
- Direction of Stream Flow
- Buildings and Other Structures

Figure 6-2
Site 49 Potentiometric Groundwater Contour Map and LTM Locations - June 18, 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

N

0 50 100 Feet

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\679734_LTM_2021\Figure 6-3 - Site 49 GW Exceedances.mxd3/7/2022scottga

Station ID	49GW208S
Sample ID	49GW208S-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
Trichloroethene	5.99

Station ID	49GW208D
Sample ID	49GW208D-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
Trichloroethene	113

Station ID	49GW207S
Sample ID	49GW207S-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
Trichloroethene	30.4
Vinyl chloride	30.7
Dissolved Metals (UG/L)	
Iron, Dissolved	30,500

Station ID	49GW207D
Sample ID	49GW207D-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	1,010
Trichloroethene	380

Station ID	49GW200
Sample ID	49GW200-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	1,250
Trichloroethene	42
Vinyl chloride	59

Station ID	49GW206S
Sample ID	49GW206S-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
Trichloroethene	29.1 J

Station ID	49GW206M*
Sample ID	49GW206M-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	245
Trichloroethene	130
Vinyl chloride	5.8

	PRG (UG/L)
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	70
Trichloroethene	5
Vinyl Chloride	2
Dissolved Metals (UG/L)	
Iron	11,000

Notes:
Shading indicates exceedance of Site 49 PRGs
NS - Not Sampled
J - Analyte present, value may or may not be accurate or precise
* - Field duplicate collected at this location
UG/L - Micrograms per liter
PRG = Preliminary Remedial Goal

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Destroyed Monitoring Well
- Abandoned Monitoring Well
- 2020 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Abandoned Injection Well
- Leaching Well Location
- Topographic Contours (feet above mean sea level)
- Former NSWC - White Oak Facility Boundary
- Fence
- Site 49 LUC Boundary
- Direction of Stream Flow
- Buildings and Other Structures

N

0 50 100 Feet

Figure 6-3
Site 49 Groundwater Exceedance Map - June 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m.

SECTION 7

SWMU 87 – Building 611 Solid Waste Storage Area

7.1 Site Chronology

A chronology of major events for SWMU 87 is provided in **Table 7-1**.

Table 7-1. Key Events and Milestones for SWMU 87

Date	Key Events and Milestones
1946-1995	SWMU 87 used at NSWC White Oak to store metal waste, wood, and other debris (NAVFAC, 2005b).
1995	A Phase I Environmental Baseline Study was conducted which included SWMU 87 (EA, 1996).
1997	An investigation to characterize background soil, sediment, groundwater, and surface water was conducted (Tetra Tech, 1998b).
1999	Surface and subsurface soil samples were collected and three temporary monitoring wells were installed downgradient of SWMU 87 (Tetra Tech, 2005a).
2002	Three temporary monitoring wells were installed during a supplemental investigation (Tetra Tech, 2005a).
June 2003	An additional investigation that included the collection of surface and subsurface soil samples was conducted (Tetra Tech, 2005a).
April 2005	A CMS was completed for SWMU 87 which included the evaluation of remedial alternatives for SWMU 87 groundwater (Tetra Tech, 2005b).
May 2005	RFI conducted at SWMU 87 to characterize the nature and extent of contamination that may impact human health and the environment (Tetra Tech, 2005a).
October 2005	ROD for SWMU 87 finalized (NAVFAC, 2005b).
April 2007	Baseline groundwater sampling conducted before the EVO injection (CH2M, 2021a).
June 2007	Injection wells installed, injections of EVO into the groundwater (CH2M, 2021a).
July 2007 – June 2020	Post-injection groundwater sampling events completed (CH2M, 2021a).

7.2 Background

7.2.1 Description and History

SWMU 87 is located in the south-central portion of the facility (**Figure 1-2**). The site is located within 50 feet of Paint Branch and west and northeast of the former Building 611 (which has been demolished) and was reportedly used to store wood, metal waste and other debris (**Figure 7-1**). As documented in the SWMU 87 ROD (NAVFAC, 2005b), numerous investigations have been conducted at the Former NSWC White Oak, beginning in the mid-1980s, that included SWMU 87.

SWMU 87 was identified during an RFA in November 1990 (Kearney/Centaur Division, 1990). A site screening was performed at SWMU 87 to determine if significant contamination was present in surface soil, subsurface soil, and groundwater as a result of solid waste storage. No significant contamination was detected in surface or subsurface soil near Building 611. However, groundwater contaminated with VOCs was detected at monitoring locations near and upgradient of Building 611. Based on the groundwater contamination identified on site and the potential risks associated with direct exposure to groundwater, it was concluded that a RCRA Facility Investigation and a CMS would be conducted for this site (Tetra Tech, 2005b). As part of the site screening, adjacent AOC M was investigated and surface water and sediment samples were collected from Paint Branch. Analytical results from these samples showed no impact from SWMU 87.

Surface and subsurface soil samples were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, TCL pesticides and PCBs, and Target Analyte List metals during the RFI for SWMU87 (Tetra Tech, 2005a). Three temporary monitoring wells were installed within and downgradient of SWMU 87 during an investigation conducted in 1999, and three additional temporary monitoring wells were installed during a supplemental investigation conducted in 2002. Groundwater samples collected from the wells installed in 1999 were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, Target Analyte List metals, and perchlorate. Based on the results from these wells, the groundwater samples from the wells from the supplemental investigation were only analyzed for TCL VOCs.

Based on the results of surface soil, subsurface soil, and groundwater samples collected during the 1999 and 2002 investigations, an additional field investigation was conducted at SWMU 87 in June 2003 to identify the source of VOCs in groundwater and delineate the extent of the VOC plume to the northeast of Building 611. Two potential source areas were identified; the catch basin at the northern end of Building 611 and the area off the edge of the former compressed air tanks slab on the eastern side of Building 611. Three surface and six subsurface soil samples were collected and analyzed for VOCs. Three temporary wells (87-WP-101, 87-WP-102, and 87-WP-103) were installed and sampled as part of this investigation. All soil and groundwater samples were analyzed for TCL VOCs.

Based on the results of this supplemental investigation, three permanent wells (87WP201, 202, and 203) were installed in the spring of 2004. Wells 87-WP-101, 87-WP-102, and 87-WP-103 were also converted to permanent monitoring wells at that time. These wells were sampled and analyzed for TCL VOCs, iron, manganese, and natural attenuation parameters. The results of this sampling round provided evidence to continue to search for upgradient sources of contamination. Ten additional permanent wells (87WP204 through 87WP213) were installed in June and September to help identify these upgradient sources of contamination at the site (**Figure 7-1**).

A quantitative risk assessment was conducted in the 2005 RFI (Tetra Tech, 2005a) which identified unacceptable risk for future child and adult residents associated with TCE and in the groundwater.

The ROD for SWMU 87 groundwater was signed in October 2005 (NAVFAC, 2005b). Groundwater at SWMU 87 is still subject to LTM and Five-Year Reviews. The MCSs developed for groundwater are presented in the ROD (NAVFAC, 2005b).

7.2.2 Physical Characteristics

SWMU 87 is located on a level area approximately 15 feet above and east of Paint Branch, but slopes quickly to the west due to erosion from the stream. To the northeast and southeast, moderately steep slopes rise above the site (**Figure 7-1**). Groundwater generally flows to the south-southwest (**Figure 7-2**).

As summarized in the CMS (Tetra Tech, 2005b), subsurface materials encountered beneath SWMU 87 consist of fill, natural unconsolidated materials, saprolite, and bedrock. The fill consists of reworked natural materials and fill that was placed to support grading activities during original building construction at SWMU 87. The fill is present in these isolated areas of prior construction and extends to

depths of approximately 5 feet; but thickens in the vicinity of Paint Branch. The natural unconsolidated material underlies the fill in disturbed areas and is present at the ground surface in undisturbed areas. The natural unconsolidated materials consist of silty sand and range in depth from approximately 5 feet along the hillsides to greater than 10 feet in the valley along Paint Branch and along the plateau on the top materials. Saprolite underlies the fill and natural unconsolidated materials, and ranges from 5 feet thick in the highlands and thickens in the valleys along Paint Branch. The bedrock consists of schist with isolated fracturing and is found at shallower depths (less than 15 feet bgs) to greater than 25 feet bgs along Paint Branch.

Groundwater is present in the fill, unconsolidated natural materials, saprolite, and bedrock. The depth to groundwater is less than 15 feet bgs in the lowlands along Paint Branch, and greater than 25 feet bgs in the higher elevations. Groundwater exists generally under unconfined conditions at shallow depths, although confined groundwater was encountered in well borings drilled in higher elevations in the bedrock. Groundwater, once encountered in the bedrock, was observed to rise in the borings until reaching equilibrium.

Shallow groundwater follows topography and flows from higher elevations to lower elevations, discharging into Paint Branch. Shallow groundwater in the highlands is present in the bedrock, and flows generally south, passing through the saprolite and unconsolidated materials in the lowlands, and ultimately discharges into Paint Branch. Groundwater flow in the bedrock is believed to be influenced by fracturing as evidenced by the varying groundwater yield in the bedrock wells. Drilling logs also indicated soft zones during drilling of some of the bedrock borings, which may be the result of fracturing.

Seepage velocity calculations were developed for the saprolite and bedrock using measured slug testing data and the potentiometric surface map for the site. An average seepage velocity in the saprolite was calculated to be 5.4 feet per day and an average seepage velocity in the bedrock was calculated to be 0.48 foot per day.

7.2.3 Land and Resource Use

The area of SWMU 87 consists of an open field adjacent to Paint Branch in the south-central portion of the property owned by the GSA. There are no buildings remaining at SWMU 87, and GSA has no immediate plans to use this area. There are no water supply wells located on the property in the area within or downgradient of the plume. Groundwater at, downgradient of SWMU 87, and throughout the Former NSWC White Oak, is not used as a potable water source and is unlikely to be used for such purposes in the future. Water for occupants of the Former NSWC White Oak and the surrounding properties is, and is expected to continue to be, supplied by a local municipal water authority. Local ordinances and Maryland state regulations prevent the installation of new private potable supply wells without a permit. However, for the purposes of the site risk assessment, the site was evaluated assuming the possibility of residential use for the entire area including the use of the groundwater as a primary drinking water source.

7.2.4 History of Contamination

Between 1942 and 1995, the site was used to store wood, metal, and other debris. As detailed in the SWMU 87 ROD (NAVFAC, 2005b), contaminants are primarily present in the surficial aquifer at SWMU 87. However, VOC concentrations have been detected in the bedrock aquifer in monitoring well 87WP212. The most commonly detected compound was PCE at concentrations ranging from 9 to 120 µg/L. TCE and cis-1,2-DCE were also detected in the SWMU 87 groundwater.

Contaminants historically migrated west toward Paint Branch. However, VOCs were not detected in surface water or sediments in Paint Branch (Tetra Tech, 2004). Additionally, all chemicals identified in

SWMU 87 soil were either below screening values or at levels that were not statistically different from background.

7.2.5 Site Risks

Both ecological and human health baseline risk assessments were conducted to evaluate risks from SWMU 87 contaminants. The ERA was conducted on a facility-wide basis, and results as they relate to SWMU 87 are discussed below (Tetra Tech, 2001a). An HHRA was conducted for SWMU 87 as part of the RFI for SWMU 87 (Tetra Tech, 2005a).

7.2.5.1 Human Health Risk Assessment

The HHRA evaluated noncarcinogenic hazards and carcinogenic hazards associated with exposure to surface soil and subsurface soil by full-time workers, maintenance/utility workers, construction workers, adult recreational users, adolescent trespassers, daycare-center children, and future child and adult residents. Although residential use is not a reasonable anticipated future site use, the future residential use scenario was evaluated to determine whether LUCs would be needed to be protective of unlimited use and unrestricted exposure. Based on a comparison of the soil data to the risk-based screening levels for residential soil and background concentrations, iron, manganese, and nickel were identified as COPCs for quantitative evaluation in the HHRA. The calculated noncarcinogenic hazards for all receptors except the child resident are within acceptable USEPA hazard levels. None of the COPCs are carcinogenic, and therefore, there are no unacceptable carcinogenic risks for all potential receptors. The noncarcinogenic hazard to the child resident is associated with iron. The noncarcinogenic hazard associated with iron was based on a provisional noncarcinogenic toxicity value for iron that is based on the average adult daily intake of iron and not based on any adverse health effects. Therefore, the HHRA concluded there were no unacceptable health risks associated with exposure to soil by any of the potential receptors.

The HHRA in the 2005 RFI (Tetra Tech, 2005a) evaluated site-specific noncarcinogenic hazards and carcinogenic hazards associated with exposure to groundwater by current full-time workers, maintenance workers, construction workers, and future child and adult residents. Although residential use is not reasonable anticipated, the future residential use scenario was evaluated to determine whether LUCs would be needed to be protective of unlimited use and unrestricted exposure to groundwater. The HHRA also evaluated noncarcinogenic hazards and carcinogenic hazards associated vapor intrusion from groundwater into indoor air for future full-time workers, daycare center children, and child and adult residents. Based on a comparison of the groundwater data to the risk-based screening levels and background concentrations, cis-1,2-DCE, PCE, and TCE were identified as groundwater COPCs for evaluation in the HHRA.

The noncarcinogenic HI for the future child (HI = 4) and adult residents (HI = 1) equaled or exceeded one. Exposures through the ingestion of groundwater were the major contributors to the HI for residents. TCE and PCE were the principal COCs in the groundwater for noncarcinogenic exposures.

Incremental cancer risks (ICRs) across all exposure pathways for construction workers, maintenance workers, full-time employees, adolescent trespassers, and daycare center children were within USEPA's target risk range of 10^{-4} to 10^{-6}. ICRs for adult (9×10^{-4}) and child (5×10^{-4}) residents exceed USEPA's target risk range under the most conservative exposure scenario. Ingestion and dermal contact with groundwater were the major contributors to the ICR for residents. TCE and PCE were the principal COCs in the groundwater for carcinogenic exposures.

Groundwater COCs identified in the SWMU 87 ROD (NAVFAC, 2005b) included PCE, TCE, and cis-1,2-DCE.

7.2.5.2 Ecological Assessment

Ecological risks from soil, surface water, and sediment at SWMU 87 were evaluated in a separate Basewide ERA (Tetra Tech, 2001a). No chemicals, detected in these media at or near the site, were retained after the preliminary screening against ERA values. Therefore, the BERA did not identify any potential unacceptable risks to ecological receptors.

Since the development of the BERA, additional surface soil samples were collected in 2002 and 2003 and analyzed for VOCs. The results were compared to screening levels developed by the USEPA Biological Technical Assistance Group (BTAG). In the additional surface soil samples, only low levels of dichlorodifluoromethane (30 to 38 micrograms per kilogram [µg/kg]) and toluene (2 µg/kg) were detected. The toluene detection was less than the BTAG screening level of 100 µg/kg. There was no BTAG screening level for dichlorodifluoromethane, but the maximum detection was well below the BTAG screening level for most VOCs (100 to 300 µg/kg). Therefore, impacts to ecological receptors from these VOCs would be unlikely.

As groundwater exposure is not associated with ecological receptors, SWMU 87 groundwater poses no ecological risks. Because no site-related chemicals were detected in the surface water or sediment in Paint Branch there is no unacceptable site related ecological risks associated with these media.

7.3 Remedial Actions

7.3.1 Basis for Remedial Action

Based on the results of previous investigations, RA is warranted to protect human health from actual or threatened releases of VOCs in groundwater at SWMU 87 under a hypothetical future residential scenario.

7.3.2 Response Actions

7.3.2.1 Selected Remedy for SWMU 87

The ROD for SWMU 87 media was signed on October 11, 2005 (NAVFAC, 2005b). The ROD summarized the risks to human health and the environment, established RAOs, and defined the selected remedy.

As discussed in Section 2.5.3 of the SWMU 87 ROD, soil, surface water, and sediment have been shown not to have been impacted by releases from SWMU 87 at concentrations that result in potential unacceptable risks for unlimited use and unrestricted exposure (NAVFAC, 2005b).

The RAOs for SWMU 87 groundwater identified in the ROD are as follows:

- Prevent human exposure (through ingestion, inhalation, and dermal contact) to groundwater having contaminants in excess of MCSs.
- Restore groundwater to quality MCSs.
- Comply with contaminant-, location-, and action-specific ARARs, and to-be-considered criteria to the extent appropriate.

The selected remedy to achieve RAOs for SWMU 87 groundwater, Alternative 3: EISB, ICs and LTM, comprised the following components:

- Installation of additional wells to define treatment area and establish an optimum groundwater monitoring network

- Installation of injection wells and injection of sodium lactate[12]
- Groundwater monitoring of baseline and post-injection conditions
- LTM
- Preparation of annual technical memoranda and five-year report
- Implementation of ICs until the MCSs are met.

7.3.3 Status of Implementation

7.3.3.1 In Situ Bioremediation

In situ bioremediation injection activities concluded in 2007, with baseline monitoring beginning in April 2007. Post injection monitoring continued every 3 months until August 2008, when it moved to yearly monitoring, and then to approximately every 15 months, as recommended in the second Five-Year Review Report (Tetra Tech, 2012b).

7.3.3.2 Long-Term Monitoring

LTM has been conducted since 2008. Seven wells were removed from the 2014 LTM sampling event, as COC concentrations were below the MCSs for two consecutive sampling rounds. For the 2018 LTM sampling, two wells (87WP201 and 87WP212) were sampled for selected VOCs (the COCs; PCE, TCE, and cis-1,2-DCE), dissolved iron and manganese, and natural attenuation parameters (alkalinity, TOC, dissolved gases [methane, ethane, ethane], carbon dioxide, chemical oxygen demand, sulfide, sulfate, chloride, nitrate and nitrite).

During the most recent round of groundwater sampling in June 2020, 87WP212 was sampled for select VOCs, dissolved iron and manganese, and natural attenuation parameters including alkalinity, TOC, dissolved gases (methane, ethane, and ethene), carbon dioxide, chemical oxygen demand, sulfide, sulfate, chloride, nitrate, and nitrite. The analytical results from this sampling event are shown on **Figure 7-3** and are summarized below.

PCE Results

PCE was detected in the groundwater at monitoring well 87WP212 at a concentration of 8.1 µg/L, which exceeded the MCS of 5 µg/L. PCE concentrations in samples from well 87WP212 have remained above the MCS since the baseline sampling event, ranging from 8.1 to 25 µg/L, with the exception of October 2011, when the PCE concentration was 1 µg/L.

TCE Results

TCE was detected in the groundwater at monitoring well 87WP212 at a concentration of 5.53 µg/L, which exceeded the MCS of 5 µg/L. TCE concentrations in samples from monitoring well 87WP212 have remained above the MCS since the baseline sampling event, ranging from 5.5 to 34 µg/L, with the exception of October 2011, when the TCE concentration was detected at 4.8 µg/L.

Cis-1,2-DCE Results

Cis-1,2-DCE was detected in samples from monitoring well 87WP212 at a concentration of 6 µg/L, which does not exceed the MCS (70 µg/L). Cis-1,2-DCE has consistently been detected at similar concentrations over the last several years in samples from this well.

[12] Sodium lactate is listed as the injection compound under the first major component of Alternative 3 in Section 2.9.3 of the SWMU 87 ROD (NAVFAC, 2005b). However, Section 2.9.3.1 of the SWMU 87 ROD states "Lactic acid or a similar (carbon-source) compound would be injected into the contaminated groundwater of the Remediation Area,…" Emulsified vegetable oil was selected as the carbon-source compound injected at SWMU 87.

7.3.3.3 Operation and Maintenance

The only O&M currently associated with SWMU 87 are inspection and maintenance of the monitoring wells.

7.3.3.4 Institutional Control Summary

ICs at SWMU 87 include LUCs to:

- Ensure no withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA) from within the restricted area until the MCSs are met and risks from groundwater use are shown to be reduced to acceptable levels.
- Ensure adequate protection to minimize potentially adverse health and environmental effects of work or development in the restricted area.
- Ensure adequate protection to minimize physical disruption of any remedial equipment, such as monitoring wells, or remedial operations in the restricted area.
- Ensure adequate notification of pertinent use restrictions to current and future owners.

ICs will be maintained until the concentrations of hazardous substances in the groundwater are at such levels as to allow for unrestricted use and exposure. The Navy intends to finalize the draft LUC RD for SWMU 87.

7.4 Progress Since Last Five-Year Review

This section includes the protectiveness determinations and statements from the last Five-Year Review as well as the recommendations from the last Five-Year Review and the current status of those recommendations (**Tables 7-2 and 7-3**).

Table 7-2. Protectiveness Determination/Statement from the Third Five-Year Review – SWMU 87

Protectiveness Determination	Protectiveness Statement
Short-term Protective	Based on the activities implemented to date, the selected remedy is protective in the short term of human health and the environment. The ICs, which prevent usage of groundwater as a potable water supply, are functioning as intended and are protecting human receptors from exposure to groundwater contamination following implementation of the RA. However, in order for the remedy to be protective in the long-term, the LUC RD for SWMU 87 needs to be finalized.

Table 7-3. Status of Recommendations from the Third Five-Year Review – SWMU 87

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to address the area of highest concentration of remaining VOCs	Groundwater monitoring should be continued at 30-month intervals to evaluate the MNA of the groundwater contaminations.	Ongoing	LTM is being conducted on a 30-month basis and groundwater conditions are re-evaluated following each event.	February 2018 June 2020
Need to implement ICs	The LUC RD should be finalized to formalize the procedures needed to limit exposure to site contaminants.	Ongoing	The Navy has prepared and intends to finalize the draft LUC RD. Although the LUC RD is not final, the Navy is performing annual inspections of the site to ensure LUCs are maintained.	Will be completed in FY2023.

7.5 Five-Year Review Process

7.5.1 Document Review

Table 7-4 summarizes the main documents reviewed in the preparation of this section of the Five-Year Review. A complete list of documents cited in the preparation of this Fourth Five-Year Review Report is included in **Section 10**.

Table 7-4. Summary of the SWMU 87 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
Basewide Ecological Risk Assessment for NSWC White Oak	Tetra Tech	1999a
ROD for SWMU 87	NAVFAC	2005
Former NSWC White Oak First Five-Year Review	JM Waller Associates	2007
Former NSWC White Oak Second Five-Year Review	Tetra Tech	2012b
Former NSWC White Oak Third Five-Year Review	CH2M	2017b
Basewide Long-Term Monitoring Report – 2017-2018, Former NSWC White Oak	CH2M	2019a
Basewide Long-Term Monitoring Report – 2020, Former NSWC White Oak	CH2M	2021a

7.5.2 Site Inspections

During the site inspections conducted annually and for this Five-Year Review, no issues were identified affecting the protectiveness of the site. Site inspection checklists are included in **Appendix B** and **Appendix D**.

7.5.3 Data Review and Evaluation

LTM is being conducted for groundwater at SWMU 87 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. Trend graphs presenting VOC COC results for select monitoring wells at SWMU 87 are provided in **Appendix C-5**.

The results of the February 2018 and June 2020 sampling events indicate that throughout most of SWMU 87, the 2007 injection has effectively reduced concentrations of PCE, TCE, and cis-1,2-DCE. One area of the SWMU, in the vicinity of well 87WP212, continues to exhibit low, but greater-than-MCS, levels of TCE and PCE (located in the upland portion of SWMU87). Concentrations of PCE and TCE have declined substantially since the 2007 injections, but remain slightly above the MCSs.

7.6 Technical Assessment

This section presents the answers to the three questions defined for the Technical Assessment for SWMU 87.

7.6.1 Question A – Is the Remedy Functioning as Designed?

The SWMU 87 remedy of EISB, LUCs that incorporate ICs, and LTM to restore groundwater quality at the site have been implemented and are functioning as intended by reducing contaminant mass and restricting exposure to contaminants by human and ecological receptors.

7.6.1.1 Implementation of Institutional Controls and Other Measures

LUCs at SWMU 87 include ICs to prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA) from within the restricted area until MCSs are met or the risks from groundwater use are determined to be reduced to levels acceptable to unrestricted use, minimize potentially adverse health and environmental effects of work or development in the restricted area, and minimize physical disruption of any remedial equipment or remedial operations within the restricted area. The LUC RD for SWMU 87 is currently in draft form and the Navy intents to finalize the LUC RD in FY2023. However, in accordance with the draft LUC RD, annual site inspections are being conducted and no signs of LUC violations have been observed.

7.6.1.2 Opportunities for Optimization

After the last Five-Year Review, the Navy implemented several changes to the LTM program for SWMU 87. These changes are summarized in **Table 7-5**.

Table 7-5. SWMU 87 Groundwater Optimization

Sampling Event	Groundwater Optimization
February 2018	• Discontinue sampling at monitoring well 87WP201. • Perform LTM at 30-month intervals.
June 2020	• Eliminate MNA parameters from sampling for monitoring well 87WP212.

7.6.2 Question B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Selection Still Valid?

The exposure assumptions and MCSs (which are MCLs) are still valid. Toxicity values for some of the detected analytes have changed since the HHRA was conducted and the ROD signed, but these revisions do not change the results of the HHRA or the COCs. Toxicity values for some of the COCs have changed, but this does not affect the MCSs since they are based on MCLs which have not changed. Although there have been some procedural changes to how human health risk assessments are conducted, including

how exposure point concentrations are calculated and the parameter values for the intake (i.e., ingestion and dermal contact) equations, none of these changes adversely affect the protectiveness of the remedy for SWMU 87.

7.6.3 Question C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

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

7.7 Issues, Recommendations, and Follow-up Actions

Based on the technical assessment evaluation in this Five-Year Review, there are no issues affecting protectiveness for SWMU 87.

7.7.1 Other Findings

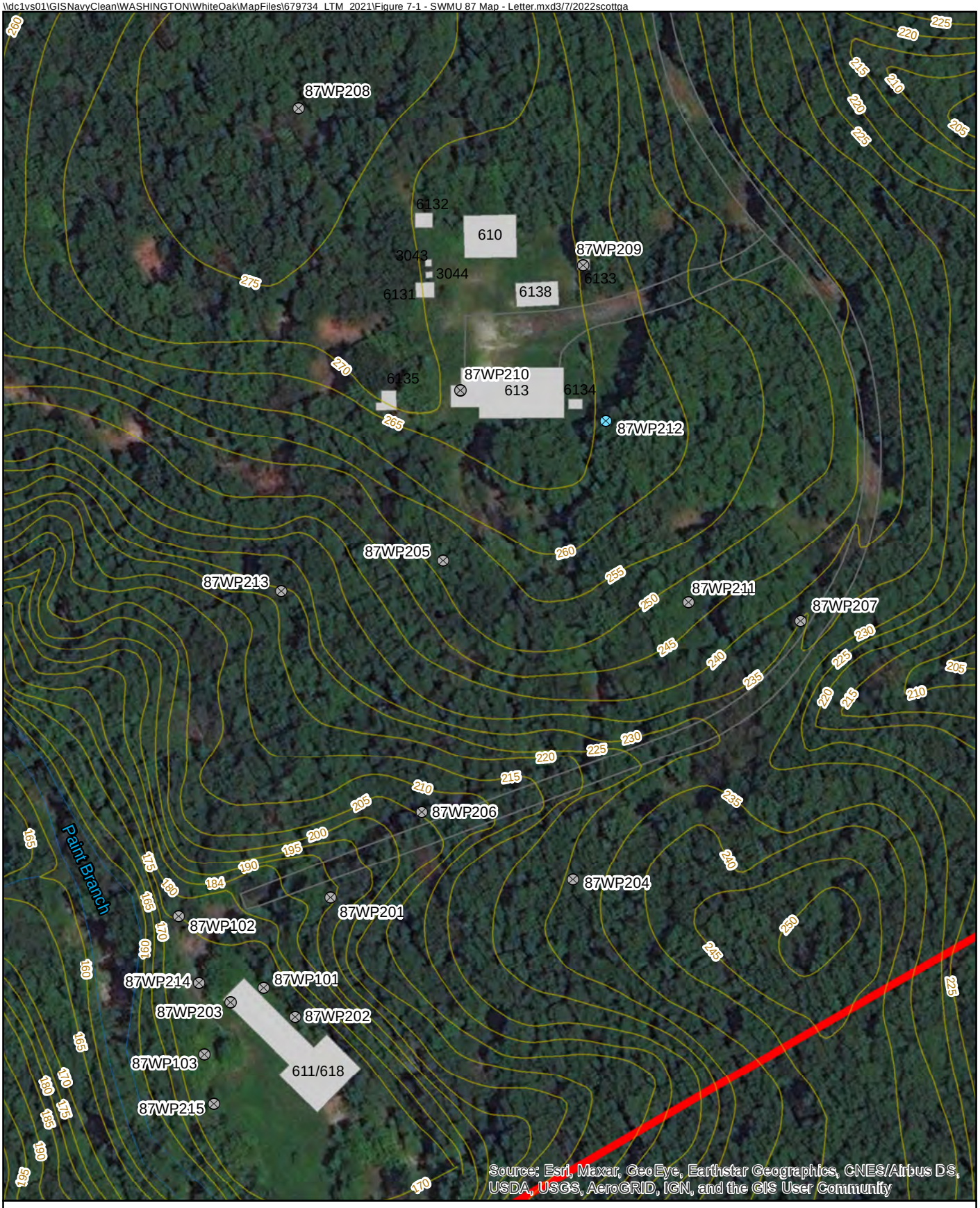
The following are recommendations that were identified during the Five-Year Review and may improve performance of the remedy, reduce costs, and/or accelerate site closeout, but do not affect current and/or future protectiveness:

- The Navy has been implementing LUCs consistent with the draft LUC RD and intends to finalize the LUC RD for SWMU 87.

7.8 Protectiveness Statement

The selected remedy for SWMU 87, consisting of EISB, LUCs that incorporate ICs, and LTM, is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\679734_LTM_2021\Figure 7-1 - SWMU 87 Map - Letter.mxd3/7/2022scottga



Legend

- 2020 Long Term Monitoring Well
- Monitoring Well
- Topographic Contours (ft msl)
- Former NSWC – White Oak Facility Boundary
- Water Bodies
- Roads
- Abandoned Building and Other Structures

N

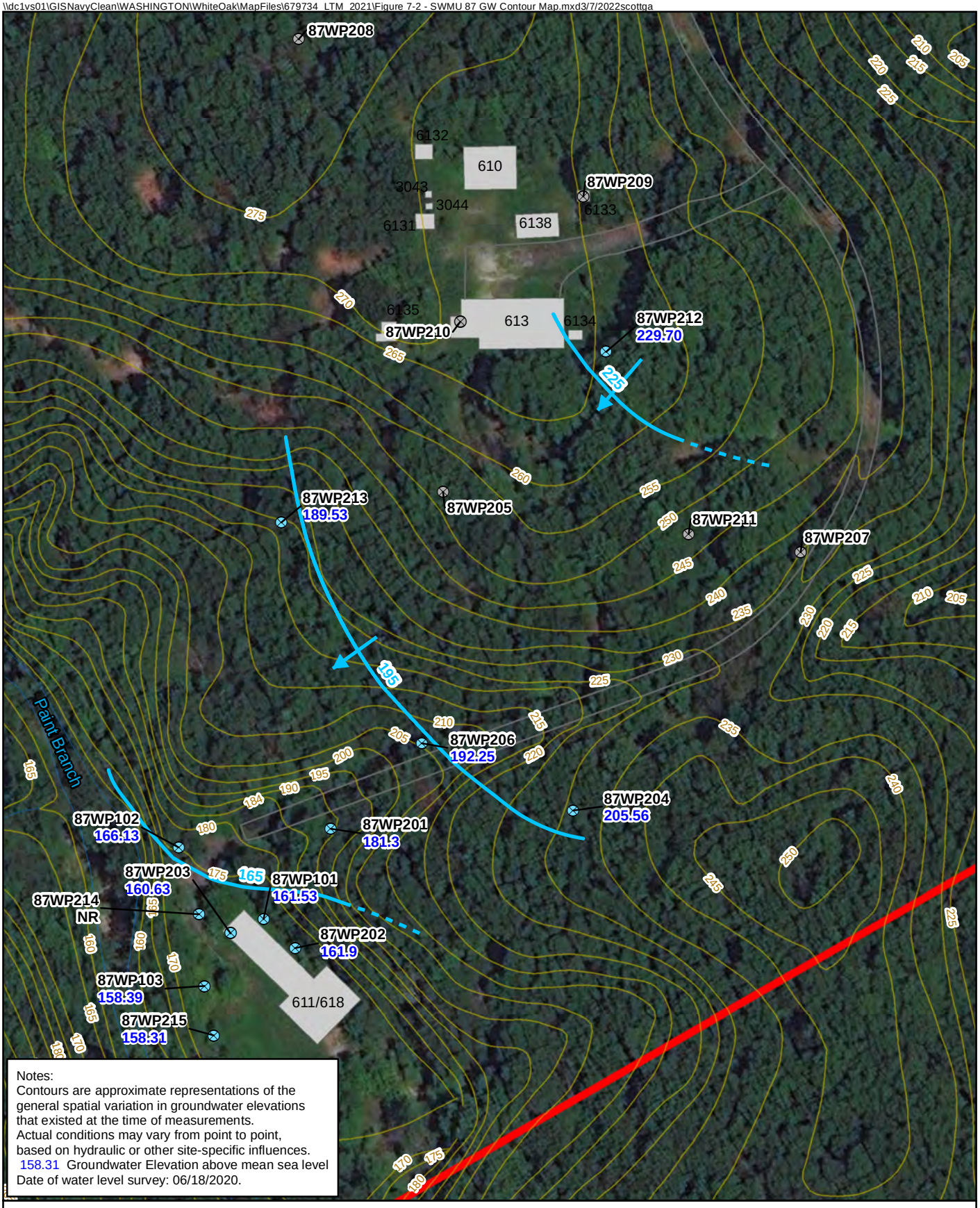
0 60 120

Feet

Figure 7-1
SWMU 87 Map
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\679734_LTM_2021\Figure 7-2 - SWMU 87 GW Contour Map.mxd3/7/2022scottga



Notes:
Contours are approximate representations of the general spatial variation in groundwater elevations that existed at the time of measurements.
Actual conditions may vary from point to point, based on hydraulic or other site-specific influences.
158.31 Groundwater Elevation above mean sea level
Date of water level survey: 06/18/2020.

