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FINAL COMPREHENSIVE THIRD FIVE YEAR REVIEW NSWC WHITE OAK MD (PUBLIC DOCUMENT)

6/23/2017

CH2M HILL

Final

Comprehensive Third Five-Year Review

Former Naval Surface Warfare Center White Oak
Silver Spring, Maryland

Contract Task Order CTO-JU08

June 2017

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Prepared by

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Comprehensive Third Five-Year Review

For

Former Naval Surface Warfare Center White Oak
Silver Spring, Maryland

June 2017

This report documents the Third 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 (ROD) for taking action, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), in accordance with CERCLA §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 7 – Ordnance Burn Area
- Site 9 – Industrial Wastewater Disposal 300 Area
- Site 11 – Industrial Wastewater Disposal 100 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 and site 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 RODs. 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 Third Five-Year Review, the remedies for all eight areas are currently protective of human health and the environment. However, while remedies for Site 49 and SWMU 87 were found to be protective in the short-term, long-term protectiveness is not confirmed. The proposed LUC Remedial Design should be finalized for each of these sites to address long-term protectiveness of human health and the environment until the applicable selected groundwater remediation technologies achieve the remedial action goals and make the LUCs unnecessary.

United States Department of the Navy

By: Paul F Burgio | Date: 6/23/17

Paul F. Burgio
BRAC 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), in accordance with CERCLA §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 report has been prepared in accordance with the United States Environmental Protection Agency (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 (RAs) 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 Third Five-Year Review Report for Former NSWC-White Oak, and has been conducted on RAs completed at the following eight 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 7 – Ordnance Burn Area
- Site 9 – Industrial Wastewater Disposal 300 Area
- Site 11 – Industrial Wastewater Disposal 100 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 February 1, 2012 and October 1, 2016. The First and Second Five-Year Review Reports were signed on April 23, 2007 and June 13, 2012, respectively. The triggering action for this third statutory review was June 13, 2012, the Navy's signature date of the Second 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 public notice in the April 14, 2016 edition of the *Montgomery County Sentinel* newspaper. 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 as follows. As outlined in this Third Five-Year Review, the remedies for all sites are currently protective of human health and the environment. However, while remedies for Site 49 and SWMU 87 were found to be protective in the short-term, long-term protectiveness is not confirmed. The land use control (LUC) Remedial Design (RD) should be finalized for each of these sites to address future long-term protectiveness of human health and the environment. A summary of the RAs completed for each site and the technical performance assessment, issues and recommendations, and protectiveness statements based on this Five-Year Review are provided as follows.

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	
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 Command (NAVFAC)
Author affiliation: United States Navy
Review period: February 1, 2012 to-October 1, 2016
Date of site inspection: June 30, 2016
Type of review: Statutory
Review number: 3
Triggering action date: June 13, 2012 (signature date of the Second Five-Year Review Report for the Former NSWC-White Oak)
Due date *(five years after triggering action date)*: June 13, 2017 (five years after the signature date of the Second Five-Year Review report for the Former NSWC-White Oak)

Issues/Recommendations				
OU(s): **OU2 and OU3**	**Issue Category: Other**			
	Issue: Site inspections not documented			
	Recommendation: 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.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	State	6/30/2022

Five-Year Review Summary Form

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 (MNA), institutional controls (ICs), and groundwater and surface water monitoring, 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.		

Issues/Recommendations				
OU(s): **Site 4**	**Issue Category: Remedy Performance**			
	Issue: Additional injection should be considered			
	Recommendation: 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.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	State	6/30/2022
OU(s): **Site 4**	**Issue Category: Other**			
	Issue: Site inspections not documented			
	Recommendation: 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.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	State	6/30/2022

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 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.		

Five-Year Review Summary Form

Issues/Recommendations				
OU(s): **Site 5 and Site 13**	**Issue Category: Other**			
	Issue: Additional groundwater characterization should be considered (Off-Site 13 and On-Site 13)			
	Recommendation: Further characterization and evaluation of Site 13 and Off-Site 13 groundwater should be conducted to optimize additional remedial activities.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	State	6/30/2022
OU(s): **Site 5 and Site 13**	**Issue Category: Other**			
	Issue: LUCs inspections not documented (Off-Site 13 and On-Site 13)			
	Recommendation: Offsite 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.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	State	6/30/2022

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 (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.		

Protectiveness Statement(s)		
Operable Unit: Site 7	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable
Protectiveness Statement: The remedy for the Site 7 - Ordnance Burn Area is protective of the human health and ecological receptors based on achieving the remedial action objectives (RAOs) specified in the ROD. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Groundwater monitoring has concluded, and risk screenings showed no unacceptable risks for the residential potable use of groundwater. Site 7 will be closed.		

Five-Year Review Summary Form

Issues/Recommendations				
OU(s): Site 9	**Issue Category: Other**			
	Issue: LUCs inspections not documented			
	Recommendation: Site inspections should be conducted at least once a year, documented in accordance with the Site 9 LUC RD, and summarized during the next Five-Year Review.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	State	12/31/2016

Protectiveness Statement(s)		
Operable Unit: Site 9	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable Click here to enter a date
Protectiveness Statement: The remedy for Site 9 groundwater and soil, consisting of enhanced anaerobic bioremediation, LTM, and LUC implementation for groundwater, as well as excavation and offsite disposal for soil in the area of the former Building 318 sump, is protective of human health and the environment. In January 2005, the sump area was excavated and 110 gallons of sodium lactate and approximately 500 gallons of water were placed into the excavation. The excavation was backfilled and a monitoring well was installed in the former location of the sump. The objective of the excavation and subsequent sodium lactate treatment was to eliminate a potential ongoing source of groundwater contamination, specifically related to cyclotrimethylenetrinitramine (RDX). The reduction in RDX concentrations in the wells immediately downgradient of this excavation, to concentrations below Preliminary Remediation Goals (PRGs), indicates that this soil remedy has been protective. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.		

Issues/Recommendations				
OU(s): Site 11	**Issue Category: Other**			
	Issue: Site inspections not documented			
	Recommendation: Site inspections should be conducted at least once a year, documented in accordance with the Site 11 LUC RD, and summarized during the next Five-Year Review.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	State	6/30/2022

Five-Year Review Summary Form

Protectiveness Statement(s)		
Operable Unit: Site 11	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not Applicable Click here to enter a date
Protectiveness Statement: The selected remedy for Site 11 groundwater, consisting of "hot spot" EISB, 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.		

Issues/Recommendations				
OU(s): **Site 49**	**Issue Category: Remedy Performance**			
	Issue: Additional injection of substrate should be considered			
	Recommendation: Begin discussions with the Navy, Maryland Department of the Environment (MDE), and General Services Administration (GSA) regarding the path forward for Site 49 groundwater. While an additional injection should be considered, it is unlikely that additional injections would reduce concentrations to PRGs due to the nature of contamination at Site 49 (present in fractured bedrock).			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	State	12/31/2017
OU(s): **Site 49**	**Issue Category: Monitoring**			
	Issue: Monitoring wells 49GW201S, 49GW201D, and 49GW201DD were washed out and subsequently abandoned in June 2015			
	Recommendation: Review LTM Plan to determine if groundwater data from these locations are still necessary to evaluate the protectiveness of the Site 49 remedy. If still necessary, determine suitable location for replacement monitoring well(s).			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	Federal Facility	State	6/30/22
OU(s): **Site 49**	**Issue Category: Institutional Controls**			
	Issue: LUCs not documented (LUC RD for Off-Site 49 should be evaluated)			
	Recommendation: The need for an offsite groundwater LUC RD for Site 49 should be evaluated and finalized, if necessary.			

Five-Year Review Summary Form

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
Yes	Yes	Federal Facility	State	6/30/2022
OU(s): **Site 49**	**Issue Category: Other**			
	Issue: LUCs inspections not documented			
	Recommendation: Site inspections should be conducted at least once a year, documented in accordance with the Site 49 onsite LUC RD and offsite LUC RD (if applicable), and summarized during the next Five-Year Review.			

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
Yes	Yes	Federal Facility	State	6/30/2022

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Planned Addendum Completion Date:*
Site 49	Short-term Protective	Not Applicable Click here to enter a date

Protectiveness Statement:
The selected remedy for Site 49, consisting of in situ chemical oxidation (ISCO), LUCs, and groundwater LTM, is protective in the short term of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: Evaluate and prepare a LUC RD for offsite groundwater for Site 49, if necessary.

Issues/Recommendations

OU(s): **SWMU 87**	**Issue Category: Institutional Controls**
	Issue: LUCs not documented (LUC RD not finalized)
	Recommendation: It is recommended that the LUC RD for SWMU 87 be finalized.

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
Yes	Yes	Federal Facility	State	6/30/2022

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Planned Addendum Completion Date:*
SWMU 87	Short-term Protective	Not Applicable Click here to enter a date

Protectiveness Statement:
The selected remedy for SWMU 87, consisting of EISB with ICs and LTM, is protective in the short term of human health and the environment. Exposure pathways that could result in and unacceptable risk are being controlled through the enforcement of LUCs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: Finalize the LUC RD for SWMU 87.

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Acronyms and Abbreviations

°F	degree Fahrenheit
mg/kg	milligram per kilogram
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.
CLEAN	Comprehensive Long-term Environmental Action—Navy
CMS	Corrective measures study
COC	constituent of concern
COPC	constituent of potential concern
CVOC	chlorinated volatile organic compound
DCA	dichloroethane
DCE	dichloroethene
DNT	dinitrotoluene
EISB	enhanced in situ bioremediation
EOS	emulsified oil substrate
ERA	ecological risk assessment
ERD	enhanced reductive dechlorination
EVO	emulsified vegetable oil
FDA	United States Food and Drug Administration
FS	feasibility study
GSA	General Services Administration
HHRA	human health risk assessment
HHRS	Human Health Risk Screening
HI	hazard index
HMX	high melting explosive
IAS	Initial Assessment Study
IC	institutional control
ICR	incremental cancer risk
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
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NEESA	Naval Energy and Environmental Support Activity
NFA	no further action
NSWC	Naval Surface Warfare Center
O&M	operations and maintenance
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
RAC	Remedial Action Contractor
RBC	risk-based concentration
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	remedial investigation
ROD	Record of Decision
Shaw	Shaw Environmental & Infrastructure, Inc.
SSL	soil screening level
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit
SVOC	semivolatile organic compound
TCE	trichloroethene
TCL	Target Compound List
Tetra Tech NUS, Inc.	Tetra Tech
TOC	total organic carbon
TRZ	Target Remediation Zone
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
WSSC	Washington Suburban Sanitation Commission
ZVI	zero-valent iron

SECTION 1

Introduction

This document presents the results of the Five-Year Review under the Atlantic Division, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, Comprehensive Long-term Environmental Action—Navy (CLEAN) Program, Contract Number N62470-16-D-9000, Contract Task Order JU08, 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, Part 300.430(f)(4)(ii) of the *Code of Federal Regulations*. CH2M HILL, Inc. (CH2M) has prepared this Five-Year Review Report on behalf of the Department of the Navy (Navy) 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 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 OU2, April 2002 (Tetra Tech, 2012).

On behalf of NAVFAC Mid-Atlantic, CH2M has conducted this Five-Year Review of the RAs implemented at the following eight sites at Former NSWC-White Oak:

- 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
- Site 5/ 13 – Open Burn Area and Oil Sludge Disposal Area
- Site 7 – Ordnance Burn Area
- Site 9 – Industrial Wastewater Disposal 300 Area
- Site 11 – Industrial Wastewater Disposal 100 Area
- Site 49 – Trichloroethene Groundwater Plume in the 400 Area
- Solid Waste Management Unit (SWMU) 87 – Building 611 Solid Waste Storage Area

This is the third Five-Year Review for Former NSWC-White Oak. The previous Five-Year Review was signed on June 13, 2012. 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 Former NSWC-White Oak Five-Year Review was led by Armalia Berry-Washington (NAVFAC Washington). Participants included Maryland Department of the Environment (MDE) (Linda Gustafson). USEPA has deferred

evaluation and comment of the Five-Year Review to the State of Maryland. Assistance with the Five-Year Review process was provided by the Navy CLEAN contractor, CH2M. The review began on June 1, 2016.

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 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, D.C. (**Figure 1-1**). The facility encompasses approximately 710 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, 7, 9, 11, 13, 49, SWMU 87, and OU2 at Former NSWC-White Oak. The United States Army (Army) Adelphi Laboratory Center and the United States Naval Reserve Training Center are 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. 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.

1.1.2 Physical Characteristics

1.1.2.1 Climate

As summarized by the National Oceanic and Atmospheric Administration for Baltimore/Washington, the closest National Weather Service Forecast Office to Silver Spring, Maryland, summers are warm and humid with an average temperature of 77.7 degrees Fahrenheit (^{o}F); winters are cool to cold with an average temperature of 38.2^{o}F (http://www.weather.gov/media/lwx/climate/dcatemps.pdf). Average annual precipitation is approximately 39.74 inches with little seasonal variation, based on data available from 1981 through 2010 (http://www.weather.gov/media/lwx/climate/dcaprecip.pdf). Massive snowfall is not common, but occasionally occurs; average snowfall is approximately 15.4 inches, based on data available from 1981 through 2010 (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, 1998), 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, 1998).

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.

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, 1998).

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, and an inactive sand and gravel quarry (Percontee quarry)[1]. 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, 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 (CH2M, 2002).

1.1.4 Regulatory and Environmental Investigation Summary

In 1995, the Navy transferred 22 acres of the property to the Army. The facility was placed on the BRAC list in 1995 and scheduled for closure. The Navy closed all research activities at the facility in 1997 and transferred approximately 600 acres of the property to the GSA. The Air Force continues to occupy the wind tunnel laboratory area as a tenant of GSA. The Army acquired another 49 acres of the property in a federal agency transfer from the Navy in 1998. 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 is the eight sites undergoing RAs: OU2 and OU3; Site 4; Site 5/13; Site 7; Site 9; Site 11; Site 49; and SWMU 87. These sites are discussed in further detail in **Sections 4** through **10**. In addition, RODs requiring no further action (NFA) have been issued for four sites at Former NSWC-White Oak, as identified in **Table 1-1**.

Table 1-1. Site and Operable Unit Summary

Site Number	Site Identification	OU Number	OU Description	ROD Status (Yes/No)	
1 and 2	Parking Lot Landfill (Site 1) and Apple Orchard Landfill (Site 2)	2	Soil, Waste, and Sediment	Yes	ROD signed July 18, 2001
1 and 2	Parking Lot Landfill (Site 1) and Apple Orchard Landfill (Site 2)	3	Groundwater	Yes	ROD signed September 30, 2004
3	Pistol Range Landfill	1	Groundwater, Soil, and Sediment	Yes	NFA ROD signed March 7, 2005
4	Chemical Burial Area	1	Soil and Groundwater	Yes	ROD signed September 28, 2005
5/13	Open Burn Area (Site 5) and Oil Sludge Disposal Area (Site 13)	1	Soil and Groundwater	Yes	ROD signed September 30, 2004
7	Ordnance Burn Area	1	Groundwater and Soil	Yes	ROD signed September 29, 2004
8	Abandoned Chemical Disposal Pit	NA	Soil	Yes	NFA ROD signed July 24, 2002
9	Industrial Wastewater Disposal 300 Area	1	Groundwater and Soil	Yes	ROD signed September 30, 2004
11	Industrial Wastewater Disposal 100 Area	NA	Groundwater	Yes	ROD signed April 8, 2004
		NA	Soil	Yes	NFA ROD signed July 24, 2002
28	Building T-14 Scrapyard	NA	Soil	Yes	NFA ROD signed May 16, 2003
47	Building 90 Drainage	NA	Soil and Sediment	Yes	NFA ROD signed May 16, 2003

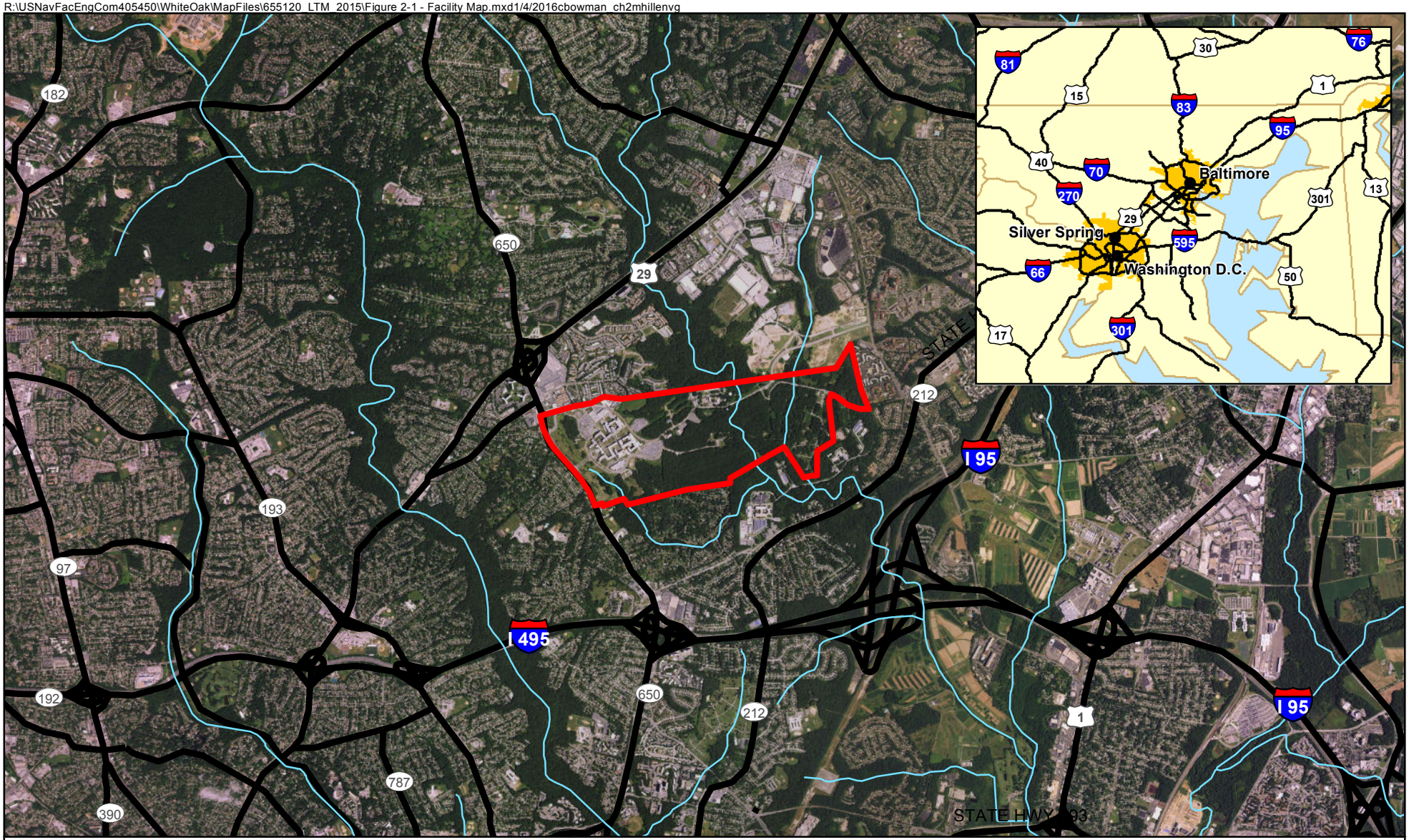
[1] Percontee is currently negotiating with Montgomery County to develop its 180-acre site as part of a 300-acre hub of medical and science companies, housing, and retail businesses adjacent to the Food and Drug Administration campus (https://www.washingtonpost.com/local/md-politics/montgomery-county-developer-reach-agreement-on-white-oak-project/2016/06/03/3995da9e-29a1-11e6-b989-4e5479715b54_story.html)

Table 1-1. Site and Operable Unit Summary

Site Number	Site Identification	OU Number	OU Description	ROD Status (Yes/No)	
49	Trichloroethene (TCE) Groundwater Plume in the 400 Area	NA	Groundwater	Yes	ROD signed November 16, 2004
SWMU 87	Building 611 Solid Waste Storage Area	NA	Groundwater	Yes	ROD signed October 11, 2005

NA = Not applicable

R:\USNavFacEngCom405450\WhiteOak\MapFiles\655120_LTM_2015\Figure 2-1 - Facility Map.mxd1/4/2016cbowman_ch2mhillenvg