Legend

- 2020 Long Term Monitoring Well
- Monitoring Well
- Topographic Contours (ft msl)
- Former NSWC – White Oak Facility Boundary
- Roads
- Water Bodies
- Abandoned Building and Other Structures
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

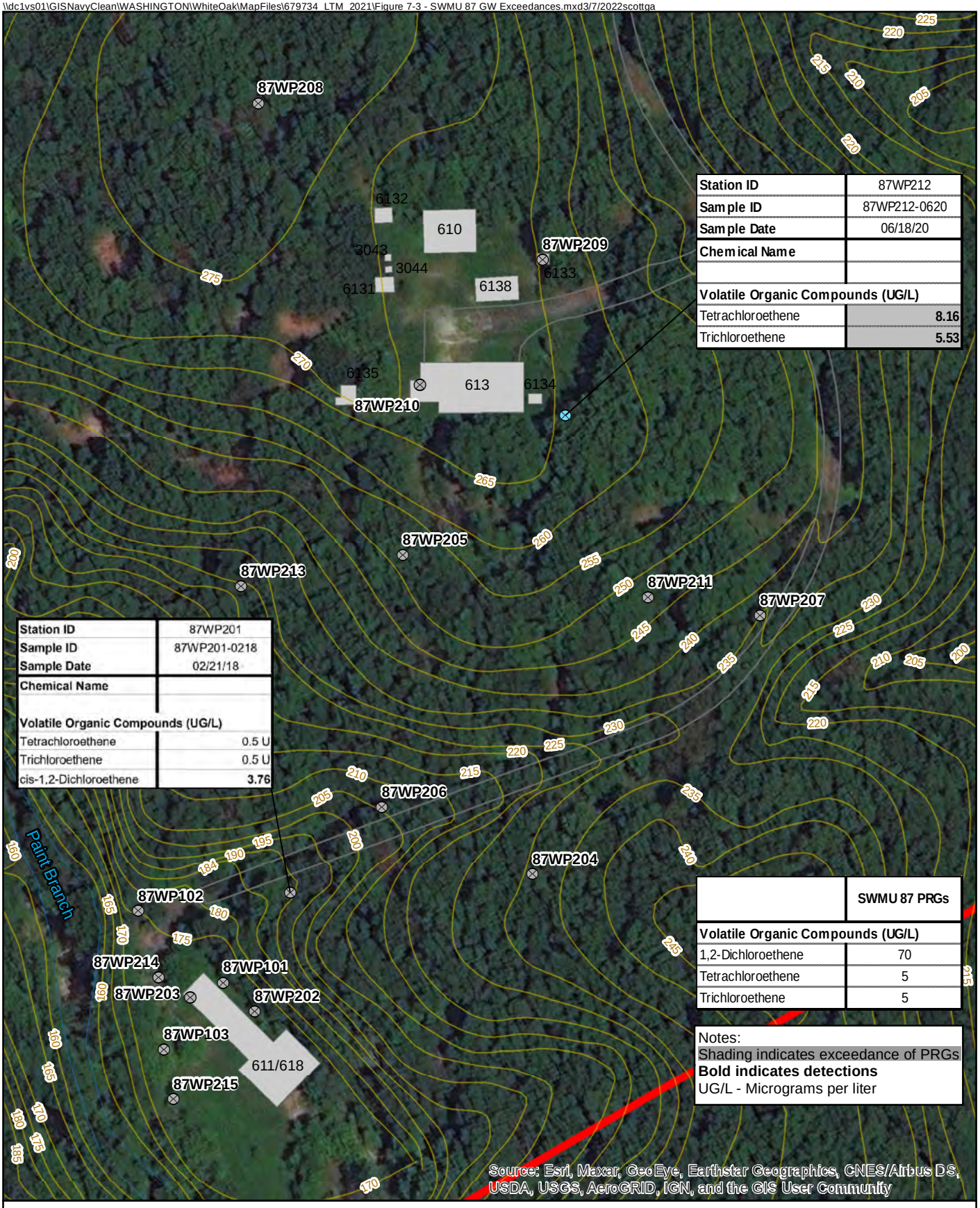
N

0 60 120 Feet

Figure 7-2
SWMU 87 Potentiometric Groundwater Contour Map and LTM Locations - June 18, 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

\\dc1vs01\GISNavyClean\WASHINGTON\WhiteOak\MapFiles\679734_LTM_2021\Figure 7-3 - SWMU 87 GW Exceedances.mxd3/7/2022scottga



Station ID	87WP212
Sample ID	87WP212-0620
Sample Date	06/18/20
Chemical Name	
Volatile Organic Compounds (UG/L)	
Tetrachloroethene	**8.16**
Trichloroethene	**5.53**

Station ID	87WP201
Sample ID	87WP201-0218
Sample Date	02/21/18
Chemical Name	
Volatile Organic Compounds (UG/L)	
Tetrachloroethene	0.5 U
Trichloroethene	0.5 U
cis-1,2-Dichloroethene	**3.76**

	SWMU 87 PRGs
Volatile Organic Compounds (UG/L)	
1,2-Dichloroethene	70
Tetrachloroethene	5
Trichloroethene	5

Notes:
Shading indicates exceedance of PRGs
Bold indicates detections
UG/L - Micrograms per liter

Legend
- 2020 Long Term Monitoring Well
- Monitoring Well
- Topographic Contours (ft msl)
- Former NSWC – White Oak Facility Boundary
- Roads
- Water Bodies
- Abandoned Building and Other Structures

Figure 7-3
SWMU 87 Groundwater Exceedance Map - June 2020
Fourth Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

N

0 60 120
Feet

ch2m:

SECTION 8

Administrative Closure – Remedial Action Completion Sites

Since the Third Five-Year Review, three sites (Site 7, Site 9, and Site 11) at Former NSWC White Oak were closed via a Remedial Action Completion Report. Reviews of these sites will not be needed in subsequent Five-Year Review Reports.

The following is a summary of the Former NSWC White Oak sites that have been closed as they pose no unacceptable risk to human health and the environment for unlimited use and unrestricted exposure (**Table 8-1**). These sites, closed since the Third Five-Year Review, are briefly discussed in the remainder of this section.

Table 8-1. Summary of all Former NSWC White Oak IR Sites that have been closed as of the Fourth Five-Year Review Period

Site	Closure Document	Document Date
Site 7	Final Remedial Action Completion Report for Site 7 Ordnance Burn Area	August 29, 2017
Site 9	Final Remedial Action Completion Report Site 9 Industrial Wastewater Disposal 300 Area	September 30, 2019
Site 11	Final Remedial Action Completion Report for Site 11 Industrial Wastewater Disposal 100 Area	January 14, 2020

8.1 Site 7 – Ordnance Burn Area

The closeout round of sampling conducted in October 2014 indicated no COCs exceeded their respective PRGs and indicated that no unacceptable risks remain. Therefore, the active phase of the RA is complete and the RAOs have been met. The remedy functioned as intended and groundwater no longer poses an unacceptable risk to human health and the environment for unlimited use and unrestricted exposure. As documented in the Site 7 RACR, Site 7 is closed and ICs are rescinded (NAVFAC, 2017).

8.2 Site 9 – Industrial Wastewater Disposal 300 Area

The closeout round of sampling conducted in November 2015 demonstrate PRGs have been met and a human health risk screening indicated no unacceptable risks remain. The active phase of the RA is complete and the RAOs have been met. The remedy functioned as intended and groundwater no longer poses an unacceptable risk to human health or the environment for unlimited use and unrestricted exposure. As documented in the Site 9 RACR, Site 9 is closed and ICs are rescinded (NAVFAC, 2019).

8.3 Site 11 – Industrial Wastewater Disposal 100 Area

The closeout round of sampling conducted in December 2018 indicated MCSs have been met and a human health risk screening indicated no unacceptable risks remain. The active phase of the RA is complete and the RAOs have been met. The remedy performed as intended, and groundwater no longer poses an unacceptable risk to human health or the environment for unlimited use and unrestricted exposure. As documented in the Site 11 RACR, Site 11 is closed and ICs are rescinded (NAVFAC, 2020).

SECTION 9

Next Review

The next Five-Year Review Report for the Former NSWC White Oak is required 5 years from the completion date of this review.

SECTION 10

References

AGVIQ Environmental Services-CH2M HILL Joint Venture (AGVIQ-CH2M). 2010a. Technical Memorandum: *Baseline Groundwater Sampling Results for Site 4 200-Series Remedial Action, Former NSWC-White Oak.* March 2.

AGVIQ-CH2M. 2010b. Technical Memorandum: *Baseline Groundwater Sampling Results for Site 4 300-Series Remedial Action, Former NSWC-White Oak.* March 2.

AGVIQ-CH2M. 2010c. *Long-Term Monitoring for Site 13 and Off-Site 13 Groundwater, Former NSWC White Oak, Silver Spring, Maryland.* October.

Brown & Root Environmental. 1998. *Master Work Plans for the Former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland.* June.

Brown & Root Environmental. 1999. *Engineering Evaluation/Cost Analysis (EE/CA) for Site 4 and Site 33 at the Former Naval Surface Warfare Center-White Oak, Silver Spring, Maryland.* January.

CH2M HILL (CH2M). 1999. *Report for Investigation of WSSC Sewer Lines Through the Former NSWC White Oak Facility*. Final. November.

CH2M. 2002. *Remedial Investigation of Operable Unit 1, NWSC White Oak, Silver Spring, Maryland*. August.

CH2M. 2003. *Feasibility Study for Operable Unit 1, NSWC White Oak, Silver Spring, Maryland*. June.

CH2M. 2004a. *Remedial Investigation Report, Site 49, Former NSWC White Oak, Silver Spring, Maryland.* Final. May.

CH2M. 2004b. *Feasibility Study for Site 49 at NSWC White Oak, Silver Spring, Maryland*. Final. June.

CH2M. 2005. *Long-Term Monitoring Plan, Site 9 Groundwater, Former NSWC White Oak, Silver Spring, Maryland.* Final. February.

CH2M. 2006. *Long-Term Monitoring for Site 49 Groundwater, Former NSWC-White Oak, Silver Spring, Maryland.* Final. May.

CH2M. 2008. *Land Use Control Remedial Design for Groundwater in the Offsite Portion of Site 13, Naval Surface Warfare Center – White Oak, Silver Spring, Maryland, EPA RCRA ID. No. MD0170023444.*

CH2M. 2009a. *Land Use Control Remedial Design for Site 7 Groundwater, Naval Surface Warfare Center – White Oak, Silver Spring, Maryland, EPA RCRA ID. No. MD0170023444.* August.

CH2M. 2009b. *1-Year Post Injection Sampling Results, Site 4 Remedial Action, Former NSWC-White Oak*. October.

CH2M. 2009c. Technical Memorandum: *White Oak SVE System Analysis and Recommendations, Former NSWC-White Oak, Silver Spring, Maryland.* November.

CH2M. 2009d. *Technical Memorandum: Completion of Emulsified Vegetable Oil Injection Activities, September 2009 through November 2009 Site 4 (Source Area, Series 200 Area, and Series 300 Area), Formal Naval Surface Warfare Center – White Oak, Silver Spring, Maryland.* December 16.

CH2M. 2010. Technical Memorandum*: Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland*. Final. October 15.

CH2M. 2011a. *Completion of Monitoring Well Installation and Zero-Valent Iron Injection Activities at Site 13 and Off-Site 13, Former Naval Surface Warfare Center-White Oak, Silver Spring, Maryland*. June.

CH2M. 2011b. *Long-Term Monitoring Plan, Site 4 Groundwater, Former NSWC White Oak, Silver Spring, Maryland*. Final. November.

CH2M. 2013a. Technical Memorandum*: Final Site 4 Soil Vapor Extraction System Decommissioning Work Plan, Former NSWC White Oak, Silver Spring, Maryland.* Final. February 4.

CH2M. 2013b. *Land Use Control Remedial Design for Sites 4/46 Groundwater, Former Naval Surface Warfare Center-White Oak, Silver Spring, Maryland*. Final. December.

CH2M. 2016. *Basewide Long-Term Monitoring Report October 2014, Former Naval Surface Warfare Center – White Oak, Silver Spring, Maryland*. Final. March.

CH2M. 2017a. *Land Use Control Remedial Design for Site 9 Groundwater, Former Naval Surface Warfare Center – White Oak, Silver Spring, Maryland.* Final. January.

2017b. *Land Use Control Remedial Design for On-site 49 Groundwater, Former Naval Surface Warfare Center – White Oak, Silver Spring, Maryland.* Final. January.

CH2M. 2017c. *Land Use Control Remedial Design for Site 5 and Site 13 Groundwater, Former Naval Surface Warfare Center – White Oak, Silver Spring, Maryland.* Final. January.

CH2M. 2017d. *Basewide Long-term Monitoring Report 2015, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* Final. March.

CH2M. 2017e. *Comprehensive Third Five-Year Review, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* Final. June.

CH2M. 2017f. *Basewide Long-term Monitoring Report 2016, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* Final. October.

CH2M. 2017g. *Off-Site 13 Natural Attenuation Assessment, Former NSWC-White Oak, Silver Spring, Maryland.* October.

CH2M. 2017h. *Final Technical Memorandum: Data Gap Investigation at Site 4/46, Former NSWC-White Oak, Silver Spring, Maryland.* November 30.

CH2M. 2019a. *Basis of Design, Site 13, Former NSWC-White Oak, Silver Spring, Maryland.* September.

CH2M. 2019b. *Basewide Long-term Monitoring Report 2017-2018, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* Final. December.

CH2M. 2020. *Completion of Monitoring Well Installation and Zero-Valent Iron Injection Activities at Site 13, Former Naval Surface Warfare Center – White Oak, Silver Spring, Maryland*. August.

CH2M. 2021a. *Basewide Long-term Monitoring Report 2020, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* Final. May.

CH2M. 2021b. *Work Plan for Additional Investigation at Site 4/46, Former NSWC-White Oak, Silver Spring, Maryland.* Final. November.

CH2M. 2022. *Long-term Monitoring Plan for Site 13 and Off-Site 13 Groundwater, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* Final. April.

Chief of Naval Operations (N45). 2011. Policy for Five Year Reviews. CNO (N45). June.

Cloos, E., G.W. Fisher, C.A. Hopson, and E.T. Cleaves (Cloos et al.). 1964. *The Geology of Howard and Montgomery Counties.*

Department of the Navy (Navy). 1984. *Initial Assessment Study of Naval Surface Weapons Center, White Oak Laboratory, Silver Spring, Maryland.*

Navy. 2002. *Action Memorandum. Time-Critical Removal Action.* July.

EA Engineering Science and Technology (EA). 1996. *Environmental Baseline Study, Naval Surface Warfare Center, White Oak, Silver Spring, Maryland.* April.

Froelich, A.J. 1975. *Bedrock Map of Montgomery County, Maryland.*

Halliburton NUS Corporation (HNUS). 1995. *Design Verification Report for Remedial Actions at Site 2, 3, 4, and 9, Naval Surface Warfare Center, White Oak.* June.

JM Waller Associates. 2007. *Five-Year Review Former Naval Surface Warfare Center White Oak, Maryland*. Final. April.

Kearney/Centaur Division. 1990. *Phase II RCRA Facility Assessment of the Naval Surface Warfare Center, White Oak Laboratory, Silver Spring, Maryland.* November.

Malcolm Pirnie, Inc. (Malcolm Pirnie). 1987. *NACIP Program Confirmation Study, Verification Phase, Naval Surface Weapons Center, White Oak, Maryland.* April.

Malcolm Pirnie. 1992. *Remedial Investigation Report, Dahlgren Division Detachment, White Oak, Silver Spring, Maryland.* October.

Malcolm Pirnie. 1993. *Feasibility Study Report, Dahlgren Division Detachment, White Oak, Silver Spring, Maryland*. March.

Naval Facilities Engineering Systems Command (NAVFAC). 2001. *Work Plan for Operable Unit 2 NSWC White Oak, Maryland*. July.

NAVFAC. 2004a. *Record of Decision, Naval Surface Warfare Center – White Oak, Operable Unit 3.* September.

NAVFAC. 2004b. *Record of Decision, Former Naval Surface Warfare Center – White Oak, Sites 5 and 13 Soil and Groundwater*. September.

NAVFAC. 2004c. *Record of Decision, Former Naval Surface Warfare Center-White Oak, Site 7 Groundwater and Soil*. September.

NAVFAC. 2004d. *Record of Decision, Former Naval Surface Warfare Center – White Oak, Site 9 Groundwater and Soil, Silver Spring, Maryland*. September.

NAVFAC. 2004e. *Record of Decision, Former Naval Surface Warfare Center – White Oak, Site 49.* November.

NAVFAC. 2005a. *Record of Decision, Former Naval Surface Warfare Center – White Oak, Site 4 Soil and Groundwater.* September.

NAVFAC. 2005b. *Record of Decision, Former Naval Surface Warfare Center – White Oak, Solid Waste Management Unit 87, Silver Spring,* Maryland. October.

NAVFAC. 2006. Technical Memorandum*: Perchlorate Remediation Goal*. December 15.

NAVFAC. 2007a. *Land Use Control Remedial Design for Operable Units 2 and 3, Naval Surface Warfare Center – White Oak, Silver Spring, Maryland, EPA RCRA Id. No. MD0170023444*.

NAVFAC. 2007b. Technical Memorandum: Disposition of the Building 502 Treatment System. April 17.

NAVFAC. 2007c. Technical Memorandum: Disposition of Site 46 Groundwater Treatment System. September 25.

NAVFAC. 2009. *Land Use Control Remedial Design for Site 11, Naval Surface Warfare Center – White Oak, Silver Spring, Maryland, EPA RCRA Id. No. MD0170023444*. March.

NAVFAC. 2017. *Remedial Action Completion Report for Site 7 Ordnance Burn Area, Former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland*. Final. August.

NAVFAC. 2019. *Remedial Action Completion Report Site 9 Industrial Wastewater Disposal 300 Area, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. Final. September.

NAVFAC. 2020. *Remedial Action Completion Report Site 11 Industrial Wastewater Disposal 100 Area, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. Final. January.

Navy Engineering Field Activity Chesapeake. 2001. *Record of Decision for Naval Surface Warfare Center – White Oak, Operable Unit 2*. July.

Navy Engineering Field Activity Chesapeake. 2002. *Record of Decision for Naval Surface Warfare Center – White Oak, Site 11 Soils*. July.

Navy Engineering Field Activity Chesapeake. 2004. *Record of Decision for Naval Surface Warfare Center – White Oak, Site 11 Groundwater*. April.

Shaw Environmental & Infrastructure, Inc. (Shaw). 2005a. *Close-out Report for Site 13-Zero Valent Iron Injection, Former Naval Surface Warfare Center-White Oak, Silver Spring, Maryland.* October.

Shaw. 2005b. *Close-out Report for In-Situ Bioremediation of Groundwater at Site 11 — Industrial Wastewater Disposal Area 100, former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland.* October.

Shaw. 2008a. Memorandum: *White Oak Site 49 Sodium Permanganate Injection, Contract Number N62470-02-D-3260, Task Order 64, Shaw Project Number 120492.* January 10.

Shaw. 2008b. W*hite Oak Site 4 Enhanced In Situ Bioremediation and Soil Vapor Extraction, Contract Number N62470-02-D-3260, Task Order 0052, Shaw Project Number 115557.* January 30.

Tetra Tech NUS, Inc. (Tetra Tech) 1998a. *Site Investigation Report for Site 46, Naval Surface Warfare Center, White Oak, Maryland.* November.

Tetra Tech. 1998b. *Background Investigation Report, Former Naval Surface Warfare Center, White Oak.* December.

Tetra Tech. 1998c. *Site Screening Report for IRP Sites 1, 5, 6, 12, 13, 28, 29, 31, 32, and 33, EBS AOC 100, Former Naval Surface Warfare Center, White Oak, Silver Spring Maryland*. December.

Tetra Tech. 1999a. *Post-Removal Action Report for Site 4 and Site 33, Former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland.* October.

Tetra Tech. 1999b. *Basewide Screening Level Ecological Risk Assessment, Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. December.

Tetra Tech. 2000a. *Resource Conservation and Recovery Act Facility Investigation Addendum, Groundwater Data Rounds 1 through 4 for Sites 2, 3, 4, 7, 8, and 9, NWSC White Oak, Maryland*. April.

Tetra Tech. 2000b. *RCRA Facility Investigation for Sites 2, 3, 4, 7, 8, 9, and Paint Branch, Naval Surface Warfare Center, White Oak, Silver Spring, Maryland*. Final. October.

Tetra Tech. 2001a*. Basewide Ecological Risk Assessment for Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* March.

Tetra Tech. 2001b. *Corrective Measures Study for Operable Unit 2, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland.* March.

Tetra Tech. 2002. *Post-Closure Report for Operable Unit 2, Former Naval Surface Warfare Center, White Oak, Silver Spring, Maryland*. April.

Tetra Tech. 2003a. Addendum-Human Health Risk Evaluation for Post-Removal Soil, Site 4-Chemical Burial Area. January.

Tetra Tech. 2003b. *Post-Closure Long-Term Monitoring Plan Operable Unit 2 at Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. February.

Tetra Tech. 2003c. *RCRA Facility Investigation for Sites 5 and 13, Naval Surface Warfare Center, White Oak, Silver Spring, Maryland*. Final. May.

Tetra Tech. 2003d. *Post-Removal Action Report for Site 7, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. June.

Tetra Tech. 2004. *Site Screening Report for Area of Concern 2 at the former Naval Surface Warfare Center White Oak, Silver Spring, Maryland*.

Tetra Tech. 2005a. *RCRA Facility Investigation for SWMU 87 Building 611 Solid Wastes Storage Unit, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. April.

Tetra Tech. 2005b. *Corrective Measures Study for SWMU 87, Building 611 Solid Waste Storage Unit, Former Naval Surface Warfare Center White Oak, Silver Spring, Maryland*. April.

Tetra Tech. 2010. *Round 9 – August 2009 OU2 Surface Water and Groundwater Sampling Memorandum, Former Naval Surface Warfare Center – White Oak*. January 29.

Tetra Tech. 2012a. *Round 10 – October 2011 OU2 Surface Water and Groundwater Sampling Memorandum, Former Naval Surface Warfare Center – White Oak.* February 3.

Tetra Tech. 2012b. *Second Five-Year Review Report for Naval Surface Warfare Center, White Oak, Maryland*. March.

United States Environmental Protection Agency (USEPA). 2001. *Comprehensive Five-Year Review Guidance.* June.

USEPA. 2016. Memorandum: *Transmittal of the Five-Year Review Recommended Template.* OLEM-9200.0-89. January 20.

Volkes, H.E. and J.E. Edwards. 1974. *Geography and Geology of Maryland.*

Appendix A
Public Notice - Five-Year Review Fact Sheet

ENVIRONMENTAL CLEANUP
2022 FIVE-YEAR REVIEW FACT SHEET

Former Naval Surface Warfare Center – White Oak
Silver Spring, Maryland

April 2022

This fact sheet summarizes the upcoming Five-Year Review at the Former Naval Surface Warfare Center (NSWC)-White Oak. The Five-Year Review will determine whether the environmental cleanup actions at five sites are continuing to protect public health and the environment.

Background

The Former NSWC-White Oak is located in Silver Spring, Maryland, approximately 4 miles northwest of Washington, D.C. The facility encompasses approximately 710 acres in both Prince George's and Montgomery counties. The Food and Drug Administration headquarters occupies about 130 acres of the property; the remainder is undeveloped and wooded. The United States Army (Army) Adelphi Laboratory Center and the United States Naval Reserve Training Center are located immediately south of the property.

The facility was established in 1946 as the Naval Ordnance Laboratory which conducted research, development, and evaluations for surface warfare weapon systems, ordnance technologies, underwater weapons, and strategic systems. The Former NSWC-White Oak was closed in 1997, under the Base Realignment and Closure Act (BRAC). Approximately 662 acres were transferred to the General Services Administration (GSA) and the remaining 48 acres were transferred to the Army.

During more than 50 years of operation at the Former NSWC-White Oak, a variety of wastes were generated. The Department of the Navy (Navy) is responsible for identifying, assessing, and cleaning up contamination resulting from past handling, storage, and disposal of these potentially hazardous wastes. The investigation and cleanup are being conducted under the Department of Defense Installation Restoration Program (IRP) and under provisions of the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA), commonly referred to as "Superfund." This cleanup effort is done in partnership with the Maryland Department of the Environment (MDE) and interested members of the community through the Restoration Advisory Board.

Overview of Environmental Restoration

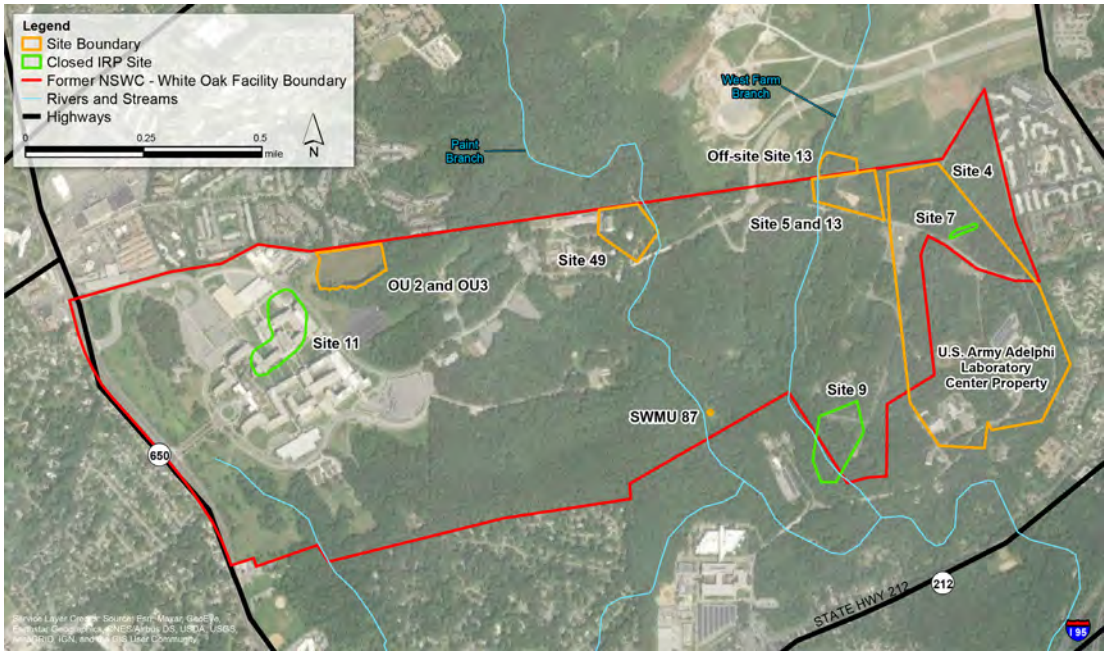
The White Oak BRAC Cleanup Team identified 126 sites, solid waste management units (SWMUs), and areas of concern (AOCs) requiring investigation and/or cleanup. These sites have been investigated; to date, the majority of them required no action or cleanup has already been completed. Cleanup and/or long-term monitoring is ongoing at the remaining sites, including:

- Operable Unit (OU) 2 – soil, waste, and sediment at Site 1 (Parking Lot Landfill) and Site 2 (the Apple Orchard Landfill) and OU3 – groundwater below and surface water adjacent to Site 1 and Site 2
- Site 4 – Chemical Burial Area
- Sites 5 and 13 – Open Burn Area and Oil Sludge Disposal Area
- Site 49 – Trichloroethene Groundwater Plume in the 400 Area
- SWMU 87 – Building 611 Solid Waste Storage Area

These sites are shown on Figure 1.

As part of a Navy nationwide emerging contaminant initiative, a base-wide per- and polyfluoroalkyl substances (PFAS), including perfluorooctanoic acid (PFOA), perfluorooctanesulfonate (PFOS), and perfluorobutanesulfonic acid (PFBS) preliminary assessment/site investigation (PA/SI) is currently being conducted at White Oak.

Figure 1 – Remaining Sites at Former NSWC-White Oak



FES0309221329VBO

Five-Year Review

The Navy, with concurrence from the MDE, is beginning a Five-Year Review of five sites at the Former NSWC-White Oak. The purpose of the Five-Year Review is to ensure that the cleanup actions are continuing to protect human health and the environment. A site is included in the Five-Year Review if contaminants remain at the site at levels that would not allow for unlimited use and unrestricted exposure and if there is a Record of Decision (ROD) in place. The ROD, which includes an evaluation of the potential human health or environmental risks posed by the site, documents the cleanup remedy that was selected following consideration of public comments.

The Navy will prepare the Five-Year Review Report under federal regulations that require a review of remedial (cleanup) actions no less often than every 5 years after start of the remedial action. Rather than conducting Five Year Reviews separately for each site, the Navy has elected to conduct an installation-wide Five-Year Review for the Former NSWC-White Oak. The Five-Year Review Report will be completed by reviewing reports related to implementation of remedial action and completion of site inspections. To determine the protectiveness of the remedy, the Five-Year Review will ask the following questions:

- Is the remedy functioning as intended?
- Are exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid? (RAOs are the cleanup objectives that were established and used to evaluate various alternatives before the remedy was selected and documented in the ROD.)
- Has other information come to light that could call into question the protectiveness of the cleanup?

This is the fourth Five-Year Review for the Former NSWC-White Oak. The Navy will submit draft findings of the Five-Year Review in April 2022 to MDE. The final report will be made available to the public by July 2022. A brief overview of the sites is provided on the remaining pages.

OU2 – Soil, Waste, and Sediment at Site 1 (Parking Lot Landfill) and Site 2 (the Apple Orchard Landfill) and OU3 – Groundwater Below and Surface Water Adjacent to Site 1 and Site 2

The Apple Orchard Landfill is located at Site 2, in the northwestern part of the Former NSWC-White Oak. The landfill itself is referred to as OU2, while the groundwater and surface water associated with Site 2 are referred to as OU3. These current operable units formerly spanned two sites, Site 1 (Parking Lot Landfill) and Site 2 (Apple Orchard Landfill). The remedy included consolidating the waste, so that there is now only one landfill, the Apple Orchard Landfill at Site 2.

Site 1, the Parking Lot Landfill, was an approximately 1-acre area used as an open disposal site and landfill from 1948 to 1953. The wastes supposedly disposed of in this landfill included lubricating oil, battery acid, metal plating wastes, and metal scrap. Records indicate about 60 automobile batteries were disposed of at the site. Ordnance-related items have also been identified at the site.

Site 2, the Apple Orchard Landfill, was an approximately 5.5-acre area that operated as an open disposal area and landfill from 1948 to 1982. In addition to domestic trash such as lunchroom waste and paper, records show that industrial wastes disposed at the site included oils containing polychlorinated biphenyls (PCBs), solvents, paint residue, acids, and miscellaneous compounds. Ordnance related items have also been identified at the site.

Contaminants in OU2 soil and sediment included total PCBs, total polycyclic aromatic hydrocarbons, volatile organic compounds (VOCs), manganese, lead, zinc, and mercury. Groundwater below the site and adjacent surface water contained iron, lead, and manganese.

The cleanup decision included closing and capping the landfill, land use controls, and conducting long-term monitoring.

Since the landfill was closed and capped in 2001, periodic groundwater and surface water monitoring and landfill inspections have been performed to verify the performance and stability of the landfill capping system. Sampling results indicate that the capping system is successfully containing waste and limiting contaminant migration.

Long-term monitoring of groundwater and surface water is ongoing.

Looking northeast toward OU2, Summer 2016

Looking southeast toward OU2, Fall 2021

Site 4 – Chemical Burial Area

Site 4 was a chemical disposal/burial area located in the northeast portion of the Former NSWC-White Oak. Wastes believed to be disposed at Site 4 included acids, explosives, kerosene, chlorinated solvents, fuel tank sludges, and chemical powder.

A removal action was conducted at Site 4 in 1999, to remove all waste material and contaminated soil. The groundwater affected by Site 4 was investigated further between 1999 and 2001 as part of the OU1 Remedial Investigation (RI). OU1 was specifically designated to focus on the nature and extent of groundwater contamination in this part of the facility. The OU1 RI concluded that the streams act as boundaries and that the VOC groundwater plume present within the area downgradient of Site 4 and the Army property was emanating from Site 4.

In 2003, an additional soil investigation indicated the soil about 17 to 20 feet below the ground across an 8,000 square foot area of Site 4 contained concentrations of VOCs that represent potential continuing sources of groundwater contamination.

To treat groundwater at Site 4, an enhanced in situ bioremediation remedial action was conducted and a soil vapor extraction (SVE) system was installed. Recent activities have included:

- July 2007 – SVE system in operation (operation stopped in 2009 because remedial goals had been met)
- September 2007 – Substrate injection completed
- November 2009 – Additional substrate injections completed.

Long-term monitoring of groundwater is ongoing.

Enhanced in situ bioremediation is a technique to accelerate the natural process where microorganisms break down harmful contaminants into less toxic ones. Enhancement accelerates the process by adding injecting nutrients (for example, emulsified vegetable oil, lactose, organic matter, and oxygen release compounds) below ground into the substrate. “In situ” means that the process occurs in place.

Soil vapor extraction removes contaminant vapors from the soil above the water table by applying a vacuum. The contaminant vapors are then treated above ground, usually by activated carbon, which captures the contaminants.

Looking north toward Site 4 injection wells, Summer 2016

Looking southeast toward Site 4, Fall 2021

Site 5 and 13 – Oil Sludge Disposal Area

Site 5 consists of three adjacent open burn areas that were used from the late 1940s until 1970, to burn paper, cardboard, wood, and other bulky flammable materials, as well as small quantities of hazardous materials. One or more of the areas may also have been used as a fire training area and for testing explosives and other pyrotechnic devices. Site 13 occupies approximately 0.7 acre, and between 1970 and 1978, reportedly was used as a disposal area for 6,000 to 10,000 gallons of oily sludge from storage tanks containing No. 6 fuel oil.

Site 13 is adjacent to the northern side of Site 5, in the northeastern portion of the Former NSWC-White Oak, along the northern property line between Coffman Road and the northern perimeter road. The area occupied by Site 13 is located entirely within property currently owned by GSA; however, the groundwater plume originating from Site 13 extends off GSA property to the northwest onto private property formerly owned by Percontee, Inc. Percontee historically used its site as a sand and gravel quarry; however, the property is currently owned by Global LifeSci Development Corporation. The property formerly owned by Percontee is referred to as Off-Site 13.

Investigation activities specific to Site 13 were first conducted in 1997, and groundwater at Sites 5 and 13 were further investigated as part of the OU1 RI. The OU1 RI delineated the extent of contamination migrating from Site 13 offsite to the northwest onto the adjoining private property and identified the contamination as VOCs.

To treat groundwater at Site 13 enhanced in situ chemical reduction with zero valent iron (ZVI) has been conducted. The following is a sequence of recent activities:

- February 2005 – Site 13 ZVI injection completed.
- June 2010 – Off-Site 13 ZVI injection completed.
- March 2020 – Additional Site 13 ZVI injection completed.

Long-term monitoring of groundwater is ongoing.

Enhanced in situ chemical reduction with zero valent iron is a process that transforms contaminants in place by chemical reaction, usually by adding a “reductant” such as ZVI. The ZVI reacts chemically with the VOCs to break down harmful contaminants into less toxic ones.

Looking northeast toward Site 5 monitoring well, Summer 2016

Site 13 injection, Spring 2020

Looking northwest toward Site 13, Fall 2021

Site 49 – Groundwater Plume in the 400 Area

Site 49 is adjacent to the eastern end of the Arnold Engineering Development Center in the north-central portion of the facility. Site 49 includes the area between Building 427, a nine-story former hydrostatic testing facility, and Paint Branch to the east. While there was no known use of trichloroethene, a 2002 visual inspection of the interior of the abandoned Building 427 found two empty 5 gallon cans labeled “solvent, dry-cleaning type” in a storage room. A limestone pit, or leaching well, designed for disposal of acidic wastewater, was present on the western side of the building; however, former building personnel stated that the leaching well was never used for its designed purpose.

Investigations at Site 49 indicated that a cleanup action was required for VOCs in groundwater. In situ chemical oxidation treatment, using sodium permanganate, was conducted in September 2007 to treat the groundwater.

Long-term monitoring of groundwater is ongoing.

In situ chemical oxidation is a process that transforms contamination in place by chemical reaction, by adding an oxidizing agent, such as sodium permanganate. Adding the oxidizing agent causes a chemical reaction that breaks down harmful contaminants into less toxic ones.

Looking southeast to Site 49 monitoring wells, Summer 2016

Looking north toward Site 49 river and road, Fall 2021

SWMU 87

SWMU 87 is located west and north of the former Building 611 in the south-central portion of the Former NSWC-White Oak. The area, located on a slope above and east of Paint Branch, was reportedly used to dispose of wood, metal waste, and other debris.

Site investigations identified the shallow aquifer was contaminated with VOCs, with limited groundwater contamination at greater depths. Groundwater contamination was observed to be migrating west toward Paint Branch; however, no contaminants have been detected within Paint Branch.

To treat VOCs present in groundwater, in situ bioremediation was conducted in June 2007.

Long-term monitoring of groundwater is ongoing.

In situ bioremediation uses microorganisms to break down organic contaminants. Bioremediation stimulates the growth of certain microbes that use contaminants as a source of food and energy. Natural microorganisms may be added or conditions may be amended to improve the bioremediation process.

Looking southwest toward SWMU 87 monitoring well, Summer 2016

Looking north toward SWMU 87, Fall 2021

For More Information

BRAC Program Management Office
Ms. W. Rachelle Knight
(215) 897-4916 | wynette.r.knight.civ@us.navy.mil

Maryland Department of the Environment
Ms. Linda Gustafson
(410) 537-4238 | linda.gustafson@maryland.gov

A repository or collection of cleanup-related documents is available for review at:
https://www.bracpmo.navy.mil/brac_bases/northeast/former_warfare_center_white_oak/documents.html

Appendix B
Five-Year Review Site Inspection Checklists and Photo Log

Appendix B-1
Fourth Five-Year Review Site Inspection Checklists

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: OU2 & OU3	**Date of inspection:** 11/18/2021
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, with a high near 70. Southwest wind 8-15 mph, with gusts as high as 24 mph.

Remedy Includes: (Check all that apply)

- ☑ Landfill cover/containment
- ☑ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☑ Other Long-term groundwater monitoring
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☑ Inspection team roster ~~attached~~ listed below ☐ Site map attached

II. INTERVIEWS (Check all that apply) (Not applicable)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

Inspection team: Stacy Bogdanski/Jacobs
Laura Lampshire/Jacobs
Kelsey Voss/Jacobs
Linda Gustafson/MDE
Armalia Berry-Washington/NAVFAC Washington

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

2. **Site-Specific Health and Safety Plan** — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☑ Contingency plan/emergency response plan — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks

3. **O&M and OSHA Training Records** — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks No O&M, but OSHA training records available

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

7. **Groundwater Monitoring Records** — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks LTM reports

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☑ N/A

    Remarks

IV. O&M COSTS (Not applicable)

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☐ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
   Remarks Gates at OU 2 landfill are locked; gate providing access to OU-2 monitoring wells directly off perimeter road not locked/secured.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
   Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☑ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☑ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☑ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☑ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☑ N/A
Violations have been reported ☐ Yes ☐ No ☑ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☑ N/A
Remarks _____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☑ No vandalism evident
Remarks _____
_____

2. **Land use changes on site** ☑ N/A
Remarks _____
_____

3. **Land use changes off site** ☑ N/A
Remarks _____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☑ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks _____
_____

B. Other Site Conditions

Remarks OU2 landfill overgrown; very tall grass observed on landfill cover.

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☑ Settlement not evident
   Areal extent _____ Depth _____
   Remarks _____

2. **Cracks** ☐ Location shown on site map ☑ Cracking not evident
   Lengths _____ Widths _____ Depths _____
   Remarks _____

3. **Erosion** ☐ Location shown on site map ☑ Erosion not evident
   Areal extent _____ Depth _____
   Remarks _____

4. **Holes** ☐ Location shown on site map ☑ Holes not evident
   Areal extent _____ Depth _____
   Remarks _____

5. **Vegetative Cover** ☑ Grass ☑ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks overgrown; very tall grass observed on landfill cover

6. **Alternative Cover (armored rock, concrete, etc.)** ☑ N/A
   Remarks _____

7. **Bulges** ☐ Location shown on site map ☑ Bulges not evident
   Areal extent _____ Height _____
   Remarks _____

8. **Wet Areas/Water Damage** ☑ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☑ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☑ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☑ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☑ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☑ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☑ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☑ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☑ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☑ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☑ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks _____

F. Cover Drainage Layer ☐ Applicable ☑ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks _____

G. Detention/Sedimentation Ponds ☐ Applicable ☑ N/A

1. **Siltation** Areal extent _____ Depth _____ ☐ N/A
   ☐ Siltation not evident
   Remarks _____

2. **Erosion** Areal extent _____ Depth _____
   ☐ Erosion not evident
   Remarks _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks _____

H. Retaining Walls ☐ Applicable ☑ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☑ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☑ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters _____
   ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   ☐ Others _____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually _____
   ☐ Quantity of surface water treated annually _____
   Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks _____

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
   ☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) (every 2.5 years)

☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition

☑ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is effective

Based on LTM analytical data, there has not been any indication of COC migration or any significant increases in COC concentrations.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None at this time.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None at this time.

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Site 4	**Date of inspection: 11/18/2021**
Location and Region: NSWC White Oak – Region 3	**EPA ID: MD0170023444**
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, with a high near 70. Southwest wind 8-15 mph, with gusts as high as 24 mph.

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☑ Other Long-term groundwater monitoring
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☑ Inspection team roster ~~attached~~ listed below ☐ Site map attached

II. INTERVIEWS (Check all that apply) (not applicable)

1. **O&M site manager** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

Inspection team: Stacy Bogdanski / Jacobs
Laura Lampshire / Jacobs
Kelsey Voss / Jacobs
Linda Gustafson / MDE
Armalia Berry-Washington / NAVFAC Washington

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

2. **Site-Specific Health and Safety Plan** — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☑ Contingency plan/emergency response plan — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks

3. **O&M and OSHA Training Records** — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks No O&M, but OSHA training records available

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

7. **Groundwater Monitoring Records** — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks LTM reports

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☑ N/A

    Remarks

IV. O&M COSTS (Not applicable)

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☐ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ To _____ _____ ☐ Breakdown attached
   (Date) (Date) (Total cost)

   From _____ To _____ _____ ☐ Breakdown attached
   (Date) (Date) (Total cost)

   From _____ To _____ _____ ☐ Breakdown attached
   (Date) (Date) (Total cost)

   From _____ To _____ _____ ☐ Breakdown attached
   (Date) (Date) (Total cost)

   From _____ To _____ _____ ☐ Breakdown attached
   (Date) (Date) (Total cost)

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☑ N/A
   Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☑ N/A
   Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☑ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☑ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☑ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☑ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☑ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☑ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks _____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☑ No vandalism evident
Remarks _____

2. **Land use changes on site** ☑ N/A
Remarks _____

3. **Land use changes off site** ☑ N/A
Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks Roads to access site in partial disrepair

B. Other Site Conditions

Remarks Source area highly vegetated

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent _____ Depth _____
   Remarks _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths _____ Widths _____ Depths _____
   Remarks _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent _____ Depth _____
   Remarks _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent _____ Depth _____
   Remarks _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent _____ Height _____
   Remarks _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks _____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent _____ Depth _____ ☐ N/A
   ☐ Siltation not evident
   Remarks _____

2. **Erosion** Areal extent _____ Depth _____
   ☐ Erosion not evident
   Remarks _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks _____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☑ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters _____
   ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   ☐ Others _____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually _____
   ☐ Quantity of surface water treated annually _____
   Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks _____

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
   ☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☑ Functioning ☑ Routinely sampled (every 2.5 years) ☐ Good condition

☑ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks Some well caps on monitoring wells were observed to be rusted (e.g. 04GW50) and could not be closed.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy appears to be effective.

Based on LTM analytical data, the COC concentrations have decreased.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None at this time.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None at this time.

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Sites 5/13	**Date of inspection:** 11/18/2021
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, with a high near 70. Southwest wind 8-15 mph, with gusts as high as 24 mph.

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☑ Other Long-term groundwater monitoring
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☑ Inspection team roster ~~attached~~ listed below ☐ Site map attached

II. INTERVIEWS (Check all that apply) (Not applicable)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

Inspection Team: Stacy Bogdanski/Jacobs
Laura Lampshire/Jacobs
Kelsey Voss/Jacobs
Linda Gustafson/MDE
Arnalia Berry-Washington/NAVFAC Washington

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks

2. **Site-Specific Health and Safety Plan** — ☑ Readily available — ☐ Up to date — ☐ N/A
   - ☑ Contingency plan/emergency response plan — ☑ Readily available — ☐ Up to date — ☐ N/A

   Remarks

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks No O&M, but OSHA training records available.

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

7. **Groundwater Monitoring Records** — ☑ Readily available — ☑ Up to date — ☐ N/A

   Remarks LTM reports

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☑ N/A

   Remarks

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☑ N/A

    Remarks

IV. O&M COSTS (Not applicable)

1. **O&M Organization**
   - ☐ State in-house
   - ☐ PRP in-house
   - ☐ Federal Facility in-house
   - ☐ Contractor for State
   - ☐ Contractor for PRP
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☑ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
   Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
   Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____

Frequency _____

Responsible party/agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☐ N/A

Other problems or suggestions: ☐ Report attached

_____

_____

_____

_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks _____

_____

_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident

Remarks _____

_____

2. **Land use changes on site** ☐ N/A

Remarks _____

_____

3. **Land use changes off site** ☐ N/A

Remarks _____

_____

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks Site 13 offsite access road - downhill portion washed-out

_____

B. Other Site Conditions

Remarks - Access road to the bottom of the ravine is eroded.
- Several locations along the easement fence are damaged by fallen trees.
- A bollard adjacent to monitoring well 13GW202 is displaced due to wash-out
- The area southeast of Site 13 appeared disturbed (gravel/sand observed)

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☑ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
   ☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled (every 2.5 years) ☑ Good condition

☑ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy appears to be effective

Based on LTM analytical data, the COC concentrations have decreased.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None at this time.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None at this time.

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Site 49	**Date of inspection:** 11/18/2021
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, with a high near 70. Southwest wind 8-15 mph, with gusts as high as 24 mph.

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☑ Other Long-term groundwater monitoring
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☑ Inspection team roster ~~attached~~ listed below ☐ Site map attached

II. INTERVIEWS (Check all that apply) (Not applicable)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

Inspection Team: Stacy Bogdanski / Jacobs
Laura Lampshire / Jacobs
Kelsey Voss / Jacobs
Linda Gustafson / MDE
Armalia Berry-Washington / NAVFAC Washington

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

2. **Site-Specific Health and Safety Plan** — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☑ Readily available — ☑ Up to date — ☐ N/A
   - Remarks

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A
   - Remarks No O&M, but OSHA training records available

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Other permits — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

7. **Groundwater Monitoring Records** — ☑ Readily available — ☐ Up to date — ☐ N/A
   - Remarks LTM reports

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☑ N/A
    - Remarks

IV. O&M COSTS (Not applicable)

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☐ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached
   From _____ (Date) To _____ (Date) _____ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☑ Gates secured ☐ N/A
   Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☑ N/A
   Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☑ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☑ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____

Frequency _____

Responsible party/agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☑ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☑ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☑ N/A

Violations have been reported ☐ Yes ☐ No ☑ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☑ N/A

Remarks _____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☑ No vandalism evident

Remarks _____

2. **Land use changes on site** ☑ N/A

Remarks _____

3. **Land use changes off site** ☑ N/A

Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks Access road to monitoring wells is steep and exhibits wash-out damage.

B. Other Site Conditions

Remarks The washed-out bridge observed in June 2016 was removed from the stream.
Stream restoration (including rip-rap) observed.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent _____ Depth _____
Remarks _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
Lengths _____ Widths _____ Depths _____
Remarks _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks _____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent _____ Depth _____
Remarks _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks _____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks _____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
Areal extent _____ Height _____
Remarks _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
- ☐ Wet areas ☐ Location shown on site map Areal extent_____
- ☐ Ponding ☐ Location shown on site map Areal extent_____
- ☐ Seeps ☐ Location shown on site map Areal extent_____
- ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☑ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
   ☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) (every 2.5 years)

☐ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks Some locks observed missing on wells. Monitoring well 49GW205 and injection wells 49INJ13 and 49INJ14 were abandoned in Dec. 2020. (continued below)

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Based on the LTM analytical data TCE concentrations have decreased at 4 wells (49GW200, 49GW206S, 49GW206D, and 49GW208S) since baseline. These wells are located downgradient of Building 427 and downgradient of a line of injection wells.
Decreases in TCE and stable to fluctuating cis-1,2-DCE and VC, and low ORP readings in 49GW207S (-147 mV) and in 49GW208S (-105 mV) suggest some anaerobic biodegradation may be taking place in the vicinity of these wells.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

Monitoring wells (continued)
- Monitoring well GW202S was not found/destroyed.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None at this time

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None at this time.

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: SWMU 87	**Date of inspection: 11/18/2021**
Location and Region: NSWC White Oak – Region 3	**EPA ID: MD0170023444**
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** Sunny, with a high near 70. Southwest wind 8-15 mph, with gusts as high as 24 mph.

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☑ Other Long-term groundwater monitoring
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☑ Inspection team roster ~~attached~~ listed below ☐ Site map attached (Not applicable)

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

Inspection Team: Stacy Bogdanske/Jacobs
Laura Lampshire/Jacobs
Kelsey Voss/Jacobs
Linda Gustafson/MDE
Armalia Berry-Washington/NAVFAC Washington

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

2. **Site-Specific Health and Safety Plan** — ☑ Readily available — ☑ Up to date — ☐ N/A
   - ☑ Contingency plan/emergency response plan — ☑ Readily available — ☑ Up to date — ☐ N/A
   - Remarks

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A
   - Remarks No O&M, but OSHA training records available

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

7. **Groundwater Monitoring Records** — ☑ Readily available — ☑ Up to date — ☐ N/A
   - Remarks LTM reports

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☑ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☑ N/A
   - Remarks

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☑ N/A
    - Remarks

IV. O&M COSTS (Not applicable)

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ☐ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other _____

2. **O&M Cost Records**
   - ☐ Readily available ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate _____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

   From _____ To _____ _____ ☐ Breakdown attached
   Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☑ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
   Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
   Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks _____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks _____
_____

2. **Land use changes on site** ☐ N/A
Remarks _____
_____

3. **Land use changes off site** ☐ N/A
Remarks _____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks _____
_____

B. Other Site Conditions

Remarks Wells appear to be in good condition

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   - ☐ Wet areas ☐ Location shown on site map Areal extent_____
   - ☐ Ponding ☐ Location shown on site map Areal extent_____
   - ☐ Seeps ☐ Location shown on site map Areal extent_____
   - ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

   Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
   Areal extent_____
   Remarks_____

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
   Remarks_____

C. Letdown Channels ☐ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
   Areal extent_____ Depth_____
   Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
   Material type_____ Areal extent_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Areal extent_____ Depth_____
   Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☑ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters _____
   ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   ☐ Others _____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually _____
   ☐ Quantity of surface water treated annually _____
   Remarks _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks _____

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
   ☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy) (every 2.5 years)

☐ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition

☑ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks Some locks are missing from monitoring wells

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is effective.

Based on LTM analytical data, the COC concentrations have decreased. However groundwater at monitoring well 87WP212 continues to exhibit low, but greater than MCLs, levels of TCE and PCE. This well is in the upland portion of SWMU 87.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

N/A

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

None at this time.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None at this time.

Appendix B-2
Photo Log – November 18, 2021

Site Inspection Photo Log
November 18, 2021
NWSC White Oak, Silver Spring, MD

Site 4 Photos

Looking southeast to the Source Area at Site 4.

Open well lid at 04GW50 looking north. Well lid will not close. J-plug present.

Site 13 Photos

Damaged perimeter fence at Site 13 looking northeast.

Fallen trees on perimeter fence at Site 13 looking northwest.

Broken bollard at 13GW202 looking west.

Recently disturbed soil in field to the south of Site 13 looking northeast.

Site 49 Photos

Missing well lock on 49GW206D.

Western side of Site 49 looking south toward 49GW207S & D and 49GW208S & D.

Looking north toward former perimeter road that crossed Paint Branch. Area recently renovated.

Missing well lock and J-plug on well along former perimeter road at Site 49.

SWMU 87 Photos

Looking north at SWMU 87.

Looking south at SWMU 87.

Missing J-plug on injection well at SWMU 87.

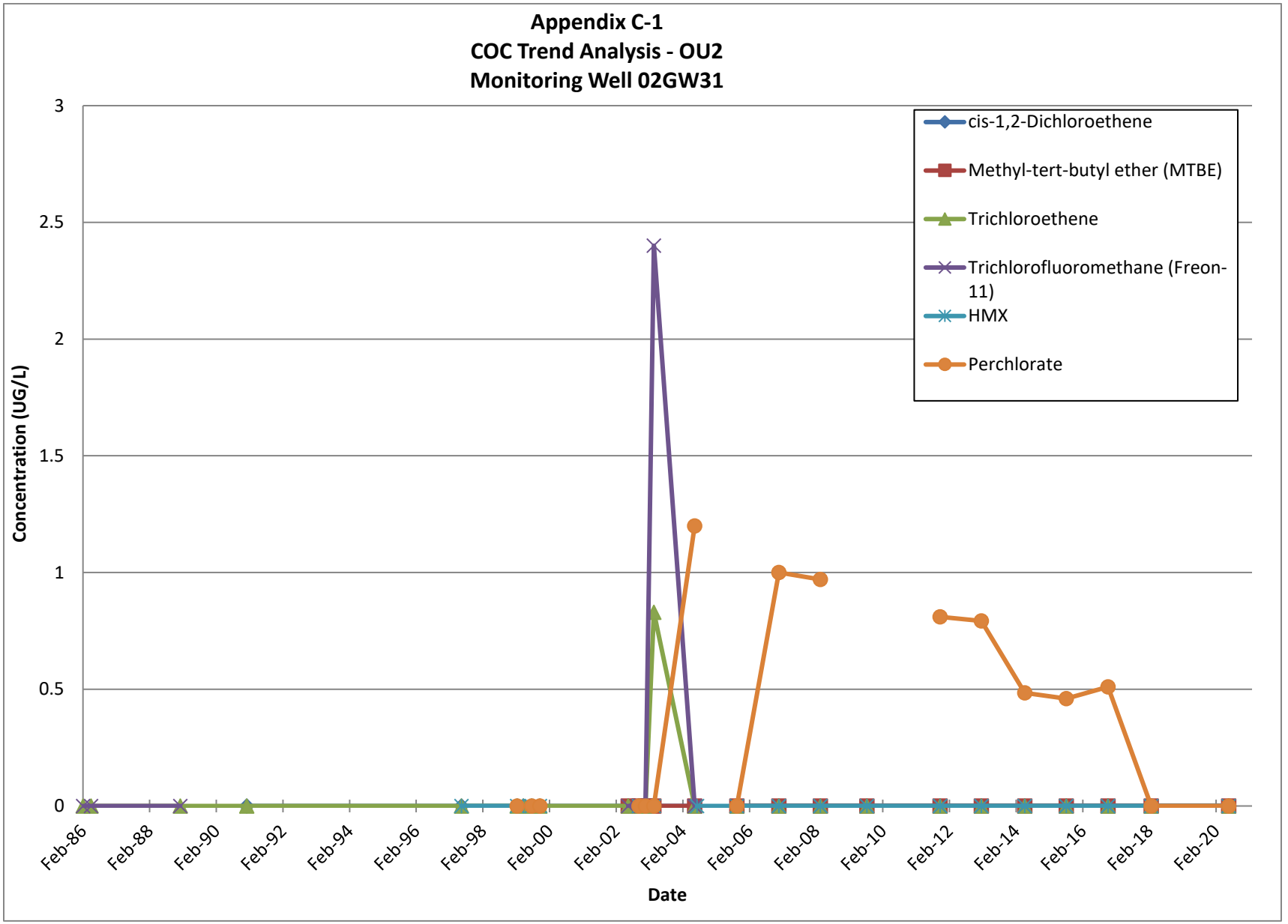
No well locks on wells at SWMU 87.

OU2 Photos

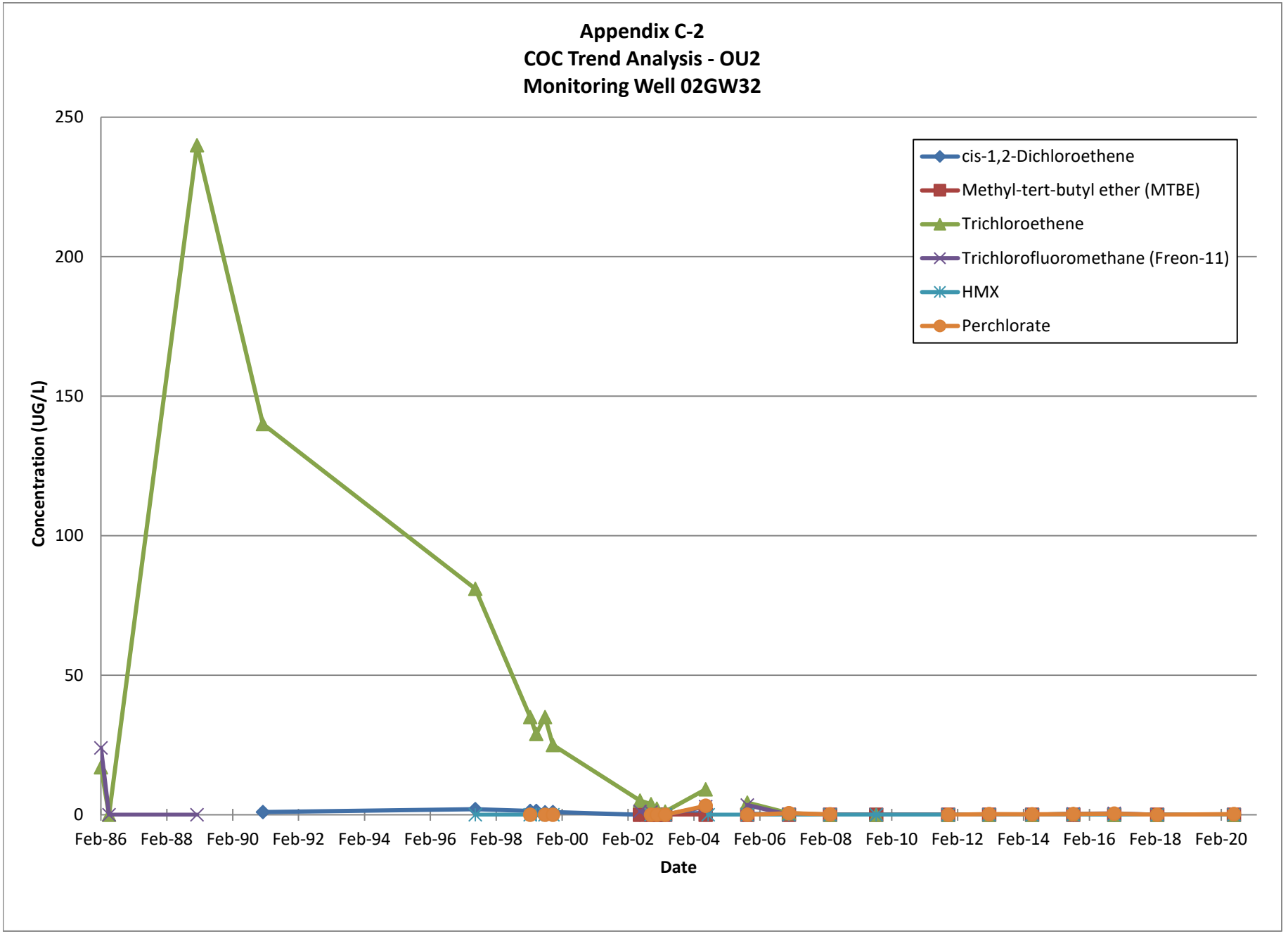
Looking southeast from Perimeter Road at OU2.

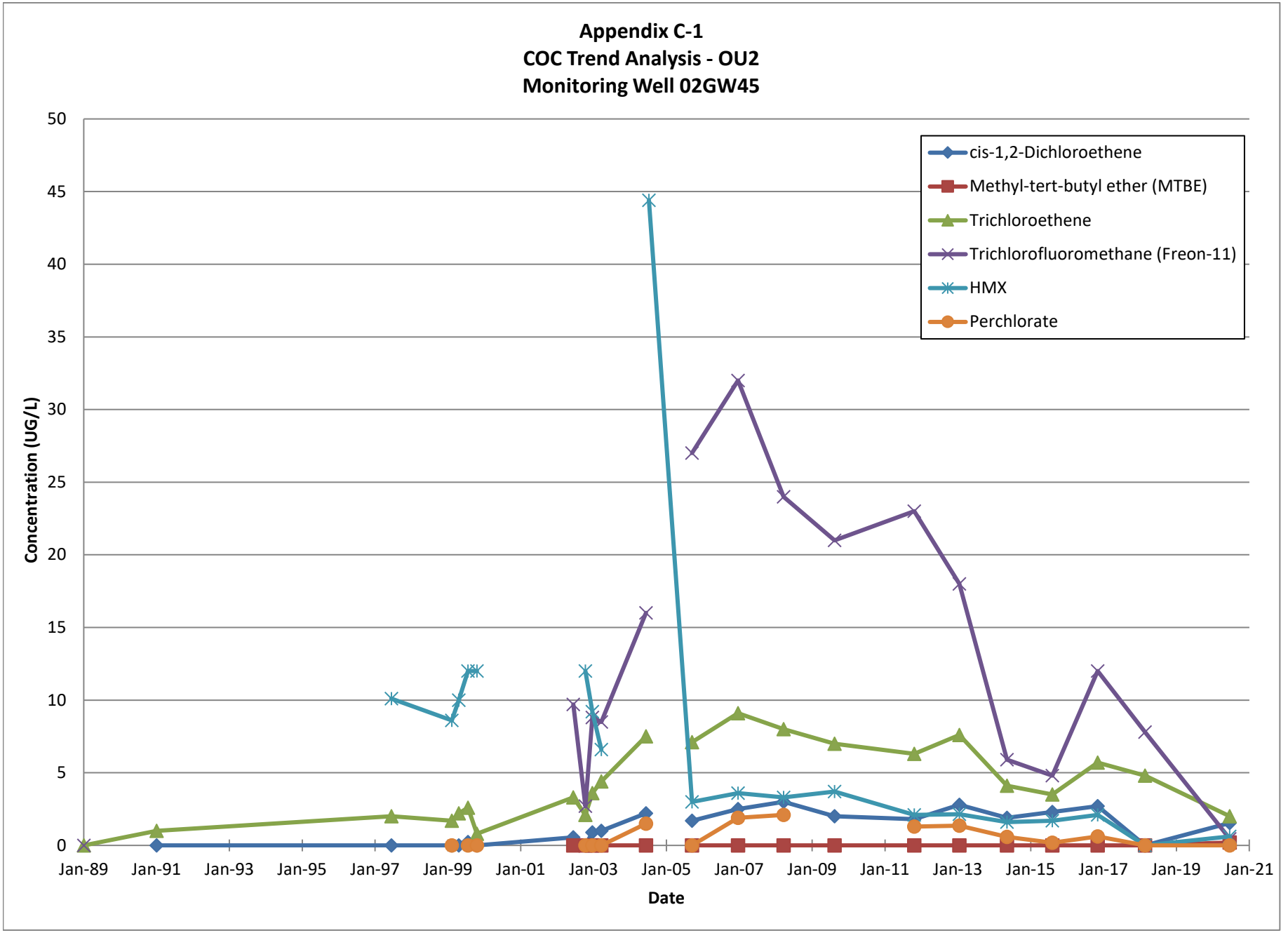
Appendix C
Five-Year Trend Graphs

Appendix C-1
OU2 Groundwater Trend Graphs

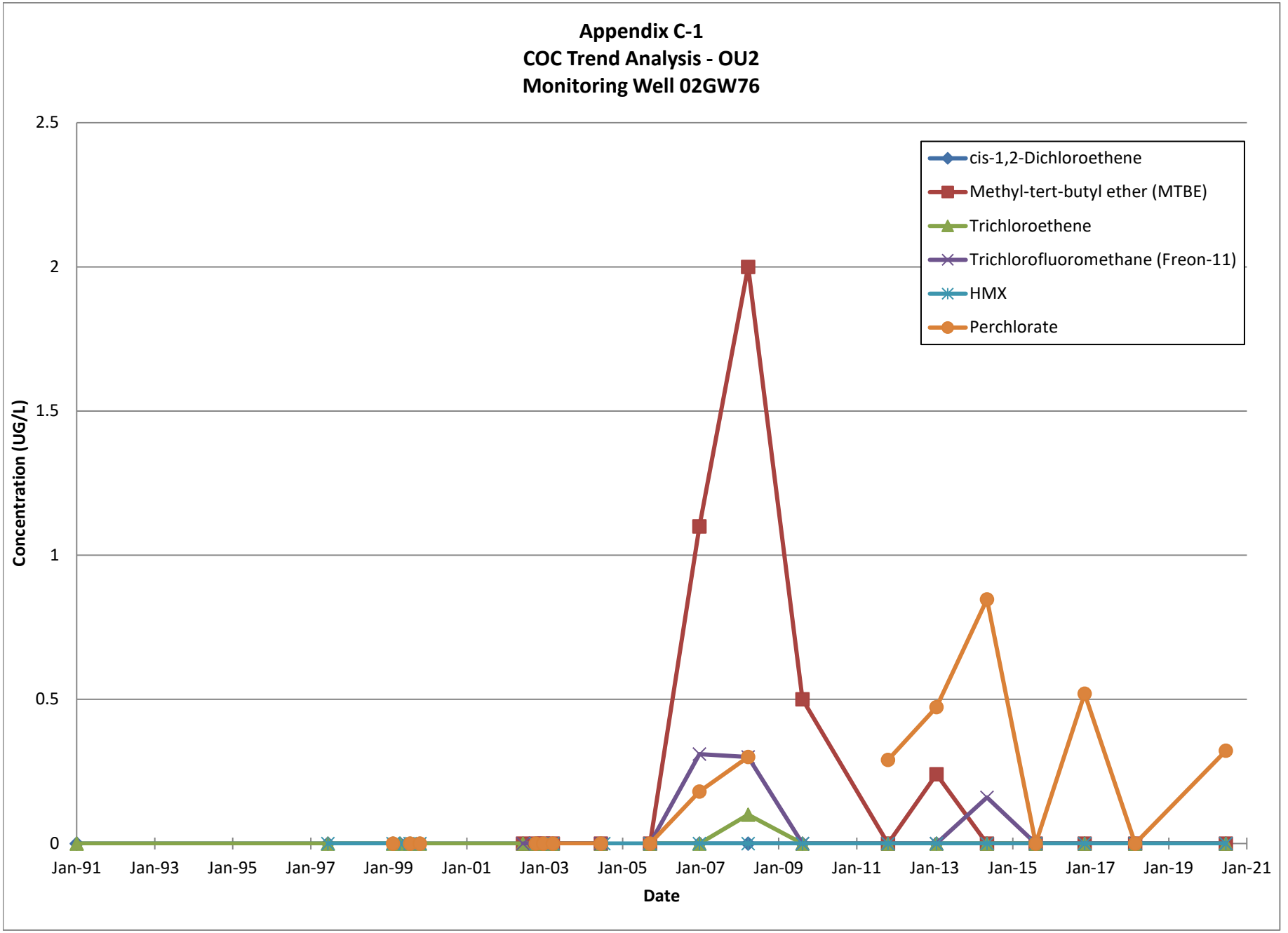

Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW31
Concentration (UG/L)
3
2.5
2
1.5
1
0.5
0
Feb-86
Feb-88
Feb-90
Feb-92
Feb-94
Feb-96
Feb-98
Feb-00
Feb-02
Feb-04
Feb-06
Feb-08
Feb-10
Feb-12
Feb-14
Feb-16
Feb-18
Feb-20
Date
cis-1,2-Dichloroethene
Methyl-tert-butyl ether (MTBE)
Trichloroethene
Trichlorofluoromethane (Freon-11)
HMX
Perchlorate