Legend

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

N

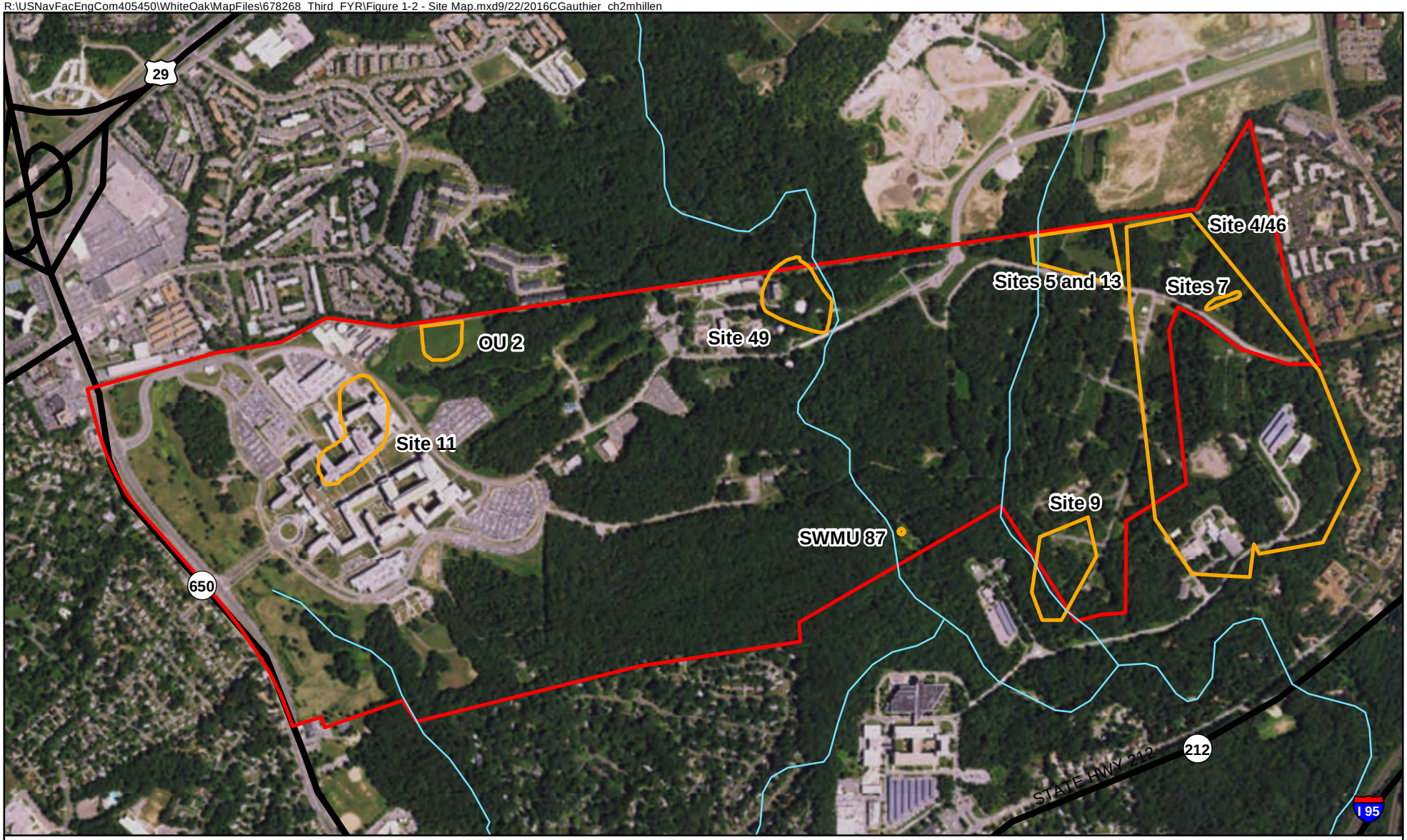
0 2,250 4,500 Feet

1 inch = 4,500 feet

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

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 1-2 - Site Map.mxd9/22/2016CGauthier_ch2mhillen



Legend

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

N

0 1,200 2,400 Feet

1 inch = 1,200 feet

Figure 1-2
Site Map
Third 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 Environmental Restoration Program. The Navy implements CERCLA at Former NSWC-White Oak in partnership with MDE[2]. Remedy protectiveness for the eight 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

A public notice (**Appendix A**) for the Third Five-Year Review for Sites OU2/OU3, 4, 5/13, 7, 9, 11, 49, and SWMU 87 was published on April 14, 2016, in the Montgomery County Sentinel. The purpose of the notice was to inform the public that the Five-Year Review was being conducted, to provide information where the RODs under review can be obtained, and how the community can contribute during the review process. No comments or questions were received from the public related to the Five-Year Review. Additionally, Remedial Advisory Board (RAB) members were notified of the review during the RAB meeting on April 20, 2016. Upon completion of this Third Five-Year Review, the results will be made available to the RAB members at their next meeting. Additionally, a notice will be sent to the local newspaper 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.

No interviews were conducted as part of the Five-Year Review process because these sites are no longer active and there were no personnel identified who are assigned to these sites on a daily basis.

2.2 Data Review

The Five-Year Review consisted of a review of site-specific documentation and data for each OU/site. 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 for each OU/site is included in in the review specific to each OU/Site, and references are provided in **Section 12**.

2.3 Site Inspections

Site Inspections for the Five-Year Review were conducted on June 30, 2016. 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 photo log of the sites are located in **Appendix B**. The purpose of the inspections was to assess the protectiveness of the remedy and, while no issues were identified affecting the immediate protectiveness of the sites, the following issues were observed or noted:

- Site 4 – The “Shaw” building was broken into in November 2015 and two generators were stolen.
- Sites 5/13 – The downhill portion of the Site 13 offsite access road was washed out.
- Site 7 – Overgrown vegetation was observed at the Site 7 monitoring wells.
- Site 9 – In general, the site conditions are good; however, the vegetation is overgrown.

[2] Note: Due to the maturity of the cleanup program as it is primarily in long-term monitoring (LTM) status, USEPA no longer provides regulatory oversight of the NSWC-White Oak sites.

- Site 11 – Monitoring well 11MW210S was destroyed during construction of the United States Food and Drug Administration (FDA) campus.
- Site 49 – Downgradient monitoring wells 49GW201S, 49GW201D, and 49GW201DD were washed out and subsequently abandoned in June 2015. Additionally, the access road was observed to be washed out during the June 2016 inspection.
- SWMU 87 – The access road was partially blocked by fallen tree limbs.

SECTION 3

Site 2 – OU2 (Apple Orchard Landfill) and OU3 (Associated Groundwater and Surface Water)

3.1 Site Chronology

A chronology of major events for OU2/OU3 is provided below.

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

Date	Key Events and Milestones
1984	Site 2 identified as IRP site during Naval Energy and Environmental Support Activity (NEESA) Initial Assessment Study (IAS).
February 1986	Tetra Tech performed sampling event.
May 1986	Tetra Tech performed sampling event.
January 1989	Tetra Tech performed sampling event.
January 1991	Tetra Tech performed sampling event.
October 1992	Malcolm Pirnie published RI report for investigation activities conducted between 1989 and 1992.
June 1996	Land transfer of NSWC-White Oak to GSA and Army agreed upon.
June 1997	Tetra Tech performed sampling event.
June 1998	USEPA issued Administrative Order to the Navy requiring interim measures be taken at NSWC-White Oak to mitigate threats to human health and the environment, and to perform a Resource Conservation and Recovery Act (RCRA) FS and corrective measures study (CMS).
February 1999	Tetra Tech performed sampling event.
April 1999	Tetra Tech performed sampling event.
July 1999	Tetra Tech performed sampling event.
October 1999	Tetra Tech performed sampling event.
2000	Tetra Tech finalized RCRA Facility Investigation (RFI) report considering soil, groundwater, surface water, and sediment data from 1998-1999.
March 2001	Tetra Tech finalized CMS which offered remedial alternatives to address risks identified during the RI.
June-December 2001	Remedial action (excavation and consolidation of waste under landfill cap) performed.
July 18, 2001	ROD for OU2 (soil, solid waste and sediment) was signed; the selected remedy is multimedia cap.
June 2002	Tetra Tech performed LTM sampling event.
October 2002	Tetra Tech performed LTM sampling event.
December 2002	Tetra Tech performed LTM sampling event.
March 2003	Tetra Tech performed LTM sampling event.
June 2004	Tetra Tech performed LTM sampling event.
July 2004	Tetra Tech performed LTM sampling event.
September 30, 2004	ROD for OU3 (groundwater/surface water) was signed; the selected remedy is natural attenuation, institutional controls (ICs), and LTM.
September 2005	Tetra Tech performed LTM sampling event.
December 2006	Tetra Tech performed LTM sampling event.

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

Date	Key Events and Milestones
March 2008	Tetra Tech performed LTM sampling event.
August 2009	Tetra Tech performed LTM sampling event.
October 2011	Tetra Tech performed LTM sampling event.
January 2013	CH2M performed LTM sampling event.
May 2014	CH2M performed LTM sampling event.
August 2015	CH2M performed LTM sampling event.

Site chronology from Tetra Tech, 2012 and Navy Engineering Field Activity Chesapeake, 2001.

3.2 Background

3.2.1 Description and History

The Apple Orchard Landfill is located at Site 2, in the northwestern portion of the Former NSWC-White Oak (**Figure 1-2**). 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 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 Initial Assessment Study (IAS) reports no information regarding the quantity of wastes disposed. It was 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. 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, 2012).

The waste from the Parking Lot Landfill was excavated and consolidated into the Apple Orchard Landfill, 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). The requirements for surface water and groundwater long-term monitoring (LTM) are specified in the ROD for OU3 signed by USEPA Region 3 and the Navy, and with concurrence by MDE (NAVFAC, 2004a). The RA selected in the ROD included natural attenuation, ICs, and LTM of both groundwater and surface water. Human health risk-based Preliminary Remediation Goals (PRGs) were not developed in the ROD, as groundwater is associated with a capped landfill. Because the RA 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 site status, assess the continued adequacy of the selected remedy, and determine whether further action is necessary (NAVFAC, 2004a).

As documented in the OU2 ROD, the constituents of concern (COCs) in OU2 soil include total PCBs, total polycyclic aromatic hydrocarbons (PAHs), trichloroethene (TCE), 1,2-dichloroethane (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).

3.2.2 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 stream 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 radially from the northwestern corner of the site to the southeast, discharging at least in part to the unnamed stream 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 x 10^{-2} feet/day for the bedrock (Tetra Tech, 2012).

3.2.3 Land and Resource Uses

Currently, the majority of property occupied by Site 2 is wooded and/or open space with a small, paved parking area associated with buildings on the west site of the site. The property is owned by the GSA. The anticipated future use of Site 2 is 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 Site 2 is not used as a potable water supply at this time and there are no known plans to use the impacted 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 and state ordinances prevent the installation of new private potable wells without a permit.

3.2.4 History of Contamination

Over the last 15 to 20 years, concentrations of constituents in groundwater and surface water (OU3) have remained consistently low (**Tables 3-2** and **3-3,** respectively). A list of constituents of potential concern (COPCs), originally developed during the RI for the purpose of risk assessment, was presented in the 2012 Five-Year Review (Tetra Tech, 2012). However, there are no cleanup levels for OU3.

Validated analytical results for groundwater and surface water from February 1986 through August 2015 are presented in **Tables 3-2** and **3-3,** respectively. Trend graphs showing concentrations of commonly detected constituents in groundwater and surface water are presented in **Appendix C-1.**

Several volatile organic compounds (VOCs) and explosive constituents have been consistently detected in groundwater during LTM. During the most recent round of groundwater sampling (August 2015), five VOCs (1,2-dichloropropane, carbon disulfide, TCE, cis-1,2-dichloroethene [cis-1,2-DCE], and trichlorofluoromethane [Freon-11]) were detected in samples collected from one or more of the six monitoring wells in the LTM program.

Two of these constituents, 1,2-dichloropropane and carbon disulfide, had not been detected in any other samples in over 10 years.

In surface water, TCE is now the only VOC that is analyzed. Other VOCs have been infrequently detected at low concentrations historically, and are no longer analyzed.

A variety of metals are typically detected in groundwater and surface water samples, at consistently similar concentrations.

3.2.5 Site Risks

Various RI activities were undertaken at OU2-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 two preceding Five-Year Reviews (JM Waller Associates, 2007; Tetra Tech, 2012). The following summary of ecological risk assessment is based on the ERA presented in the Screening Level Ecological Risk Assessment (Tetra Tech, 1999a) and full quantitative ERA (Tetra Tech, 2001a).

3.2.5.1 Human Health Risk Assessment

The HHRA 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-OU3 at the time of the HHRA. Exposure to soil and sediment was evaluated for both a reasonably anticipated commercial/industrial site use scenario and a less likely future residential use scenario. Lead was the only analyte identified as presenting a potential unacceptable risk to human health under the reasonably anticipated commercial/industrial use for Site 1. Risks associated with exposure to surface soil 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, 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 this potential use. PAHs, PCBs (Aroclor 1260), dieldrin, and arsenic 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 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. Risk calculations were performed to quantitatively evaluate risks associated with exposure to groundwater for six potential future exposure scenarios: Full-Time Worker, Maintenance/Utility Worker, Construction Worker, Day Care Center Child, Adult Resident, and Child Resident. Noncarcinogenic hazards associated with exposure to OU3 groundwater and surface water under a construction or hypothetical future residential scenario exceeded the USEPA's target hazard level. Carcinogenic risks associated with exposure to groundwater under a hypothetical future residential scenario exceeded USEPA’s target risk range.

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. First, a Screening Level Ecological Risk Assessment (Tetra Tech, 1999a) was conducted for all sites at Former NSWC-White Oak. This entailed comparison of soil and sediment data to ecological screening criteria to identify COPCs. Later, a full, quantitative ERA (Tetra Tech, 2001a) was conducted that evaluated those COPCs in conjunction with site-specific toxicity and bioaccumulation data. This full ERA concluded that concentrations of

PAHs and PCBs detected in soil and sediment posed potential risks to ecological receptors. However, the potential risks from exposure to sediment and soil were mitigated through the removal of contaminated sediment and capping of the landfill during the OU2 RA.

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 baseline ecological risk assessment (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, 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.

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:

- Natural attenuation to allow naturally occurring processes to significantly reduce the concentrations of COCs. These processes include a combination of dispersion, dilution, adsorption, and biodegradation.
- Implementation of LUCs to:
  - Ensure no withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA and RCRA) from within the restricted area (shown on Figure 2-3 of the OU3 ROD [NAVFAC, 2004a]) until the PRGs[3] 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.

[3] 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.

  - Ensure adequate notification of pertinent use restrictions to current and future owners.

- LTM, consisting of regular collection and analysis of groundwater and surface water samples to assess the progress of natural attenuation and warn of potential migration of contaminants. The primary goal of LTM of 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 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 LANTDIV Remedial Action Contractor (RAC) 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. Following completion of excavation and verification sampling, OU2 was restored by the RAC. The site 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

In accordance with the February 2003 Post-Closure LTM Plan (Tetra Tech, 2003a), groundwater and surface water sampling has been performed in approximate 15-month intervals since 2003, in order to assess the progress of natural attenuation, and warn of any potential migration of COCs. The landfill has been inspected during each sampling event to ensure the continued integrity and effectiveness of the cap.

The following is a summary of the most recent OU3 LTM groundwater surface water sampling event conducted in August 2015.

1,2-Dichloropropane

1,2-dichloropropane was only detected in one groundwater sample from monitoring well 02GW32, at a concentration of 0.17 µg/L. 1,2-dichloropropane has not been detected in any other samples since 2004.

Carbon Disulfide

Carbon disulfide was only detected in one groundwater sample from monitoring well 02GW103 at a concentration of 3 µg/L. Carbon disulfide has not been detected in any other samples since 1999.

TCE

TCE was detected in groundwater samples collected from three monitoring wells (02GW103, 02GW32, and 02GW45) with detected concentrations ranging from 0.14 J to 3.5 µg/L. Prior to the August 2015 sampling event, TCE was mostly detected in groundwater samples collected from monitoring well 02GW45 with TCE decreasing from a concentration of 7.6 µg/L in 2013 to 3.5 µg/L in August 2015.

TCE was the only organic constituent analyzed in the four surface water samples collected in August 2015. TCE was detected in one surface water sample (from OU2SW05) at a concentration of 0.1 µg/L. During the May 2014 LTM event, TCE was also only detected at OU2SW05, at a concentration of 0.14 µg/L.

Cis-1,2-DCE

In August 2015, cis-1,2-DCE was only detected in the sample collected from monitoring well 02GW45. Cis-1,2-DCE has fluctuated over time in this monitoring well with detected concentrations ranging from 1.8 µg/L to 3 µg/L from 2008 to 2015.

Freon-11

Freon-11 was detected in groundwater samples from three monitoring wells (02GW103, 02GW32, and 02GW45) in August 2015. Detected concentrations ranged from 0.3 µg/L to 4.8 µg/L. In samples collected from monitoring well 02GW103, Freon-11 has fluctuated between 8.4 µg/L in October 2011 and 2.9 µg/L in 2015. Freon-11 had not been detected in the groundwater at 02GW32 since 2005; however, it was detected at a concentration of 0. 3 J µg/L in 2015. In groundwater samples collected from monitoring well 02GW45, Freon-11 concentrations ranged from 24 µg/L in March 2008 to 4.8 µg/L in August 2015.

High Melting Explosive

High melting explosive (HMX) was detected in samples from two monitoring wells (02GW103 and 02GW45) in August 2015 at concentrations of 6 µg/L and 1.7 µg/L, respectively. Historically, HMX concentrations have fluctuated over time. In samples collected from monitoring well 02GW103, the HMX concentration ranged from 1.1 µg/L to 6 µg/L between March 2008 and August 2015. The HMX concentrations in samples from monitoring well 02GW45 remained relatively stable from 2005 to 2015, with concentrations ranging from 1.6 µg/L to 3.7 µg/L.

Perchlorate

In August 2015, perchlorate was detected in samples from all monitoring wells, except 02GW104 and 02GW76. Detected concentrations ranged from 0.187 µg/L to 0.955 µg/L.

Total Metals

Twenty metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, thallium, vanadium, and zinc) were detected in the groundwater samples collected in August 2015.

Twenty-one metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, vanadium, and zinc) were detected in the surface water samples collected in August 2015.

Metals concentrations in both groundwater and surface water have remained consistent over the last several years.

3.3.3.3 Operation and Maintenance

An operation and maintenance plan has been prepared for the OU2 landfill (NAVFAC, 2001). Based on the site visit conducted on June 30, 2016, O&M activities appear adequate in maintaining the integrity of the landfill cap.

The only O&M activities currently associated with OU3 are inspection and maintenance of the monitoring wells.

3.3.3.4 Institutional Control Summary

ICs documented in the OU2 ROD (NAVFAC, 2001) include land use restrictions and/or deed notifications to prohibit residential use of the property and to ensure the integrity of the cap is maintained. In addition, access to the area of OU2 outside of the cap will be restricted to preclude daycare children unless a post-excavation risk assessment demonstrates that there is no unacceptable risk for this use.

As per the OU3 ROD (NAVFAC, 2004a), ICs will be implemented to meet the following LUC objectives:

- Ensure no withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA and RCRA) from within the restricted area shown on Figure 2-3 of the OU3 ROD (NAVFAC, 2004a) until the 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.

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 OU2 and OU3 Land Use Control RD, describing the specific nature of the ICs and how they will be implemented, was finalized in 2007 (NAVFAC, 2007a).

3.4 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.

Table 3-4. Protectiveness Determination/Statement from the 2012 Five-Year Review – OU2 and OU3

Protectiveness Determination	Protectiveness Statement
Protective	Based on a review of the existing monitoring data and the site inspection, the selected remedy of a multimedia cap, MNA of the groundwater, and ICs, is functioning as intended and is protecting human and ecological receptors from exposure to soil and groundwater contamination.

Table 3-5. Status of Recommendations from the 2012 Five-Year Review – OU2 and OU3

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Consistency is needed in the LTM efforts; the 15-month period has not been met on a regular basis.	Groundwater monitoring should be continued at 15-month intervals to determine the type and concentration of contaminants leaving the landfill and to meet state and federal regulations.	Ongoing	15-month sampling intervals are being adhered to, providing a consistent sampling interval.	January 2013 May 2014 August 2015
Parameter list for surface water is too extensive.	Recommend removal of explosives, perchlorate, and all VOCs with the exception of TCE from the surface water sampling program.	Completed	Explosives, perchlorate, and all VOCs except TCE have been removed from the surface water analyte list.	January 2013
Number of surface water sampling locations too large given the lack of observed contamination.	Recommend that the number of sampling locations be reduced from six to four.	Completed	02SW02 and 02SW04 were removed from the surface water sampling program.	January 2013

4 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 3-6 summarizes the main documents reviewed in the preparation of this section of the Five-Year Review. Documents cited in the preparation of this section are included in **Section 12**.

Table 3-6. 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	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	Tetra Tech	2012
Final Basewide Long-term Monitoring Report - 2015	CH2M	2017

3.5.2 Data Review and Evaluation

Groundwater and surface water monitoring is being conducted as part of the post-closure activities associated with OU2-OU3 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. Surface water and groundwater quality at OU2-OU3 have generally remained the same since the landfill cap was emplaced in 2001 (**Tables 3-2** and **3-3**). While VOCs, explosives, and metals continue to be consistently detected in groundwater, they are generally present at low concentrations (**Table 3-2**). 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. Only TCE and metals continue to be analyzed in surface water.

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?

The previous Five-Year Review Report included the following protectiveness statement for OU2/OU3:

Based on a review of the existing monitoring data and the site inspection, the selected remedy of a multimedia cap, MNA, institutional controls, and groundwater monitoring is functioning as intended and is protecting human and ecological receptors from exposure to soil and groundwater contamination.