Appendix C-2
COC Trend Analysis - OU2
Monitoring Well 02GW32

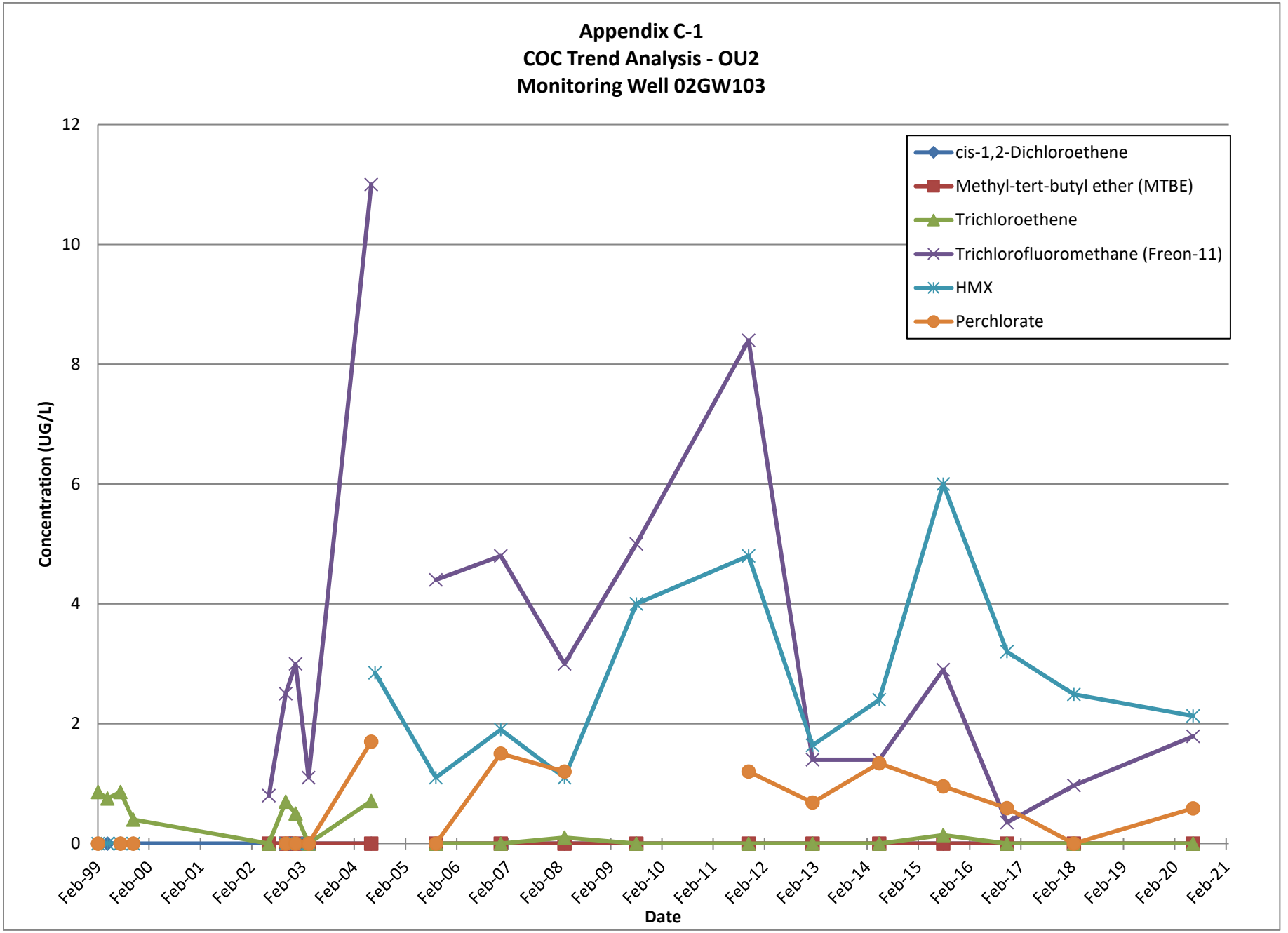



Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW45
Concentration (UG/L)
50
45
40
35
30
25
20
15
10
5
0
Jan-89
Jan-91
Jan-93
Jan-95
Jan-97
Jan-99
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
Jan-19
Jan-21
Date
cis-1,2-Dichloroethene
Methyl-tert-butyl ether (MTBE)
Trichloroethene
Trichlorofluoromethane (Freon-11)
HMX
Perchlorate

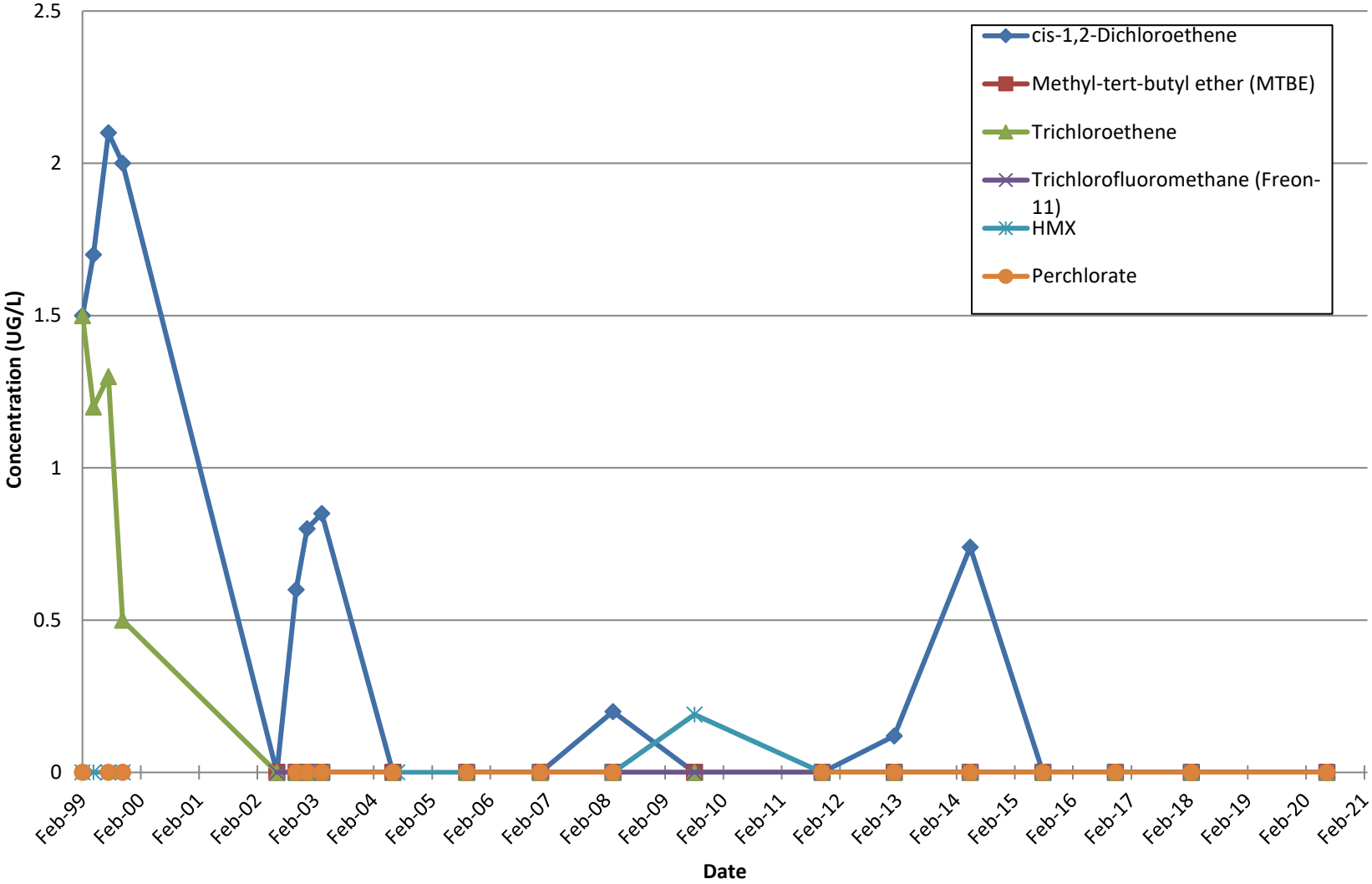
Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW76



Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW103

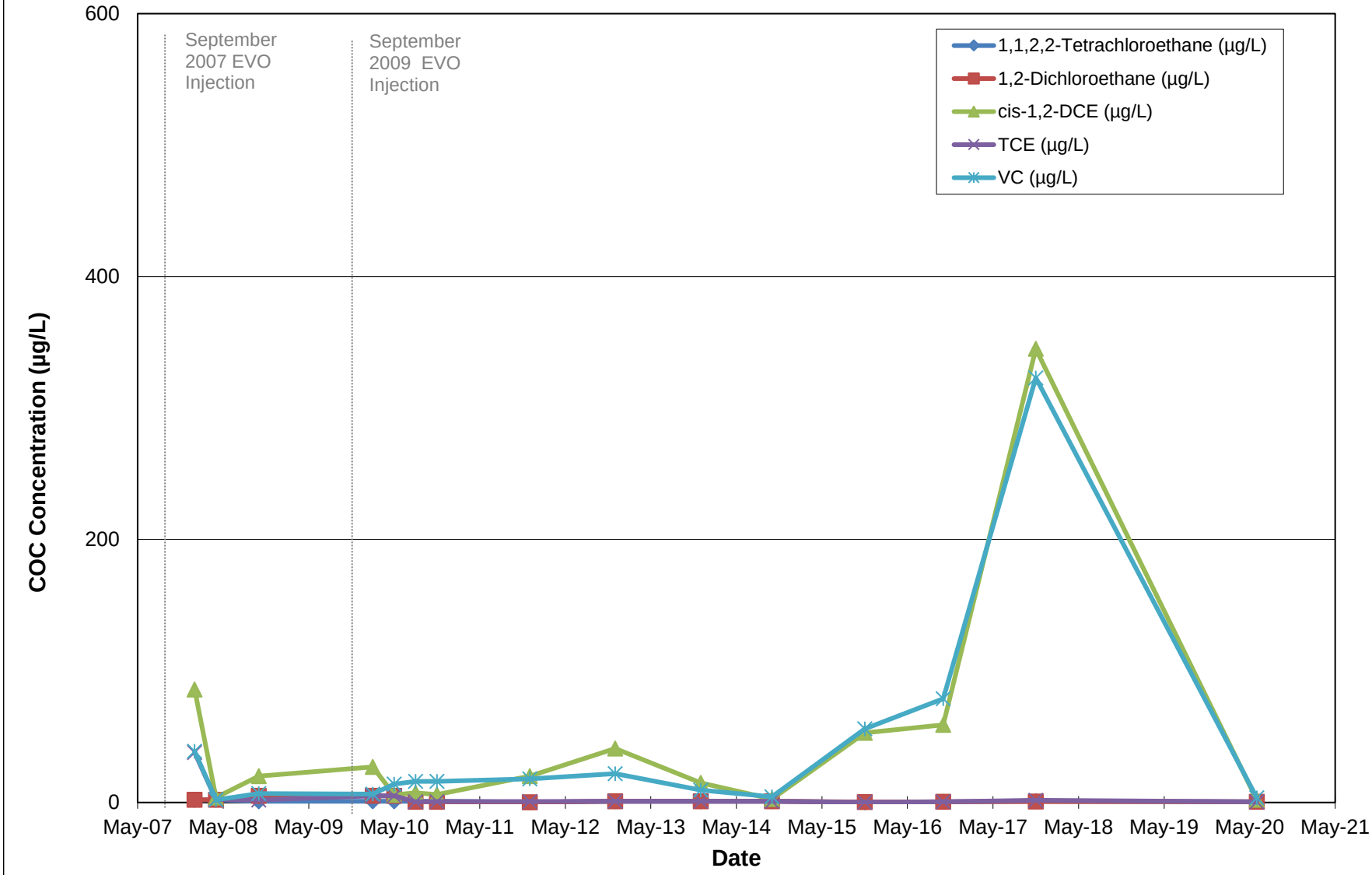


Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW104

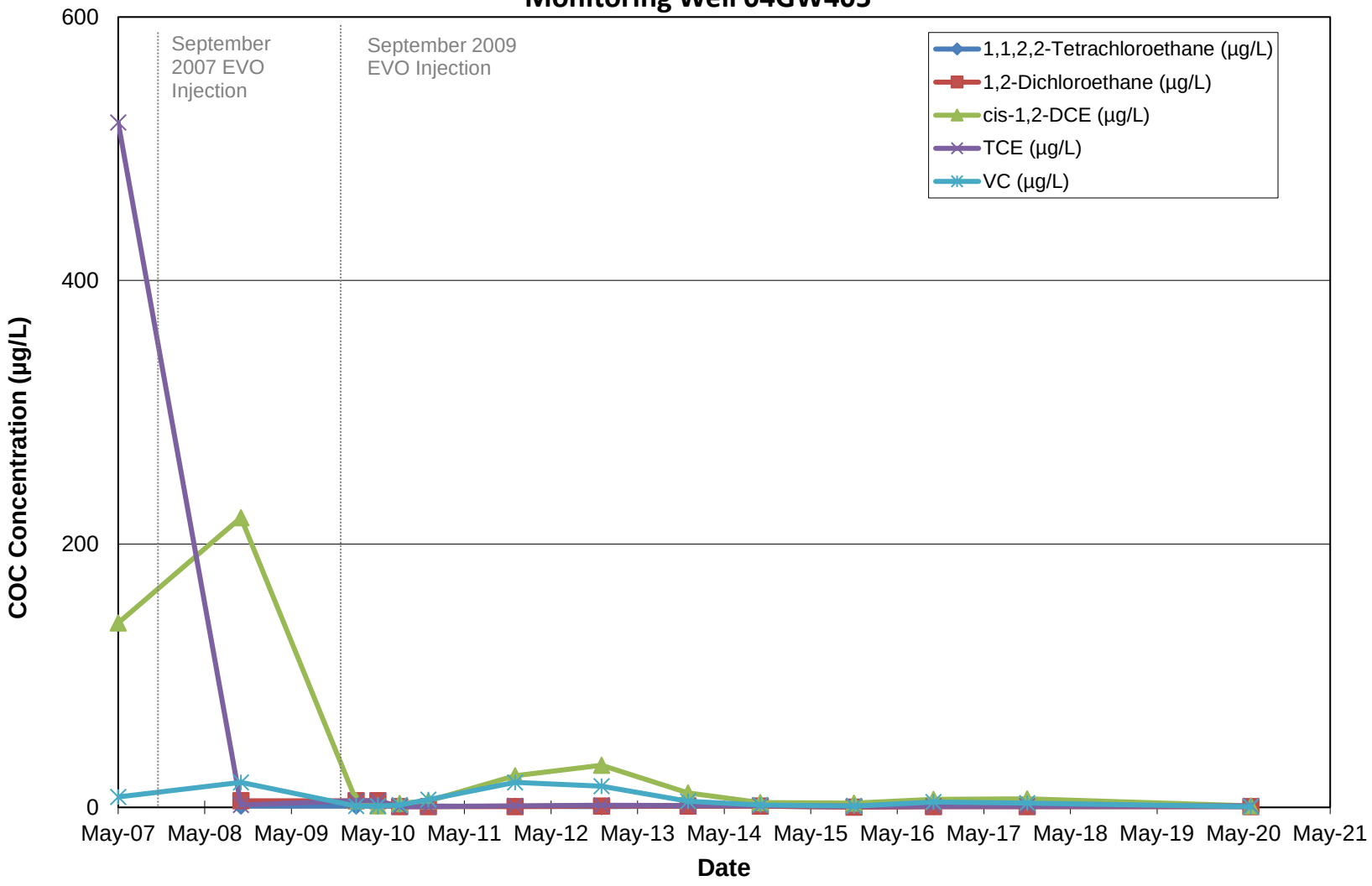


Appendix C-2
Site 4 Groundwater Trend Graphs

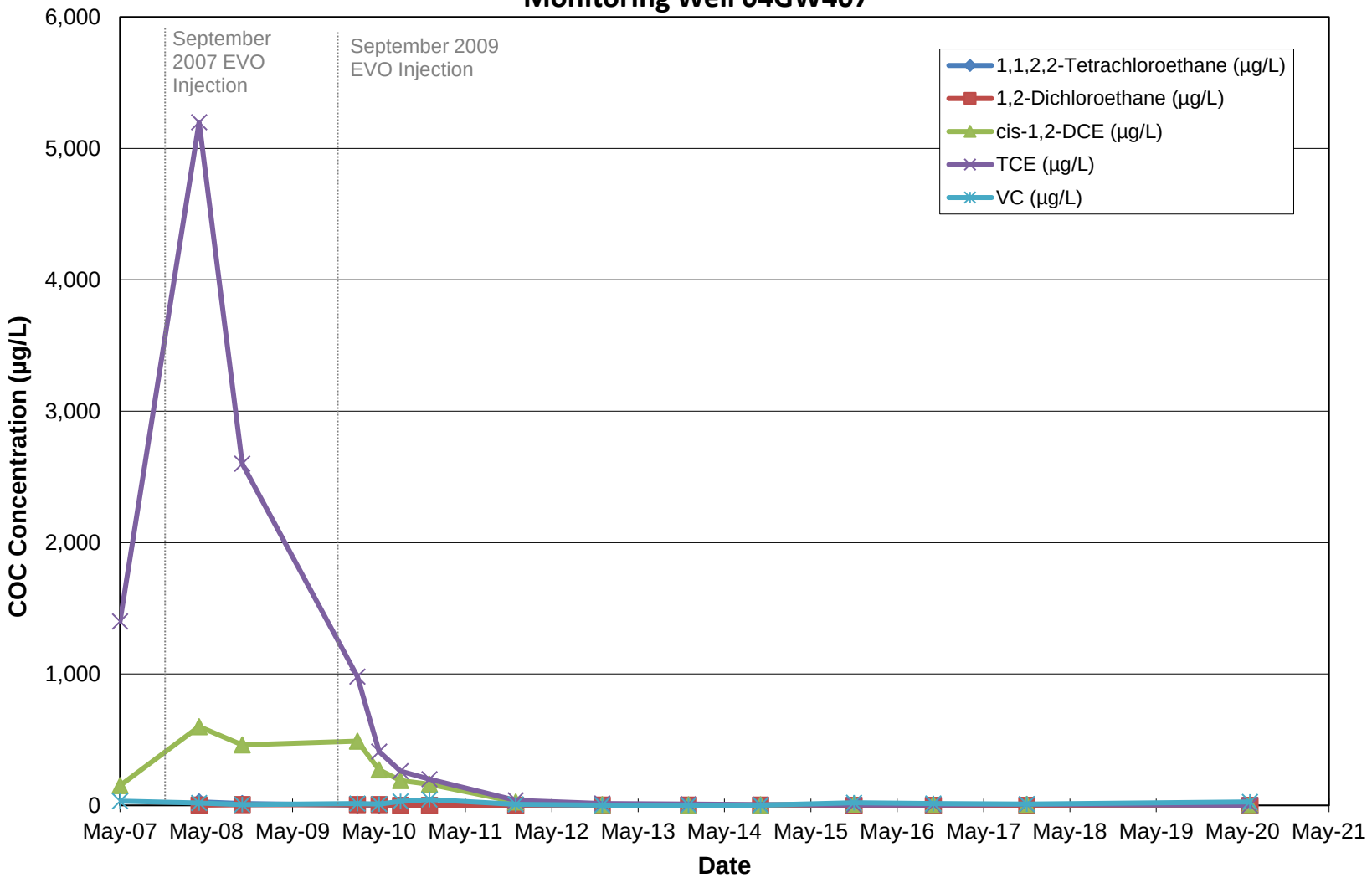
Appendix C-2.1
VOC Trend Analysis - Site 4 100-Series
Monitoring Well 04GW402



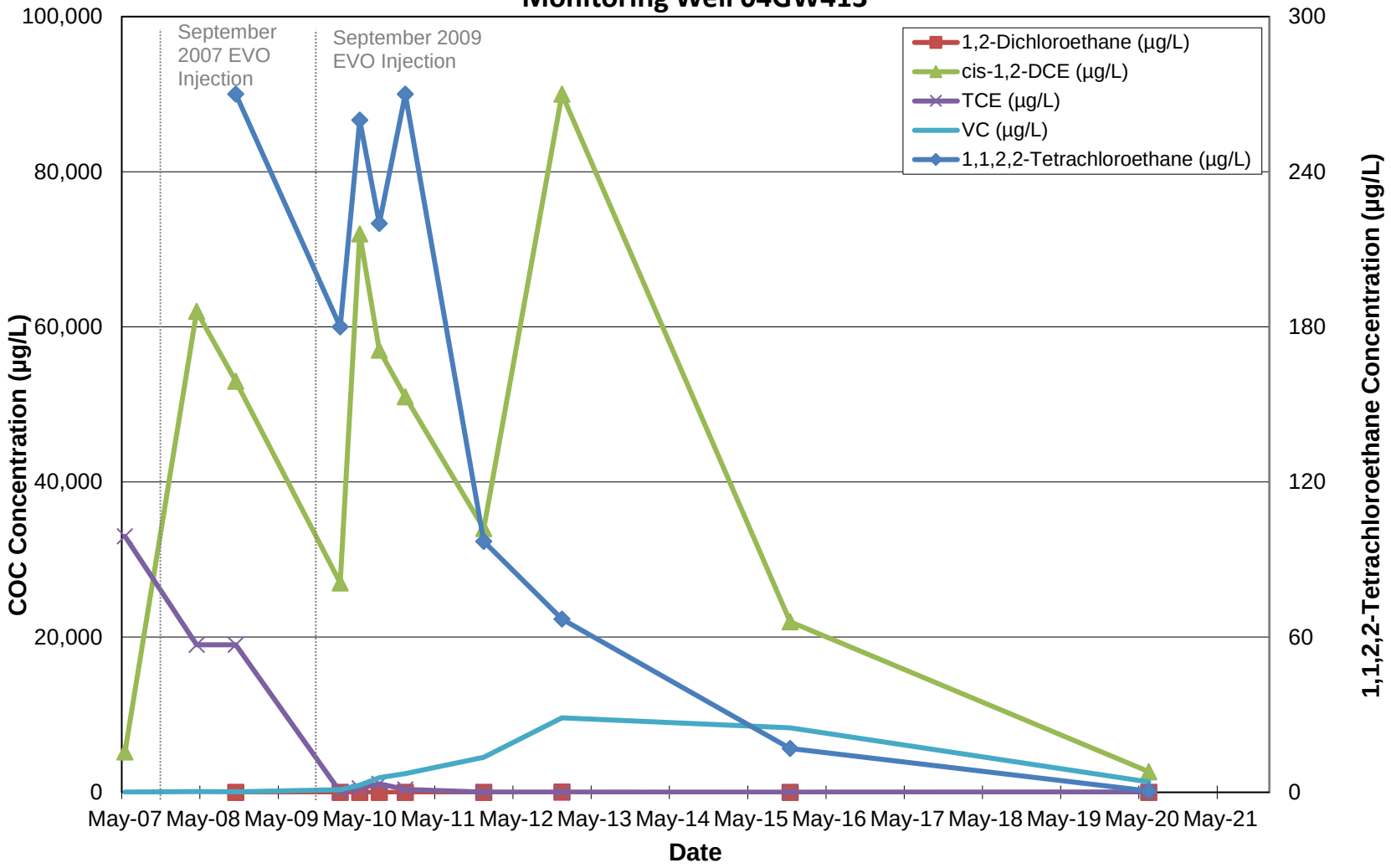
Appendix C-2.1
VOC Trend Analysis - Site 4 100-Series
Monitoring Well 04GW405



Appendix C-2.1
VOC Trend Analysis - Site 4 Source Area
Monitoring Well 04GW407

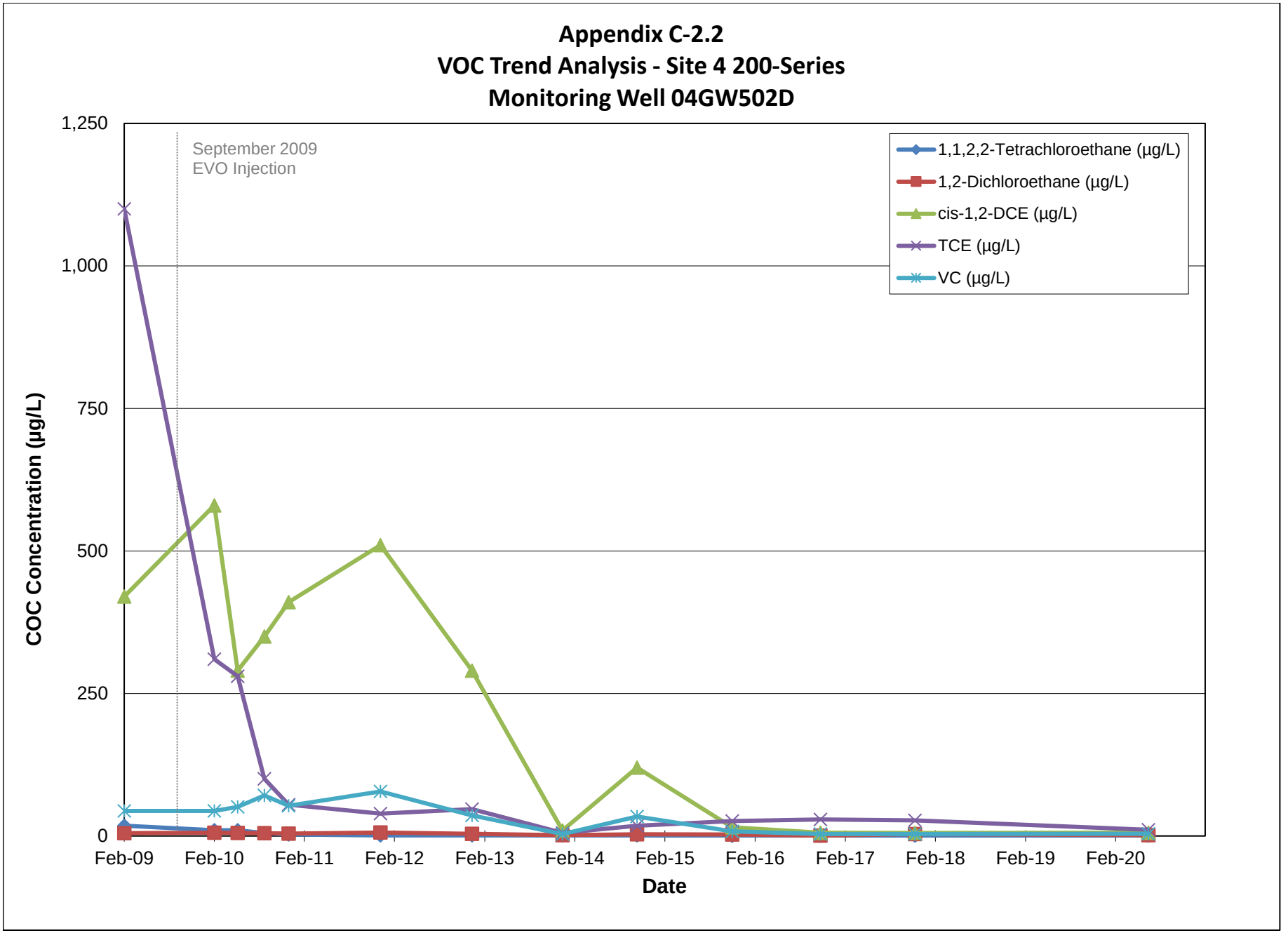


Appendix C-2.1
VOC Trend Analysis - Site 4 Source Area
Monitoring Well 04GW413

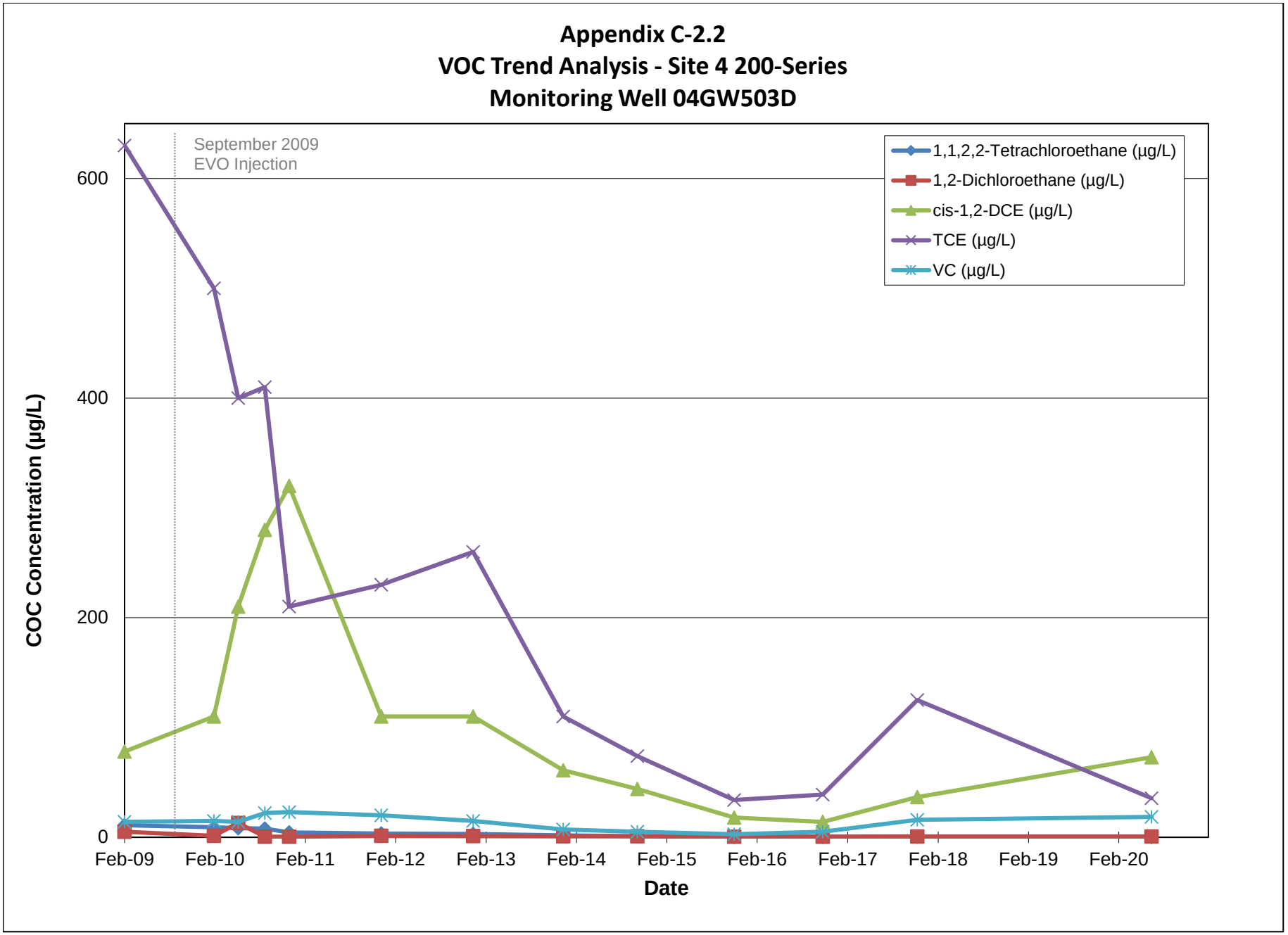


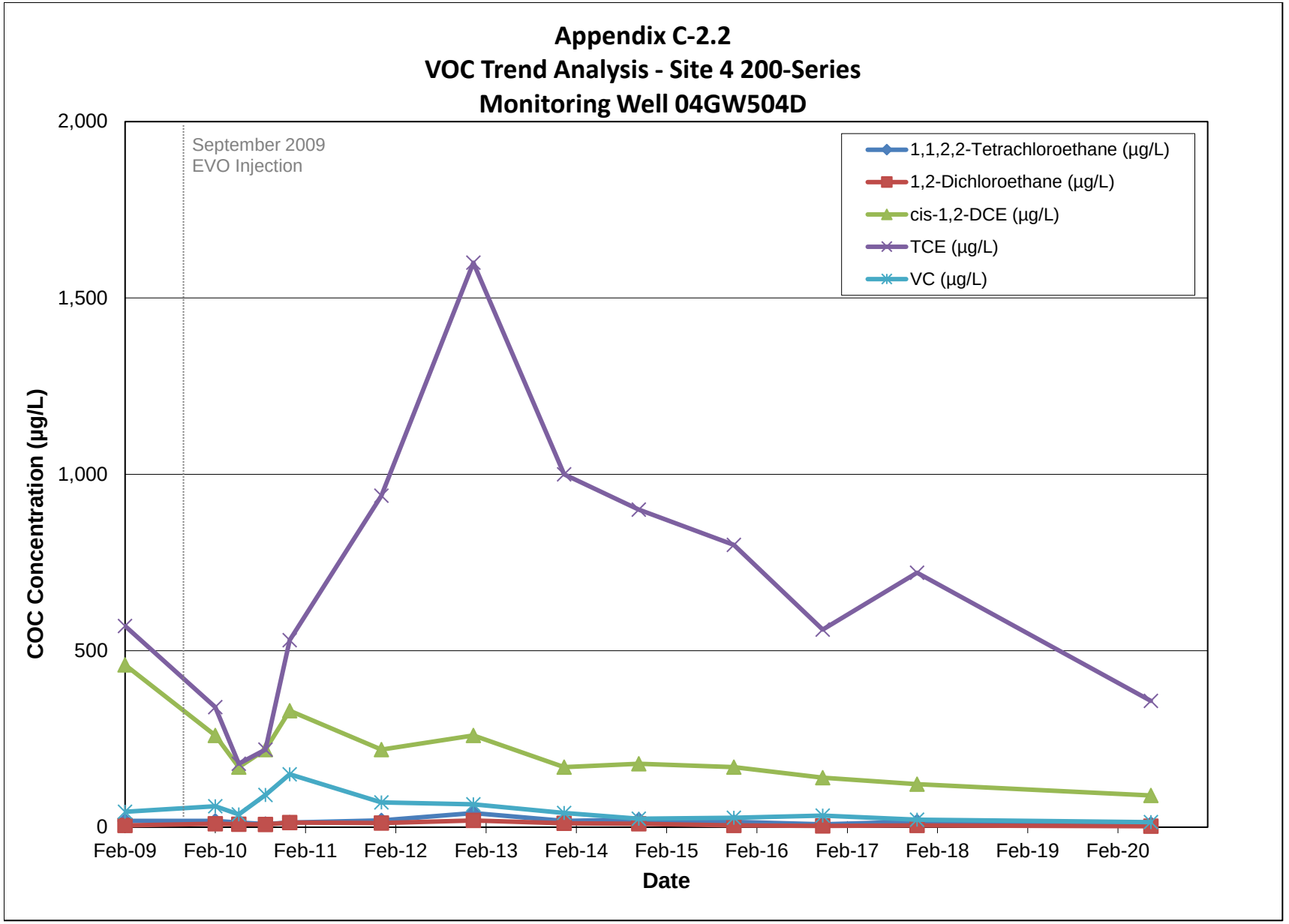
Note: No data is shown for 1,1,2,2-tetrachloroethane for 2013 and 2015 due to a high reporting limit (1,000 µg/L).

Appendix C-2.2
VOC Trend Analysis - Site 4 200-Series
Monitoring Well 04GW502D

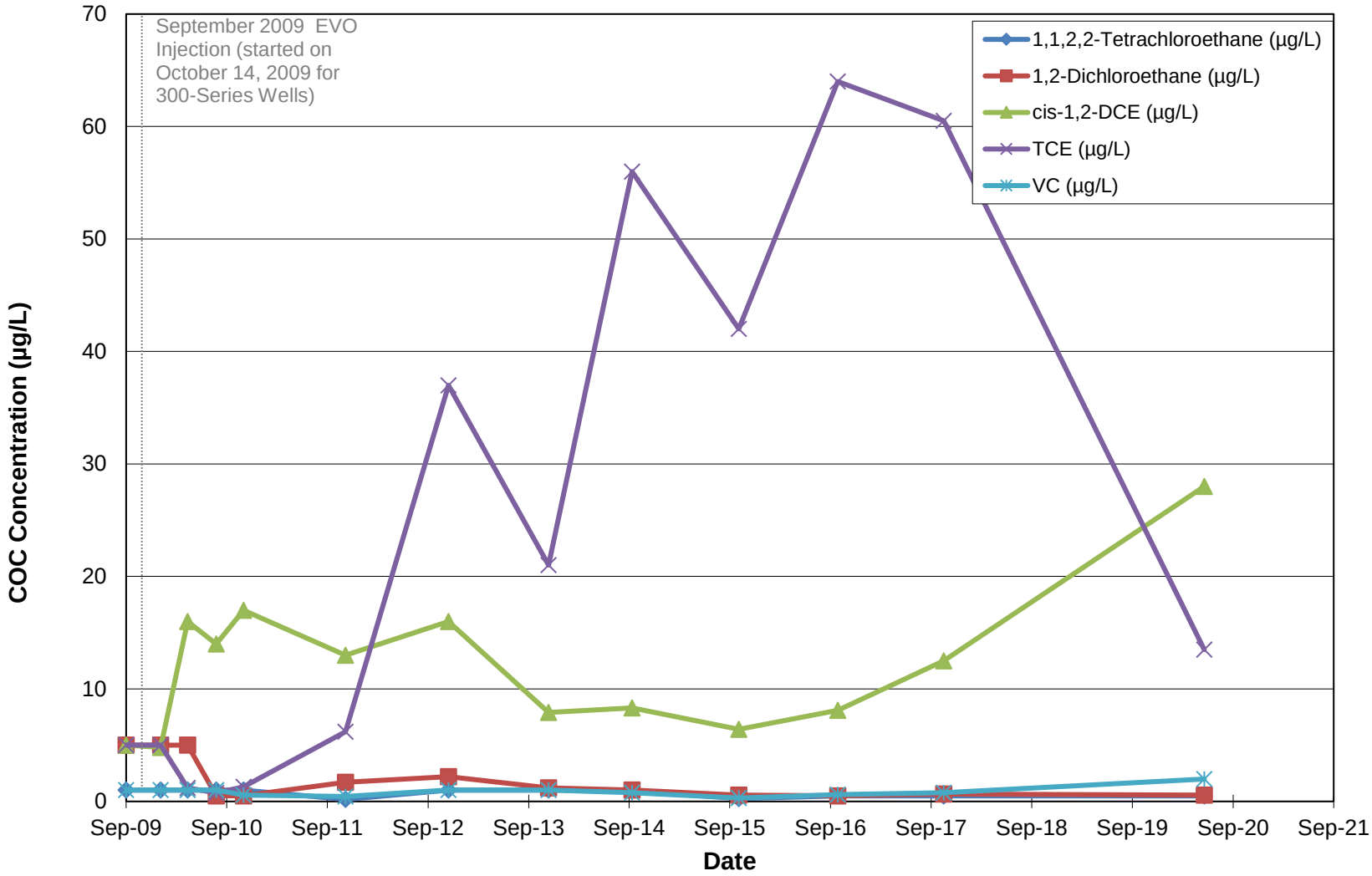


Appendix C-2.2
VOC Trend Analysis - Site 4 200-Series
Monitoring Well 04GW503D

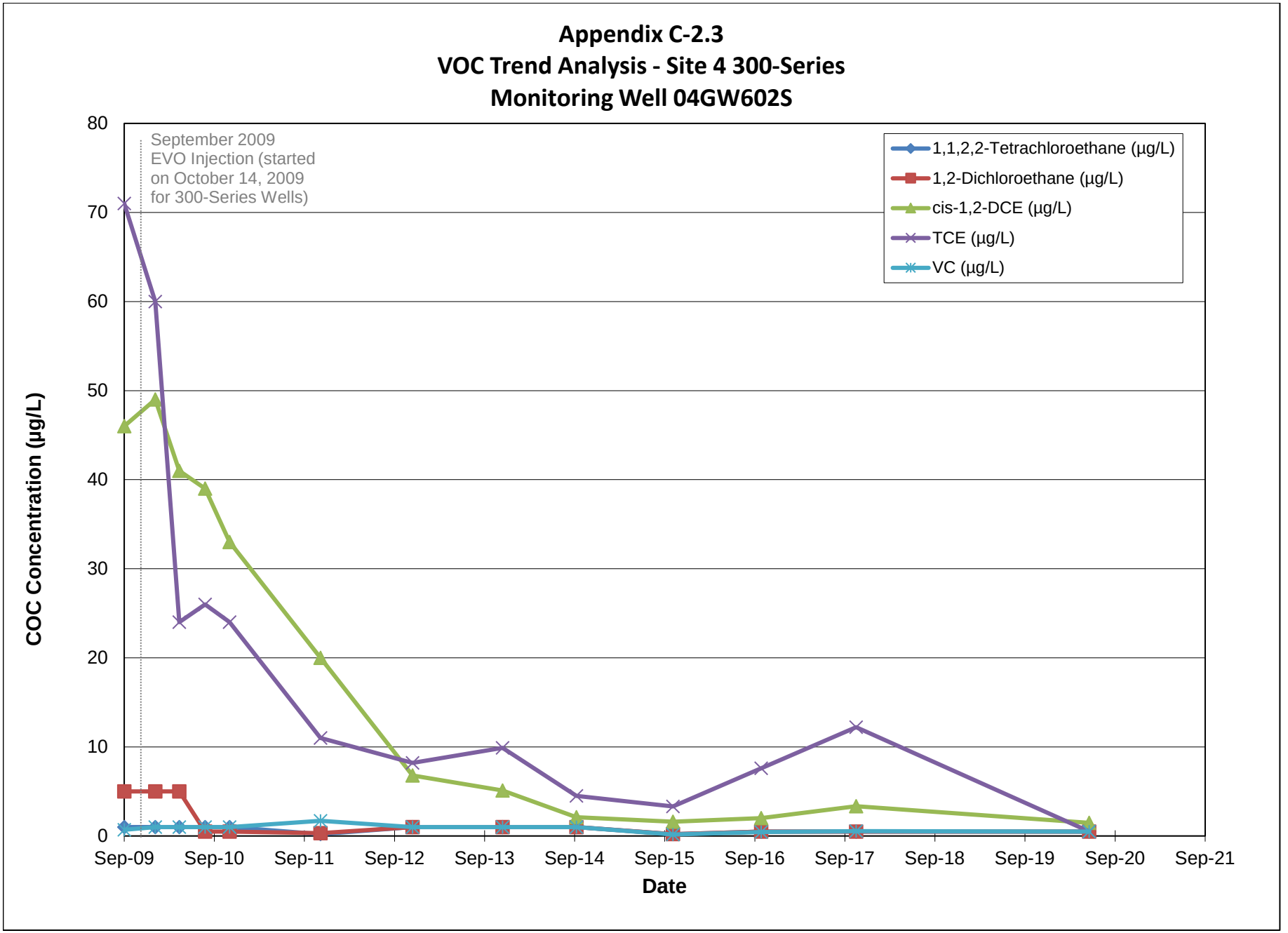



Appendix C-2.2
VOC Trend Analysis - Site 4 200-Series
Monitoring Well 04GW504D
2,000
1,500
1,000
500
0
COC Concentration (µg/L)
September 2009
EVO Injection
1,1,2,2-Tetrachloroethane (µg/L)
1,2-Dichloroethane (µg/L)
cis-1,2-DCE (µg/L)
TCE (µg/L)
VC (µg/L)
Feb-09
Feb-10
Feb-11
Feb-12
Feb-13
Feb-14
Feb-15
Feb-16
Feb-17
Feb-18
Feb-19
Feb-20
Date

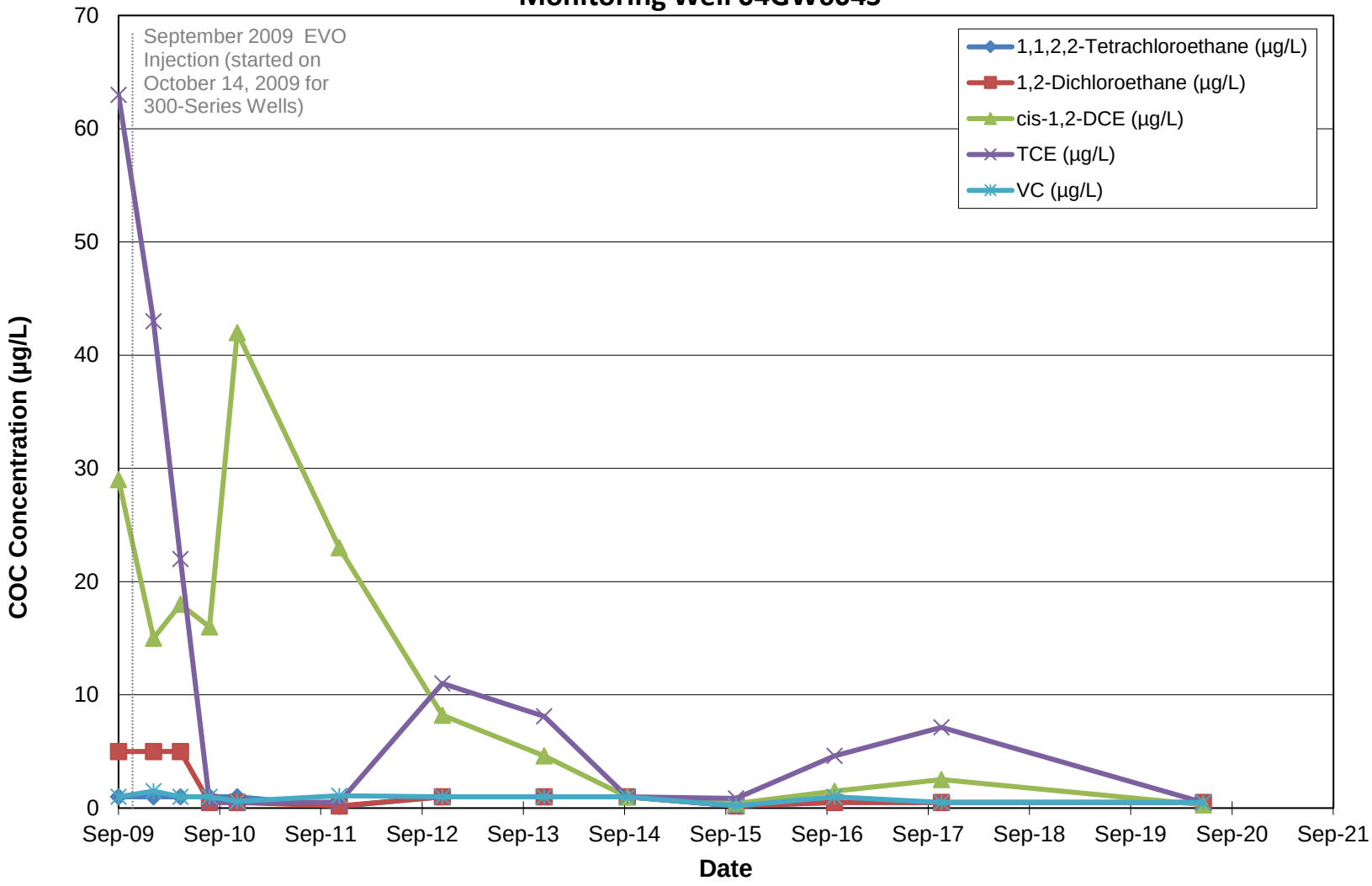
Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW601D



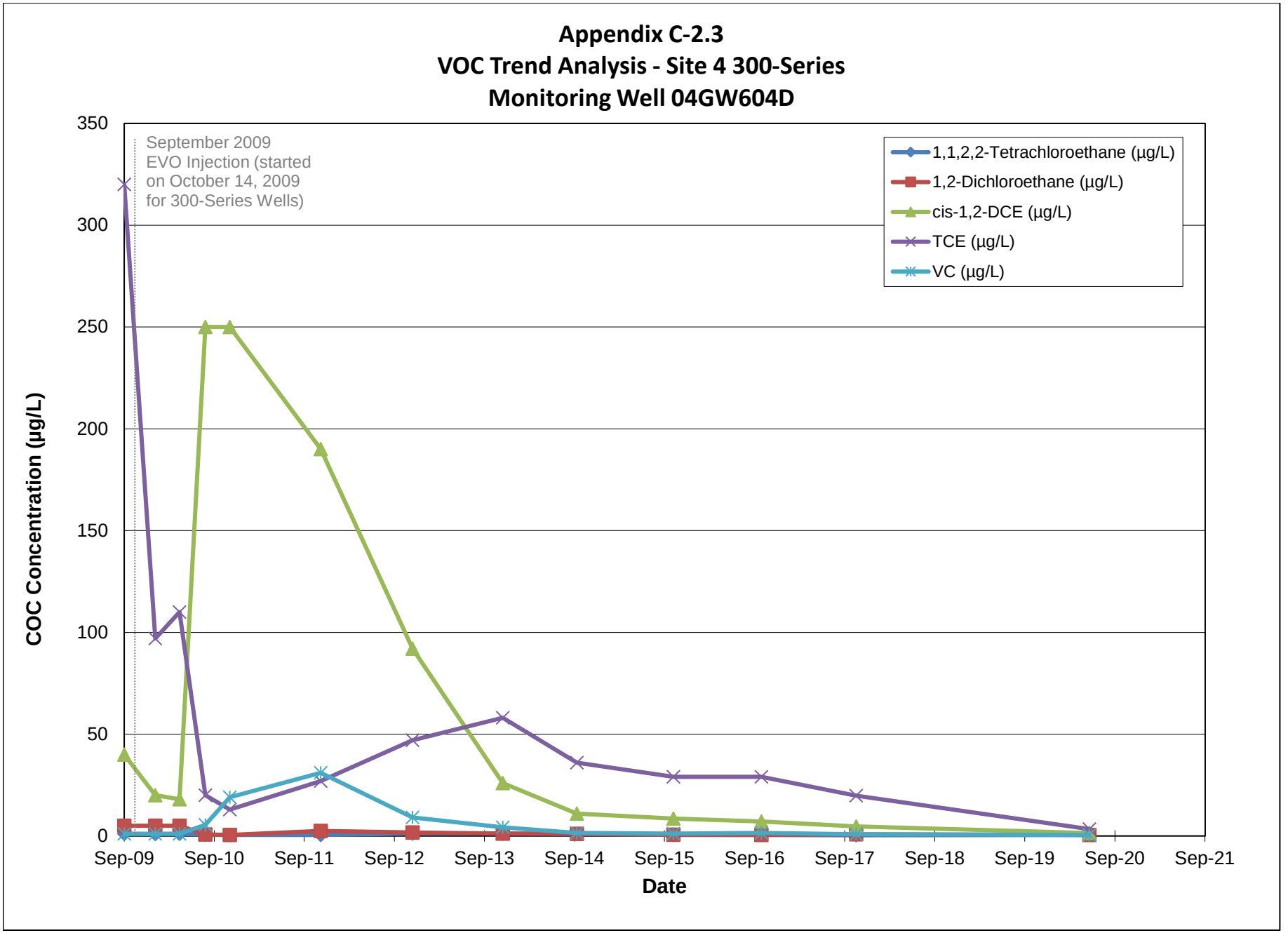
Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW602S



Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW604S

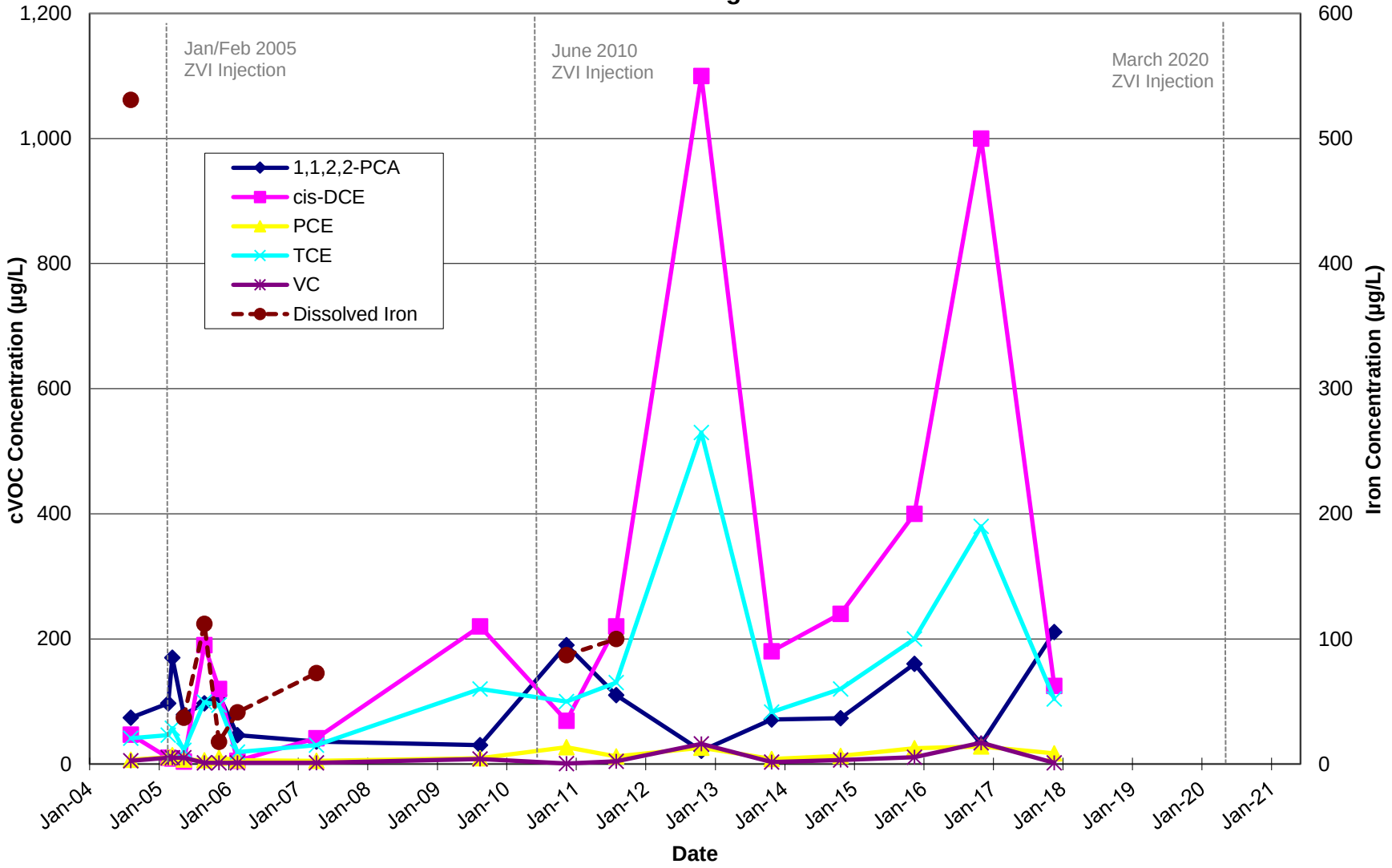


Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW604D

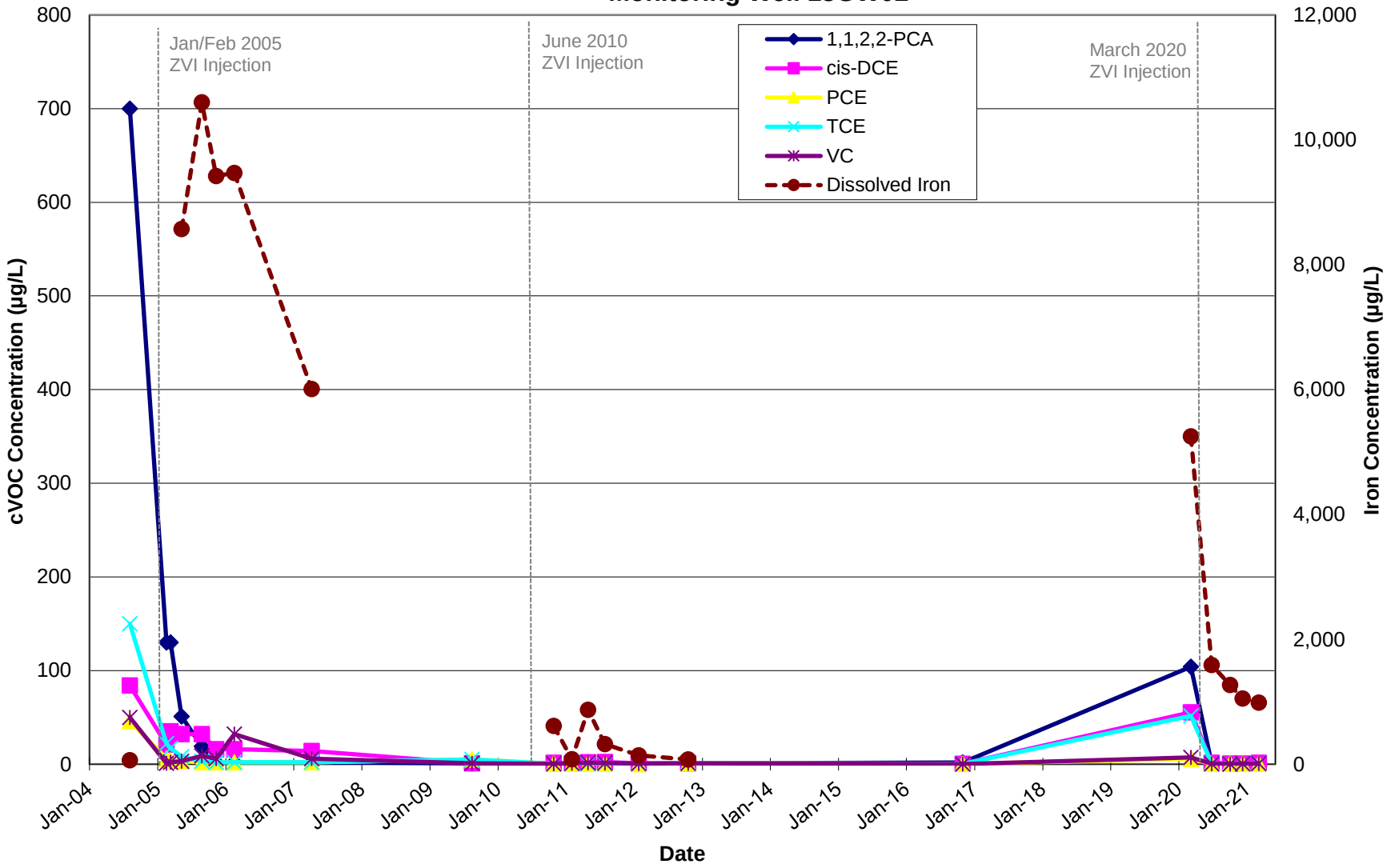


Appendix C-3
Sites 5 and 13 Groundwater Trend Graphs

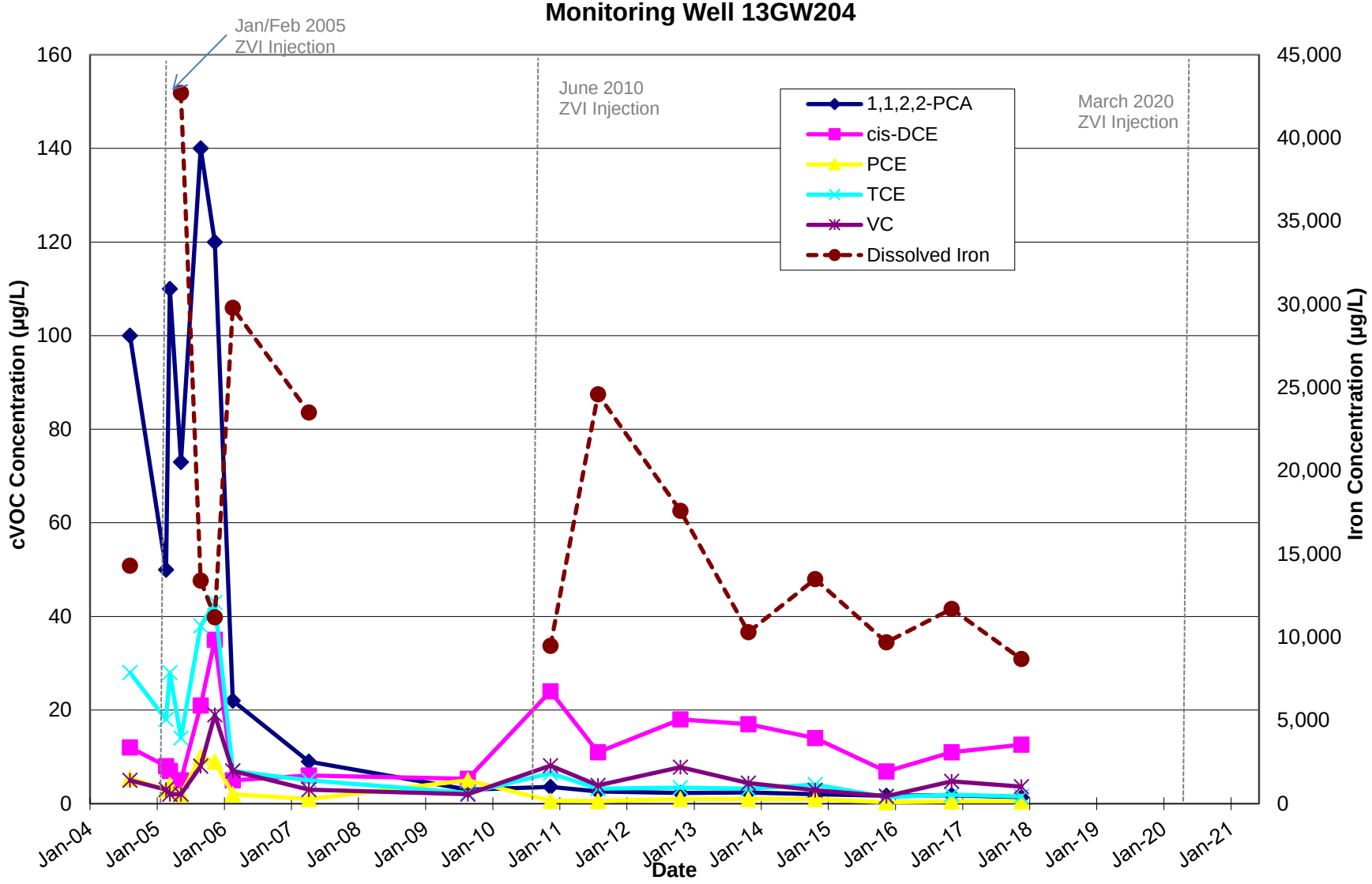
Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW01



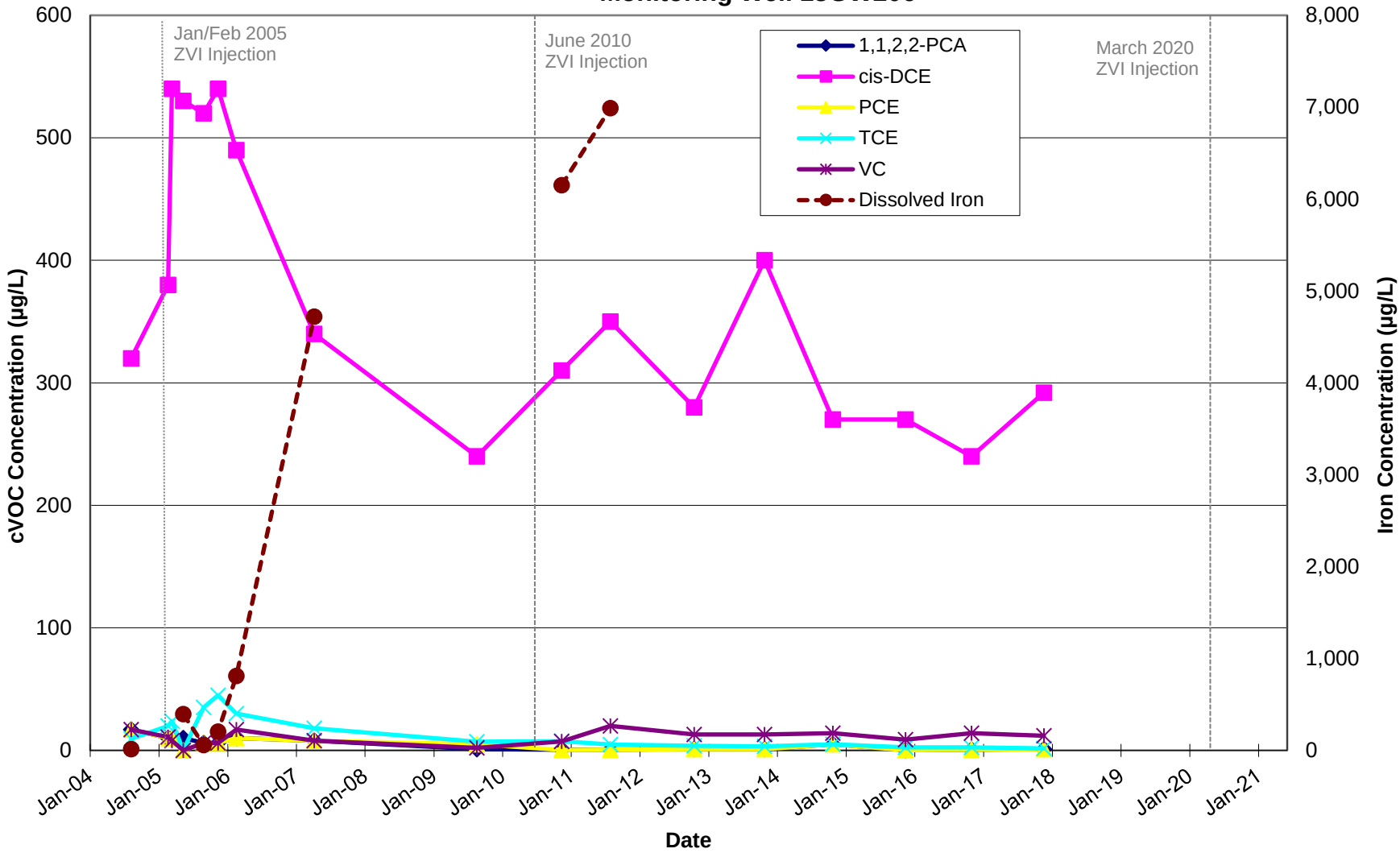
Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW02