No issues with the landfill cap or with groundwater quality have been identified, therefore, the remedy is still functioning as intended.

3.6.1.1 Remedial Action Performance

The landfill cap at OU2 is in good condition, based on inspections conducted during LTM since its construction in 2001 through 2015. Long-term monitoring of groundwater and surface water associated with the OU2 landfill has not indicated any COC migration or any significant increases in COC concentrations.

3.6.1.2 Implementation of Institutional Controls and Other Measures

ICs at OU2/OU3 include LUCs 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

No opportunities for optimization have been identified since the last Five-Year Review.

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

Since land use is not anticipated to change, 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). No PRGs or cleanup levels were established for OU3, as groundwater is associated with a capped landfill.

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. Additionally, 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 the information presented as answers to questions A–C above, the remedies for OU2-OU3 are still functioning as intended. No issues with the landfill cap or with groundwater or surface water quality have been identified, and no changes to the LTM program are recommended at this time.

It is recommended that site inspections be conducted at least once a year, and that documentation of these inspections be included in an annual LUC Inspection Report for LUCs at OU2 and OU3 in accordance with the OU2 and OU3 LUC RD (NAVFAC, 2007a). A summary of the annual LUC Inspection Reports should be included in the next Five-Year Review.

3.8 Protectiveness Statement

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 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW103															
Sample ID	2GW1030001	2GW1030001-F	2GW1030002	2GW1030002-F	2GW1030003	2GW1030003-F	2GW1030004	2GW1030004-F	02GW103-0602	02GW103-1002	02GW103-1202	02GW103-0303	02GW103-0604	OU2GW103-0704	02GW103-0905	02GW103-1206
Sample Date	02/10/99	02/10/99	04/19/99	04/19/99	07/21/99	07/21/99	10/20/99	10/20/99	06/12/02	10/10/02	12/18/02	03/21/03	06/09/04	07/06/04	09/13/05	12/19/06
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
1,1-Dichloroethane	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
1,2-Dichloroethane	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 UJ	NA	0.5 U	0.5 U
1,2-Dichloropropane	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
2-Butanone	5 R	NA	5 U	NA	5 R	NA	5 R	NA	5 R	5 U	5 U	5 U	5 U	NA	5 U	5 U
Acetone	5 R	NA	5 R	NA	2.9 U	NA	5 R	NA	4 J	5 U	5 U	5 U	5 UJ	NA	5 U	5 U
Benzene	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Bromoform	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 UJ
Carbon disulfide	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 UJ	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Chloroform	1 U	NA	0.16 J	NA	0.18 J	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Chloromethane	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
cis-1,2-Dichloroethene	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 UJ	0.5 U	NA	0.5 U	0.5 U
Dibromochloromethane	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Methylene chloride	0.65 J	NA	2 U	NA	2 U	NA	2 U	NA	0.5 U	1 U	1 U	0.82 B	0.5 U	NA	0.5 U	1 B
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Tetrachloroethene	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 UJ
Toluene	1 U	NA	1 U	NA	1 U	NA	1 U	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Trichloroethene	0.86 J	NA	0.75 J	NA	0.86 J	NA	0.4 J	NA	0.5 U	0.7 J	0.5 J	0.5 U	0.71	NA	0.5 U	0.5 U
Trichlorofluoromethane (Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA	0.8	2.5	3	1.1	11	NA	4.4	4.8
Semivolatile Organic Compounds (UG/L)																
4-Bromophenyl-phenylether	5 U	NA	5 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	2.1 J	NA	2.8 U	NA	1.2 U	NA	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	5 U	NA	5 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	5 U	NA	5 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)																
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)																
1,3-Dinitrobenzene	0.2 U	NA	0.31	NA	0.2 U	NA	0.2 U	NA	NA	0.23 U	1.3 U	1 U	NA	0.2 U	0.16 U	0.4 U
HMX	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	NA	NA	0.68 U	1.3 U	1 U	NA	2.85	1.1	1.9
Perchlorate	5 U	NA	NA	NA	8 U	NA	8 U	NA	NA	4 U	4 U	4 U	1.7	NA	5 UJ	1.5
RDX	0.87	NA	0.88	NA	0.86	NA	0.64	NA	0.21 B	0.73 J	1.3 U	1 U	NA	1.31 J	0.33	0.43 J
Total Metals (UG/L)																
Aluminum	2,000	NA	4,260	NA	2,690	NA	75.4 U	NA	498	292 B	236 B	35.2 B	23.8	NA	6 U	14 U
Antimony	1.9 U	NA	34.2 UL	NA	1.7 U	NA	2.2 U	NA	3 U	4.4 U	2.5 U	3 U	3 U	NA	3 U	1.4 B
Arsenic	1.5 U	NA	1.3 U	NA	1.7	NA	2.3 U	NA	3 U	2.9 U	2.8 U	3 U	3 U	NA	3 U	1.6 U
Barium	64.6	NA	79.6	NA	66.4	NA	35.4	NA	94.5 J	90.1	68	54	96.9	NA	71.8	77.9
Beryllium	0.1 U	NA	0.28 U	NA	0.16 U	NA	0.26 U	NA	2 U	1.3 B	0.4 UL	0.5 U	0.5 U	NA	0.3 U	0.15 U
Cadmium	2.7 UJ	NA	3 UJ	NA	3 UL	NA	0.4 U	NA	2 U	3.4 B	0.3 U	0.7 U	0.7 U	NA	0.2 U	0.21
Calcium	21,200	NA	16,600	NA	19,100	NA	11,600	NA	23,100	17,500	15,100 J	12,400	12,400	NA	15,600	19,400
Chromium	5.1 U	NA	11.3 K	NA	5	NA	0.93 U	NA	3 U	1.5 B	2.9 U	0.6 U	0.6 U	NA	0.74	0.38 U
Cobalt	3.3 U	NA	4.6	NA	3.8 U	NA	0.6 U	NA	3 U	1 B	0.5 UL	0.9 U	0.9 U	NA	0.3 U	0.17 B
Copper	4.4	NA	10.4 K	NA	7.6 U	NA	0.7	NA	4.3 B	7 U	1.2 B	4 U	4 U	NA	0.94	6.3 U
Cyanide	2.7 U	NA	1.1 U	NA	1.4 U	NA	1.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	3,860	NA	8,030	NA	5,320	NA	98.7 U	NA	2,450	962	867	53.3 B	26 U	NA	11.9	247 J
Lead	1 U	NA	2.3	NA	1.8 K	NA	1.1 U	NA	1 U	2.4 L	2 B	4 U	4 U	NA	2 U	0.46 U
Magnesium	8,320	NA	6,960	NA	7,590	NA	3,730	NA	9,000	5,970	4,710	4,840	7,130	NA	6,140	7,150 J
Manganese	441	NA	483	NA	298	NA	104	NA	1,180 J	198	147	7.3	28.8	NA	9.8	13.5 J
Mercury	0.2 U	NA	0.1 U	NA	0.1 U	NA	0.2 UL	NA	0.15 UL	0.01 U	0.02 UL	0.13 U	0.16 U	NA	0.066 U	0.12
Nickel	7.5 U	NA	14.2	NA	10.8	NA	6.4	NA	7.3 J	6.9 B	4.8 U	2.5 B	4.3	NA	2.4 B	2.5
Potassium	8,740	NA	8,590	NA	7,380	NA	2,870	NA	7,090	4,010 J	3,720 J	4,120	2,860	NA	3,830	4,710
Selenium	2.5 U	NA	2 U	NA	2.7 U	NA	3.5 U	NA	8 U	2.8 UL	2.3 U	9 U	9 U	NA	4 U	8.3 B
Silver	2.8 U	NA	3.3 U	NA	2.2 U	NA	0.6 U	NA	2 R	0.4 U	2.5 U	2 U	2 U	NA	2 U	0.91 U
Sodium	40,200	NA	23,800	NA	34,400	NA	18,400	NA	22,200	33,800	20,500 J	14,100	11,600	NA	12,800	15,200
Thallium	2.9 U	NA	5.8 U	NA	4.5	NA	3.2 U	NA	4 U	4 U	3.6 U	3 U	3 U	NA	3 U	1.2 U
Vanadium	2.1 U	NA	8.6	NA	2.4 U	NA	0.6 U	NA	3.2	9 U	0.51	0.7 U	0.7 U	NA	0.7 U	0.47 U
Zinc	20.4 U	NA	31.9	NA	22.3	NA	7.7 U	NA	8 U	26.7	4.4 B	7 U	9.6 B	NA	7.4	17.1 B

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW103															
Sample ID	2GW1030001	2GW1030001-F	2GW1030002	2GW1030002-F	2GW1030003	2GW1030003-F	2GW1030004	2GW1030004-F	02GW103-0602	02GW103-1002	02GW103-1202	02GW103-0303	02GW103-0604	OU2GW103-0704	02GW103-0905	02GW103-1206
Sample Date	02/10/99	02/10/99	04/19/99	04/19/99	07/21/99	07/21/99	10/20/99	10/20/99	06/12/02	10/10/02	12/18/02	03/21/03	06/09/04	07/06/04	09/13/05	12/19/06
Chemical Name																
Dissolved Metals (UG/L)																
Aluminum, Dissolved	NA	12.7 U	NA	38.5 U	NA	36.4 U	NA	14.3 U	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	NA	27.1	NA	30	NA	25.4	NA	36.9	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	NA	2.7 UJ	NA	3 UJ	NA	3 UL	NA	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved	NA	20,700	NA	18,900	NA	19,100	NA	11,000	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	NA	2.3 U	NA	3 U	NA	2.4 U	NA	0.8 U	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt, Dissolved	NA	3.3 U	NA	2.5 U	NA	3.8 U	NA	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	NA	2.4 U	NA	2.4 U	NA	2 U	NA	0.7 U	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	NA	26.2 U	NA	38.9 U	NA	85.6 U	NA	53.4 U	NA	NA	NA	NA	NA	NA	NA	NA
Lead, Dissolved	NA	1 U	NA	0.92 U	NA	1 U	NA	1.1 U	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	NA	7,420	NA	7,090	NA	7,340	NA	3,710	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	NA	366	NA	406	NA	163	NA	98.2	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, Dissolved	NA	0.2 U	NA	0.1 U	NA	0.1 U	NA	0.2 UL	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved	NA	7.5 U	NA	7.8	NA	8.8 U	NA	6.1	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	NA	7,260	NA	8,250	NA	6,900	NA	2,850	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	NA	37,600	NA	30,000	NA	38,800	NA	19,100	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved	NA	2.9 U	NA	6.9 U	NA	3.7 U	NA	3.2 U	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	NA	3.9 U	NA	7.6	NA	8.3	NA	14.2 K	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry																
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	5.93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Salinity (%) (pct)	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	0.586	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	54.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3	1	6 U	6 U	NA	10 U	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.3 UL	0.3 U	NA	0.03 U	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity (NTU) (ntu)	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)																
Dissolved oxygen	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()																
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	1,100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	350 J	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW103								02GW104							
Sample ID	02GW103-0308	02GW103-0809	02GW103-0809-D	02GW103-1011	02GW103-0113	02GW103-0514	02GW103-0815	02GW103P-0815	2GW1040001	2GW1040002	2GW1040002-F	2GW1040003	2GW1040003-F	2GW1040004	2GW1040004-F	02GW104-0602
Sample Date	03/18/08	08/11/09	08/11/09	10/20/11	01/17/13	05/07/14	08/05/15	08/05/15	02/10/99	04/20/99	04/20/99	07/22/99	07/22/99	10/20/99	10/20/99	06/12/02
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	0.5 U	0.3 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
1,1-Dichloroethane	0.5 U	0.2 U	0.2 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
1,2-Dichloroethane	0.5 U	0.3 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
1,2-Dichloropropane	0.5 U	0.3 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
2-Butanone	5 U	1 U	1 U	2.5 R	4 U	4 U	4 UJ	4 UJ	5 R	5 U	NA	5 R	NA	5 R	NA	3,100 J
Acetone	5 U	2 U	2 U	2.5 UJ	5 U	5 U	2.8 B	5 UJ	2.5 L	5 R	NA	4.4 U	NA	5 R	NA	1,900 L
Benzene	0.5 U	0.3 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1.1	1 U	NA	1 U	NA	1 U	NA	0.5 U
Bromoform	0.5 U	0.4 U	0.4 U	0.5 UJ	0.3 U	0.3 U	0.3 U	0.3 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
Carbon disulfide	0.5 U	0.2 U	0.2 U	0.5 UJ	0.5 U	0.5 U	0.5 U	3	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
Chloroform	0.5 U	0.2 U	0.2 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
Chloromethane	0.5 U	0.3 U	0.3 U	0.5 UJ	0.3 U	0.3 U	0.3 U	0.3 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
cis-1,2-Dichloroethene	0.5 U	0.2 U	0.2 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1.5	1.7	NA	2.1	NA	2	NA	0.5 U
Dibromochloromethane	0.5 U	0.3 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
Methylene chloride	0.5 U	0.3 U	0.3 U	0.5 UJ	0.89 B	1 U	1 U	1 U	2 U	2 U	NA	2 U	NA	2 U	NA	0.5 U
Methyl-tert-butyl ether (MTBE)	0.5 U	0.5 U	0.5 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA	0.5 U
Tetrachloroethene	0.5 UL	0.4 U	0.4 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	0.5 U
Toluene	0.5 UL	0.4 U	0.4 U	0.5 UJ	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	NA	1 U	NA	1 U	NA	8.6
Trichloroethene	0.1 J	0.4 U	0.4 U	0.5 UJ	0.2 U	0.2 U	0.14 J	0.14 J	1.5 J	1.2	NA	1.3	NA	0.5 J	NA	0.5 U
Trichlorofluoromethane (Freon-11)	3	5	5	8.4 J	1.4	1.4	2.9	2.7	NA	NA	NA	NA	NA	NA	NA	0.5 U
Semivolatile Organic Compounds (UG/L)																
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	NA	1.4 J	NA	5 U	NA	NA
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	NA	3.8 U	NA	2 U	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	NA	5 U	NA	5 U	NA	NA
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	25	5 U	NA	5 U	NA	5 U	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)																
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)																
1,3-Dinitrobenzene	1 U	0.045 U	0.045 U	0.11 U	0.347 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA
HMX	1.1	3.8	4	4.8	1.64	2.4	4.2 J	6 J	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	NA
Perchlorate	1.2	NA	NA	1.2	0.685	1.34	0.955	0.945	5 U	NA	NA	8 U	NA	20 U	NA	NA
RDX	1 U	0.34	0.046 U	0.31 J	0.347 U	0.2 U	0.2 U	0.2 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.2 U
Total Metals (UG/L)																
Aluminum	14.6 U	12.5 U	12.5 U	25.9 B	42.5 B	668	24.7 B	22.4 B	104 U	921	NA	1,320	NA	654	NA	13.3 B
Antimony	0.93 B	1.33 U	2	12.5 UL	0.5 U	0.5 U	0.5 U	0.5 U	1.9 U	34.2 UL	NA	1.7 U	NA	2.2 U	NA	3 U
Arsenic	1.69 U	1.2 U	1.2 U	5 UL	0.2 U	0.136 J	0.2 U	0.2 U	1.5 U	1.3 U	NA	2.4	NA	2.3 U	NA	3 U
Barium	58.5 J	77.8	78.8	87.9	52.2	55.8	68.4	67.4	317	334	NA	302	NA	265	NA	309 J
Beryllium	0.13 U	0.17 B	0.11 B	1.5 U	0.0725 J	0.127 J	0.111 J	0.108 J	0.1 U	0.18 U	NA	0.11 U	NA	0.11 U	NA	2 U
Cadmium	0.25 B	0.12 U	0.12 U	1.5 U	0.2 U	0.11 J	0.2 U	0.2 U	2.7 UJ	3 UJ	NA	3 UL	NA	0.29 U	NA	2 U
Calcium	13,900	11,000	10,700	13,700	7,350	5,950	7,870	7,660	75,600	82,300	NA	68,100	NA	64,900	NA	44,600
Chromium	0.41 U	0.44 U	0.44 U	2.5 U	6.75	6.82 B	2.64 B	2.55 B	8.8 U	14.8 K	NA	2.4 U	NA	3.5 U	NA	3 U
Cobalt	0.27 B	0.27 U	0.27 U	7.5 U	0.519 B	1.08	0.513 B	0.529 B	3.3 U	4.1	NA	3.8 U	NA	0.6 U	NA	3 U
Copper	0.96	0.7 U	0.7 U	6.21 B	6.3	2.62 B	3.14	2.55 B	3.6	7.3 K	NA	7.2 U	NA	1.6	NA	4 B
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	2.7 U	1.1 U	NA	1.4 U	NA	1.3 U	NA	NA
Iron	11.5 B	5.8 B	5.17 U	54.1 K	115 B	1,410	34.1 B	31.2 B	1,740	4,300	NA	3,760	NA	2,250	NA	2,390
Lead	0.97 U	1.02 U	1.02 U	3 U	0.266 B	0.435 B	0.373 J	0.228 B	1 U	0.92 U	NA	1 U	NA	1.1 U	NA	1 U
Magnesium	5,660	5,270	5,190	6,010	3,700	3,790	4,410	4,340	20,200	22,800	NA	19,900	NA	19,000	NA	17,400
Manganese	10.5 K	22.8	20.7	25.4	35.6	52.4	18.1	17.6	389	509	NA	413	NA	272	NA	408 J
Mercury	0.04 B	0.03	0.03	0.1 UL	0.111 B	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U	NA	0.1 U	NA	0.2 UL	NA	0.14 UL
Nickel	1.6 B	3.3	3.3	10 U	7.73	9.68	5.31 B	5.32 B	7.5 U	8.2	NA	8.8 U	NA	2.1	NA	0.77 J
Potassium	3,230	2,500	2,390	2,720	2,200	2,360	2,190	2,170	8,790	7,860	NA	6,930	NA	7,300	NA	11,300
Selenium	0.96 U	3.03 U	3.03 U	5 U	0.3 U	0.3 U	0.3 U	0.3 U	2.5 U	2 U	NA	2.7 U	NA	3.5 U	NA	8 U
Silver	0.29 U	0.79 U	0.79 U	2.5 U	0.2 U	0.2 U	0.2 U	0.2 U	2.8 U	3.3 U	NA	2.2 U	NA	0.6 U	NA	2 R
Sodium	12,100	9,950	9,760	10,800	6,620	6,190 B	8,700	8,570	46,000	38,200	NA	30,700	NA	33,100	NA	26,800
Thallium	1.64 U	3.4 B	0.7 B	10 U	0.2 U	0.2 U	0.2 U	0.2 U	2.9 U	6.1 U	NA	5.3	NA	4 U	NA	4 U
Vanadium	0.38 U	5.12 U	5.12 U	10 U	0.5 U	1.52	0.5 U	0.5 U	2.1 U	5.3	NA	2.4 U	NA	2.4 U	NA	4.8
Zinc	6.5	4.8	4.6	8.62 J	19.5 B	17.3 B	30.1	29.1 B	7.7 U	156	NA	49.3	NA	24.2 K	NA	8 U

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW103								02GW104							
Sample ID	02GW103-0308	02GW103-0809	02GW103-0809-D	02GW103-1011	02GW103-0113	02GW103-0514	02GW103-0815	02GW103P-0815	2GW1040001	2GW1040002	2GW1040002-F	2GW1040003	2GW1040003-F	2GW1040004	2GW1040004-F	02GW104-0602
Sample Date	03/18/08	08/11/09	08/11/09	10/20/11	01/17/13	05/07/14	08/05/15	08/05/15	02/10/99	04/20/99	04/20/99	07/22/99	07/22/99	10/20/99	10/20/99	06/12/02
Chemical Name																
Dissolved Metals (UG/L)																
Aluminum, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.5 U	NA	29.4 U	NA	102 U	NA
Barium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	339	NA	282	NA	269	NA
Cadmium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3 U	NA	3 UL	NA	0.2 U	NA
Calcium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	78,100	NA	59,100	NA	67,700	NA
Chromium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3 U	NA	2.4 U	NA	0.8 U	NA
Cobalt, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5 U	NA	3.8 U	NA	0.6 U	NA
Copper, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4 U	NA	1.4 U	NA	0.7 U	NA
Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	559	NA	561	NA	60.1 U	NA
Lead, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9 U	NA	1 U	NA	1.1 U	NA
Magnesium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	24,700	NA	19,900	NA	19,600	NA
Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	469	NA	352	NA	253	NA
Mercury, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U	NA	0.1 U	NA	0.2 UL	NA
Nickel, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.9 U	NA	8.8 U	NA	1.5 U	NA
Potassium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8,100	NA	7,510	NA	8,250	NA
Sodium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	43,000	NA	34,300	NA	34,000	NA
Thallium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.7 U	NA	3.7 U	NA	3.8 U	NA
Zinc, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90.3	NA	17.1	NA	16.8 K	NA
Wet Chemistry																
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	NA	NA	NA	NA	NA	NA	NA	NA	7.69	NA	NA	NA	NA	NA	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	NA	NA	NA	NA	0.04	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA	0.93	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	NA	NA	NA	NA	52.7	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)																
Dissolved oxygen	NA	NA	NA	NA	NA	NA	NA	NA	5.6	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()																
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000 U	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100 UJ	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW104													
Sample ID	02GW104-1002	02GW104-1202	02GW104-0303	02GW104-0604	OU2GW104-0704	02GW104-0905A	02GW104-0905	02GW104-1206	02GW104-0308	02GW104-0809	02GW104-1011	02GW104-0113	02GW104-0514	02GW104-0815
Sample Date	10/11/02	12/18/02	03/21/03	06/09/04	07/06/04	09/13/05	09/14/05	12/19/06	03/19/08	08/12/09	10/20/11	01/16/13	05/07/14	08/05/15
Chemical Name														
Volatile Organic Compounds (UG/L)														
1,1,2,2-Tetrachloroethane	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U
1,1-Dichloroethane	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.2 U	0.5 UJ	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	1 U	1 U	0.5 U	0.5 UJ	NA	NA	0.5 U	0.5 U	0.5 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U
2-Butanone	430 B	60	5 U	5 U	NA	NA	5 U	5 U	5 U	1 U	2.5 R	4 U	4 U	4 UJ
Acetone	510	37 B	5 U	5 UJ	NA	NA	5 U	5 U	5 U	2 U	2.5 UJ	5 U	5 U	3.6 B
Benzene	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U
Bromoform	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 UJ	0.5 U	0.4 U	0.5 UJ	0.3 U	0.3 U	0.3 U
Carbon disulfide	1 UJ	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.2 U	0.5 UJ	0.5 U	0.5 U	0.5 U
Chloroform	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.2 U	0.5 UJ	0.2 U	0.2 U	0.2 U
Chloromethane	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.3 J	0.5 UJ	0.3 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	0.6 J	0.8 J	0.85	0.5 U	NA	NA	0.5 U	0.5 U	0.2 J	0.2 U	0.5 UJ	0.12 J	0.74 J	0.2 U
Dibromochloromethane	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.3 U	0.5 UJ	0.2 U	0.2 U	0.2 U
Methylene chloride	1 U	1 U	0.52 B	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.3 U	0.5 UJ	1 U	1 U	1 U
Methyl-tert-butyl ether (MTBE)	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.2 U	0.2 U	0.2 U
Tetrachloroethene	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 UJ	0.5 U	0.4 U	0.5 UJ	0.2 U	0.2 U	0.2 U
Toluene	2.5	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.4 U	0.5 UJ	0.2 U	0.21 B	0.2 U
Trichloroethene	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.4 U	0.5 UJ	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane (Freon-11)	1 U	1 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.3 U	0.3 U	0.3 U
Semivolatile Organic Compounds (UG/L)														
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)														
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)														
1,3-Dinitrobenzene	0.35 U	0.23 U	1 U	NA	0.2 U	NA	0.18 U	0.4 U	1 U	0.045 U	0.105 U	0.342 U	0.2 U	0.2 U
HMX	0.35 U	0.23 U	1 U	NA	0.2 U	NA	0.18 U	0.4 U	1 U	0.19 J	0.21 U	0.342 U	0.2 U	0.2 U
Perchlorate	4 U	4 U	4 U	0.5 U	NA	NA	5 UJ	0.2 U	0.06 U	NA	0.2 U	0.1 U	0.1 U	0.1 U
RDX	0.35 U	0.23 U	1 U	NA	0.2 U	NA	0.18 U	0.4 U	1 U	0.046 U	0.21 U	0.342 U	0.2 U	0.2 U
Total Metals (UG/L)														
Aluminum	86.4 U	45.7 U	42.1 B	48.4	NA	NA	49.3 B	55.8 B	14.6 U	12.5 U	15.8 B	27.6 B	182 B	32.8 J
Antimony	4.4 U	2.5 U	3 U	3 U	NA	NA	3 U	1.3 B	0.78 U	2	12.5 UL	0.5 U	0.3 J	0.5 U
Arsenic	2.9 U	2.8 U	3 U	3 U	NA	NA	3 U	1.6 U	1.69 U	1.2 U	5 UL	0.516 J	0.291 J	0.457 J
Barium	298	251	331	263	NA	NA	283	281	308 J	305	378	358	269	249
Beryllium	1.4 B	0.4 UL	0.5 U	0.5 U	NA	NA	0.3 U	0.15 U	0.13 U	0.09 U	1.5 U	0.1 U	0.1 U	0.1 U
Cadmium	3.8	0.31 B	0.7 U	0.7 U	NA	NA	0.6	0.23	0.47 B	0.12 U	1.5 U	0.2 U	0.2 U	0.154 J
Calcium	48,100	48,500 J	53,600	49,800	NA	NA	53,100	52,000	58,200	58,200	59,200	58,500	48,200	44,300
Chromium	0.3 U	4	0.6 U	0.63	NA	NA	1.5	1.4 B	1.1	0.53	2.5 U	3.58 B	5 B	14.2
Cobalt	0.8 U	0.5 UL	0.9 U	0.9 U	NA	NA	0.3 U	0.15 B	0.37 B	0.27 U	7.5 U	0.921 J	0.554 B	1.68
Copper	7 U	0.7 U	4 U	4 U	NA	NA	11.6	6.3 U	10.1	0.71	3.4 B	1.88 B	1.81 B	6.3
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	2,810	826	1,230	1,510	NA	NA	982	488 J	519	259	1,390	1,190	720 B	563
Lead	2.4 UL	2.3 B	4 U	4 U	NA	NA	2 U	0.46 U	1.8	1.02 U	3.57 B	0.291 B	0.689 B	0.346 J
Magnesium	16,100	17,000	20,100	19,100	NA	NA	18,900	19,300 J	20,400	18,500	19,800	18,100	15,700	14,200
Manganese	434	97.8	205	281	NA	NA	339	158 J	97.4	83.8	1,330	1,170	183	382
Mercury	0.01 U	0.02 UL	0.13 U	0.14 U	NA	NA	0.067 U	0.13	0.03 B	0.03	0.1 UL	0.1 U	0.1 U	0.1 U
Nickel	1.8 B	4.8 U	1.6 B	0.8 U	NA	NA	2.2 B	2	0.9 B	0.24 U	10 U	5.25	4.41 B	13.3
Potassium	10,600 J	10,300 J	7,940	10,400	NA	NA	11,300	10,500	10,900	6,810	6,680	7,480	5,720	5,530
Selenium	2.8 UL	2.3 U	9 U	9 U	NA	NA	4 U	11 B	0.96 U	3.03 U	5 U	0.3 U	0.3 U	0.3 U
Silver	0.4 U	2.5 U	2 U	2.2 B	NA	NA	2 U	0.91 U	0.29 U	0.79 U	2.5 U	0.2 U	0.2 U	0.2 U
Sodium	22,100	19,900 J	17,400	19,300	NA	NA	20,100	18,000	18,300	14,400	15,700	15,000	15,000	20,300
Thallium	4 U	3.6 U	3 U	3 U	NA	NA	3 U	1.2 U	3 B	0.6 U	10 U	0.2 U	0.2 U	0.2 U
Vanadium	9 U	0.41	1.4	3.2 B	NA	NA	2.1 B	1.4	1.2	5.12 U	10 U	0.921 J	2.08	2.62
Zinc	16.7 U	1.9 B	9.8	15.9 B	NA	NA	19.5	19.2 B	10.7	1.73 U	12.3 J	12.3 B	38.3 B	20.7

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW104													
Sample ID	02GW104-1002	02GW104-1202	02GW104-0303	02GW104-0604	OU2GW104-0704	02GW104-0905A	02GW104-0905	02GW104-1206	02GW104-0308	02GW104-0809	02GW104-1011	02GW104-0113	02GW104-0514	02GW104-0815
Sample Date	10/11/02	12/18/02	03/21/03	06/09/04	07/06/04	09/13/05	09/14/05	12/19/06	03/19/08	08/12/09	10/20/11	01/16/13	05/07/14	08/05/15
Chemical Name														
Dissolved Metals (UG/L)														
Aluminum, Dissolved	NA	NA	17 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	NA	NA	330	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	NA	NA	0.7 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium, Dissolved	NA	NA	54,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	NA	NA	0.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt, Dissolved	NA	NA	0.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	NA	NA	4.6 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	NA	NA	26 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, Dissolved	NA	NA	4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	NA	NA	20,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	NA	NA	129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, Dissolved	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, Dissolved	NA	NA	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	NA	NA	8,090	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	NA	NA	17,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved	NA	NA	3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	NA	NA	7 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry														
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	2.5	1.6	6 U	6 U	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	0.05 U	0.05 U	0.3 UL	0.3 U	NA	0.03 U	NA	NA	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)														
Dissolved oxygen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()														
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW31													
Sample ID	2GW31 02/01/86(OLD)	2GW31 05/01/86(OLD)	2GW31 a mp(OLD)	2GW31DS 1989(OLD)	2GW31-F a mp(OLD)	2GW31-T a mp(OLD)	2GW31 b mp(OLD)	2GW31DS 1991(OLD)	2GW31-F b mp(OLD)	2GW31-T b mp(OLD)	WO-2GW31	2GW310001	2GW310001-F	2GW310002
Sample Date	02/01/86	05/01/86	01/01/89	01/01/89	01/01/89	01/01/89	01/01/91	01/01/91	01/01/91	01/01/91	06/10/97	02/10/99	02/10/99	04/21/99
Chemical Name														
Volatile Organic Compounds (UG/L)														
1,1,2,2-Tetrachloroethane	5 U	5 U	NA	NA	NA	NA	5 U	NA	NA	NA	1 U	1 U	NA	1 U
1,1-Dichloroethane	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
1,2-Dichloroethane	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
1,2-Dichloropropane	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
2-Butanone	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA	5 R	5 R	NA	5 U
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 R	2 L	NA	5 R
Benzene	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Bromoform	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Carbon disulfide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Chloroform	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Chloromethane	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	10 U	NA	NA	NA	1 U	1 U	NA	1 U
Dibromochloromethane	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Methylene chloride	5 U	5 U	5 U	NA	NA	NA	5 U	NA	NA	NA	2 U	2 U	NA	2 U
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Toluene	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	1 U
Trichloroethene	5 U	5 U	5 U	NA	NA	NA	5 U	NA	NA	NA	1 U	1 U	NA	1 U
Trichlorofluoromethane (Freon-11)	5 U	5 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/L)														
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8 U	5 U	NA	5 U
bis(2-Ethylhexyl)phthalate	NA	NA	8 J	NA	NA	NA	10 U	NA	NA	NA	8 U	5 U	NA	2.5 U
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8 U	5 U	NA	5 U
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 J	5 U	NA	5 U
Pesticide/Polychlorinated Biphenyls (UG/L)														
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)														
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6 U	0.2 U	NA	0.2 U
HMX	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3 U	0.5 U	NA	0.5 U
Perchlorate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
RDX	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3 U	0.5 U	NA	0.5 U
Total Metals (UG/L)														
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8,480	24,700	NA	28,600
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 U	1.9 U	NA	34.2 UL
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6 U	5.8	NA	5.3
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	55.9	333	NA	117
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1 B	3.2 U	NA	2.1 U
Cadmium	17	5 U	NA	NA	NA	3 U	NA	NA	NA	74	0.52 B	2.7 UJ	NA	3 UJ
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,840 K	8,300	NA	4,020
Chromium	216	10 U	NA	NA	NA	55	NA	NA	NA	179 R	33	24.4	NA	28.8
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.5	38.7	NA	20.8
Copper	349	25 U	NA	NA	NA	80.2	NA	NA	NA	1,680	25.2	59	NA	44 K
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.5	2.7 U	NA	1.1 U
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14,500 L	41,800	NA	42,500
Lead	95	34	NA	NA	NA	34.2	NA	NA	NA	377	5.4 L	20.2	NA	9.6
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,760 K	9,490	NA	8,200
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	321	1,390	NA	655
Mercury	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	0 R	0.16	0.92	NA	0.24
Nickel	316	40 U	NA	NA	NA	NA	NA	NA	NA	NA	33.5	39.1	NA	35.4
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,740	6,610	NA	6,580
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6 U	2.5 U	NA	2.4 U
Silver	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	2.8 U	NA	3.3 U
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,020 L	3,970	NA	3,670 U
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4 B	4.5 U	NA	5.9 U
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.6	25.7	NA	34.2
Zinc	720	26	NA	NA	NA	173	NA	NA	NA	3,400	113	105	NA	94.4

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
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Former NSWC-White Oak

Station ID	02GW31													
Sample ID	2GW31 02/01/86(OLD)	2GW31 05/01/86(OLD)	2GW31 a mp(OLD)	2GW31DS 1989(OLD)	2GW31-F a mp(OLD)	2GW31-T a mp(OLD)	2GW31 b mp(OLD)	2GW31DS 1991(OLD)	2GW31-F b mp(OLD)	2GW31-T b mp(OLD)	WO-2GW31	2GW310001	2GW310001-F	2GW310002
Sample Date	02/01/86	05/01/86	01/01/89	01/01/89	01/01/89	01/01/89	01/01/91	01/01/91	01/01/91	01/01/91	06/10/97	02/10/99	02/10/99	04/21/99
Chemical Name														
Dissolved Metals (UG/L)														
Aluminum, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.2 U	NA
Barium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.8	NA
Cadmium, Dissolved	NA	NA	NA	3 U	3 U	NA	NA	5 U	5 U	NA	NA	NA	2.7 UJ	NA
Calcium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,500	NA
Chromium, Dissolved	NA	NA	NA	7 U	7 U	NA	NA	10 U	10 U	NA	NA	NA	2.3 U	NA
Cobalt, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.3 U	NA
Copper, Dissolved	NA	NA	NA	3 U	3 U	NA	NA	25 U	25 U	NA	NA	NA	2.4 U	NA
Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16 U	NA
Lead, Dissolved	NA	NA	NA	28 U	28 U	NA	NA	3 U	3 U	NA	NA	NA	1 U	NA
Magnesium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,260	NA
Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22.5	NA
Mercury, Dissolved	NA	NA	NA	0.2 U	0.2 U	NA	NA	0 R	0 R	NA	NA	NA	0.2 U	NA
Nickel, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.5 U	NA
Potassium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,120	NA
Sodium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,010	NA
Thallium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.5 U	NA
Zinc, Dissolved	NA	NA	NA	29.4	29.4	NA	NA	32	32	NA	NA	NA	7.3 U	NA
Wet Chemistry														
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.58	NA	NA	NA
pH (ph)	5.5	5.9	NA	NA	5.5	NA	NA	NA	NA	NA	NA	5.03	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.054	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.78	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	53.4	NA	NA
Total dissolved solids (TDS) (mg/l)	430	288	NA	NA	20 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	4	5	NA	NA	0.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	0.006	0.064	NA	NA	0.008	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	1,930	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	999 >	NA	NA
Dissolved Wet Chemistry (MG/L)														
Dissolved oxygen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.55	NA	NA
Total Petroleum Hydrocarbons ()														
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW31															
Sample ID	2GW310002-F	2GW310003	2GW310003-F	2GW310004	02GW031-0602	02GW031-1002	02GW031-1002-D	02GW031-1202	02GW031-0303	02GW031-0303-D	OU2GW31-0604	OU2GW031-0704	02GW31-0905A	02GW31-0905	02GW31-1206	02GW31-0308
Sample Date	04/21/99	07/21/99	07/21/99	10/19/99	06/11/02	10/09/02	10/09/02	12/17/02	03/21/03	03/21/03	06/08/04	07/05/04	09/13/05	09/14/05	12/19/06	03/18/08
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
1,2-Dichloropropane	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
2-Butanone	NA	5 R	NA	5 R	5 R	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U
Acetone	NA	2.7 U	NA	5 R	5 R	5 U	5 U	5 UJ	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U
Benzene	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Bromoform	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 UJ	0.5 U
Carbon disulfide	NA	1 U	NA	1 U	0.5 U	1 UJ	1 UJ	1 UJ	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Chloroform	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Chloromethane	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 UJ	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Dibromochloromethane	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Methylene chloride	NA	2 U	NA	2 U	1.4 B	1 U	1 U	1 U	0.51 B	0.57 B	0.5 U	NA	NA	0.5 U	0.92 B	0.5 U
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Tetrachloroethene	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 UJ	0.5 U
Toluene	NA	1 U	NA	1 U	0.58	1 U	1 U	1 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Trichloroethene	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	0.83	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Trichlorofluoromethane (Freon-11)	NA	NA	NA	NA	0.5 U	1 U	1 U	1 U	2.4 J	0.5 UJ	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U
Semivolatile Organic Compounds (UG/L)																
4-Bromophenyl-phenylether	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	NA	4.1 U	NA	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)																
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)																
1,3-Dinitrobenzene	NA	0.2 U	NA	0.2 U	NA	0.32 U	0.42 U	1.3 U	1 U	1 U	NA	0.2 U	NA	0.16 U	0.4 U	1 U
HMX	NA	0.5 U	NA	0.5 U	NA	0.32 U	0.42 U	1.3 U	1 U	1 U	NA	0.2 U	NA	0.16 U	0.4 U	1 U
Perchlorate	NA	4 U	NA	4 U	NA	4 U	4 U	4 U	4 U	4 U	1.2	NA	NA	5 UJ	1	0.97
RDX	NA	0.5 U	NA	0.5 U	0.2 U	0.32 U	0.42 U	1.3 U	1 U	1 U	NA	0.2 U	NA	0.16 U	0.4 U	1 U
Total Metals (UG/L)																
Aluminum	NA	52,500	NA	1,310	40.4 B	2,110 J	8,680 J	45.7 U	76.1 B	69.6 B	26	NA	NA	14.3 B	25.8 B	14.6 U
Antimony	NA	1.7 U	NA	2.2 U	3 U	4.4 U	4.4 U	3.2 B	3 U	3 U	3 U	NA	NA	3 U	1.2 U	0.78 U
Arsenic	NA	9.4	NA	2.3 U	3 U	2.9 U	11	2.8 U	3 U	3 U	3 U	NA	NA	3 U	1.6 U	3 B
Barium	NA	222	NA	28.2	30.2 J	34.8	56.5	26.8	28.8	25.4	28.8	NA	NA	32.3	32.9	27.9 J
Beryllium	NA	4.2 U	NA	0.92 U	2 U	0.71 B	2.2 B	0.4 UL	0.5 U	0.5 U	0.5 U	NA	NA	0.3 U	0.15 U	0.13 B
Cadmium	NA	3 UL	NA	0.53 U	2 U	0.6 U	0.6 U	0.3 U	0.7 U	0.7 U	0.7 U	NA	NA	0.2 U	0.23	0.1 B
Calcium	NA	5,620	NA	2,290	3,240	3,480	3,340	2,980 J	1,560	1,660	3,130	NA	NA	3,820	3,410	3,380
Chromium	NA	51.5	NA	3.3 U	3 U	2.5 B	9.3	2.9 U	0.6 U	0.6 U	0.68	NA	NA	0.66	0.38 U	0.41 U
Cobalt	NA	48.2	NA	9.8	3 U	1.8 B	5.6 B	1.4 B	1.6	1.6	0.9 U	NA	NA	0.3 U	0.17 B	0.43 B
Copper	NA	87.7	NA	2.5	3 B	7 U	16.1	0.7 U	4.4 B	4 U	4 U	NA	NA	0.9 U	6.3 U	0.75 U
Cyanide	NA	1.4 U	NA	1.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	80,100	NA	4,030	875	4,600 J	52,500 J	177	690	540	50.5	NA	NA	116	188 B	14.5 B
Lead	NA	21.7	NA	1.1 U	1 U	2.5 L	8.3	2.7 B	4 U	4 U	4 U	NA	NA	2 U	0.46 U	0.97 U
Magnesium	NA	12,700	NA	1,950	2,490	2,620	3,440	2,160	1,710	1,770	2,560	NA	NA	2,760	2,650 J	2,660
Manganese	NA	1,580	NA	564	23.1 J	86.6 J	215 J	33.5	42.9	42.3	10.2	NA	NA	11.9	12.1 J	9.8 K
Mercury	NA	0.29	NA	0.2 UL	0.13 UL	0.01 U	0.079	0.02 UL	0.13 U	0.13 U	0.14 U	NA	NA	0.064 U	0.13	0.04 B
Nickel	NA	74.1	NA	6.3	0.46 J	7.9	15.4	4.8	4.2 B	3.6 B	4.7	NA	NA	6.1 B	3.9	4.7
Potassium	NA	10,200	NA	1,900	1,630	1,360 J	2,100 J	1,040 J	1,080	1,160	1,560	NA	NA	1,860	1,730	1,610
Selenium	NA	2.7 U	NA	3.5 U	8 U	2.8 UL	2.8 UL	2.3 U	9 U	9 U	9 U	NA	NA	4 U	1.8 B	0.96 U
Silver	NA	3.3	NA	0.6 U	2 R	0.4 U	0.4 U	2.5 U	2 U	2 U	2 U	NA	NA	2 U	0.91 U	0.29 U
Sodium	NA	3,990	NA	3,530	4,810	3,520	2,920	5,450 J	4,070	4,150	4,340	NA	NA	5,330	4,970	5,240
Thallium	NA	5.8	NA	3.9 U	4 U	4 U	4 U	3.6 U	3 U	3 U	3 U	NA	NA	3 U	1.2 U	1.64 U
Vanadium	NA	54.5	NA	2.5 U	3 U	9 U	12.3	0.4 U	0.7 U	0.7 U	0.87 B	NA	NA	0.7 U	0.47 U	0.38 U
Zinc	NA	172	NA	12.2 K	8 U	16.7 U	29.6	5.8 B	7 U	7 U	10.7 B	NA	NA	5.5	22.4 B	6.9