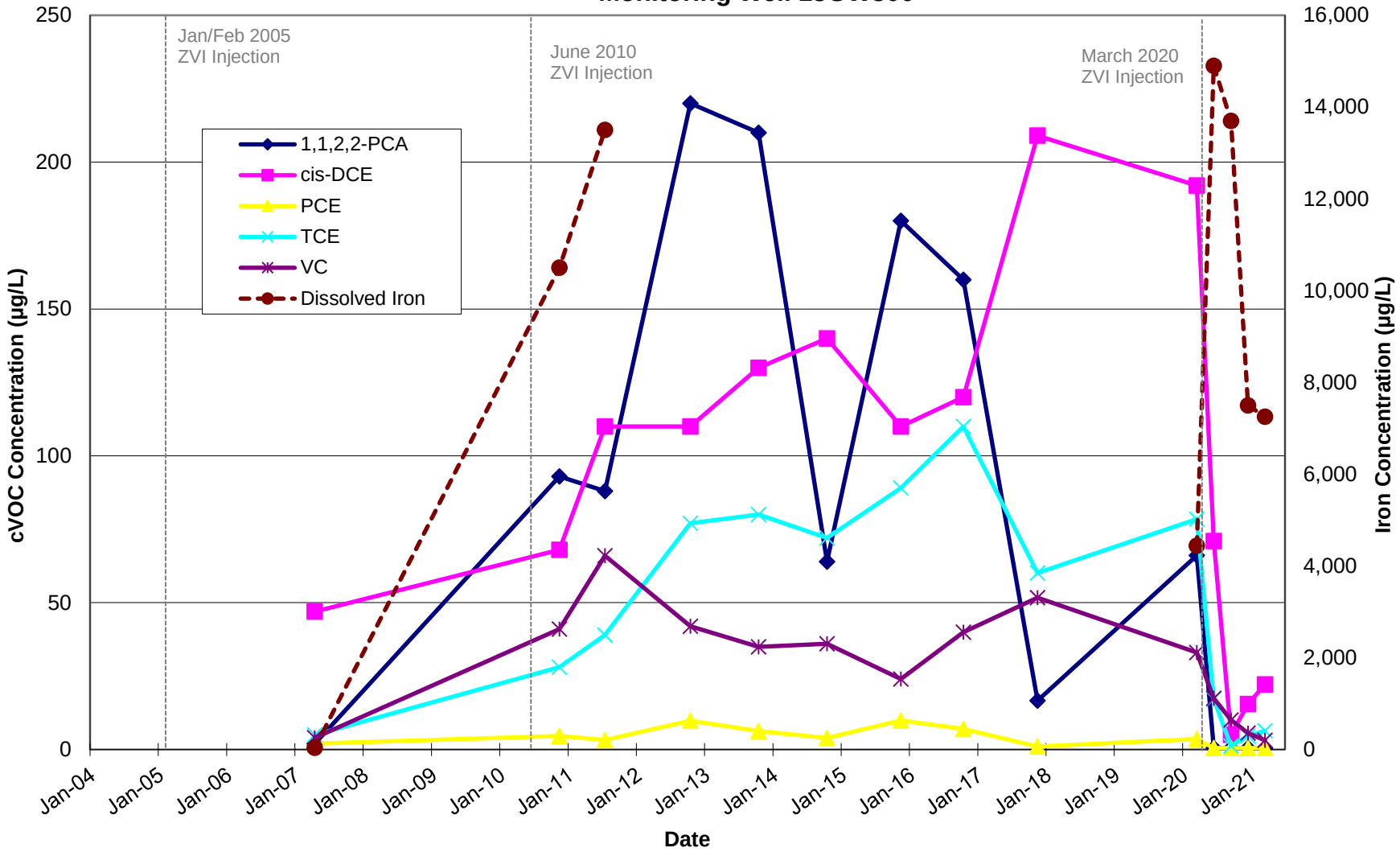
Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW204



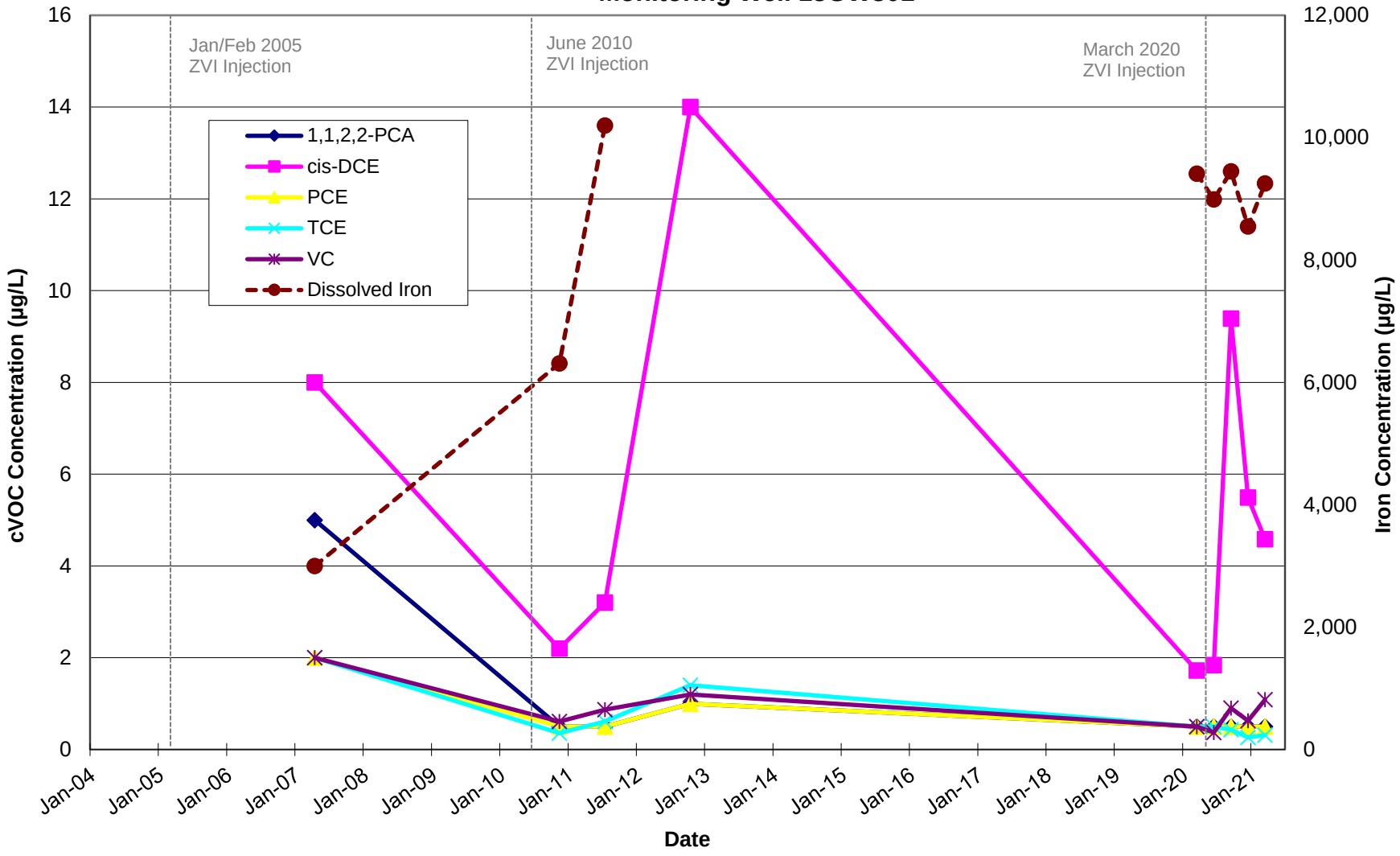
Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW206



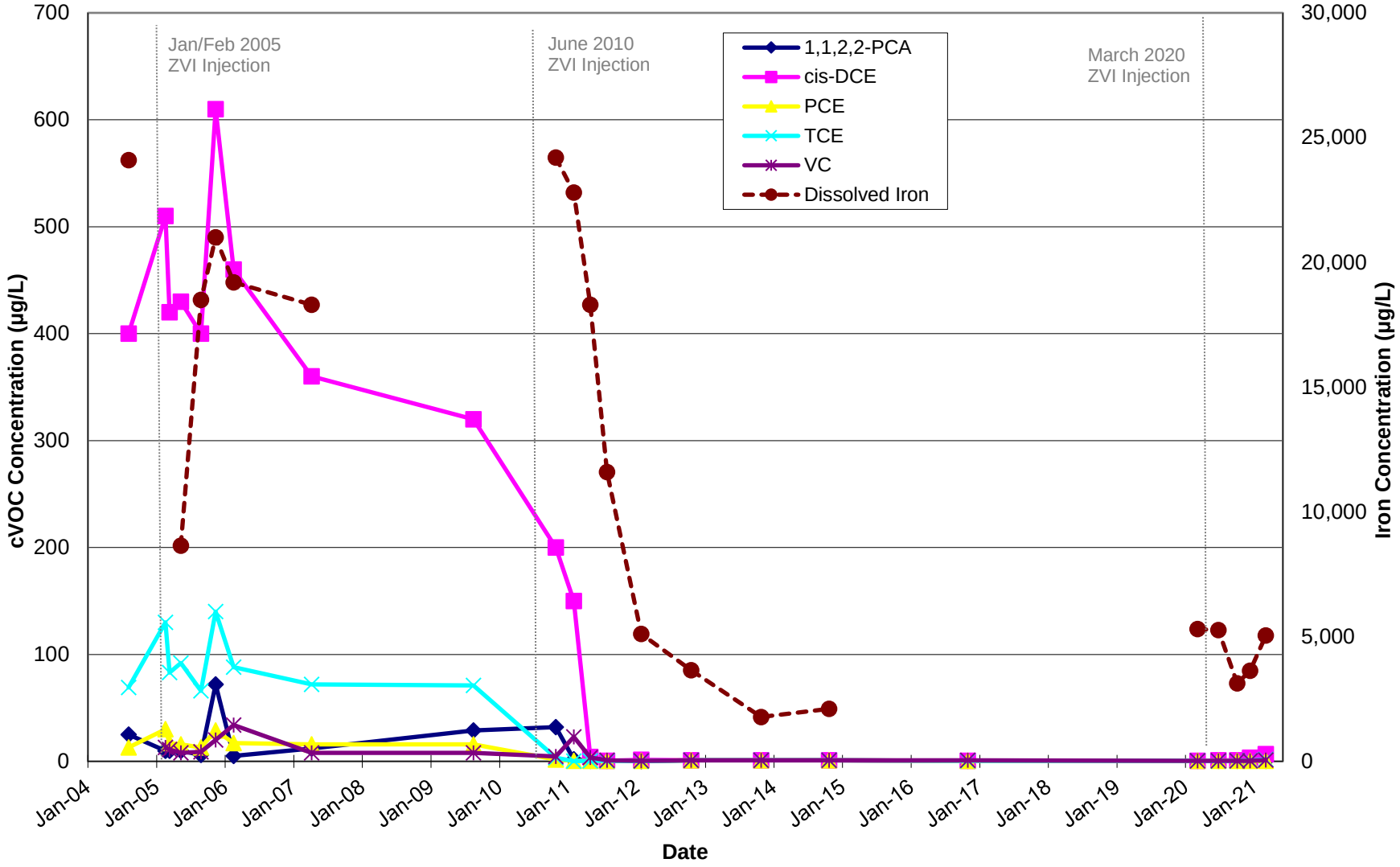
Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW300



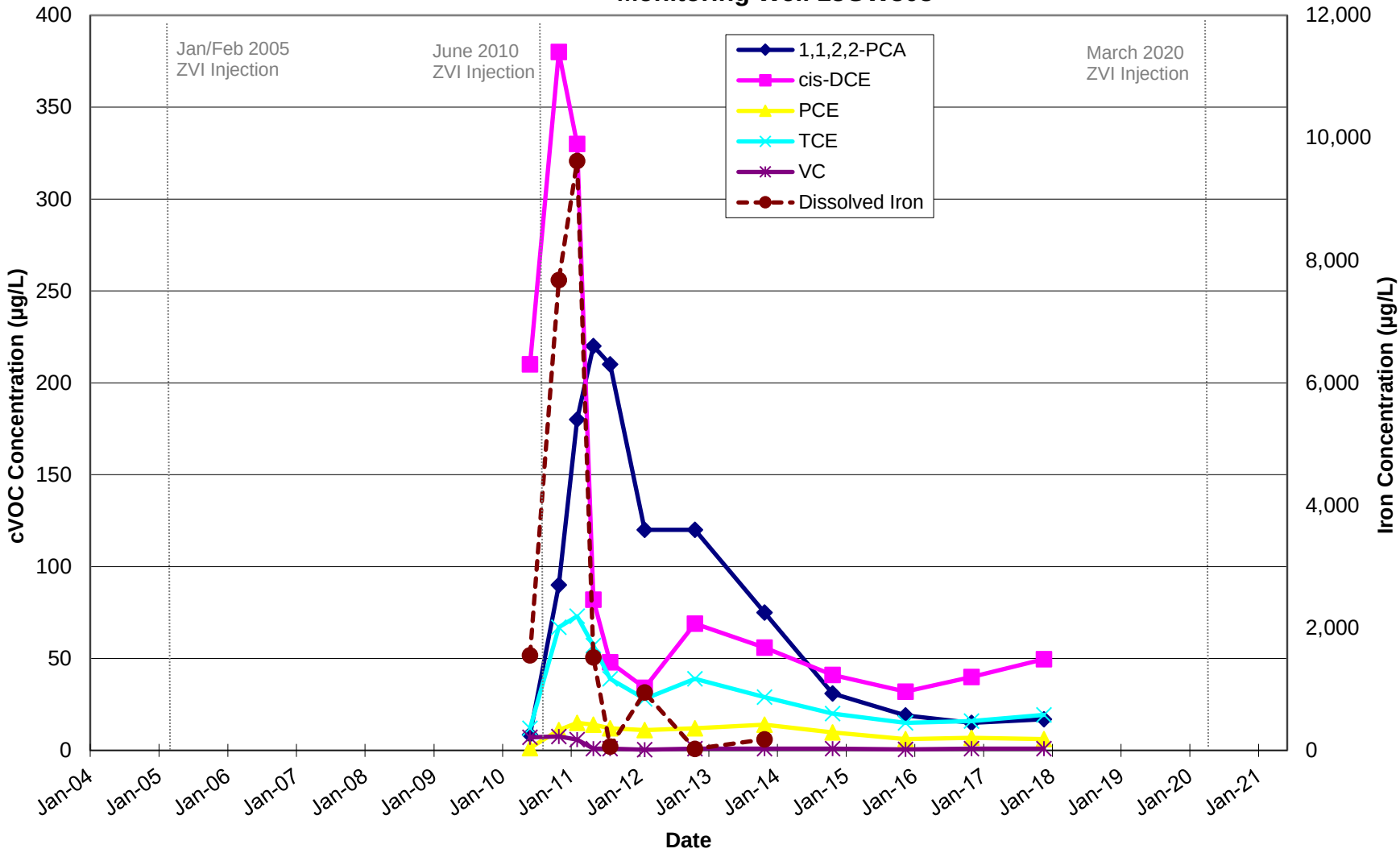
Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW301



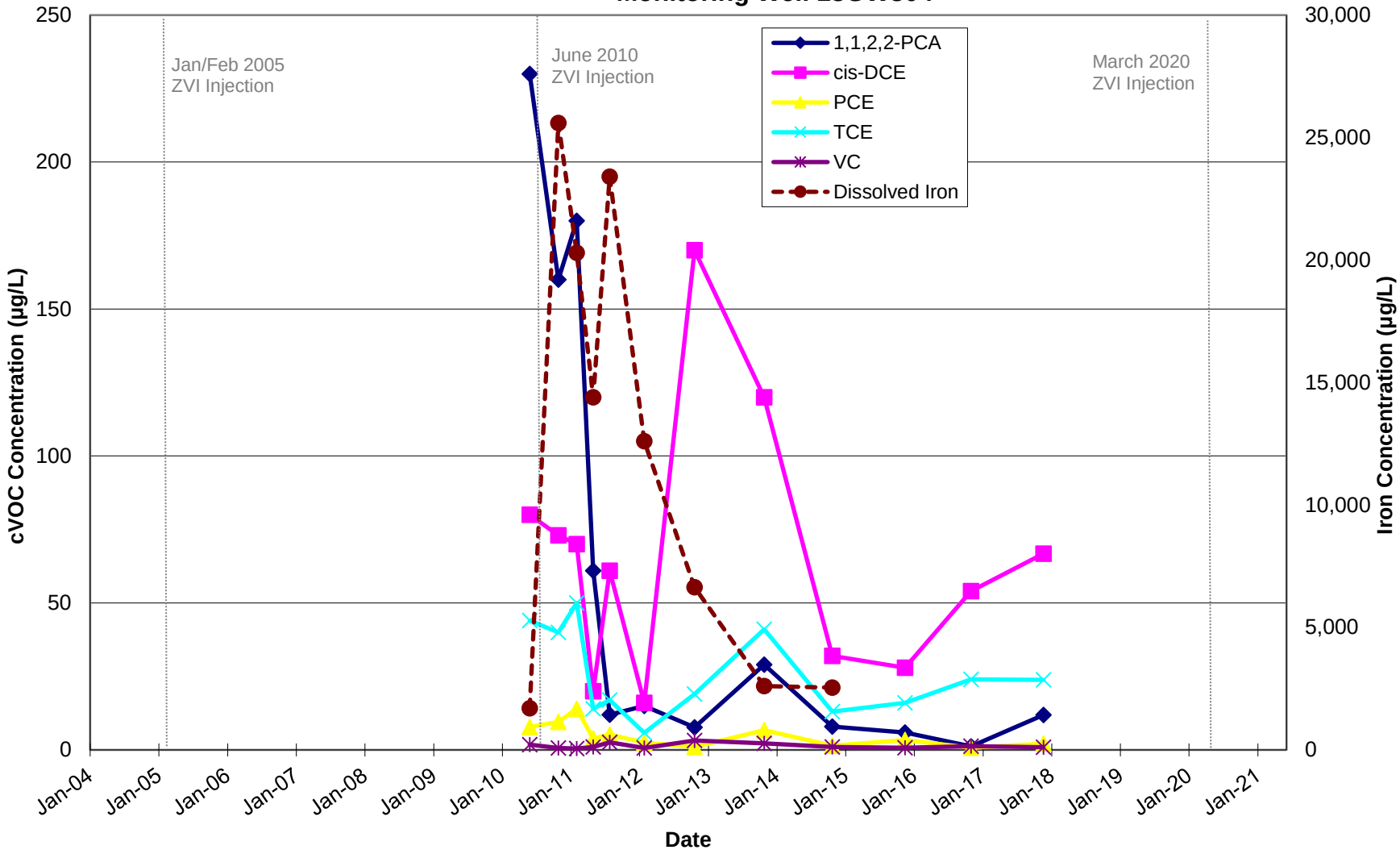
Appendix C-3.2
COC Trend Analysis - Offsite 13
Monitoring Well 13GW202



Appendix C-3.2
COC Trend Analysis - Offsite 13
Monitoring Well 13GW303

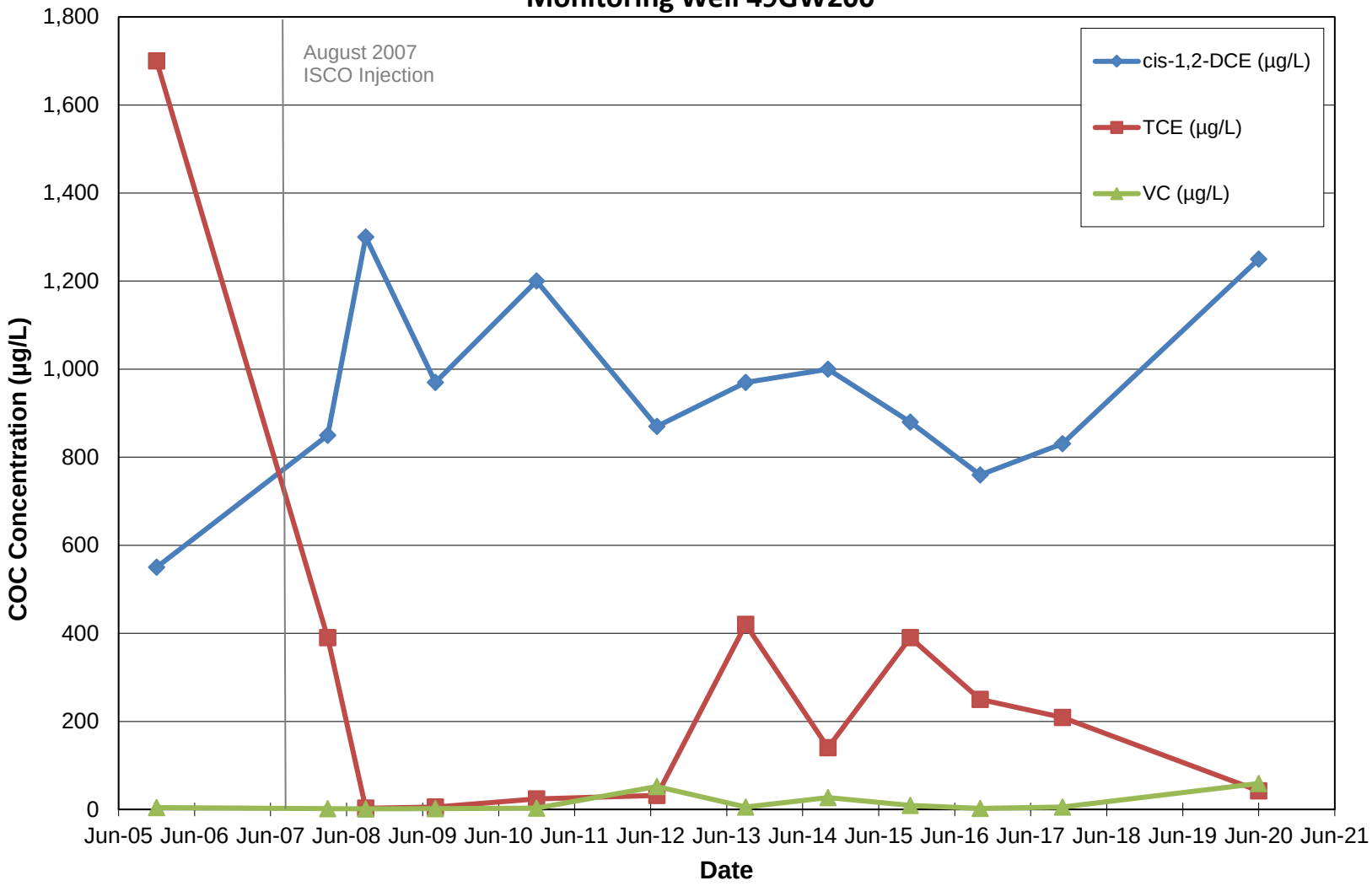


Appendix C-3.2
COC Trend Analysis - Offsite 13
Monitoring Well 13GW304

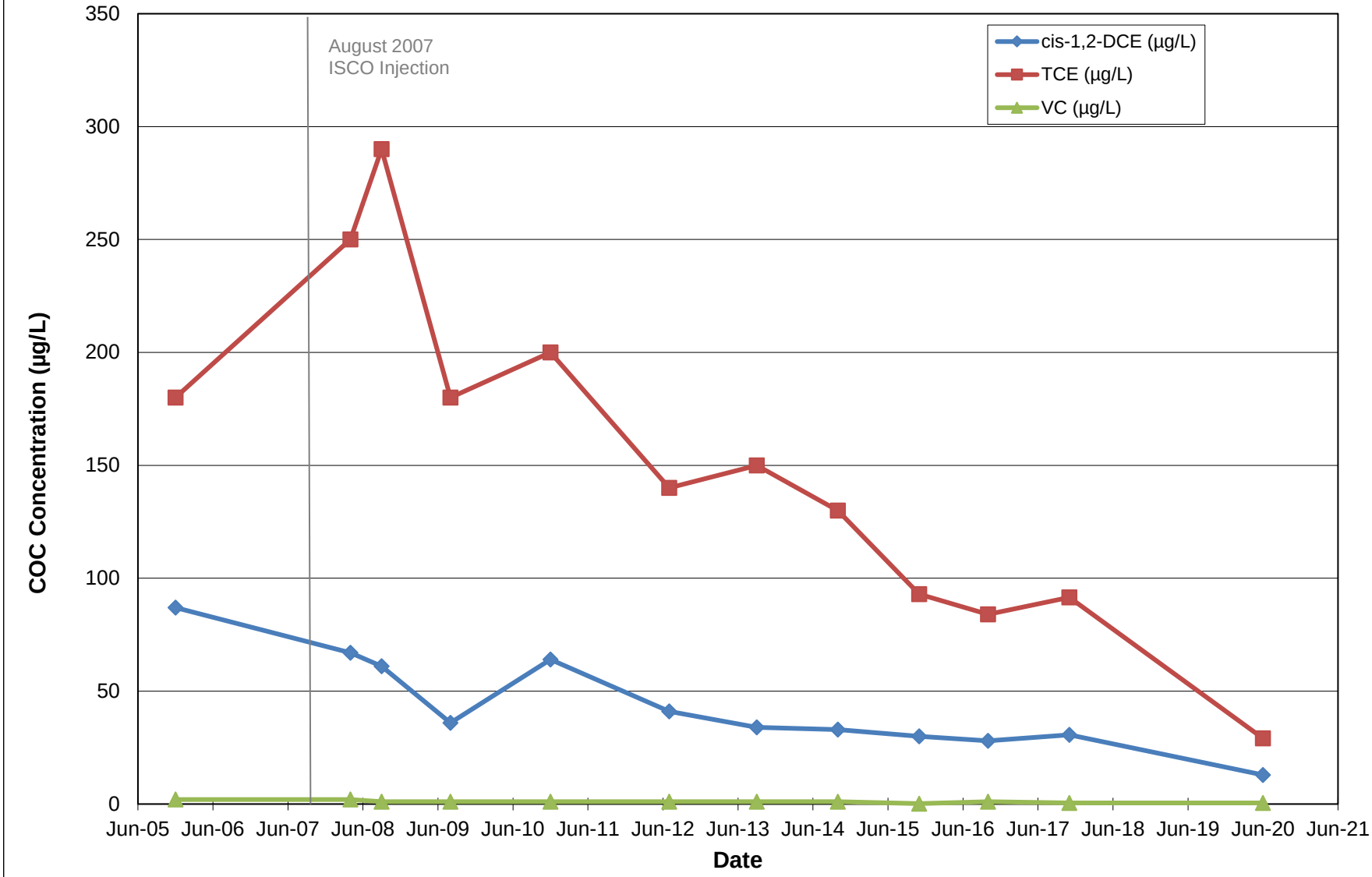


Appendix C-4
Site 49 Groundwater Trend Graphs

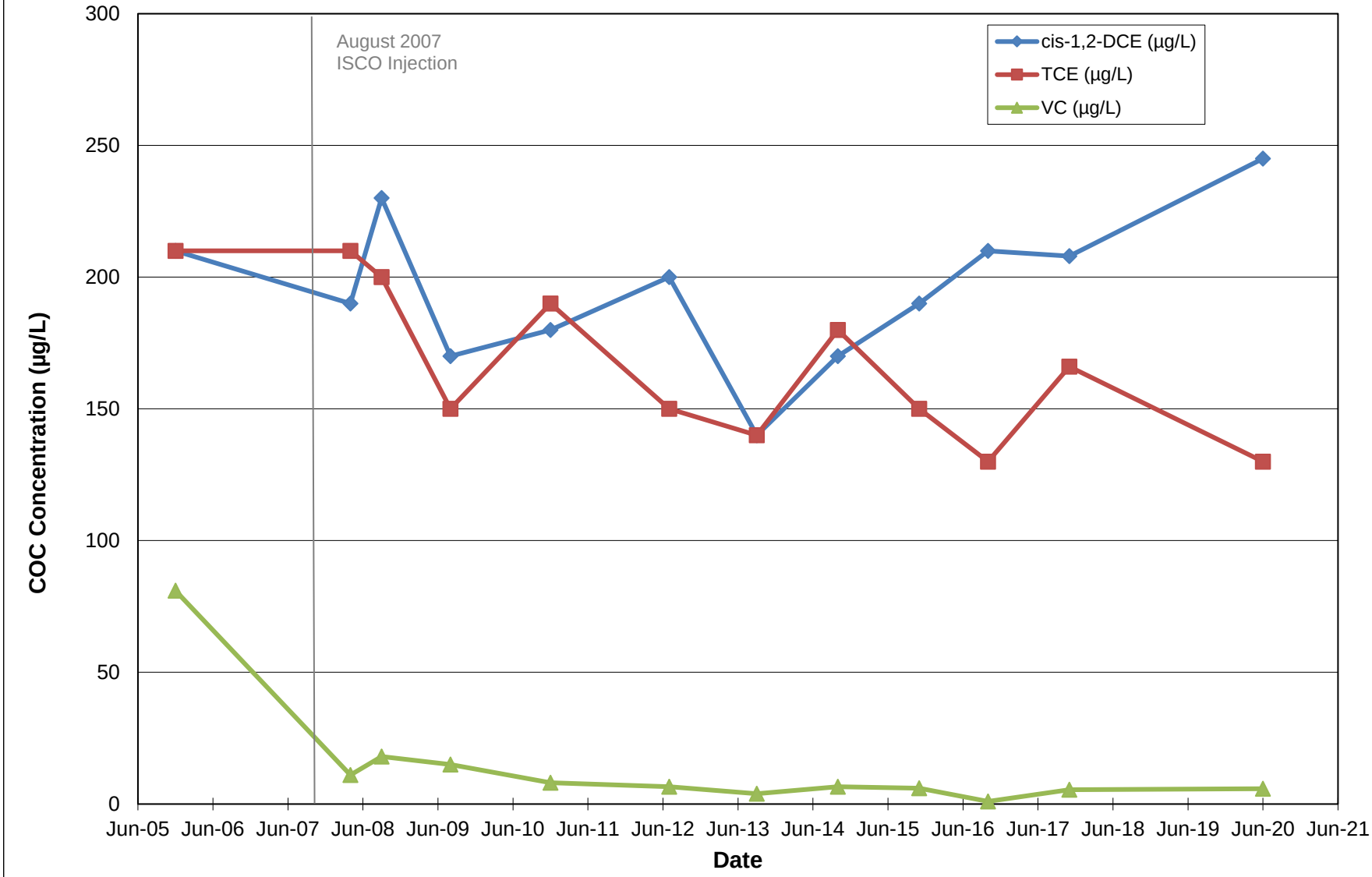
Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW200



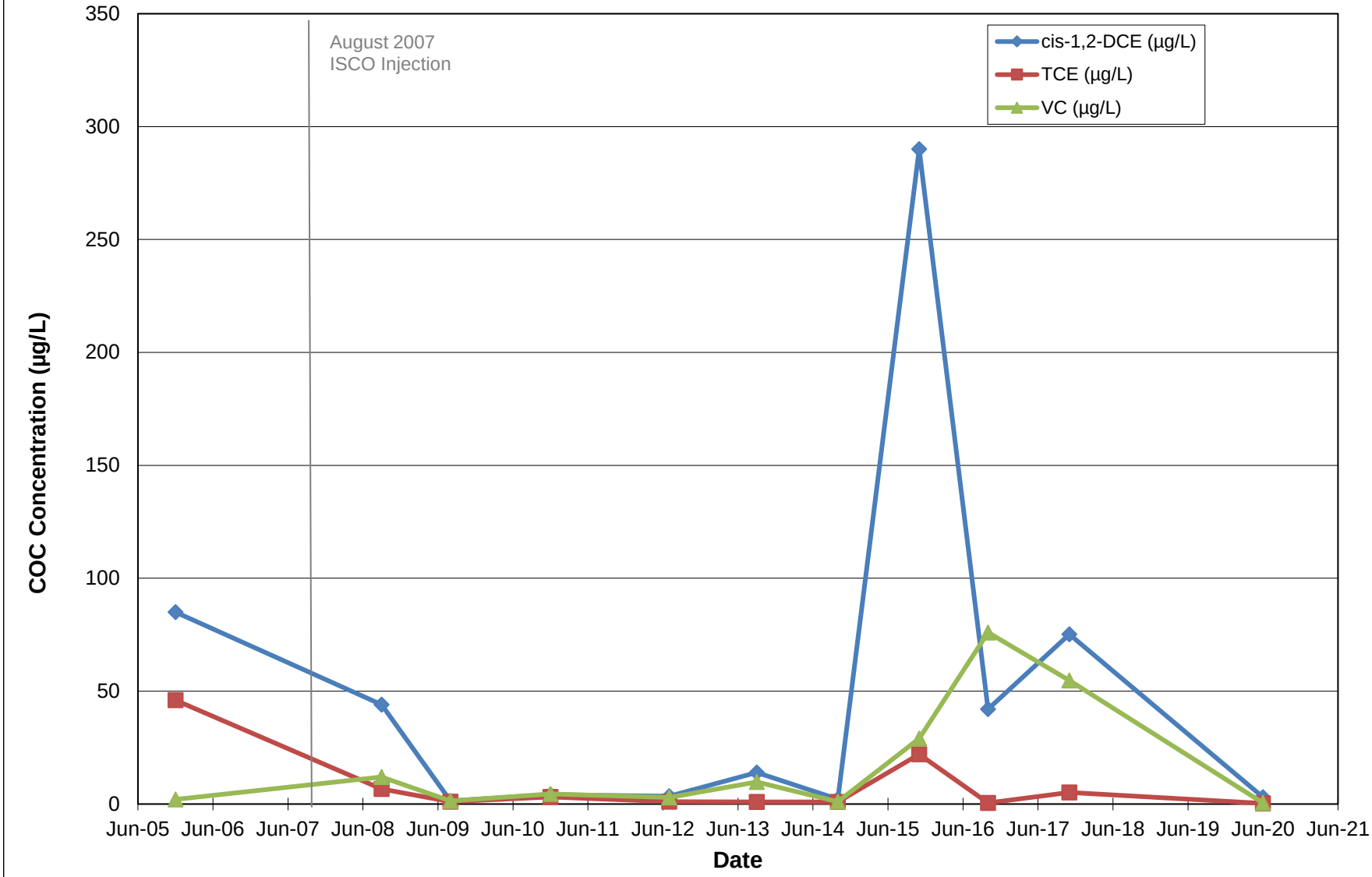
Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW206S