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
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Station ID	02GW31															
Sample ID	2GW310002-F	2GW310003	2GW310003-F	2GW310004	02GW031-0602	02GW031-1002	02GW031-1002-D	02GW031-1202	02GW031-0303	02GW031-0303-D	OU2GW31-0604	OU2GW031-0704	02GW31-0905A	02GW31-0905	02GW31-1206	02GW31-0308
Sample Date	04/21/99	07/21/99	07/21/99	10/19/99	06/11/02	10/09/02	10/09/02	12/17/02	03/21/03	03/21/03	06/08/04	07/05/04	09/13/05	09/14/05	12/19/06	03/18/08
Chemical Name																
Dissolved Metals (UG/L)																
Aluminum, Dissolved	49.2 U	NA	42.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.6 U
Barium, Dissolved	16.3	NA	19.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.7
Cadmium, Dissolved	3 UJ	NA	3 UL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.21 B
Calcium, Dissolved	3,290 U	NA	3,490	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,680
Chromium, Dissolved	3 U	NA	2.4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.41 U
Cobalt, Dissolved	2.5 U	NA	3.8 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.42 B
Copper, Dissolved	2.4 U	NA	1.4 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.75 U
Iron, Dissolved	50.8	NA	25.3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9 U
Lead, Dissolved	0.92 U	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.97 U
Magnesium, Dissolved	2,390	NA	2,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,850
Manganese, Dissolved	10.9	NA	17.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.4 K
Mercury, Dissolved	0.1 U	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.04 B
Nickel, Dissolved	5.9 U	NA	8.8 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.9
Potassium, Dissolved	1,620	NA	1,210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,640
Sodium, Dissolved	3,130 U	NA	3,450	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5,540
Thallium, Dissolved	4.7 U	NA	3.7 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4 B
Zinc, Dissolved	5.7	NA	4.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.1
Wet Chemistry																
Ammonia (mg/l)	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	1 U	1 U	1 U	6 U	6 U	6 U	NA	NA	10 U	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	0.11 J	0.05 UJ	0.05 U	0.03 UL	0.03 UL	0.03 U	NA	0.03 U	NA	NA	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)																
Dissolved oxygen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()																
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	1,100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

DEG/F - Degrees Fahrenheit

MG/L - Milligrams per liter

MS/CM - Milliseimens per centimeter

NTU - Nephelometric turbidity units

PCT - Percent

PH - pH units

UG/L - Micrograms per liter

UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW31							02GW32						
Sample ID	02GW31-0308-D	02GW31-0809	02GW31-1011	02GW031-0113	02GW031-0514	02GW031P-0514	02GW031-0815	2GW32 02/01/86(OLD)	2GW32 05/01/86(OLD)	2GW32 a mp(OLD)	2GW32DS 1989(OLD)	2GW32-F a mp(OLD)	2GW32-T a mp(OLD)	2GW32 b mp(OLD)
Sample Date	03/18/08	08/11/09	10/20/11	01/16/13	05/07/14	05/07/14	08/05/15	02/01/86	05/01/86	01/01/89	01/01/89	01/01/89	01/01/89	01/01/91
Chemical Name														
Volatile Organic Compounds (UG/L)														
1,1,2,2-Tetrachloroethane	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	1
1,1-Dichloroethane	0.5 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
2-Butanone	5 U	1 U	2.5 R	4 U	4 U	4 U	4 UJ	10 U	10 U	NA	NA	NA	NA	NA
Acetone	5 U	2 U	2.5 U	5 U	5 U	5 U	5 UJ	NA	NA	NA	NA	NA	NA	NA
Benzene	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
Bromoform	0.5 U	0.4 U	0.5 U	0.3 U	0.3 U	0.3 U	0.3 U	5 U	5 U	NA	NA	NA	NA	NA
Carbon disulfide	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.1 J	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
Chloromethane	0.5 U	0.3 J	0.63 J	0.3 U	0.3 U	0.3 U	0.3 U	10 U	10 U	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.5 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	1
Dibromochloromethane	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
Methylene chloride	0.5 U	0.3 U	0.5 UL	1 U	1 U	1 U	1 U	5 U	5 U	6 U	NA	NA	NA	5 U
Methyl-tert-butyl ether (MTBE)	0.5 U	0.5 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.5 U	0.4 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
Toluene	0.5 U	0.4 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	5 U	5 U	NA	NA	NA	NA	NA
Trichloroethene	0.5 U	0.4 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	17	5 U	240	NA	NA	NA	140
Trichlorofluoromethane (Freon-11)	0.5 U	0.5 U	0.5 U	0.3 U	0.3 U	0.3 U	0.3 U	24	5 U	10 U	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/L)														
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	NA	NA	NA	10 U
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)														
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)														
1,3-Dinitrobenzene	1 U	0.045 U	0.1 U	0.351 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA
HMX	1 U	0.043 U	0.2 U	0.351 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA
Perchlorate	0.96	NA	0.81	0.793	0.485 J	0.458 J	0.46 J	NA	NA	NA	NA	NA	NA	NA
RDX	1 U	0.046 U	0.2 U	0.351 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)														
Aluminum	14.6 U	33.7	35.4 B	93.5 J	454 J	148 B	232	NA	NA	NA	NA	NA	NA	NA
Antimony	0.78 U	1.33 U	12.5 UL	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA
Arsenic	3.7 B	1.2 U	5 UL	0.17 J	0.383 J	0.144 J	0.183 J	NA	NA	NA	NA	NA	NA	NA
Barium	28.7 J	31.2	30.4 B	30.6	30.5	22.1	26.2	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.13 U	0.09 U	1.5 U	0.0659 J	0.125 J	0.0685 J	0.0875 J	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.16 B	0.12 U	1.5 U	0.2 U	0.161 J	0.2 U	0.101 J	29	28	NA	NA	NA	3 U	NA
Calcium	3,390	3,630	3,670	3,650	2,160	2,170	3,100	NA	NA	NA	NA	NA	NA	NA
Chromium	0.41 U	0.44 U	2.5 U	2.6 B	19.4 J	4.66 B	7.39 B	180	27	NA	NA	NA	261	NA
Cobalt	0.48 B	0.27 U	7.5 U	0.352 J	2.4	0.673 J	0.741 B	NA	NA	NA	NA	NA	NA	NA
Copper	0.75 U	0.7 U	2.61 B	10.5	3.92 B	1.91 B	10.3	267	62	NA	NA	NA	241	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	15.8 B	27.2 B	39.6 J	354	1,220 J	287 B	441	NA	NA	NA	NA	NA	NA	NA
Lead	0.97 U	1.02 U	3 U	2.69	1.36	0.299 B	0.468 B	70	20 U	NA	NA	NA	28 U	NA
Magnesium	2,660	2,540	2,410	2,500	2,040	1,910	2,230	NA	NA	NA	NA	NA	NA	NA
Manganese	10.3 K	9.2	31.1	14.3	96.8 J	25.6 J	17.3	NA	NA	NA	NA	NA	NA	NA
Mercury	0.05 B	0.03	0.1 UL	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA	NA	NA	62.7	NA
Nickel	4.8	4.9	10 U	6.59	27.7 J	8.01 B	11.7	609	557	NA	NA	NA	NA	NA
Potassium	1,580	1,670	1,500	1,730	1,600	1,420	1,610	NA	NA	NA	NA	NA	NA	NA
Selenium	0.96 U	3.03 U	5 U	0.3 U	0.3 U	0.3 U	0.3 U	NA	NA	NA	NA	NA	NA	NA
Silver	0.29 U	0.79 U	2.5 U	0.2 U	0.2 U	0.2 U	0.2 U	10 U	17	NA	NA	NA	NA	NA
Sodium	5,260	6,160	5,940	6,350	3,880 B	3,880 B	5,120	NA	NA	NA	NA	NA	NA	NA
Thallium	2.6 B	1.2 B	10 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA	NA
Vanadium	0.38 U	5.12 U	10 U	0.409 J	1.82	0.49 J	0.535 J	NA	NA	NA	NA	NA	NA	NA
Zinc	7.6	4.4	10.2 J	39.8	14.2 B	12.1 B	33.2 B	1,042	939	NA	NA	NA	1,640	NA

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW31							02GW32						
Sample ID	02GW31-0308-D	02GW31-0809	02GW31-1011	02GW031-0113	02GW031-0514	02GW031P-0514	02GW031-0815	2GW32 02/01/86(OLD)	2GW32 05/01/86(OLD)	2GW32 a mp(OLD)	2GW32DS 1989(OLD)	2GW32-F a mp(OLD)	2GW32-T a mp(OLD)	2GW32 b mp(OLD)
Sample Date	03/18/08	08/11/09	10/20/11	01/16/13	05/07/14	05/07/14	08/05/15	02/01/86	05/01/86	01/01/89	01/01/89	01/01/89	01/01/89	01/01/91
Chemical Name														
Dissolved Metals (UG/L)														
Aluminum, Dissolved	59.4 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	29.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	0.15 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.6	27.6	NA	NA
Calcium, Dissolved	3,650	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	0.41 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	7 U	7 U	NA	NA
Cobalt, Dissolved	0.57 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	0.86	NA	NA	NA	NA	NA	NA	NA	NA	NA	208	208	NA	NA
Iron, Dissolved	9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, Dissolved	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	28 U	28 U	NA	NA
Magnesium, Dissolved	2,830	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	10.4 K	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, Dissolved	0.06 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.9	10.9	NA	NA
Nickel, Dissolved	5.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	1,680	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	5,550	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved	1.64 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	961	961	NA	NA
Wet Chemistry														
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	NA	NA	NA	NA	NA	NA	NA	4.5	3.8	NA	NA	4.7	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	2,930	30,000	NA	NA	37,700	NA	NA
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	NA	NA	5	5	NA	NA	3.3	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	NA	NA	0.112	0.665	NA	NA	0.035	NA	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7,690	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)														
Dissolved oxygen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()														
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	02GW32															
Sample ID	2GW32DS 1991(OLD)	2GW32-F b mp(OLD)	2GW32-T b mp(OLD)	WO-2GW32	2GW320001	2GW320002	2GW320003	2GW320004	02GW032-0602	02GW032-1002	02GW032-1202	02GW032-0303	02GW32-0604	OU2GW32-0704	02GW32-0905	02GW32-1206
Sample Date	01/01/91	01/01/91	01/01/91	06/12/97	02/10/99	04/19/99	07/26/99	10/20/99	06/12/02	10/11/02	12/17/02	03/19/03	06/09/04	07/06/04	09/13/05	12/19/06
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
1,1-Dichloroethane	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
1,2-Dichloroethane	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.5 U	1 U	1 U	0.5 U	0.5 UJ	NA	0.5 U	0.5 U
1,2-Dichloropropane	NA	NA	NA	1 U	1.4	1 U	3 U	1	0.5 U	0.6 J	1 U	0.5 U	3.2	NA	0.5 U	0.5 U
2-Butanone	NA	NA	NA	5 R	5 R	5 U	15 R	5 R	5 R	5 U	5 U	5 U	5 U	NA	5 U	5 U
Acetone	NA	NA	NA	5 R	2 L	5 R	15 R	5 R	5 R	5 U	5 UJ	1.9 J	5 UJ	NA	5 U	5 U
Benzene	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Bromoform	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.5 U	1 U	1 U	0.5 U	1.3	NA	0.5 U	0.5 UJ
Carbon disulfide	NA	NA	NA	1 U	1 U	1 U	3 U	0.1 J	0.5 U	1 UJ	1 UJ	0.5 U	0.5 U	NA	0.5 U	0.5 U
Chloroform	NA	NA	NA	1 U	0.55 J	0.52 J	3 U	0.4 J	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Chloromethane	NA	NA	NA	1 U	0.29 J	0.29 J	3 U	0.2 J	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
cis-1,2-Dichloroethene	NA	NA	NA	2	1.4	1.4	0.93 J	1	0.5 U	1 U	1 U	0.5 UJ	0.72	NA	0.41 J	0.5 U
Dibromochloromethane	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.84	1 U	1 U	0.5 U	0.3 J	NA	0.5 U	0.5 U
Methylene chloride	NA	NA	NA	3 B	1.9 J	1.3 U	1.8 U	1 U	0.53 B	1 U	1 U	0.39 B	0.53	NA	0.5 U	0.92 B
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Tetrachloroethene	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 UJ
Toluene	NA	NA	NA	1 U	1 U	1 U	3 U	1 U	11	1 U	1 U	0.5 U	0.5 U	NA	0.5 U	0.5 U
Trichloroethene	NA	NA	NA	81	35 J	29	35	25	5.1	3.8	2.2	1.1	9.1	NA	4.4	0.53
Trichlorofluoromethane (Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA	1.2	1 J	1 U	0.5 U	2.9	NA	3.5	0.5 U
Semivolatile Organic Compounds (UG/L)																
4-Bromophenyl-phenylether	NA	NA	NA	5 U	5 U	5 U	2.3 J	5 U	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	NA	NA	NA	5 U	5 U	5 U	6.8 U	2 U	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	NA	NA	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)																
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)																
1,3-Dinitrobenzene	NA	NA	NA	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	0.27 U	1.2 U	0.8 U	NA	0.2 U	0.18 U	0.4 U
HMX	NA	NA	NA	1.3 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.27 U	1.2 U	0.8 U	NA	0.2 U	0.18 U	0.4 U
Perchlorate	NA	NA	NA	NA	5 U	NA	200 U	200 U	NA	20 U	8 U	4 U	3.2	NA	5 UJ	0.54
RDX	NA	NA	NA	1.3 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 B	0.27 U	1.2 U	0.8 U	NA	0.2 U	0.18 U	0.4 U
Total Metals (UG/L)																
Aluminum	NA	NA	NA	18,800 J	14,300	9,500	7,710	5,550	588	35,800	324 B	910	1,740	NA	1,070	73.6 B
Antimony	NA	NA	NA	2 UL	3.8 U	34.2 UL	3.4 UL	2.2 U	3 U	4.4 U	2.5 U	3.4 B	3 U	NA	3 U	1.8 B
Arsenic	NA	NA	NA	24.6	15.2	11	10	7.9	3 U	20.3	2.8 U	3 U	3 U	NA	3 U	1.6 U
Barium	NA	NA	NA	207 J	182	151	182	194	98.6 J	233	61.6	28.3	355	NA	309	24.1
Beryllium	NA	NA	NA	9.9	7	5.6	6 U	5.4 U	2 U	3.7 B	0.4 UL	0.5 U	2.1 B	NA	1.9	0.15 U
Cadmium	NA	NA	10	12 J	12.1 U	11.3 L	12.3 L	7.4	2 U	3.7	1.2 B	0.7 U	4.2	NA	3.7	0.19
Calcium	NA	NA	NA	193,000 J	205,000	160,000	145,000	99,100	20,400	15,200	13,400 J	3,890	56,600	NA	43,800	2,800
Chromium	NA	NA	53	0.4 UL	4 U	3 U	2.4 U	7 U	3 U	63	2.9 U	1.2	0.6 U	NA	0.4 U	0.38 U
Cobalt	NA	NA	NA	134 J	132	98.6	93.5	73.5	15.8	28.6	9 L	3.4	39	NA	29.1	1.5
Copper	NA	NA	102	83.7 J	19.2	23.3 K	16.2	25.7	4.5 B	72.1	1.7 B	7.1 B	4 U	NA	3.4	6.3 U
Cyanide	NA	NA	NA	5 U	2.7 U	1.1 U	1.4 U	1.3 U	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	426 J	87.4 U	167	130	75.2 U	54.8	95,400	179	1,460	40.1	NA	234	56.3 B
Lead	NA	NA	41	21.5	7.7	5.3 L	7.3	6.2	1 U	33.5	2.5 B	4 U	4 U	NA	2 U	0.46 U
Magnesium	NA	NA	NA	120,000 J	130,000	97,900	88,600	65,200	15,100	16,300	10,100	2,630	48,500	NA	36,200	2,330 J
Manganese	NA	NA	NA	21,300 J	24,700	18,700	18,200	13,100	2,870 J	2,370	1,860	319	7,480	NA	6,070	289 J
Mercury	NA	NA	16 R	0.52	2.4	2.5	1.8	1.6	0.28 L	8.8	0.052 L	0.14 U	0.14 U	NA	0.19	0.15
Nickel	NA	NA	NA	171 J	206	159	155	130	26.7 J	66.9	18.2	8 B	56.2	NA	51.7	3.7
Potassium	NA	NA	NA	45,500 J	34,400	25,800	26,500	26,800	12,500	18,000 J	9,100 J	2,210	9,830	NA	10,800	1,700
Selenium	NA	NA	NA	1.6 UL	5 U	4 U	5.4 U	3.5 U	8 U	2.8 L	2.5 B	9 U	9 U	NA	4 U	3.6 B
Silver	NA	NA	NA	0.59	2.8 U	5.3 K	3.8 K	1.3	2 R	0.4 U	2.5 U	2 U	10 B	NA	2 U	0.91 U
Sodium	NA	NA	NA	6,020,000	4,720,000	3,500,000	3,400,000	3,270,000	705,000	507,000	403,000 J	96,200	838,000	NA	687,000	72,700
Thallium	NA	NA	NA	10.6 B	11.9 U	10.6 U	12.3 L	14.2 U	4 U	4 U	3.6 U	3 U	3 U	NA	28.8	1.2 U
Vanadium	NA	NA	NA	0.6 UL	2.1 U	5.1 U	2.4 U	0.6 U	5	108	0.4 U	1.1	0.7 U	NA	0.7 U	0.47 U
Zinc	NA	NA	508	442 J	411	321	300	236	45.7	191	33.3 L	12.1	104	NA	77.8	18.1 B

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
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Former NSWC-White Oak

Station ID	02GW32																
Sample ID	2GW32DS 1991(OLD)	2GW32-F b mp(OLD)	2GW32-T b mp(OLD)	WO-2GW32	2GW320001	2GW320002	2GW320003	2GW320004	02GW032-0602	02GW032-1002	02GW032-1202	02GW032-0303	02GW32-0604	OU2GW32-0704	02GW32-0905	02GW32-1206
Sample Date	01/01/91	01/01/91	01/01/91	06/12/97	02/10/99	04/19/99	07/26/99	10/20/99	06/12/02	10/11/02	12/17/02	03/19/03	06/09/04	07/06/04	09/13/05	12/19/06
Chemical Name																
Dissolved Metals (UG/L)																
Aluminum, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	63.2 B	NA	NA	NA	NA
Barium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	28.7	NA	NA	NA	NA
Cadmium, Dissolved	6	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.7 U	NA	NA	NA	NA
Calcium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3,820	NA	NA	NA	NA
Chromium, Dissolved	10 U	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6 U	NA	NA	NA	NA
Cobalt, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	NA	NA	NA	NA
Copper, Dissolved	25 U	25 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.6 B	NA	NA	NA	NA
Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35 B	NA	NA	NA	NA
Lead, Dissolved	17	17	NA	NA	NA	NA	NA	NA	NA	NA	NA	4 U	NA	NA	NA	NA
Magnesium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,460	NA	NA	NA	NA
Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	303	NA	NA	NA	NA
Mercury, Dissolved	0 R	0 R	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA
Nickel, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.2	NA	NA	NA	NA
Potassium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,030	NA	NA	NA	NA
Sodium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	94,800	NA	NA	NA	NA
Thallium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3 U	NA	NA	NA	NA
Zinc, Dissolved	381	381	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.3	NA	NA	NA	NA
Wet Chemistry																
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	NA	0.48	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	17.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	NA	NA	NA	NA	4.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	1.53	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	25.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	153 L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	60.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	2.7	6 U	6 U	NA	10 U	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.0348	0.03 U	NA	0.046	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	0.59	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)																
Dissolved oxygen	NA	NA	NA	NA	5.68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()																
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	NA	1,000 U	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	NA	100 UJ	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
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Former NSWC-White Oak

Station ID	02GW32							02GW45					
Sample ID	02GW32-1206-D	02GW32-0308	02GW32-0809	02GW32-1011	02GW032-0113	02GW032-0514	02GW032-0815	2GW45 a mp(OLD)	2GW45DS 1989(OLD)	2GW45-F a mp(OLD)	2GW45-T a mp(OLD)	2GW45 b mp(OLD)	2GW45DS 1991(OLD)
Sample Date	12/19/06	03/19/08	08/12/09	10/20/11	01/16/13	05/07/14	08/05/15	01/01/89	01/01/89	01/01/89	01/01/89	01/01/91	01/01/91
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,2,2-Tetrachloroethane	0.5 U	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	5 U	NA
1,1-Dichloroethane	0.5 U	0.5 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	0.5 U	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	0.5 U	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.17 J	NA	NA	NA	NA	NA	NA
2-Butanone	5 U	5 U	1 U	2.5 R	4 U	4 U	4 UJ	NA	NA	NA	NA	NA	NA
Acetone	5 U	5 U	2 U	2.5 U	5 U	5 U	5 UJ	NA	NA	NA	NA	NA	NA
Benzene	0.5 U	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Bromoform	0.5 UJ	0.5 U	0.4 U	0.5 U	0.3 U	0.3 U	0.3 U	NA	NA	NA	NA	NA	NA
Carbon disulfide	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA
Chloroform	0.5 U	0.5 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Chloromethane	0.5 U	0.5 U	0.3 J	0.42 J	0.3 U	0.3 U	0.3 U	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.5 U	0.5 U	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	10 U	NA
Dibromochloromethane	0.5 U	0.5 U	0.3 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Methylene chloride	0.52 B	0.5 U	0.3 U	0.5 UL	1 U	1 U	1 U	5 U	NA	NA	NA	5 U	NA
Methyl-tert-butyl ether (MTBE)	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Tetrachloroethene	0.5 UJ	0.5 U	0.4 U	0.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Toluene	0.5 U	0.5 U	0.4 U	0.5 U	0.2 U	0.14 B	0.2 U	NA	NA	NA	NA	NA	NA
Trichloroethene	0.56	0.5 U	0.4 U	0.5 U	0.2 U	0.2 U	0.32 J	5 U	NA	NA	NA	1	NA
Trichlorofluoromethane (Freon-11)	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	0.3 U	0.3 J	10 U	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/L)													
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	23	NA	NA	NA	10 U	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	23	NA	NA	NA	NA	NA
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (UG/L)													
No Detections	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)													
1,3-Dinitrobenzene	0.4 U	1 U	0.045 U	0.1 U	0.347 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
HMX	0.4 U	1 U	0.043 U	0.205 U	0.347 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Perchlorate	0.58	0.2	NA	0.2 U	0.221	0.167 J	0.25 J	NA	NA	NA	NA	NA	NA
RDX	0.4 U	1 U	0.046 U	0.205 U	0.347 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)													
Aluminum	59.4 B	45.3 B	72.2	34.2 B	708	117 B	282 B	NA	NA	NA	NA	NA	NA
Antimony	2.2 B	0.78 U	1.33 U	12.5 UL	0.5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA
Arsenic	1.6 U	1.69 U	1.2 U	5 UL	0.505 J	0.213 J	0.215 J	NA	NA	NA	NA	NA	NA
Barium	24.2	18.1 J	27.9	27.9 B	33.8	29.5	133	NA	NA	NA	NA	NA	NA
Beryllium	0.15 U	0.13 U	0.16 B	1.5 U	0.145 J	0.0801 J	0.218 J	NA	NA	NA	NA	NA	NA
Cadmium	0.18	0.26 B	0.12 U	1.5 U	0.2 U	0.2 U	0.312 J	NA	NA	NA	3 U	NA	NA
Calcium	2,870	2,530	4,020	6,220	7,670	3,820	12,900	NA	NA	NA	NA	NA	NA
Chromium	0.38 U	0.41 U	0.44 U	2.5 U	8.09	1.86 B	4.54	NA	NA	NA	34.7	NA	NA
Cobalt	1.5	1.2 B	0.58 B	7.5 U	3.35	0.854 B	1.52	NA	NA	NA	NA	NA	NA
Copper	6.3 U	7	0.7 U	5.21 B	6.48	2.59 B	4.74	NA	NA	NA	40.8	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	39.8 B	95.5	137	237	1,800	238 B	470	NA	NA	NA	NA	NA	NA
Lead	0.46 U	0.97 U	1.02 U	3 U	1.1	0.463 B	0.699 J	NA	NA	NA	28 U	NA	NA
Magnesium	2,350 J	2,130	3,290	9,530	8,950	4,810	13,400	NA	NA	NA	NA	NA	NA
Manganese	288 J	169	191	635	474 K	146	380	NA	NA	NA	NA	NA	NA
Mercury	0.14	0.08 B	0.09	0.1 UL	0.1 U	0.1 U	0.1 U	NA	NA	NA	0.2 U	NA	NA
Nickel	3.9	4.2	5.6	10 U	9.06	4.46 B	20	NA	NA	NA	NA	NA	NA
Potassium	1,730	1,160	1,670	1,110	5,380	1,730	3,670	NA	NA	NA	NA	NA	NA
Selenium	3.8 B	0.96 U	3.03 U	5 U	0.206 J	0.3 U	0.3 U	NA	NA	NA	NA	NA	NA
Silver	0.91 U	0.29 U	0.79 U	2.5 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Sodium	72,600	28,800	19,800	13,600	51,000 L	10,800	46,100	NA	NA	NA	NA	NA	NA
Thallium	1.2 U	2.4 B	0.6 U	10 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
Vanadium	0.47 U	0.38 U	5.12 U	10 U	1.68	0.318 B	0.482 J	NA	NA	NA	NA	NA	NA
Zinc	18.4 B	8.6	5.6	10 J	14.2 B	21.5 B	41.6	NA	NA	NA	94.1	NA	NA

TABLE 3-2
Historical Constituents Detected in Groundwater at OU2
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Former NSWC-White Oak

Station ID	02GW32							02GW45					
Sample ID	02GW32-1206-D	02GW32-0308	02GW32-0809	02GW32-1011	02GW032-0113	02GW032-0514	02GW032-0815	2GW45 a mp(OLD)	2GW45DS 1989(OLD)	2GW45-F a mp(OLD)	2GW45-T a mp(OLD)	2GW45 b mp(OLD)	2GW45DS 1991(OLD)
Sample Date	12/19/06	03/19/08	08/12/09	10/20/11	01/16/13	05/07/14	08/05/15	01/01/89	01/01/89	01/01/89	01/01/89	01/01/91	01/01/91
Chemical Name													
Dissolved Metals (UG/L)													
Aluminum, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	3.7	3.7	NA	NA	5 U
Calcium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	7 U	7 U	NA	NA	10 U
Cobalt, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	3 U	3 U	NA	NA	25 U
Iron, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	28 U	28 U	NA	NA	3 U
Magnesium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	0.2 U	0.2 U	NA	NA	0 R
Nickel, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	NA	NA	NA	NA	NA	NA	NA	NA	24	24	NA	NA	75
Wet Chemistry													
Ammonia (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.1	NA	NA	NA
Salinity (%) (pct)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specific conductance (MS/CM) (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Temperature (deg/f)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,020	NA	NA	NA
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.4	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.033	NA	NA	NA
Total suspended solids (TSS) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,650	NA	NA	NA
Turbidity (NTU) (ntu)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Wet Chemistry (MG/L)													
Dissolved oxygen	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons ()													
Total petroleum hydrocarbons (TPH) (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-diesel range (UG/L)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
DEG/F - Degrees Fahrenheit
MG/L - Milligrams per liter
MS/CM - Milliseimens per centimeter
NTU - Nephelometric turbidity units
PCT - Percent
PH - pH units
UG/L - Micrograms per liter
UMHOS - Micro mho

TABLE 3-3
Historical Constituents Detected in Surface Water at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	OU2SW01														
Sample ID	OU2SW01-0602	OU2SW01-1002	OU2SW01-1002-D	OU2SW01-1202	OU2SW01-0303	OU2SW01-0604	OU2SW01-0704	OU2SW01-0905	OU2SW01-1206	02SW01-0308	OU2SW01-0809	OU2SW01-1011	OU2SW01-0113	OU2SW01-0514	OU2SW01-0815
Sample Date	06/13/02	10/10/02	10/10/02	12/16/02	03/17/03	06/08/04	07/07/04	09/13/05	12/18/06	03/18/08	08/10/09	10/21/11	01/17/13	05/08/14	08/03/15
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1-Dichloroethene					2.4	13	NA	0.6	0.62				NA	NA	NA
Acetone					5.9		NA						NA	NA	NA
Chloroform							NA			0.2 J			NA	NA	NA
Chloromethane							NA						NA	NA	NA
cis-1,2-Dichloroethene					0.51		NA		0.46 J	0.2 J			NA	NA	NA
Methyl-tert-butyl ether (MTBE)			0.7 J		0.38 J	0.47 J	NA		0.72	0.3 J			NA	NA	NA
Tetrachloroethene				0.7 J	5.6 J	0.34 J	NA		0.48 J	0.1 J			NA	NA	NA
Trichloroethene				0.8 J	0.99	0.55	NA		0.75	0.3 J					
Trichlorofluoromethane (Freon-11)					0.44 J	0.38 J	NA		0.81	0.3 J		0.54 J	NA	NA	NA
Vinyl chloride						0.46 J	NA						NA	NA	NA
Semivolatile Organic Compounds (UG/L)															
No Detections															
Explosives (UG/L)															
HMX	NA					NA							NA	NA	NA
Perchlorate	NA					0.56	NA		0.57	0.61	NA	0.37	NA	NA	NA
Total Metals (UG/L)															
Aluminum	17.2 B	2,890	2,540	749	14,200 L	212	NA	186	192	23.2 B	103	325	457	67.5 J	11.5 J
Antimony	3 U	4.4 U	4.4 U	3.5 B	3.8 B	3 U	NA	3 U	2.1 B	0.8 B	1.5	12.5 UL	0.37 J	0.39 J	0.5 U
Arsenic		4.7	3.8	2.8 U	8.9		NA						0.62 J	0.448 J	0.396 J
Barium	66.8 J	29	26.6	68.8	152	73.2	NA	48.8	76.2	146 J	112	93.1	40.4	83.7	114
Beryllium					0.88		NA								
Cadmium		3.5	3.9	1 B	1.1		NA		0.3					0.134 J	0.123 J
Calcium	15,400	14,900	15,100	30,700 J	54,200	34,800	NA	30,700	34,100	39,400	39,600	36,800	30,000	35,400	39,100
Chromium		10.2	9.6	11.6	38.1		NA	1.1			0.59	1.77 J		0.389 J	0.186 J
Cobalt		2.4 B	2 B	1.8 B	9.6	1.1	NA			3.5				0.73 J	0.277 J
Copper		18.4	19	21.3	29.6 B		NA	2.7			0.87			2.1	2.49
Iron		5,490	5,340	1,350	27,900 L	669	NA	682	342 J	109	296	662	587	189	66.6 J
Lead		21.4	20.1	5.6 B	27.3		NA							0.318 J	0.0714 J
Magnesium	6,900	2,340	2,330	7,050	14,500	6,990	NA	6,960	8,360 J	14,500	10,600	9,230	6,090	9,410	12,100
Manganese	240 J	85.3	83.9	440	877	411	NA	122	292 J	1,210	579	466	156	330	203
Mercury	0.14 UL	0.01 U	0.01 U	0.02 UL	0.12 UL		NA		0.14		0.03				
Nickel	12.7 J	10.4	9.7	20.6	18.7	7.6	NA		10.2	19.8	9.2	10.8 J		8.25	5.57
Potassium	3,080	1,930 J	1,880 J	10,600 J	9,200	4,370	NA	6,100	4,310	7,000	6,210	10,000	6,140	5,870	5,430
Selenium							NA					5.22 J	0.171 J		
Silver							NA			0.4					
Sodium	21,200	2,840	2,820	22,200 J	30,100	20,900	NA	39,700	23,400	49,500	46,100	46,200	39,000	65,000	65,800
Vanadium		12.1	11.5	2	45.3		NA		0.79				1.9	1.12	0.518 J
Zinc		48.2	48.4	389	61.3		NA	25.9		18.1	6.5	21		11.3 J	13.2 J
Wet Chemistry															
Total organic carbon (TOC) (mg/l)	NA	7.4	7.7	6			NA		NA	NA	NA	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	0.0564		NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

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R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 3-3
Historical Constituents Detected in Surface Water at OU2
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Former NSWC-White Oak

Station ID	OU2SW03															
Sample ID	OU2SW03-0602	OU2SW03-1002	OU2SW03-1202	OU2SW03-0303	OU2SW03-0604	OU2SW03-0704	OU2SW03-0905	OU2SW03-1206	OU2SW03-1206-D	02SW03-0308	OU2SW03-0809	OU2SW03-1011	OU2SW03-1011-D	OU2SW03-0113	OU2SW03-0514	OU2SW03-0815
Sample Date	06/13/02	10/10/02	12/16/02	03/17/03	06/08/04	07/07/04	09/13/05	12/18/06	12/18/06	03/18/08	08/10/09	10/21/11	10/21/11	01/17/13	05/08/14	08/03/15
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1-Dichloroethene				0.54	1.3	NA	0.31 J							NA	NA	NA
Acetone				4.9 J		NA								NA	NA	NA
Chloroform						NA								NA	NA	NA
Chloromethane						NA							0.78 J	NA	NA	NA
cis-1,2-Dichloroethene						NA								NA	NA	NA
Methyl-tert-butyl ether (MTBE)						NA								NA	NA	NA
Tetrachloroethene				0.42 J		NA								NA	NA	NA
Trichloroethene						NA						0.4 J		0.12 J		
Trichlorofluoromethane (Freon-11)						NA				0.1 J				NA	NA	NA
Vinyl chloride						NA								NA	NA	NA
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
HMX	NA				NA									NA	NA	NA
Perchlorate	NA				0.5	NA	5 UJ	0.74	0.75	0.64	NA	0.4	0.4	NA	NA	NA
Total Metals (UG/L)																
Aluminum	24.1 B	2,230	450 B	6,380 L	224	NA	152	796	673	14.6 U	39.3	204	183	354	49.8 J	896
Antimony	3 U	4.4 U	3.8 B	3 U	3 U	NA	3 U	2.9 B	2.4 B	0.78 U	1.33 U	12.5 UL	12.5 UL	0.371 J	0.5 U	0.457 J
Arsenic		4.2		4.1		NA								0.501 J	0.309 J	1.24
Barium	58.7 J	28.8	64.2	104	37.8	NA	50.6	58.7	58.2	109 J	76.1	78.1	78.8	39.4	70.4	251
Beryllium						NA								0.1 U		0.541 J
Cadmium						NA		0.34	0.32	0.36 B	0.12 U	1.5 U	1.5 U	0.101 J		2.21
Calcium	17,500	15,200	29,600 J	32,800	20,100	NA	29,200	25,900	26,200	30,000	32,000	31,700	31,900	27,700 K	31,200	40,700
Chromium		8.2	6.9	16.7		NA	0.88	1.1 B	0.87 B	0.41 U	0.47	1.21 J	1.61 J	1.53 B	0.295 J	1.68
Cobalt		1.5 B		5.4	1.3	NA	0.66 B	1.2	1.1	3	0.34 B	7.5 U	7.5 U	0.715 B	0.34 J	9.67
Copper		16.1		15.4 B		NA	3.7	6.3 U	6.3 U	0.78	0.7 U	3.48 B	3.97 B	3.17 B	1.98	9.01
Iron		3,970	901	11,800 L	479	NA	208	1,480 J	1,190 J	211	161	430	454	461 J	94.8 J	2,060
Lead		14.7		16.1		NA	2 U	0.61 B	0.59 B	1	1.02 U	3 U	3.44 B	0.827 B	0.108 J	2.28
Magnesium	7,160	2,520	6,950	9,250	4,940	NA	7,080	7,310 J	7,280 J	11,900	8,780	8,880	8,830	6,070	9,220	13,900
Manganese	50.9 J	78.5	327	543	230	NA	110	147 J	145 J	841	222	401	402	153	137	4,980
Mercury						NA	0.063 U	0.14	0.13	0.03 U	0.03	0.1 UL	0.1 UL	0.1 U		
Nickel		8.9	15.4	14.3	4.8	NA	4.3 B	6.1	5.7	15.8	5.9	9.02 J	8.89 J	6.43 B	6.39	91.2
Potassium	3,600	2,050 J	8,540 J	7,400	3,440	NA	6,040	4,060	4,080	5,890	5,100	8,380	8,350	5,820	5,430	5,720
Selenium						NA	4 U	7.5 B	8.1 B	0.96 U	3.03 U	5 U	5 U	0.156 J		0.21 J
Silver						NA	2 U	0.91 U	0.91 U	0.29 U	0.79 U	2.5 U	2.5 U	0.2 U		0.106 J
Sodium	33,900	3,730	28,400 J	29,700	42,000	NA	56,200	24,800	24,300	44,600	38,100	46,000	47,000	38,000	58,500	70,500
Vanadium		9.1	1.8	20.1		NA	1.3 B	1.8	1.5	0.38 U	5.12 U	10 U	10 U	1.53	0.723 J	4.32
Zinc		41.4		33.3		NA	19.6	20.4 B	19.1 B	16.4	5.4	22.3	18.3 J	17.1 B	9.33 J	105
Wet Chemistry																
Total organic carbon (TOC) (mg/l)	NA	7.8	4.6			NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

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R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 3-3
Historical Constituents Detected in Surface Water at OU2
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Former NSWC-White Oak

Station ID	OU2SW05															
Sample ID	OU2SW05-0602	OU2SW05-0602-D	OU2SW05-1002	OU2SW05-1202	OU2SW05-1202-D	OU2SW05-0303	OU2SW05-0303-D	OU2SW05-0604	OU2SW05-0604-D	OU2SW05-0704	OU2SW05-0704-D	OU2SW05-0905	OU2SW05-1206	02SW05-0308	02SW05-0308-D	OU2SW05-0809
Sample Date	06/13/02	06/13/02	10/10/02	12/16/02	12/16/02	03/17/03	03/17/03	06/08/04	06/08/04	07/07/04	07/07/04	09/13/05	12/18/06	03/18/08	03/18/08	08/10/09
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1-Dichloroethene						0.3 J	0.51	0.88	0.83	NA	NA					
Acetone						3.5 J	2.5 J			NA	NA					
Chloroform										NA	NA					
Chloromethane										NA	NA					
cis-1,2-Dichloroethene										NA	NA					
Methyl-tert-butyl ether (MTBE)										NA	NA					
Tetrachloroethene							0.52 J			NA	NA					
Trichloroethene				0.5 J			0.33 J			NA	NA			0.3 J	0.3 J	
Trichlorofluoromethane (Freon-11)										NA	NA			0.1 J	0.2 J	
Vinyl chloride										NA	NA					
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
HMX	NA	NA						NA	NA			0.21				
Perchlorate	NA	NA						0.71	0.71	NA	NA		0.72	0.69	0.71	NA
Total Metals (UG/L)																
Aluminum	19.2 B	19 B	2,630	725	657	1,380 L	1,400 L	344	324	NA	NA	167	850	14.6 U	14.6 U	18.9
Antimony	3 U	3 U	4.4 U	2.6 B	4 B	3.6 B	3.1 B	3 U	3 U	NA	NA	3 U	2.3 B	0.78 U	0.78 U	1.33 U
Arsenic	3 U	3 U	3	4.1	2.8 U	3 U	3 U	3 U	3 U	NA	NA					
Barium	57 J	57.6 J	31.8	61.6	62.8	85.1	83.4	56.2	58.6	NA	NA	49.3	55	99.6 J	103 J	68.8
Beryllium	2 U	2 U	1.6 B	0.4 UL	0.4 UL	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA					
Cadmium	2 U	2 U	3.2 B	1 B	1.2 B	0.7 U	0.7 U	0.7 U	0.7 U	NA	NA		0.18			
Calcium	20,500	20,700	15,300	31,700 J	31,300 J	35,000	35,500	31,700	31,900	NA	NA	30,300	23,500	29,300	30,000	31,400
Chromium	3 U	3 U	9.1	8.2	7.8	3.7	3.8	0.6 U	0.6 U	NA	NA	1.1				0.51
Cobalt	3 U	3 U	1.8 B	0.95 B	0.89 B	4	3.9	1.5	1.6	NA	NA	0.45 B				
Copper	4.4 B	4.6 B	17.4	4.3	5.1	7.8 B	5.8 B	6.6 B	7.6 B	NA	NA	2.6		1.3		
Iron	42.7 B	38.5 B	4,770	1,350	1,280	2,530 L	2,710 L	811	739	NA	NA	226	1,250 J	113	119	132
Lead	1 U	1 U	17.5	5.1 B	2.5 B	4 U	4.2	4 U	4 U	NA	NA					
Magnesium	9,030	9,090	2,790	7,690	7,670	10,100	10,300	8,420	8,340	NA	NA	7,420	6,960 J	12,100	12,400	8,930
Manganese	89.2 J	89.4 J	101	355	352	601	605	339	330	NA	NA	87.9	142 J	722	747	109
Mercury	0.14 UL	0.14 UL	0.01 U	0.02 UL	0.02 UL	0.13 UL	0.13 UL	0.13 U	0.13 U	NA	NA		0.14			0.03
Nickel	4.9 B	4.8 B	9.1	13.2	14.1	12.2	12.4	7.7	7.6	NA	NA		5.2	14.4	15.4	4.1
Potassium	4,110	4,060	2,090 J	9,670 J	9,900 J	7,680	7,790	4,990	5,060	NA	NA	6,020	3,990	6,020	6,300	5,160
Selenium	8 U	8 U	2.8 UL	3.5 B	3.2 B	9 U	9 U	9 U	9 U	NA	NA					
Silver	2 R	2 R	0.4 U	2.5 U	2.5 U	2 U	2 U	2 U	2 U	NA	NA				0.32	
Sodium	60,200	61,400	5,810	38,200 J	38,500 J	34,700	35,000	73,300	71,700	NA	NA	53,000	30,000	51,900	53,800	40,700
Vanadium	3 U	3 U	10.3	2.3	2.3	4.2	4.5	2.3 B	2.3 B	NA	NA		1.7			
Zinc	12.9 B	10.2 B	41.9	14.7 B	14.2 B	16.9	16.7	24.6 B	26.2 B	NA	NA	11.6		15.4	15.2	3.4
Wet Chemistry																
Total organic carbon (TOC) (mg/l)	NA	NA	7.6	4.6	4.7	6 U	6 U	6 U	6 U	NA	NA	10 U	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	0.0987 J	0.03 UJ	0.03 U	0.03 U	NA	NA	NA	NA	NA	NA	NA