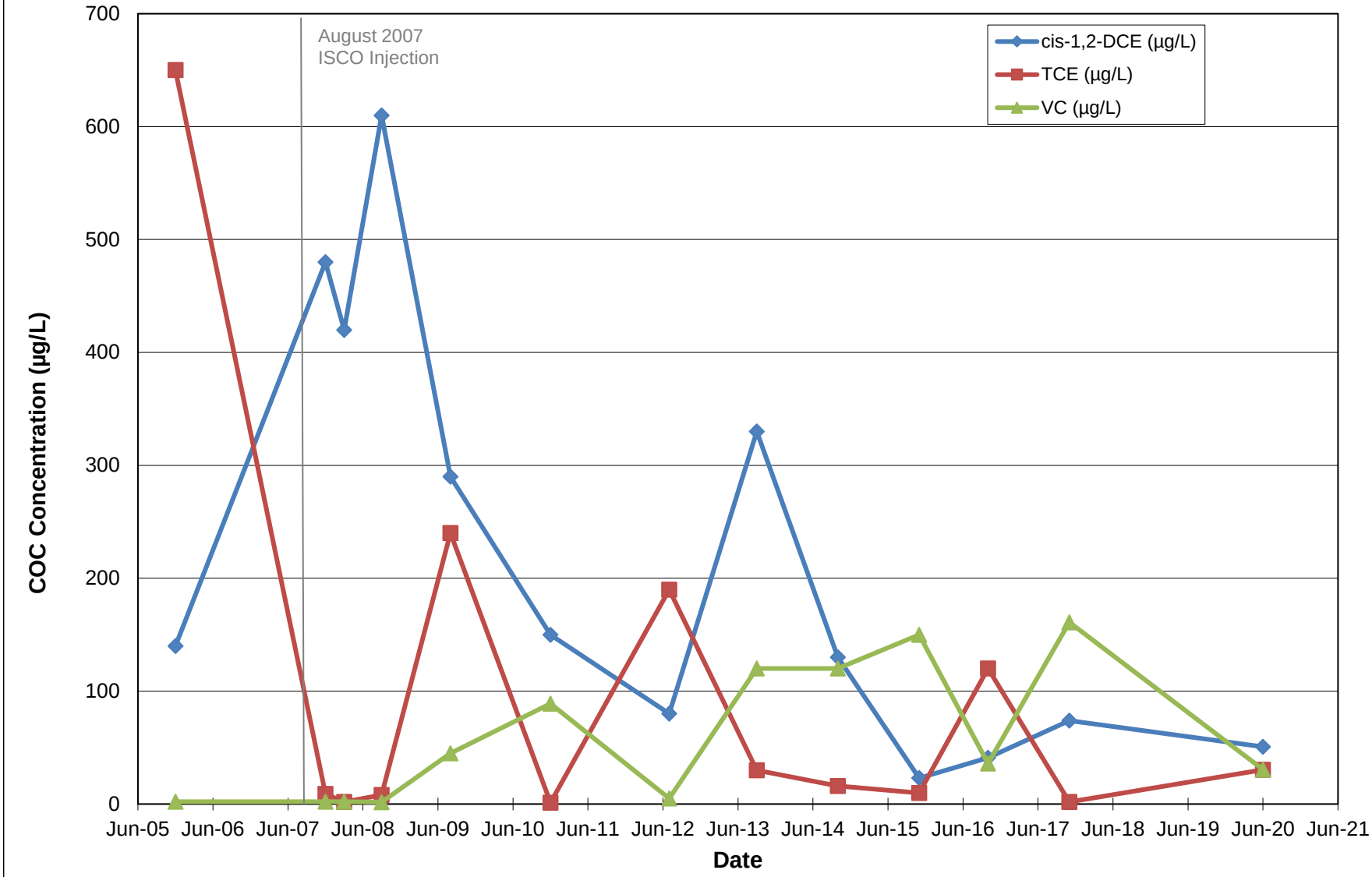
Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW206M



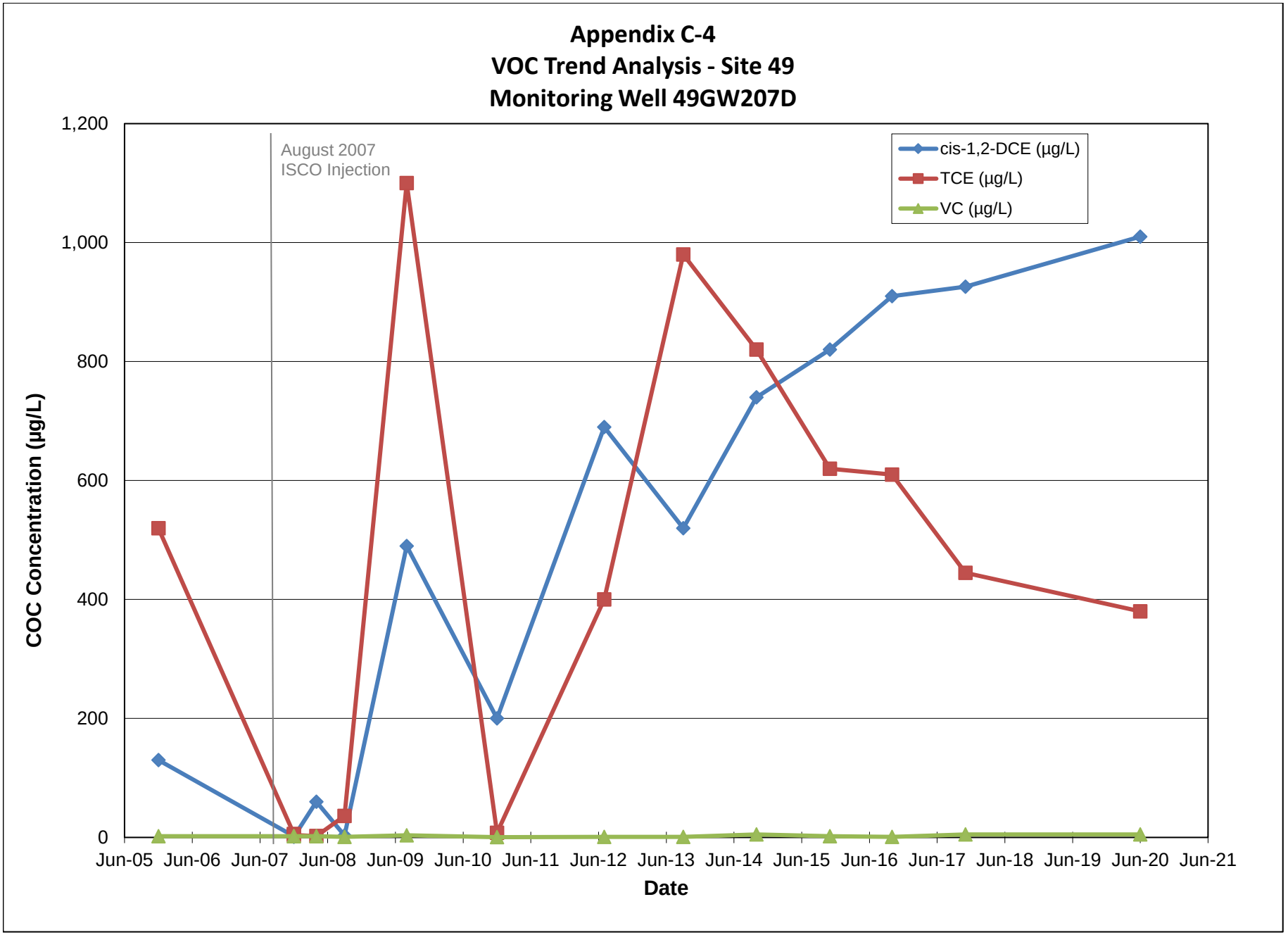
Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW206D



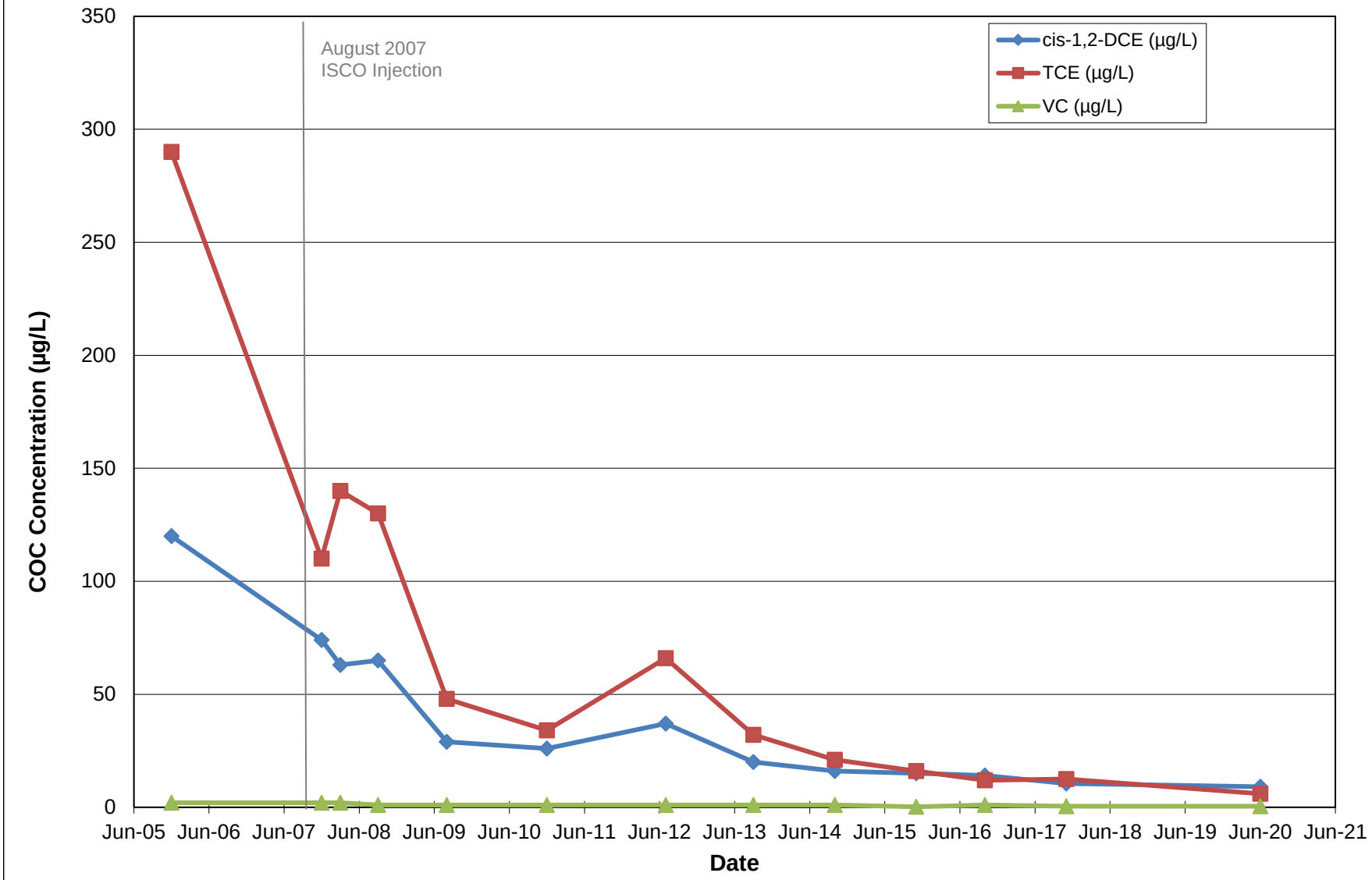
Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW207S



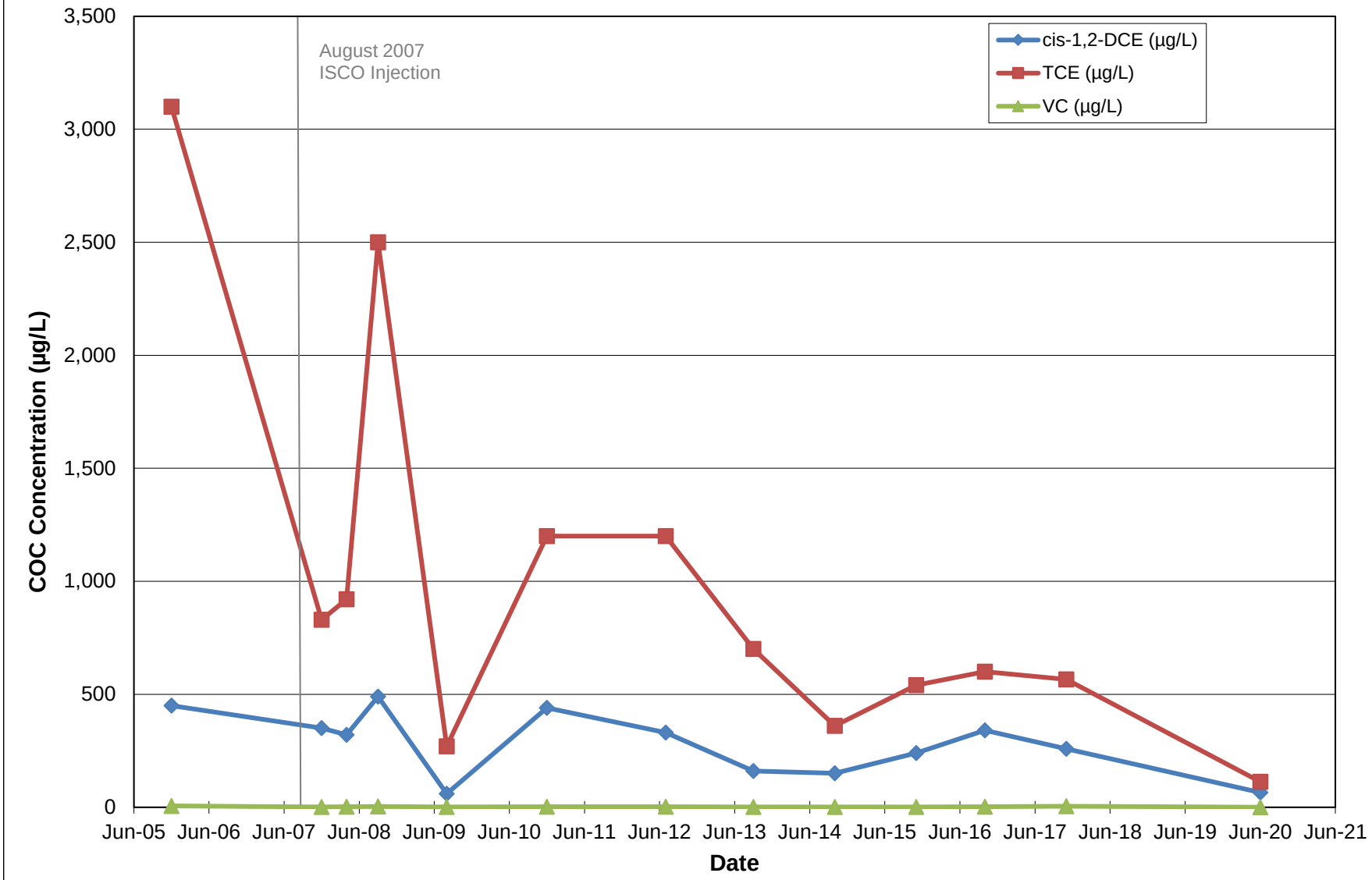
Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW207D



Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW208S

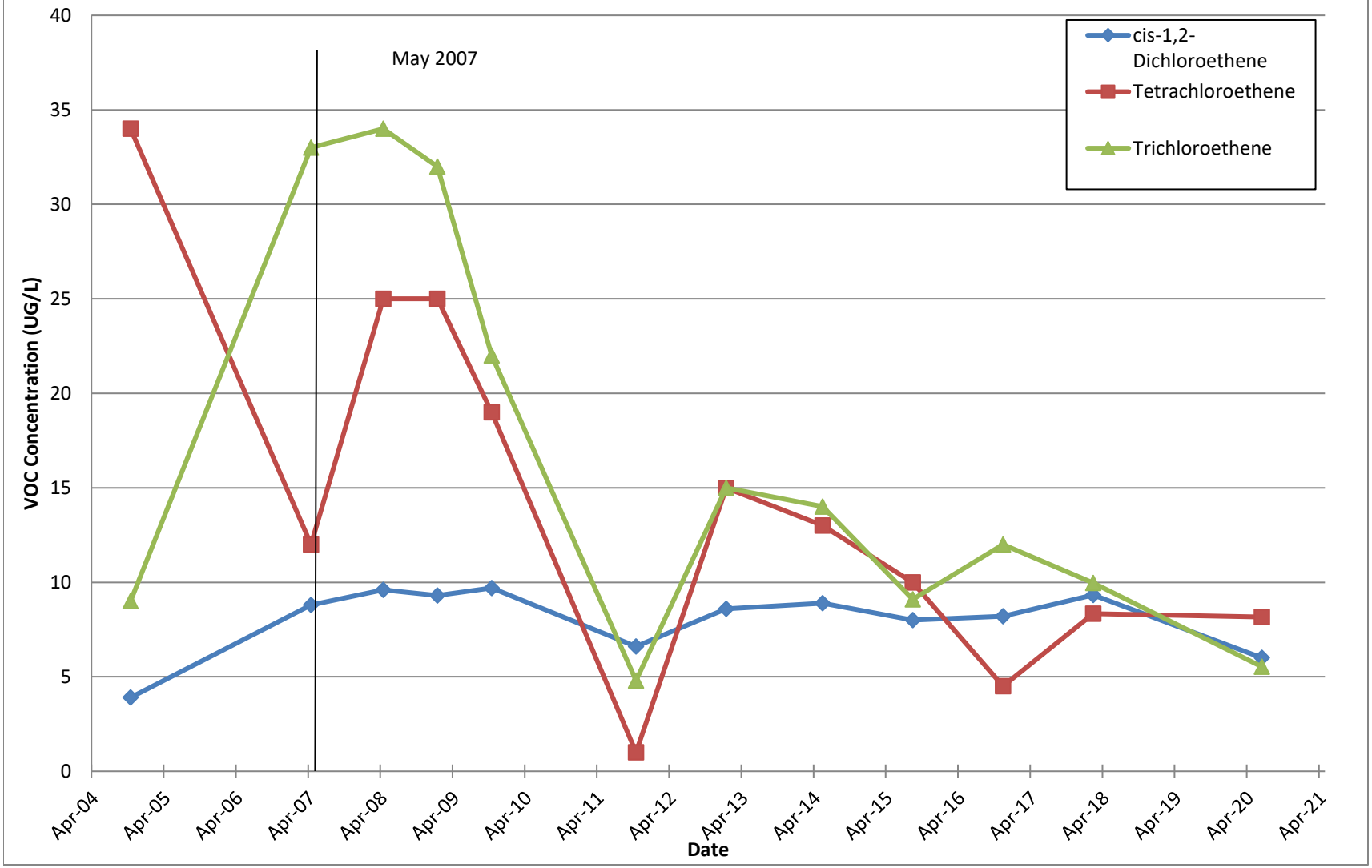


Appendix C-4
VOC Trend Analysis - Site 49
Monitoring Well 49GW208D



Appendix C-5
SWMU 87 Groundwater Trend Graphs

Appendix C-5
COC Trend Analysis - SWMU 87
Monitoring Well 87WP212



Appendix D
Land Use Controls Checklists

NSWC-White Oak
Inspection of Land Use Controls Check List

Site	Media		Inspection Details			LUC Maintained (Y/N/NA)				
	Groundwater	Soil / Waste	Date of Last Inspection (mm/dd/yyyy)	Inspection Required this Period (Y/N)	Inspection Frequency	Groundwater Not Being Used	Fencing / Signs in Place	Monitoring Wells not Disturbed	Remediation System Not Disturbed	Landfill Cover Not Disturbed
Site 4/46	●	N/A	10/24/2016	Y	Annual	Y	N/A	Y	N/A	N/A
Site 9	●	N/A	10/27/2016	Y	Annual	Y	N/A	Y	N/A	N/A
Site 11	●	N/A	11/03/2016	Y	Annual	Y	N/A	Y	N/A	N/A
On-Site 13	●	N/A	10/27/2016	Y	Annual	Y	N/A	Y	N/A	N/A
Off-Site 13	●	N/A	10/27/2016	Y	Annual	Y	N/A	Y	N/A	N/A
On-Site 49	●	N/A	10/31/2016	Y	Annual	Y	N/A	Y	N/A	N/A
Off-Site 49	●	N/A	10/31/2016	Y	Annual	Y	N/A	Y	N/A	N/A
SWMU 87	●	N/A	10/27/2016	Y	Annual	Y	N/A	Y	N/A	N/A
OU 2	●	●	11/02/2016	Y	Annual	Y	Y	Y	N/A	Y

NA - Not Applicable

Description of any deficiencies found: —

Efforts taken to correct deficiencies: —

Inspections conducted by: Emily Cutter Date: 11/03/2016

NSWC-White Oak
Inspection of Land Use Controls Check List

Site	Media		Inspection Details			LUC Maintained (Y/N/NA)				
	Groundwater	Soil / Waste	Date of Last Inspection (mm/dd/yyyy)	Inspection Required this Period (Y/N)	Inspection Frequency	Groundwater Not Being Used	Fencing / Signs in Place	Monitoring Wells not Disturbed	Remediation System Not Disturbed	Landfill Cover Not Disturbed
Site 4	●	N/A	11/20/2017	Y	Annual	Y	N/A	Y	N/A	N/A
Site 11	●	N/A	11/20/2017	Y	Annual	Y	N/A	Y	N/A	N/A

NA - Not Applicable

Description of any deficiencies found: None

Efforts taken to correct deficiencies: None

Inspections conducted by: Caitlin Dronfield Date: 11/20/2017

Caitlin Dronfield Date: 11/20/17

INSPECTION CHECKLIST				
Site Name: Site 9				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Caitlin Dronfield / CH2M Hill	**Date:** 11/20/2017			
Weather and Temperature Conditions: 45 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc):				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?				N/A
b) Are any sign posts loose or otherwise damaged?				N/A
c) Are any signs illegible?				N/A
d) Have any signs been defaced?				N/A
e) Does the information on the signs need to be updated (e.g. phone numbers)?				N/A
f) Any signs missing?				N/A
Access Roads and Swales				
a) Any signs of erosion within drainage swale?				N/A
b) Any obstructions within the flow path?				N/A
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?				N/A
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?		X		
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?		X		
c) Any obstructions within the flow path of Toe Drains?				N/A
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?				N/A
f) Any signs of animal burrows?		X		
g) Any signs of sideslope failure along the road?		X		
h) Any signs of Rip Rap missing from the Toe Drains?				N/A
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site: (Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)
Notes: (Discuss and clarify any comments or observations related to this inspection.)
Deficiencies/Items Requiring Corrections: (Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Printed Name of Inspector	Signature of Inspector/Date

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.
Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	09GW01	09GW02	09GW03	09GW04	09GW05	09GW06	09GW07	09GW100
a) Any signs of erosion or disturbance on the ground around the well?	N	*	*	*	*	*	*	N
b) Any cracks in or other damage to the concrete apron?	N	N/A	N/A	N/A	N/A	N/A	N/A	N
c) Is the well cap missing or showing signs of damage?	N	N/A	N/A	N/A	N/A	N/A	N/A	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Lock rusted open	N/A	N/A	N/A	N/A	N/A	N/A	Y, Lock rusted open
e) Is there rust or other damage on the protective steel casing?	Y, Rusted	N/A	N/A	N/A	N/A	N/A	N/A	Y, Rusted
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rusted	N/A	N/A	N/A	N/A	N/A	N/A	Y, No paint
g) Any signs of tampering or vandalism?	N	N/A	N/A	N/A	N/A	N/A	N/A	N
h) Is the well identification tag missing from the steel casing?	Y, No tag	N/A	N/A	N/A	N/A	N/A	N/A	N

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A = Not Applicable

Monitoring Wells	09GW101	09GW102	09GW103	09GW104	09GW105	09GW106	09GW107	09GW108
a) Any signs of erosion or disturbance on the ground around the well?	N	*	*	N	N	*	*	*
b) Any cracks in or other damage to the concrete apron?	N	N/A	N/A	N	N	N/A	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N	N/A	N/A	N	N	N/A	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Lock rusted open	N/A	N/A	Y, No lock	Y, Lock rusted open	N/A	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	Y, Rusted	N/A	N/A	Y, Rusted	Y, Rusted	N/A	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rusted, No paint	N/A	N/A	Y, Rusted	Y, Rusted	N/A	N/A	N/A
g) Any signs of tampering or vandalism?	N	N/A	N/A	N	N	N/A	N/A	N/A
h) Is the well identification tag missing from the steel casing?	N	N/A	N/A	N	N	N/A	N/A	N/A

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A = Not Applicable

Monitoring Wells	09GW109	09GW110	09GW200D	09GW200S	09GW201D	09GW201S	09GW202	09GW203D
a) Any signs of erosion or disturbance on the ground around the well?	*	*	*	*	N	N	*	*
b) Any cracks in or other damage to the concrete apron?	N/A	N/A	N/A	N/A	N	N	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N/A	N/A	N/A	N/A	N/A, Cannot access	N/A, Cannot access	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	N/A	N/A	N/A	N/A	Y, Lock rusted shut	Y, Lock rusted shut	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	N/A	N/A	N/A	N/A	Y, Rusted	Y, Rusted	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	N/A	N/A	N/A	N/A	Y, Rusted	Y, Rusted	N/A	N/A
g) Any signs of tampering or vandalism?	N/A	N/A	N/A	N/A	N	N	N/A	N/A
h) Is the well identification tag missing from the steel casing?	N/A	N/A	N/A	N/A	N	N	N/A	N/A

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A = Not Applicable

Monitoring Wells	09GW204	09GW205	09GW206	09GW207	09GW208	09GW209	09GW210	09GW211
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N	N	Y, Cracked in half	N
c) Is the well cap missing or showing signs of damage?	N	N	N	N	N	N/A, case top inaccessible due to brambles	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Lock rusted open	Y, No lock	Y, Lock rusted open	Y, Lock rusted open	Y, Lock rusted open	Y, No lock	Y, No lock	Y, Lock rusted open
e) Is there rust or other damage on the protective steel casing?	Y	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, Slight rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, 3 Bollards are down	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, Slight rust	Y, No Bollards	Y, Slight rust
g) Any signs of tampering or vandalism?	N	N	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	Y, No tag	Y, No tag	Y, No tag	Y, No tag	Y, No tag	Y, No tag	Y, No tag	Y, No tag

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A = Not Applicable

Monitoring Wells	09GW212	09GW213	09GW214	09GW215	09GW57D	09GW57S	09GW58	09GW59
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	N	N	*	*
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N	N	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N	N	N	Y, Case doesn't cover cap	N	N	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, No lock	Y, No lock	Y, No lock	Y, No lock	Y, Lock rusted shut, hinges broken	Y, Lock rusted shut, hinges broken	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	Y, Slight rust	Y, Rusted	Y, Slight rust	Y, Slight rust	Y	Y	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Slight rust	Y, Rusted	Y, Slight Rust, 2 bollards down	Y, No bollards	Y, 2 bollards are steel spikes	Y, 2 bollards are steel spikes	N/A	N/A
g) Any signs of tampering or vandalism?	N	N	N	N	N	N	N/A	N/A
h) Is the well identification tag missing from the steel casing?	Y, No tag	Y, No tag	Y, No tag	Y, No tag	N	N	N/A	N/A

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A = Not Applicable

Monitoring Wells	09GW74	09GW75	09GW83
a) Any signs of erosion or disturbance on the ground around the well?	*	*	*
b) Any cracks in or other damage to the concrete apron?	N/A	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N/A	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	N/A	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	N/A	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	N/A	N/A	N/A
g) Any signs of tampering or vandalism?	N/A	N/A	N/A
h) Is the well identification tag missing from the steel casing?	N/A	N/A	N/A

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A = Not Applicable

INSPECTION CHECKLIST				
Site Name: Site 13				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Caitlin Dronfield / CH2M Hill	**Date:** 11/20/2017			
Weather and Temperature Conditions: 38 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc):				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?				N/A
b) Are any sign posts loose or otherwise damaged?				N/A
c) Are any signs illegible?				N/A
d) Have any signs been defaced?				N/A
e) Does the information on the signs need to be updated (e.g. phone numbers)?				N/A
f) Any signs missing?				N/A
Access Roads and Swales				
a) Any signs of erosion within drainage swale?				N/A
b) Any obstructions within the flow path?				N/A
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?				N/A
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?		X		
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?		X		
c) Any obstructions within the flow path of Toe Drains?				N/A
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?				N/A
f) Any signs of animal burrows?		X		
g) Any signs of sideslope failure along the road?		X		
h) Any signs of Rip Rap missing from the Toe Drains?				N/A
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site: (Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)
Notes: (Discuss and clarify any comments or observations related to this inspection.)
Deficiencies/Items Requiring Corrections: (Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Printed Name of Inspector	Signature of Inspector/Date

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.
Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	05GW01	05GW02	13GW01	13GW02	13GW03	13GW04	13GW200	13GW201	13GW202
a) Any signs of erosion or disturbance on the ground around the well?	N	*	N	N	*	N	N	*	N
b) Any cracks in or other damage to the concrete apron?	Y, Cracked	N/A	N	N	N/A	N	N	N/A	N
c) Is the well cap missing or showing signs of damage?	N	N/A	Y, No plug	N	N/A	N	N	N/A	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, No lock	N/A	Y, No lock	Y, No lock	N/A	Y, No lock	Y, No lock	N/A	Y, No lock
e) Is there rust or other damage on the protective steel casing?	Y, Slight rust	N/A	Y, Slight rust	Y, Rusted	N/A	Y, Rusted	Y, Slight Rust	N/A	Y, Slight Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Slight Rust, No paint	N/A	Y, Slight Rust, No paint	Y, Rusted, No paint	N/A	Y, Rusted, No paint	Y, Rusted, No paint	N/A	Y, 1 bollard knocked over
g) Any signs of tampering or vandalism?	N	N/A	N	N	N/A	N	N	N/A	N
h) Is the well identification tag missing from the steel casing?	Y	N/A	Y	N	N/A	Y	N	N/A	N

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A= Not Applicable

Monitoring Wells	13GW203	13GW204	13GW205	13GW206	13GW300	13GW301	13GW302	13GW303	13GW304
a) Any signs of erosion or disturbance on the ground around the well?	*	N	N	N	N	N	N	Y	N
b) Any cracks in or other damage to the concrete apron?	N/A	N	N	N	N	N	N	N	N
c) Is the well cap missing or showing signs of damage?	N/A	N	N	N	N	N	N	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	N/A	Y, Lock rusted, cannot shut	Y, Lock rusted, cannot shut	Y, No lock	Y, Lock rusted, cannot shut	Y, Lock rusted, cannot shut	Y, No lock	Y, No lock	Y, Lock rusted, cannot shut
e) Is there rust or other damage on the protective steel casing?	N/A	Y, Rusted	Y, Rusted	Y, Slight Rust	Y, Slight Rust	Y, Slight Rust	Y, Slight Rust	Y, Slight Rust	Y, Slight Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	N/A	Y, Rusted, No paint	Y, Rusted, No paint	Y, No paint	Y, No bollards	Y, No bollards	N	Y, Base foundation erosion	N
g) Any signs of tampering or vandalism?	N/A	N	N	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N/A	Y, No tag	Y, No tag	Y, No tag	N	N	Y, No tag	Y, No tag	Y, No tag