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MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 3-3
Historical Constituents Detected in Surface Water at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	OU2SW05					OU2SW06										
Sample ID	OU2SW05-1011	OU2SW05-0113	OU2SW05-0514	OU2SW05-0815	OU2SW05P-0815	OU2SW06-0602	OU2SW06-1002	OU2SW06-1202	OU2SW06-0303	OU2SW06-0604	OU2SW06-0704	OU2SW06-0905	OU2SW06-1206	02SW06-0308	OU2SW06-0809	OU2SW06-1011
Sample Date	10/21/11	01/17/13	05/08/14	08/03/15	08/03/15	06/13/02	10/10/02	12/16/02	03/17/03	06/08/04	07/07/04	09/13/05	12/18/06	03/18/08	08/10/09	10/21/11
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1-Dichloroethene		NA	NA	NA	NA				0.58	0.37 J	NA					
Acetone		NA	NA	NA	NA				5.5		NA					
Chloroform		NA	NA	NA	NA						NA					
Chloromethane	0.42 J	NA	NA	NA	NA						NA					
cis-1,2-Dichloroethene		NA	NA	NA	NA						NA					
Methyl-tert-butyl ether (MTBE)		NA	NA	NA	NA		0.7 J				NA					
Tetrachloroethene		NA	NA	NA	NA				0.55 J		NA					
Trichloroethene		0.16 J	0.14 J		0.1 J				0.34 J		NA			0.2 J		
Trichlorofluoromethane (Freon-11)		NA	NA	NA	NA						NA					
Vinyl chloride		NA	NA	NA	NA						NA					
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
HMX		NA	NA	NA	NA	NA				NA						
Perchlorate	0.4	NA	NA	NA	NA	NA				0.68	NA		0.76	0.7	NA	0.4
Total Metals (UG/L)																
Aluminum	168	301	44.3 J	13.1 J	15.6 J	79.5 B	2,350	547 B	672 L	193	NA	491	884	14.6 U	26.6	161
Antimony	12.5 UL	0.335 J	0.5 U	0.5 U	0.257 J	3 U	4.4 U	3.4 B	3 U	3 U	NA	3 U	2.1 B	0.78 U	1.33 U	12.5 UL
Arsenic		0.478 J	0.27 J	0.356 J	0.364 J						NA		3.1			
Barium	73.9	38.8	66.5	137	140	58.4 J	31.3	62	66.3	45	NA	48.1	62	94.3 J	67.8	71.9
Beryllium											NA					
Cadmium				0.103 J	0.101 J		3.6				NA		0.25			
Calcium	31,800	27,800	30,900	40,200	40,400	21,200	14,700	33,400 J	26,100	26,300	NA	27,300	26,200	29,800	31,600	31,400
Chromium			0.264 J	0.179 J	0.173 J		8.4	8.9	2.7		NA	1.3			0.46	1.21 J
Cobalt			0.285 J	0.224 J	0.287 J				3.1	1	NA	0.71 B				
Copper			1.57	1.7	1.59		16.4	4.6			NA	3.2		1.2	0.89	
Iron	402	382	85.2 J	39.8 J	51.2 J		4,400	962	1,530 L	426	NA	553	1,450 J	120	148	398
Lead			0.115 J	0.0595 J	0.0677 J		16				NA			1.1		
Magnesium	9,160	6,430	9,300	13,900	14,000	9,270	2,860	8,000	8,090	7,190	NA	6,840	7,920 J	12,200	8,900	8,870
Manganese	304	145	94.2	70.8 J	99.3 J	87.8 J	112	333	485	283	NA	174	127 J	628	69.6	247
Mercury											NA		0.14		0.04	
Nickel	7.77 J		4.77	5.76	6.13		9.4	12.6	11.3	5.8	NA		5.8	13.5	3.4	7.21 J
Potassium	8,470	5,760	5,370	5,650	5,680	4,080	2,240 J	10,600 J	5,230	4,230	NA	5,510	4,200	6,340	5,200	8,220
Selenium		0.174 J									NA					
Silver											NA					
Sodium	44,800	39,900	58,100	73,900	73,800	61,000	6,100	39,600 J	32,600	62,100	NA	49,300	32,000	52,000	40,900	45,500
Vanadium		1.34	0.647 J	0.396 J	0.407 J		9.9	2.4	2.6		NA		2.4			
Zinc	28.8		7.69 J	5.85 J	8.38 J		41.9		14.9		NA	19		13.9	2	19.2 J
Wet Chemistry																
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA	NA	NA	7.7	5	6 U	6 U	NA		NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA	NA	NA	NA	NA	0.03 U	0.03 U	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates detections

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MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 3-3
Historical Constituents Detected in Surface Water at OU2
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	OU2SW06			
Sample ID	OU2SW06-0113	OU2SW06-0514	OU2SW06P-0514	OU2SW06-0815
Sample Date	01/17/13	05/08/14	05/08/14	08/03/15
Chemical Name				
Volatile Organic Compounds (UG/L)				
1,1-Dichloroethene	NA	NA	NA	NA
Acetone	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	NA	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA
Trichloroethene	0.13 J			
Trichlorofluoromethane (Freon-11)	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/L)				
No Detections				
Explosives (UG/L)				
HMX	NA	NA	NA	NA
Perchlorate	NA	NA	NA	NA
Total Metals (UG/L)				
Aluminum	472	40.7 J	38.4 J	11.9 J
Antimony	0.366 J	0.5 U	0.5 U	0.304 J
Arsenic	0.539 J	0.285 J	0.272 J	0.352 J
Barium	38.4	64.7	63.5	135
Beryllium				
Cadmium				
Calcium	27,700	30,600	30,000	40,800
Chromium		0.252 J	0.233 J	0.148 J
Cobalt		0.228 J	0.222 J	0.215 J
Copper		1.54	1.51	1.98
Iron	561	72.3 J	70.4 J	34.2 J
Lead		0.0948 J	0.0808 J	0.0618 J
Magnesium	6,670	9,300	9,050	14,100
Manganese	121	68.7	66.7	48.6
Mercury				
Nickel		4.46	4.3	4.11
Potassium	5,700	5,420	5,260	5,710
Selenium	0.154 J			
Silver				
Sodium	39,100	57,600	57,100	74,300
Vanadium	1.66	0.618 J	0.588 J	0.38 J
Zinc		9.01 J	8.07 J	
Wet Chemistry				
Total organic carbon (TOC) (mg/l)	NA	NA	NA	NA
Total organic halogens (TOX) (mg/l)	NA	NA	NA	NA

Notes:

Shading indicates detections

B - Analyte not detected above the level reported in blanks

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

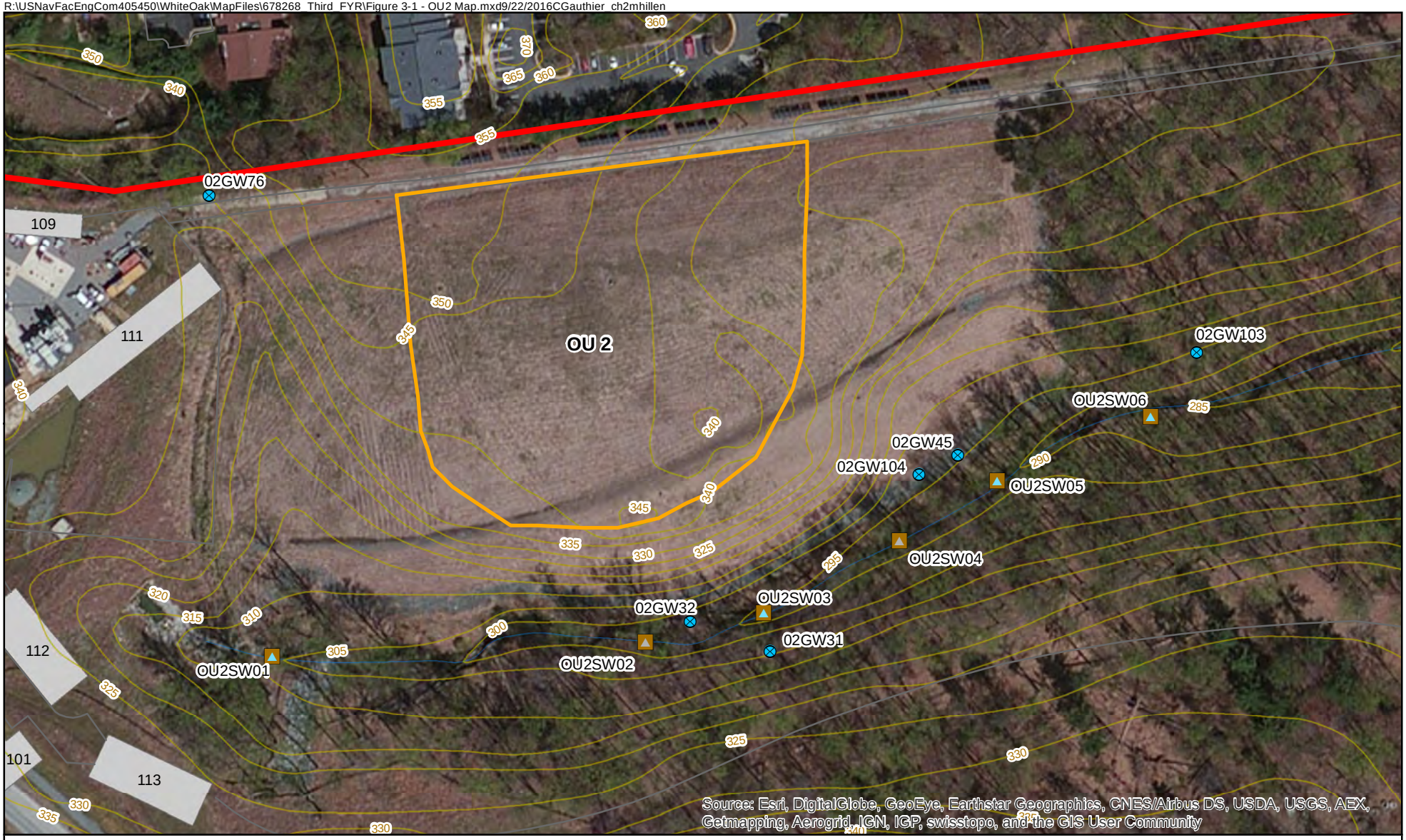
R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 3-1 - OU2 Map.mxd9/22/2016CGauthier_ch2mhillen



Legend

- 2015 Long Term Monitoring Well
- 2015 Long Term Monitoring Surface Water Location
- Surface Water Location
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Abandoned Building and Other Structures
- Site Boundary

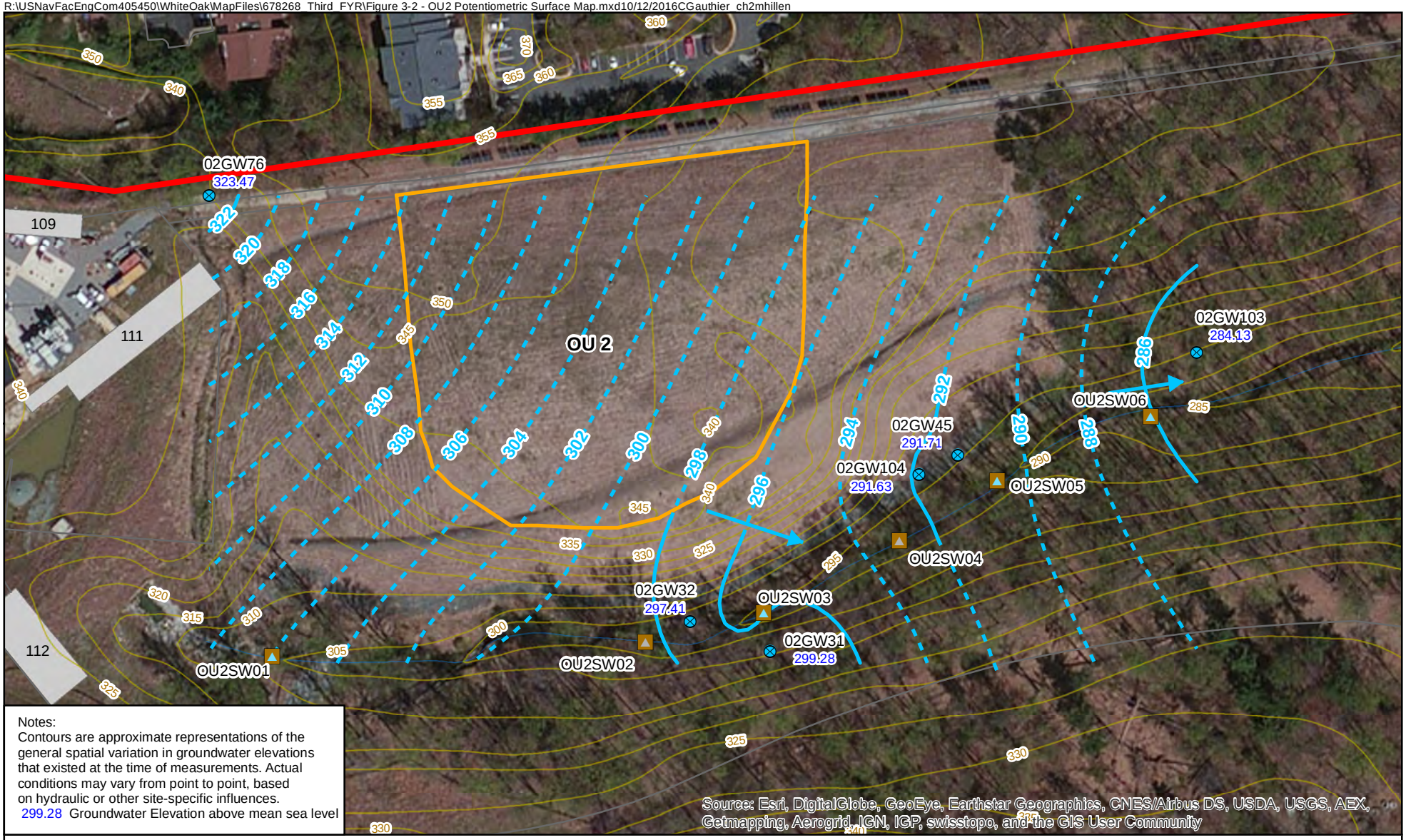
N

0 60 120 Feet

Figure 3-1
OU2 Map
Third Five-Year Report Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 3-2 - OU2 Potentiometric Surface Map.mxd10/12/2016CGauthier_ch2mhillen



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.
299.28 Groundwater Elevation above mean sea level

Legend

- 2015 Long Term Monitoring Well
- 2015 Long Term Monitoring Surface Water Location
- Surface Water Location
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Abandoned Building and Other Structures
- Site Boundary
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

N

0 60 120 Feet

Figure 3-2
OU2 Potentiometric Surface Map and LTM Locations - August 3, 2015
Third 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 Department of the Navy's IAS (Navy, 1984).
1985	Malcolm Pirnie conducted a Confirmation Study Verification Phase for NSWC White Oak to confirm the findings of the IAS and obtain additional information in characterizing site hazards (Malcolm Pirnie, 1987).
1990	A RCRA Facility Assessment (RFA) was conducted at NSWC White Oak by Kearney/Centaur Division. 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 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	Malcolm Pirnie completed a draft FS for Site 4 (Malcolm Pirnie, 1993).
1995	A Design Verification Study was conducted by Halliburton NUS Corporation 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	The former NSWC White Oak was selected for closure on the BRAC IV list, and a Phase I Environmental Baseline Survey was conducted by EA Engineering Science and Technology in 1996).
1997	An SI was conducted at Site 46 by Tetra Tech to investigate the nature and extent of chlorinated volatile organic compounds (CVOCs) detected in this area, which is situated immediately downgradient of Site 4 (Tetra Tech, 1998)
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, 2000a).
June-September 1999	A soil removal action was conducted by Tetra Tech 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, 1999b).
2002	CH2M completed the RI report for OU1 (Sites 4 and 46 [Site 4/46] are part of OU1) (CH2M, 2002)
2003	CH2M completed the FS report for OU1. The recommended alternative for soil at Site 4 was soil-vapor extraction (SVE) and the recommended alternative for groundwater at Site 4/46 was pump-and-treat (CH2M, 2003a).
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 in situ bioremediation (EISB), with ICs, and long term monitoring until groundwater remediation goals are met (NAVFAC, 2005a).
September-October 2007	The initial implementation of EISB using emulsified vegetable oil (EVO) was performed by Shaw Environmental & Infrastructure, Inc. (Shaw) with emulsified oil substrate injected at the Source Area, 50 Series Area, and 100 Series Area.

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

Date	Key Events and Milestones
October 2008	CH2M conducted LTM sampling at the Site 4 Source Area and 100 Series monitoring wells 1 year after the 2007 EISB injection.
February 2009	AGVIQ Environmental Services/CH2M Joint Venture (AGVIQ/CH2M) conducted baseline groundwater sampling event for the 200 Series Area (AGVIQ/CH2M, 2010a).
September 2009	AGVIQ/CH2M conducted baseline groundwater sampling event for the 300 Series (AGVIQ/CH2M, 2010b).
September-November 2009	AGVIQ/CH2M performed a second injection of EVO (slow-release substrate) 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.
February 2010	AGVIQ/CH2M conducted 3-month post-injection sampling event (AGVIQ/CH2M, 2010c).
May 2010	AGVIQ/CH2M conducted 6-month post-injection sampling event (AGVIQ/CH2M, 2010d, 2011a).
August 2010	AGVIQ/CH2M conducted 9-month post-injection sampling event (AGVIQ/CH2M, 2011b).
November-December 2010	AGVIQ/CH2M conducted 12-month post-injection sampling event (AGVIQ/CH2M, 2011c).
December 2011	CH2M conducted annual LTM groundwater sampling event (CH2M, 2012).
December 2012	CH2M conducted annual LTM groundwater sampling event (CH2M, 2014).
December 2013	CH2M conducted annual LTM groundwater sampling event (CH2M, 2016a).
October 2014	CH2M conducted annual LTM groundwater sampling event (CH2M, 2016b).
November 2015	CH2M conducted annual LTM groundwater sampling event (CH2M, 2017a).

Site chronology from the first White Oak Five-Year Review Report (JM Waller Associates, 2007), the Site 4 ROD (NAVFAC, 2005a), and the Final White Oak 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. 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 1999, in preparation for the 1999 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). 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. Site 4 groundwater is defined as the groundwater contaminant plume (consisting primarily of CVOCs) 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.

Site 4 was first identified as a Navy IRP site in the IAS conducted by the Navy's Naval NEESA in 1984. Investigation activities have been conducted at Site 4 since 1985 to meet the requirements of both a CERCLA Remedial Investigation (RI) and an RFI. The investigative activities focused on characterizing surface and subsurface soil and groundwater and are listed in **Table 4-1** above and summarized in the Long-Term Monitoring Plan for Site 4 Groundwater (CH2M, 2011a).

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 TCE contamination remained at levels which were above 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, 1999b).

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. 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, 2003a). Because the soil at Site 4 contained TCE and 1,1,2,2-PCA, and the wells located on the upgradient side of Site 4 were relatively free from contamination, Site 4 was recognized as the source of the TCE, PCA, and several other VOCs found in the groundwater in this area.

The Site 4 ROD was signed in 2005 and stated that in situ enhanced reductive dechlorination (ERD) with ICs and LTM to address groundwater contamination, and 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, in order to maintain plume containment while treatment was ongoing and specific criteria were met.

As stated in the Site 4 ROD, Site 4 groundwater 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 groundwater does not include the plume of explosives-contaminated groundwater originating at Site 7, except where this plume overlaps the Site 4 VOC plume. The Site 4 groundwater plume extends from the property currently owned by GSA onto the Army property, and the leading edge of the plume has migrated onto private residential property located between the Federal Government property and the Paint Branch stream and stream along Floral Drive (NAVFAC, 2005a). Groundwater at Site 4 is still subject to LTM and Five-Year Reviews.