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A= Not Applicable

INSPECTION CHECKLIST				
Site Name: Site 49				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Caitlin Dronfield / CH2M Hill	**Date:** 11/20/2017			
Weather and Temperature Conditions: 40 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc):				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?				N/A
b) Are any sign posts loose or otherwise damaged?				N/A
c) Are any signs illegible?				N/A
d) Have any signs been defaced?				N/A
e) Does the information on the signs need to be updated (e.g. phone numbers)?				N/A
f) Any signs missing?				N/A
Access Roads and Swales				
a) Any signs of erosion within drainage swale?				N/A
b) Any obstructions within the flow path?				N/A
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?				N/A
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?		X		
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?	X			
c) Any obstructions within the flow path of Toe Drains?				N/A
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?				N/A
f) Any signs of animal burrows?		X		
g) Any signs of sideslope failure along the road?		X		
h) Any signs of Rip Rap missing from the Toe Drains?				N/A
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site: (Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)
Notes: (Discuss and clarify any comments or observations related to this inspection.)
Deficiencies/Items Requiring Corrections: (Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Printed Name of Inspector	Signature of Inspector/Date

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.
Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	49GW200	49GW202D	49GW202S	49GW203	49GW204	49GW205	49GW206D
a) Any signs of erosion or disturbance on the ground around the well?	N	N	*	N	N	Y, buried in sediment	N
b) Any cracks in or other damage to the concrete apron?	N	N	N/A	N	N	N/A, buried	N
c) Is the well cap missing or showing signs of damage?	N	N	N/A	N	N	Y	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rusted, won't close	Y, Rusted shut	N/A	Y, No lock	N/A, No lock	Y, Rusted shut	Y, No lock
e) Is there rust or other damage on the protective steel casing?	Y, Rusted	Y, Slight rust	N/A	Y, Rusted	N	Y, Rusted	Y, Rusted
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rusted, No paint	Y, Rusted, No paint	N/A	Y, Rusted, No paint	N/A, No bollards	Y, Rusted	Y, Rusted, No paint
g) Any signs of tampering or vandalism?	N	N	N/A	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N	N	N/A	N	N	N/A, buried	N

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N = No
N/A = Not Applicable

Monitoring Wells	49GW206M	49GW206S	49GW207D	49GW207S	49GW208D	49GW208S	49GW209
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	Y, Slight cracks	N	N	N	N	N
c) Is the well cap missing or showing signs of damage?	N	N	Y, No plug, steel covers borehole	Y, No plug, open borehole	N	Y, No plug, open borehole	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rusted, won't shut	Y, Rusted, won't shut	N	Y, No lock	Y, No lock	Y, rusted, won't shut	Y, No lock
e) Is there rust or other damage on the protective steel casing?	Y, Rusted	Y, Rusted	Y, Rusted	Y, Rusted	Y, Rusted	Y, Rusted	Y, Rusted
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rusted, No paint	Y, Rusted, No paint	Y, No bollards	Y, No bollards	Y, No bollards	Y, No bollards	Y, No bollards
g) Any signs of tampering or vandalism?	N	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N	N	N	Y, No tag	N	Y, No tag	N

Notes:
Well inspection was completed on 11/20/2017
* Indicates monitoring well could not be found
Y= Yes
N = No
N/A = Not Applicable

NSWC-White Oak
Inspection of Land Use Controls Check List

Site	Media		Inspection Details			LUC Maintained (Y/N/NA)				
	Groundwater	Soil / Waste	Date of Last Inspection (mm/dd/yyyy)	Inspection Required this Period (Y/N)	Inspection Frequency	Groundwater Not Being Used	Fencing / Signs in Place	Monitoring Wells not Disturbed	Remediation System Not Disturbed	Landfill Cover Not Disturbed
Site 4/46	●	N/A			Annual		N/A		N/A	N/A
Site 7	●	N/A			Annual		N/A		N/A	N/A
Site 11	●	N/A			Annual		N/A		N/A	N/A
SWMU 87	●	N/A	2/21/2018	Y	Annual	Y	N/A	Y	N/A	N/A
OU 2	●	●	2/21/2018	Y	Annual	Y	Y	Y	N/A	Y

NA - Not Applicable

Description of any deficiencies found: None

Efforts taken to correct deficiencies: None

Inspections conducted by: Emily Curbo Date: 2/20/2018

Date: 02/20/2018

NSWC-White Oak
Inspection of Land Use Controls Check List

Site	Media		Inspection Details			LUC Maintained (Y/N/NA)				
	Groundwater	Soil / Waste	Date of Last Inspection (mm/dd/yyyy)	Inspection Required this Period (Y/N)	Inspection Frequency	Groundwater Not Being Used	Fencing / Signs in Place	Monitoring Wells not Disturbed	Remediation System Not Disturbed	Landfill Cover Not Disturbed
Site 4/46	●	N/A	12/13/2018	Y	Annual	Y	N/A	Y	N/A	N/A
Site 7	●	N/A	12/13/2018	Y	Annual	Y	N/A	Y	N/A	N/A
Site 11	●	N/A	12/13/2018	Y	Annual	Y	N/A	Y	N/A	N/A
SWMU 87	●	N/A	Unable to Access		Annual		N/A		N/A	N/A
OU 2	●	●	12/13/2018	Y	Annual	Y	Y	Y	N/A	Y

NA - Not Applicable

Description of any deficiencies found: None

Efforts taken to correct deficiencies: None

Inspections conducted by: Stephen Dronfield Date: 12/13/2018

Date: 12/13/18

INSPECTION CHECKLIST				
Site Name: Site 9				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Stephen Dronfield / Jacobs	**Date:** 12/13/2018			
Weather and Temperature Conditions: 39 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc):				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?				N/A
b) Are any sign posts loose or otherwise damaged?				N/A
c) Are any signs illegible?				N/A
d) Have any signs been defaced?				N/A
e) Does the information on the signs need to be updated (e.g. phone numbers)?				N/A
f) Any signs missing?				N/A
Access Roads and Swales				
a) Any signs of erosion within drainage swale?				N/A
b) Any obstructions within the flow path?				N/A
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?				N/A
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?		X		
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?		X		
c) Any obstructions within the flow path of Toe Drains?				N/A
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?				N/A
f) Any signs of animal burrows?		X		
g) Any signs of sideslope failure along the road?		X		
h) Any signs of Rip Rap missing from the Toe Drains?				N/A
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site:

(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Notes:

(Discuss and clarify any comments or observations related to this inspection.)

Deficiencies/Items Requiring Corrections:

(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Stephen Dronfield	12/13/18
Printed Name of Inspector: Stephen Dronfield	Signature of Inspector/Date: 12/13/18

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

LUC Inspection Checklist - Sheet 2

Monitoring Wells	09GW01	09GW02	09GW03	09GW04	09GW05	09GW06	09GW07	09GW100
a) Any signs of erosion or disturbance on the ground around the well?	N	*	*	*	*	*	*	N
b) Any cracks in or other damage to the concrete apron?	N	N/A	N/A	N/A	N/A	N/A	N/A	N
c) Is the well cap missing or showing signs of damage?	N	N/A	N/A	N/A	N/A	N/A	N/A	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rust	N/A	N/A	N/A	N/A	N/A	N/A	Y, Rust
e) Is there rust or other damage on the protective steel casing?	Y, Rust	N/A	N/A	N/A	N/A	N/A	N/A	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust	N/A	N/A	N/A	N/A	N/A	N/A	Y, Rust
g) Any signs of tampering or vandalism?	N	N/A	N/A	N/A	N/A	N/A	N/A	N
h) Is the well identification tag missing from the steel casing?	Y	N/A	N/A	N/A	N/A	N/A	N/A	N

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

LUC Inspection Checklist - Sheet 2

Monitoring Wells	09GW101	09GW102	09GW103	09GW104	09GW105	09GW106	09GW107	09GW108
a) Any signs of erosion or disturbance on the ground around the well?	N	*	*	N	N	*	*	*
b) Any cracks in or other damage to the concrete apron?	N	N/A	N/A	N	N	N/A	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N	N/A	N/A	N	N	N/A	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rust	N/A	N/A	Y, No lock	Y, Lock rusted open	N/A	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	Y, Rusted	N/A	N/A	Y, Rusted	Y, Rusted	N/A	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rusted	N/A	N/A	Y, Rusted	Y, Rusted	N/A	N/A	N/A
g) Any signs of tampering or vandalism?	N	N/A	N/A	N	N	N/A	N/A	N/A
h) Is the well identification tag missing from the steel casing?	N	N/A	N/A	N	N	N/A	N/A	N/A

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

LUC Inspection Checklist - Sheet 2

Monitoring Wells	09GW109	09GW110	09GW200D	09GW200S	09GW201D	09GW201S	09GW202	09GW203D
a) Any signs of erosion or disturbance on the ground around the well?	*	*	N	N	*	*	*	*
b) Any cracks in or other damage to the concrete apron?	N/A	N/A	N	N	N/A	N/A	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N/A	N/A	N/A, across fence	N/A, across fence	N/A	N/A	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	N/A	N/A	N	N	N/A	N/A	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	N/A	N/A	N	N	N/A	N/A	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	N/A	N/A	Y, Some rust	Y, Rust	N/A	N/A	N/A	N/A
g) Any signs of tampering or vandalism?	N/A	N/A	N	N	N/A	N/A	N/A	N/A
h) Is the well identification tag missing from the steel casing?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

LUC Inspection Checklist - Sheet 2

Monitoring Wells	09GW204	09GW205	09GW206	09GW207	09GW208	09GW209	09GW210	09GW211
a) Any signs of erosion or disturbance on the ground around the well?	Y, on a cliff	N	N	N	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N	N	Y, Broken	N
c) Is the well cap missing or showing signs of damage?	N	N	N	N	N	N	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rust	Y, Missing	Y, Rust	Y, Rust	Y, Rust	Y, Missing	Y, Missing	Y, Rust
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, collapsed due to erosion	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust
g) Any signs of tampering or vandalism?	N	N	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	Y, GIS Coordinates Incorrect	Y	Y	Y	Y	Y	Y	Y

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

LUC Inspection Checklist - Sheet 2

Monitoring Wells	09GW212	09GW213	09GW214	09GW215	09GW57D	09GW57S	09GW58	09GW59
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	N	N	*	*
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N	N	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N	N	N	N	N	N	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rust	Y, Missing	Y, Missing	Y, Missing	Y, Rust	Y, Rust	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Lock rusted, hinge cut	Y, Lock rusted, hinge cut	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust	Y, Rust	Y, Rust, fallen	Y, Rust, fallen	Y, Rust, 2 bollards gone	Y, Rust, 2 bollards gone	N/A	N/A
g) Any signs of tampering or vandalism?	N	N	N	N	N	N	N/A	N/A
h) Is the well identification tag missing from the steel casing?	Y	Y	Y	N	N	N	N/A	

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

LUC Inspection Checklist - Sheet 2

Monitoring Wells	09GW74	09GW75	09GW83
a) Any signs of erosion or disturbance on the ground around the well?	*	*	*
b) Any cracks in or other damage to the concrete apron?	N/A	N/A	N/A
c) Is the well cap missing or showing signs of damage?	N/A	N/A	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	N/A	N/A	N/A
e) Is there rust or other damage on the protective steel casing?	N/A	N/A	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	N/A	N/A	N/A
g) Any signs of tampering or vandalism?	N/A	N/A	N/A
h) Is the well identification tag missing from the steel casing?	N/A	N/A	N/A

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

INSPECTION CHECKLIST				
Site Name: Site 13				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Stephen Dronfield / Jacobs	**Date:** 12/13/2018			
Weather and Temperature Conditions: 40 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc):				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?				N/A
b) Are any sign posts loose or otherwise damaged?				N/A
c) Are any signs illegible?				N/A
d) Have any signs been defaced?				N/A
e) Does the information on the signs need to be updated (e.g. phone numbers)?				N/A
f) Any signs missing?				N/A
Access Roads and Swales				
a) Any signs of erosion within drainage swale?				N/A
b) Any obstructions within the flow path?				N/A
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?				N/A
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?		X		
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?	X			Access road shows erosion, asphalt falling away
c) Any obstructions within the flow path of Toe Drains?				N/A
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?				N/A
f) Any signs of animal burrows?		X		
g) Any signs of sideslope failure along the road?	X			Some sideslope failure along main access
h) Any signs of Rip Rap missing from the Toe Drains?				N/A
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
3				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site:
(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Notes:
(Discuss and clarify any comments or observations related to this inspection.)

Deficiencies/Items Requiring Corrections:
(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Stephen Dronfield	
Printed Name of Inspector: Stephen Dronfield	Signature of Inspector/Date: 12/13/18

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title	
Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	05GW01	05GW02	13GW01	13GW02	13GW03	13GW04	13GW200
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	*	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N/A	N	N
c) Is the well cap missing or showing signs of damage?	N	N	N/A, too many brambles	N	N/A	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Missing	Y, Missing	Y, Missing	Y, Missing	N/A	Y, Missing	Y, Missing
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	N/A	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	N/A	Y, Rust	Y, Rust
g) Any signs of tampering or vandalism?	N	N	N	N	N/A	N	N
h) Is the well identification tag missing from the steel casing?	Y	N	Y	N	N/A	Y	N

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

Monitoring Wells	13GW201	13GW202	13GW203	13GW204	13GW205	13GW206	13GW300
a) Any signs of erosion or disturbance on the ground around the well?	*	Y, Bollard tilting	*	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N/A	N	N/A	N	N	N	N
c) Is the well cap missing or showing signs of damage?	N/A	N	N/A	N	N	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	N/A	Y, Missing	N/A	Y, Rust	Y, Rust	Y, Missing	Y, Rust
e) Is there rust or other damage on the protective steel casing?	N/A	Y, Rust	N/A	Y, Rust	Y, Rust	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	N/A	Y, Rust	N/A	Y, Rust	Y, Rust	Y, Rust	Y, No bollards
g) Any signs of tampering or vandalism?	N/A	N	N/A	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N/A	N	N/A	Y	Y	Y	N

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

Monitoring Wells	13GW301	13GW302	13GW303	13GW304
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N
c) Is the well cap missing or showing signs of damage?	N	N	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Missing	Y, Missing	Y, Missing	Y, Rust
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, None	N	Y, Eroded	N
g) Any signs of tampering or vandalism?	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N	Y	Y	Y

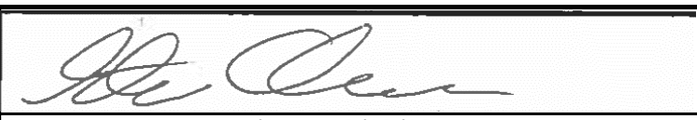
Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable

INSPECTION CHECKLIST				
Site Name: Site 49				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Stephen Dronfield / Jacobs	**Date:** 12/13/2018			
Weather and Temperature Conditions: 40 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc):				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?				N/A
b) Are any sign posts loose or otherwise damaged?				N/A
c) Are any signs illegible?				N/A
d) Have any signs been defaced?				N/A
e) Does the information on the signs need to be updated (e.g. phone numbers)?				N/A
f) Any signs missing?				N/A
Access Roads and Swales				
a) Any signs of erosion within drainage swale?				N/A
b) Any obstructions within the flow path?				N/A
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?				N/A
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?	X			Slope failure along river area
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?	X			Road severely eroded to the east
c) Any obstructions within the flow path of Toe Drains?				N/A
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?				N/A
f) Any signs of animal burrows?		X		
g) Any signs of sideslope failure along the road?	X			Slope failure to the east
h) Any signs of Rip Rap missing from the Toe Drains?				N/A
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site:
(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Notes:
(Discuss and clarify any comments or observations related to this inspection.)

Deficiencies/Items Requiring Corrections:
(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Stephen Dronfield	
Printed Name of Inspector: Stephen Dronfield	Signature of Inspector/Date: 12/13/18

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title	
Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	49GW200	49GW202D	49GW202S	49GW203	49GW204	49GW205
a) Any signs of erosion or disturbance on the ground around the well?	N	N	*	N	N	N/A
b) Any cracks in or other damage to the concrete apron?	N	N	N/A	N	N	N/A
c) Is the well cap missing or showing signs of damage?	N	N	N/A	N	N	N/A
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Rust	Y, Rust	N/A	Y, Missing	Flush mount	N/A
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	N/A	Y, Rust	Flush mount	N/A
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust	Y, Rust	N/A	Y, Rust	Flush mount	N/A
g) Any signs of tampering or vandalism?	N	N	N/A	N	N	N/A
h) Is the well identification tag missing from the steel casing?	N	N	N/A	N	N	N/A

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable
49GW205 no longer accessible due to massive slope failure at old bridge

Monitoring Wells	49GW206D	49GW206M	49GW206S	49GW207D	49GW207S	49GW208D
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N, No pad	N
c) Is the well cap missing or showing signs of damage?	N	N	N	Y, Missing	Y, Open	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Missing	N	N	Y, Missing	Y, Missing	Y, Missing
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust	Y, Rust	Y, Rust	N, None	N, None	N, No bollards
g) Any signs of tampering or vandalism?	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N	N	N	N	Y, No tag	N

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable
49GW205 no longer accessible due to massive slope failure at old bridg

Monitoring Wells	49GW208S	49GW209
a) Any signs of erosion or disturbance on the ground around the well?	N	N
b) Any cracks in or other damage to the concrete apron?	N, No apron, No pad	N
c) Is the well cap missing or showing signs of damage?	Y, Open borehole	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Missing	Y, Missing
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	N, No bollards	N, No bollards
g) Any signs of tampering or vandalism?	N	N
h) Is the well identification tag missing from the steel casing?	Y, No tag	Y

Notes:
Well inspection was completed on 12/13/2018
* Indicates monitoring well could not be found
Y = Yes
N = No
N/A = Not Applicable
49GW205 no longer accessible due to massive slope failure at old bridg

NSWC-White Oak
Inspection of Land Use Controls Check List

Site	Media		Inspection Details			LUC Maintained (Y/N/NA)				
	Groundwater	Soil / Waste	Date of Last Inspection (mm/dd/yyyy)	Inspection Required this Period (Y/N)	Inspection Frequency	Groundwater Not Being Used	Fencing / Signs in Place	Monitoring Wells not Disturbed	Remediation System Not Disturbed	Landfill Cover Not Disturbed
Site 4/46	●	N/A	1/22/2020	Y	Annual	Y	Y	Y	N/A	N/A
SWMU 87	●	N/A	1/22/2020	Y	Annual	Y	N/A	Y	N/A	N/A
OU 2	●	●	1/22/2020	Y	Annual	Y	Y	Y	N/A	Y

NA - Not Applicable

Description of any deficiencies found: Unable to locate monitoring well 87PW214 and SWMU 87. At OU2, potenitally exposed liner on the northwest side of landfill by rip-rap channel.

Efforts taken to correct deficiencies: Notified project manager about deificiencies.

Inspections conducted by: Jared Clark Date: 1/22/2020

Date: 1/22/2020

INSPECTION CHECKLIST				
Site Name: Site 13				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Jared Clark / Jacobs	**Date:** 01/21/2020			
Weather and Temperature Conditions: 21 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc): Annual				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?		X		No signs present
b) Are any sign posts loose or otherwise damaged?		X		
c) Are any signs illegible?		X		
d) Have any signs been defaced?		X		
e) Does the information on the signs need to be updated (e.g. phone numbers)?		X		
f) Any signs missing?		X		
Access Roads and Swales				
a) Any signs of erosion within drainage swale?		X		
b) Any obstructions within the flow path?		X		
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?	X			
e) Any signs of animal burrows?		X		
f) Any signs of sideslope failure?		X		
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		X		
b) Any signs of erosion along the road?	X			
c) Any obstructions within the flow path of Toe Drains?		X		No Toe Drains
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?		X		
f) Any signs of animal burrows?		X		Same as above
g) Any signs of sideslope failure along the road?		X		
h) Any signs of Rip Rap missing from the Toe Drains?		X		Same as above
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site:
(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Notes:
(Discuss and clarify any comments or observations related to this inspection.)

Unable to locate 13GW03. Replace well cap at 13GW01. Perimeter fence is damaged by fallen tree.

Deficiencies/Items Requiring Corrections:
(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Missing and/or damaged locks need to be replaced, determine status of 13GW03.

Jared Clark	1-21-2020
Printed Name of Inspector: Jared Clark	Signature of Inspector/Date: 01/21/2020

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	05GW01	05GW02	13GW01	13GW02	13GW03	13GW04	13GW200	13GW201	13GW202	13GW203	13GW204	13GW205	13GW206	13GW300	13GW301	13GW302	13GW303	13GW304	13GW305	13GW306	13GW307
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	*	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	*	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
c) Is the well cap missing or showing signs of damage?	N	N	Y, No J-Plug[a]	N	*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, No Lock	Y, No Lock	Y, No Lock	Y, No Lock	*	Y, No Lock	Y, No Lock	N	Y, No Lock	N	Y, Unlocked	Y, Unlocked	Y, No Lock	Y, Unlocked	Y, Unlocked	Y, No Lock	Y, No Lock	Y, Damaged	Y, No Lock	Y, No Lock	Y, No Lock
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	*	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	N	N
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust	Y, Rust	Y, Rust	Y, Rust	*	Y, Rust	Y, Rust	Y, Rust	Y, Rust, Bollard Tipped Over	Y, Rust	Y, Rust	Y, Rust	Y, Rust	N/A	N/A	Y, Rust	Y, Rust	Y, Rust	N	N	N
g) Any signs of tampering or vandalism?	N	N	N	N	*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N	N	N	N	*	N	N	N	N	N	Y, No Tag	Y, No Tag	Y, No Tag	N	N	Y, No Tag	Y, No Tag	Y, No Tag	N	N	N

Notes:

[a] -Replaced J-Plug

Well inspection was completed on 01/21/2020

* Indicates monitoring well could not be found

Y= Yes

N= No

N/A= Not Applicable

INSPECTION CHECKLIST				
Site Name: Site 49				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Kelsey Voss / Jacobs	**Date:** 01/22/2020			
Weather and Temperature Conditions: 25 F, Sunny				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc): Annual				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?		X		
b) Are any sign posts loose or otherwise damaged?		X		
c) Are any signs illegible?		X		
d) Have any signs been defaced?		X		
e) Does the information on the signs need to be updated (e.g. phone numbers)?		X		
f) Any signs missing?		X		
Access Roads and Swales				
a) Any signs of erosion within drainage swale?	X			Access road severely eroded to the east
b) Any obstructions within the flow path?	X			Swales visible
c) Does vegetation show signs of stress?		X		
d) Any signs of saplings growing in the Swale?	X			
e) Any signs of animal burrows?	X			
f) Any signs of sideslope failure?	X			Slope failure along river area
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?	X			
b) Any signs of erosion along the road?	X			Road is eroding
c) Any obstructions within the flow path of Toe Drains?		X		No toe drains
d) Does vegetation show signs of stress?		X		
e) Any saplings growing in the Toe Drains?		X		
f) Any signs of animal burrows?	X			
g) Any signs of sideslope failure along the road?	X			
h) Any signs of Rip Rap missing from the Toe Drains?		X		
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site:
(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Notes:
(Discuss and clarify any comments or observations related to this inspection.)

Replaced monitoring well cap at 49GW207D. Severe erosion along the road next to the river. Damaged injection and monitoring wells from erosion. Monitoring well 49GW205 was found burried under a thick layer of sediment.

Deficiencies/Items Requiring Corrections:
(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Missing and/or damaged locks need to be replaced.

Kelsey Voss	Kelsey Voss / 1/22/2020
Printed Name of Inspector: Kelsey Voss	Signature of Inspector/Date: 01/22/2020

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	49GW200	49GW202D	49GW203	49GW204	49GW205	49GW206D	49GW206M	49GW206S	49GW207D	49GW207S	49GW208D	49GW208S	49GW209
a) Any signs of erosion or disturbance on the ground around the well?	N	N	N	N	Y, Covered with Sediment	N	N	N	N	N	N	N	N
b) Any cracks in or other damage to the concrete apron?	N	N	N	N	N/A	N	N	N	N	N, No pad	N	N, No apron, No pad	N
c) Is the well cap missing or showing signs of damage?	N	N	N	N	N	N	N	N	Y, Missing	Y, Open	N	Y, Open borehole	N
d) Is the well cap lock missing, unlocked, or showing signs of damage?	Y, Unlocked	N	Y, Missing	Flush mount	Y, Broken	Y, Lock Missing	Y, Unlocked	Y, Unlocked	N	Y, Missing	Y, Missing	Y, Missing	Y, Missing
e) Is there rust or other damage on the protective steel casing?	Y, Rust	Y, Rust	Y, Rust	Y, Rust, Flush mount	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust	Y, Rust
f) Are bollards showing signs of rust, damage, or loose foundations?	Y, Rust, 1 bollard knocked over	Y, Rust	Y, Rust	Flush mount	Y, Rust	Y, Rust	Y, Rust	Y, Rust	N, None	N, None	N, No bollards	N, No bollards	N, No bollards
g) Any signs of tampering or vandalism?	N	N	N	N	N	N	N	N	N	N	N	N	N
h) Is the well identification tag missing from the steel casing?	N	N	N	N	N/A	N	N	N	N	Y, No tag	N	Y, No tag	Y, No tag

Notes:
Well inspection was completed on 01/22/2020
Y = Yes
N = No
N/A = Not Applicable

NSWC-White Oak
Inspection of Land Use Controls Check List

Site	Media		Inspection Details			LUC Maintained (Y/N/NA)				
	Groundwater	Soil / Waste	Date of Last Inspection (mm/dd/yyyy)	Inspection Required this Period (Y/N)	Inspection Frequency	Groundwater Not Being Used	Fencing / Signs in Place	Monitoring Wells not Disturbed	Remediation System Not Disturbed	Landfill Cover Not Disturbed
Site 4/46	●	**N/A**	**1/22/2020**	**Y**	Annual	**Y**	**Y**	**N**	**N/A**	**N/A**
SWMU 87	●	**N/A**	**1/22/2020**	**Y**	Annual	**Y**	**N/A**	**N**	**N/A**	**N/A**
OU 2	●	●	**1/22/2020**	**Y**	Annual	**Y**	**Y**	**Y**	**N/A**	**Y**

NA - Not Applicable

Description of any deficiencies found: OU 2 - Wells are missing locks and landfill cover is partially exposed near wells close to stream.

SWMU 87-Wells are missing locks and 87WP207 riser is leaning significantly. Site 4/46-Wells are missing locks, bollards are damaged, and wells are damaged. See log book for more information.

Efforts taken to correct deficiencies:

Inspections conducted by: A. Overman and K. Davis Date: 1/14 & 1/15/21

INSPECTION CHECKLIST				
Site Name: Site 13				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Alex Overman	**Date:** 1/14/2021			
Weather and Temperature Conditions: Sunny, 53				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc): Semi-annual				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?		No		
b) Are any sign posts loose or otherwise damaged?		No		
c) Are any signs illegible?		No		
d) Have any signs been defaced?		No		
e) Does the information on the signs need to be updated (e.g. phone numbers)?		No		
f) Any signs missing?		No		There are no signs
Access Roads and Swales				
a) Any signs of erosion within drainage swale?		No		
b) Any obstructions within the flow path?		No		
c) Does vegetation show signs of stress?		No		
d) Any signs of saplings growing in the Swale?		No		
e) Any signs of animal burrows?	Yes			
f) Any signs of sideslope failure?		No		Access road is in bad condition, the asphalt has many cracks
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?	Yes			
b) Any signs of erosion along the road?	Yes			
c) Any obstructions within the flow path of Toe Drains?		No		
d) Does vegetation show signs of stress?		No		
e) Any saplings growing in the Toe Drains?		No		
f) Any signs of animal burrows?	Yes			
g) Any signs of sideslope failure along the road?		No		
h) Any signs of Rip Rap missing from the Toe Drains?		No		
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				See monitoring well form for individual well details.
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				

Adequacy of O&M at Site:
(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Overgrown biologics make it difficult to access wells;
access road itself is deteriorated and oak road
has multiple trees down across it.

Notes:
(Discuss and clarify any comments or observations related to this inspection.)

Deficiencies/Items Requiring Corrections:
(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

Vegetation clearance around wells; perimeter
fence is compromised and broken; access
roads around the site need work; several bollards need to be fixed.

Alex Overman	Alex Overman 1/14/2021
Printed Name of Inspector	Signature of Inspector/Date

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	05GW01	05GW02	13GW01	13GW02	13GW03	13GW04	13GW200	13GW201	13GW202	13GW203	13GW204	13GW205	13GW206	13GW300	13GW301	13GW302	13GW303	13GW304	13GW305	13GW306	13GW307
a) Any signs of erosion or disturbance on the ground around the well?	Yes	No	No	No	*	No	No	Yes	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No
b) Any cracks in or other damage to the concrete apron?	No	No	No	No	*	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
c) Is the well cap missing or showing signs of damage?	No	No	No	No	*	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
d) Is the well cap lock missing, unlocked, or showing signs of damage?	No	No	No	No	*	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No
e) Is there rust or other damage on the protective steel casing?	Yes	Yes	Yes	Yes	*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
f) Are bollards showing signs of rust, damage, or loose foundations?	Yes	Yes	Yes	Yes	*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	Yes	Yes	Yes	No	No	No
g) Any signs of tampering or vandalism?	No	No	No	No	*	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
h) Is the well identification tag missing from the steel casing?	No	No	No	No	*	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes: 13GW03 was abandoned.
Well inspection was completed on 1/14/2021
* Indicates monitoring well could not be found
Y= Yes
N= No
N/A= Not Applicable

INSPECTION CHECKLIST				
Site Name: Site 49				
Site Location: Former NSWC White Oak				
Remedy at Site: LTM				
Inspector/Company: Alex Overman	**Date:** 1/14/2021			
Weather and Temperature Conditions: Cloudy, 43				
Type of Inspection (Semi-annual, Post-major weather event, Re-inspection, etc): Semi-annual				
Area of Inspection	**Yes**	**No**	**Environmental Office Noted**	**Notes and Comments**
Security Signs (instititional Controls)/Carsonite Markers/Brass Monuments				
a) Are any signs/brass monuments missing?		No		
b) Are any sign posts loose or otherwise damaged?		No		
c) Are any signs illegible?		No		
d) Have any signs been defaced?		No		
e) Does the information on the signs need to be updated (e.g. phone numbers)?		No		
f) Any signs missing?		No		There are no signs
Access Roads and Swales				
a) Any signs of erosion within drainage swale?	Yes			
b) Any obstructions within the flow path?	Yes			
c) Does vegetation show signs of stress?		No		
d) Any signs of saplings growing in the Swale?	Yes			
e) Any signs of animal burrows?		No		
f) Any signs of sideslope failure?	Yes			Site overgrown with biologics
Perimeter Access Road and Toe Drains				
a) Any signs of settlement within drainage ditch or Access Road?		No		
b) Any signs of erosion along the road?	Yes			
c) Any obstructions within the flow path of Toe Drains?		No		
d) Does vegetation show signs of stress?		No		
e) Any saplings growing in the Toe Drains?		No		
f) Any signs of animal burrows?		No		
g) Any signs of sideslope failure along the road?	Yes			
h) Any signs of Rip Rap missing from the Toe Drains?		No		No toe drains.
Monitoring Wells: Each well should be individually inspected. Please see Sheet 2.				
a) Any signs of erosion or disturbance on the ground around the well?				
b) Any cracks in or other damage to the concrete apron?				
c) Is the well cap missing or showing signs of damage?				
d) Is the well cap lock missing, unlocked, or showing signs of damage?				
e) Is there rust or other damage on the protective steel casing?				
f) Are bollards showing signs of rust, damage, or loose foundations?				
g) Any signs of tampering or vandalism?				
h) Is the well identification tag missing from the steel casing?				See well inspection form. All locks on wells need to be replaced.

Adequacy of O&M at Site:
(Discuss issues and Observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.)

Much of the site is overgrown and vegetation clearance needs to occur.

Notes:
(Discuss and clarify any comments or observations related to this inspection.)

Stream at the bottom of the site is undergoing remediation at the time of visit.

Deficiencies/Items Requiring Corrections:
(Discuss all items that were deficient during the inspection. Also provide recommendations for the deficient items - such as continued monitoring and inspection or repair and further remedial action.)

49GW200 needs bollard replaced; vegetation clearance needed; all wells need locks; 49GW207D needs casing cover replaced; bolts stripped on 49GW204

Alex Overman	Alex Overman 1/14/2021
Printed Name of Inspector	Signature of Inspector/Date

Certification Statement: I hereby certify that a complete and thorough inspection and evaluation of the site and implemented remedy has been performed, and that the items noted on this inspection form have been assessed with respect to the intent of the implemented remedy and the remedial action objectives established for the site.

Printed Name of O&M Engineer, title

Signature of O&M Engineer/Date	IRP Manager's Signature

Provide additional notes, photographs, or sketch of the site as needed:

Monitoring Wells	49GW200	49GW202D	49GW203	49GW204	49GW205	49GW206D	49GW206M	49GW206S	49GW207D	49GW207S	49GW208D	49GW208S	49GW209
a) Any signs of erosion or disturbance on the ground around the well?	No	No	No	No	*	No	No	No	No	No	No	No	No
b) Any cracks in or other damage to the concrete apron?	No	No	No	No	*	No	No	No	N/A	N/A	N/A	No	No
c) Is the well cap missing or showing signs of damage?	No	No	No	No	*	Yes	No	No	Yes	No	No	No	Yes
d) Is the well cap lock missing, unlocked, or showing signs of damage?	No	No	Yes	N/A	*	Yes	No	No	No	Yes	Yes	Yes	Yes
e) Is there rust or other damage on the protective steel casing?	Yes	Yes	Yes	N/A	*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
f) Are bollards showing signs of rust, damage, or loose foundations?	Yes	Yes	Yes	N/A	*	Yes	No	No	N/A	N/A	N/A	N/A	N/A
g) Any signs of tampering or vandalism?	No	No	No	No	*	No	No	No	No	No	No	No	No
h) Is the well identification tag missing from the steel casing?	No	N/A	No	N/A	*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes

Notes: 49GW205 was abandoned.
Well inspection was completed on _1/14/2021_
* Indicates monitoring well could not be found
Y= Yes
N = No
N/A = Not Applicable