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).

The PRGs developed for groundwater and presented in the Sites 4 and 46 ROD are provided in **Table 4-2.** The PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs, and the updated values are also presented in **Table 4-2** (CH2M, 2010).

Table 4-2. PRGs for COCs for Site 4 Groundwater Attainment Areas

Constituent of Concern	Groundwater PRGs for Site 4 Attainment Area – 2005 ROD (µg/L)	Groundwater PRGs for Site 46 Attainment Area – 2005 ROD (µg/L)	Basis	Updated Groundwater PRG* (µg/L)	Updated Basis
1,1,2,2-PCA	3	5.9	RB	2.4	RB
TCE	5	5	MCL	5	MCL
Cis-1,2-DCE	70	70	MCL	70	MCL
1,2-DCA	5	5	MCL	5	MCL
VC	52	2	MCL	2	MCL
1,1-DCE	A	-	MCL	-	-
Benzene	A	5 B	MCL	-	-
Toluene	-	1,000 B	MCL	-	-
2-amino-4,6-dinitrotoluene	-	0.18	RB	-	-
4-amino-2,6-dinitrotoluene	-	0.18	RB	-	-
2,4,6-dinitrotoluene	-	-	RB	-	-
RDX	-	-	RB	-	-
Iron (dissolved)	4,600	9,300	RB	11,000	RB
Perchlorate**	-	-	-	15	DoD LOC

Notes:

µg/L = microgram per liter

1,1-DCE = 1,1-dichloroethene

1,2-DCA = 1,2-dichloroethane

A = compound was detected throughout the attainment area at concentrations below MCL, but incremental risk from compound was included in the overall risk calculations to determine risk-based PRGs for other compounds

B = compound was detected in only one well in the attainment area, but because it exceeded the MCL it was included as a PRG. The incremental risk from the compound was not included in the overall risk calculations to determine risk-based PRGs for other compounds.

DoD LOC = Department of Defense Level of Concern

MCL – PRG is the maximum contaminant level drinking water standard

Risk Based (RB) – PRG is a site-specific risk-based standard calculated using guidance developed by USEPA Region 3.

RDX = cyclotrimethylenetrinitramine

VC= vinyl chloride

* As per *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2010)

** Perchlorate added as per NAVFAC Memorandum dated December 15, 2006 (NAVFAC, 2006)

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).

As summarized in the Long-Term Monitoring Plan for Site 4 Groundwater (CH2M, 2011a), the depth to water at the Site 4 source area (where the Phase I of the EISB was implemented) is approximately 27 feet bgs because much of the overburden in this area was removed as part of a previous 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.

The depth to groundwater throughout the down-gradient plume varies from about 50 feet (just south of Site 4) to 40 feet (just north of the existing extraction wells at the centrifuge). The plume occurs primarily in the Coastal Plain deposits, which range in thickness from roughly 55 feet in the vicinity of Site 4 to 80 feet immediately downgradient (south) of Site 4, 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 area addressed by the EISB 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 for the plume is to the south-southeast. The hydraulic gradient between the Site 4 source area and the existing 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

Currently, Site 4 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. 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 Site 4 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 southern edge of plume these properties 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 at this time and is unlikely to be used for such purposes in the future. Local ordinances and Maryland state regulations 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 current 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 they are deeper than would be contacted, but do represent a 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[5] within the Site 4 plume (generally defined by groundwater containing TCE at concentrations greater than 5 µg/L) was (in order of prevalence):

- TCE: 4,300 µg/L
- 1,1,2,2 PCA: 317 µg/L
- VC: 73 µg/L
- cis-1,2- DCE: 402 µg/L
- 1,2-dichloroethane (1,2-DCA): 285 µg/L
- 2-amino-4,6-dinitrotoluene (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[1]: 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/1,1,2,2-PCA groundwater plume, these contaminants appear to have originated from other known sources (Site 7 and a former gasoline underground storage tank at the centrifuge at Site 46).

During the most recent round of groundwater sampling in November 2015, selected monitoring wells were sampled for select VOCs and natural attenuation parameters including total sodium, alkalinity, total organic carbon (TOC), dissolved gases (methane, ethane, 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, 2003b) 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.

5 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.

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, 2003b) evaluated exposure to soil by current and future industrial workers, maintenance workers, construction workers, adult recreational users, adolescent trespassers, potential future day-care-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 1.0 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, Vinyl Chloride, 1-1-dichloroethene (1,1-DCE), Benzene, Toluene, 2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4,6-TNT, RDX, and iron (dissolved). 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 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, Site 4 groundwater 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 preliminary remediation goals [PRGs] identified).

To achieve the RAOs:

- The selected remedy for Site 4 soil, “Alternative 2: Soil Vapor Extraction,” comprised 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.
- The selected remedy for Site 4 groundwater, a combination of “Alternative 6: Additional Groundwater Extraction and Ex-Situ Treatment with ICs and LTM and Continued Operation of the Existing Groundwater Extraction Systems” and “Alternative 7: Mid-Plume Extraction System,” comprised 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.
  - Long-term monitoring of the in situ reductive dechlorination area, existing extraction system areas and downgradient portions of the plume.
  - Preparation of annual technical memoranda and 5-year reports.
  - Implementation of ICs until PRGs are met.

4.3.3 Status of Implementation

4.3.3.1 Soil Vapor 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 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 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, 2009a). 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 soil Target Remediation Zone (TRZ).

Based on the analysis of the data collected in 2010 and 2011 from the Site 4 monitoring wells located within the TRZ, the SVE system met one of the shutdown conditions listed in the Site 4 ROD. Specifically, “Groundwater concentrations of TCE and 1,1,2,2-PCA beneath the soil TRZ 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 Final 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

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 Joint Venture III. 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

As reported in the second Five Year Review report for Former NSWC-White Oak (Tetra Tech, 2012), the groundwater component of the remedy for Site 46 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. Although these three systems comprised the Site 46 treatment systems, they were addressing the contaminated plume from Site 4. These systems were inspected monthly and repaired/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 Final LTM Plan for Site 4 Groundwater (CH2M, 2011a), groundwater sampling has been performed in approximate 12-month intervals since 2010 in order to assess the effectiveness of the RA, and includes assessing the effectiveness of the EISB and the achievement of PRGs, as well as evaluating the need to optimize the LTM approach or to discontinue LTM.

The following is a summary of the most recent Site 4 LTM groundwater sampling event conducted in November 2015. The 2015 event did not include analysis of metals. The 2014 LTM report (CH2M, 2016b) recommended temporarily discontinuing analyzing for select metals until after the proposed injection because the presence of elevated metals is a result of the induced reducing conditions. Additional injection will further enhance these conditions and metals will not decrease until the injected substrate is depleted. As such, monitoring wells which were previously sampled for metals and natural attenuation parameters only were not included in this sampling event. Since the October 2014 iron analytical results are the most recent LTM data, they have been included in the summary below.

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

Ten monitoring wells from the Source Area, 50 Series, and 100 Series Areas (04GW301, 04GW402, 04GW403, 04GW405, 04GW407, 04GW409, 04GW412, 04GW413, 04GW414, and 04GW415) were sampled for various VOC constituents (**Table 4-3**) and the analytical results are provided in **Table 4-4** and summarized as follows:

- 1,1,2,2-PCA was only detected in groundwater at one monitoring well, 04GW413, with a concentration of 17 µg/L, which exceeds the PRG of 2.4 µg/L.
- TCE was detected in groundwater samples from seven monitoring wells (04GW301, 04GW402, 04GW405, 04GW407, 04GW409, 04GW412, and 04GW413). Groundwater at one monitoring well, 04GW412, exceeded the PRG of 5 µg/L with a detected concentration of 5.8 µg/L at 04GW412.
- Cis-1,2-DCE was detected in groundwater samples from all 10 monitoring wells. Detected concentrations ranged from 0.5 µg/L (04GW414 and 04GW415) to 22,000 µg/L (04GW413). The detection at 04GW413 exceeded the PRG of 70 µg/L.
- 1,2-DCA was detected in groundwater samples from six monitoring wells (04GW301, 04GW402, 04GW407, 04GW412, 04GW413, and 04GW414). Detected concentrations were below the PRG (5 µg/L) and ranged from 0.13 µg/L (04GW407) to 4.6 µg/L (04GW13).
- VC was detected in groundwater samples from eight monitoring wells (04GW301, 04GW402, 04GW405, 04GW407, 04GW409, 04GW412, 04GW413, and 04GW414). Detected concentrations ranged from 0.38 µg/L (04GW409) to 8,300 µg/L (04GW413). The detected concentrations at four monitoring well locations (04GW402, 04GW407, 04GW412, and 04GW413) exceeded the PRG of 2 µg/L.

During the October 2014 Site 4 LTM groundwater sampling event, total and dissolved iron were collected from the groundwater of eight monitoring wells at the Source Area, 50 Series, and 100 Series Areas (04GW203, 04GW301, 04GW400, 04GW403, 04GW409, 04GW412, 04GW413, and 04GW415). Dissolved iron was only collected from the groundwater of six monitoring wells (04GW402, 04GW404, 04GW405, 04GW407, 04GW408, and 04GW414). The analytical results are presented in Table 3-6 and Appendix A-1 of the 2014 LTM report (CH2M, 2016b) and are summarized as follows:

- Total iron was detected in groundwater samples from seven monitoring wells (04GW203, 04GW301, 04GW400, 04GW403, 04GW412, 04GW413, and 04GW415). Detected concentrations ranged from 43,200 µg/L (04GW203) to 187,000 µg/L (04GW413). Total iron concentrations exceeded the PRG (11,000 µg/L) at each of the seven monitoring wells.
- Dissolved iron concentrations ranged from 957 µg/L (04GW407) to 186,000 µg/L (04GW413). Each sample exceeded the PRG of 11,000 µg/L, except the groundwater sample collected from monitoring well 04GW407.

4.3.3.6 200 Series Wells

Three 200 Series monitoring wells (04GW502D, 04GW503D, and 04GW504D) were sampled for various VOC constituents (**Table 4-3**) and the analytical results are provided in **Table 4-5** and summarized as follows:

- 1,1,2,2-PCA was detected in groundwater samples from all three 200 Series monitoring wells at concentrations of 0.29 µg/L (04GW502D), 0.42 µg/L (04GW503D), and 15 µg/L (04GW504D). The detected concentration at 04GW504D exceeded the PRG of 2.4 µg/L.
- TCE exceeded the PRG of 5 µg/L in the groundwater at all three 200 Series monitoring wells with detected concentrations of 26 µg/L (04GW502D), 34 µg/L (04GW503D), and 800 µg/L (04GW504D).
- Cis-1,2-DCE was detected in groundwater samples from all three 200 Series monitoring wells at concentrations of 15 µg/L (04GW502D), 18 µg/L (04GW503D), and 170 µg/L (04GW504D). The detected concentration at 04GW504D exceeded the PRG (70 µg/L).
- 1,2-DCA was detected in groundwater samples from all three 200 Series monitoring wells at concentrations of 2.7 µg/L (04GW502D), 0.47 µg/L (04GW503D), and 5 µg/L (04GW504D). Detected concentrations did not exceed the PRG (5 µg/L).
- VC was detected in the groundwater at all three 200 Series monitoring wells at concentrations of 8.1 µg/L (04GW502D), 2.8 µg/L (04GW503D), and 27 µg/L (04GW504D), which all exceed the PRG of 2 µg/L.

During the October 2014 Site 4 LTM groundwater sampling event, groundwater samples from four monitoring wells at the 200 Series Area (04GW502D, 04GW502S, 04GW503S, and 04GW504S) were analyzed for total and dissolved iron. Groundwater samples from four monitoring wells (04GW501D, 04GW501S, 04GW503D, and 04GW504D) were analyzed for dissolved iron only. The analytical results are presented in Table 3-7 and Appendix A-1 of the 2014 LTM report (CH2M, 2016b) and are summarized as follows:

- Total iron was detected in groundwater samples from monitoring wells, 04GW503S and 04GW504S. Detected concentrations were above the PRG (11,000 µg/L) at concentrations of 74,100 µg/L and 50,500 µg/L respectively.
- Dissolved iron was detected above the PRG (11,000 µg/L) in each of the eight monitoring wells. Detected concentration of dissolved iron ranged from 23,600 µg/L (04GW504D) and 115,000 µg/L (04GW502D).

4.3.3.7 300 Series Wells

Five 300 Series monitoring wells (04GW601D, 04GW602S, 04GW602D, 04GW604S, and 04GW604D) were sampled for various VOC constituents (**Table 4-3**) and the analytical results are provided in **Table 4-6** and summarized as follows:

- 1,1,2,2-PCA was detected in groundwater samples from two of the monitoring wells (04GW601D and 04GW604D) at concentrations of 0.26 µg/L and 0.44 µg/L, respectively; neither of these detections exceeded the PRG (2.4 µg/L).
- TCE was detected in groundwater samples from all five monitoring wells. Detected concentrations ranged from 0.85 µg/L (04GW604S) to 42 µg/L (04GW601D). Detected concentrations at three of the five locations (04GW601D, 04GW602D, and 04GW604D) exceeded the PRG (5 µg/L).

- Cis-1,2-DCE was detected in groundwater samples from all five monitoring wells. Detected concentrations ranged from 0.41 µg/L (04GW604S) to 36 µg/L (04GW602D), and were all below the PRG (70 µg/L).
- 1,2-DCA was detected in groundwater samples from three monitoring wells (04GW601D, 04GW602D, and 04GW604D). All detected concentrations were less than 1 µg/L and below the PRG (5 µg/L).
- VC was detected in groundwater samples from four monitoring wells (04GW601D, 04GW602S, 04GW602D, and 04GW604D). Detected concentrations ranged from 0.16 µg/L (04GW602S) to 1.3 µg/L (04GW602D) and were all below the PRG (2 µg/L).

During the October 2014 Site 4 LTM groundwater sampling event, groundwater samples from three monitoring wells at the 300 Series Area (04GW601S, 04GW604S, and 04GW604D) were analyzed for total and dissolved iron. Groundwater samples from five monitoring wells (04GW601D, 04GW602S, 04GW602D, 04GW603S, and 04GW603D) were analyzed for dissolved iron only. The analytical results are presented in Table 3-8 and Appendix A-1 of the 2014 LTM report (CH2M, 2016b) and are summarized as follows:

- Total iron was detected above the PRG (11,000 µg/L) in groundwater samples from each of the three monitoring wells sampled. Detected concentrations of total iron included 12,000 µg/L (04GW604S), 89,700 µg/L (04GW601S), and 128,000 µg/L (04GW604D).
- Dissolved iron concentrations ranged from 1,960 µg/L (04GW602S) to 123,000 µg/L (04GW604D). Dissolved iron concentrations in six monitoring wells (04GW601S, 04GW602D, 04GW603S, 04GW603D, 04GW604S, and 04GW604D) exceeded the PRG of 11,000 µg/L.

4.3.3.8 Site 46 Wells

Three performance monitoring wells located within Site 46 (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. Monitoring well 46GW219 was not sampled in November 2015 due to a mix-up in the field during sampling; monitoring well 46GW122 was inadvertently sampled instead. Groundwater was sampled for various VOC constituents (**Table 4-3**) and the analytical results are provided in **Table 4-6** and summarized as follows:

- 1,1,2,2-PCA was detected in groundwater samples from both monitoring wells, 46GW123D and 46GW134, at concentrations of 1.1 µg/L and 0.32 µg/L, respectively. Neither detection exceeded the PRG (2.4 µg/L).
- TCE was detected in groundwater samples from both wells at concentrations of 38 µg/L (46GW123D) and 18 µg/L (46GW134). The detected concentrations exceeded the PRG of 5 µg/L.
- Cis-1,2-DCE was detected in groundwater samples from both monitoring wells, 46GW123D and 46GW134, at concentrations of 5.8 µg/L and 4.2 µg/L, respectively. Neither detection exceeded the PRG (70 µg/L).
- 1,2-DCA was detected in groundwater samples from both monitoring wells, both at concentrations of 0.19 µg/L. Neither detection exceeded the PRG (5 µg/L).
- VC was detected in groundwater samples from both monitoring wells, 46GW123D and 46GW134, at concentrations of 0.13 µg/L and 0.21 µg/L, respectively. Neither detection exceeded the PRG (2 µg/L).

During the October 2014 Site 4 LTM groundwater sampling event, groundwater from monitoring well 046GW219 was analyzed for total and dissolved iron. Groundwater samples from monitoring wells 046GW123D and 046GW134 were analyzed for dissolved iron only. The analytical results are presented in Table 3-8 and Appendix A-1 of the 2014 LTM report (CH2M, 2016b) and are summarized as follows:

- Total iron was detected at monitoring well 046GW219 below the PRG (11,000 µg/L) at a concentration of 2,230 µg/L. Dissolved iron concentrations were below the PRG in all three monitoring wells with concentrations of 24.1 µg/L (046GW134), 26.4 µg/L (046GW123D), and 2,420 µg/L (046GW219).

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 Institutional Control 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 preliminary remediation goals 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 4-7**) as well as the recommendations from the last Five-Year Review and the current status of those recommendations (**Table 4-8**).

Table 4-7. Protectiveness Determination/Statement from the 2012 Five-Year Review – Site 4

Protectiveness Determination	Protectiveness Statement
Protective	The remedy for the Site 4 Chemical Burial Area is protective of human health and ecological receptors. The implementation of the EISB component has been effective in significantly reducing contaminant concentrations while LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Long-term monitoring of groundwater and five-year reviews help to ensure that the RAs are functioning as intended and that an overall reduction in groundwater contamination is being achieved.

Table 4-8. Status of Recommendations from the 2012 Five-Year Review – Site 4

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
The downgradient edge of the TCE and cis-1,2-DCE plumes contain concentrations above their respective PRGs.	In order to further refine the understanding of the downgradient groundwater contaminant conditions and to give an indication of the downgradient edge of the TCE and cis-1,2-DCE plumes it is recommended the groundwater data from downgradient monitoring wells be evaluated along with the Site 4 LTM data.	Ongoing	The LTM sampling includes monitoring wells from the Site 4 Source area, along with monitoring wells from the 50 Series, 100 Series, 200 Series, and 300 Series Areas, located approximately 150 feet, 250 feet, 500 feet, and 1000 feet south-southeast of the Site 4 Source Area, respectively, to monitor and evaluate the downgradient edge of the TCE and cis-1,2-DCE plumes. Since the 2nd Five-Year Review, three monitoring wells (46GW123D, 46GW219, and 46GW134) were added to the LTM sampling program.	December 2011 December 2012 December 2013 October 2014 November 2015

Table 4-8. Status of Recommendations from the 2012 Five-Year Review – Site 4

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to assess whether reductive dechlorination is continuing at Site 4 and whether additional treatment at Site 4 may be warranted.	Continued post-injection LTM should be performed at Site 4, based on the Site 4 LTM Plan, with annual sampling events.	Ongoing	LTM sampling includes collection of geochemistry indicators to evaluate the oxidation-reduction conditions of groundwater at Site 4 Source Area, 50 Series, 200 Series, and 300 Series Areas.	December 2011 December 2012 December 2013 October 2014 November 2015

4.5 Five-Year Review Process

4.5.1 Document Review

Table 4-9 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 section is given in the References section.

Table 4-9. Summary of the Site 4 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	2001
ROD for Site 4 Soil and Groundwater	NAVFAC	2005
Memorandum Re: Perchlorate Remediation Goal	NAVFAC	2006
NSWC-White Oak First Five-Year Review	JM Waller Associates	2007
Memorandum Re: Disposition of the Building 502 Treatment System	NAVFAC	2007
Memorandum Re: Disposition of the Site 46 Groundwater Treatment System	NAVFAC	2007
Final Long-Term Monitoring Plan for Site 4 Groundwater	CH2M	2011
Former NSWC-White Oak Second Five-Year Review	Tetra Tech	2012
Final Land Use Control Remedial Design for Sites 4/46 Groundwater	CH2M	2013
Final Basewide Long-Term Monitoring Report – 2015, Former NSWC-White Oak	CH2M	2017

4.5.2 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. The Site 4 historical LTM groundwater analytical data collected from 2008 (baseline) through November 2015 are provided in **Tables 4-4** through **4-6**, and 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**. Conclusions based on evaluations of the analytical data from the Source and Series Areas, as well as Site 46, are summarized below.

4.5.2.1 Source Area, 50 Series, and 100 Series Conclusion

Overall, the changes in VOC concentrations in groundwater at the Source Area and 100 Series 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. Persistently elevated concentrations of cis-1,2-DCE in well 04GW413 suggest that a residual source zone may remain in the Source Area. TOC levels in this well appear adequate to sustain ERD at this time. However, if VOC concentrations begin to increase in this well, further treatment may be required to fully eliminate this residual source zone. The

2014 LTM data indicate that iron concentrations remain above the PRG, however, concentrations are expected to continue to decrease as reducing conditions in groundwater return to baseline conditions.

4.5.2.2 200 Series Conclusion

VOC concentrations in groundwater from the deep monitoring wells continue to be above 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 injection area. However, the data indicate that additional substrate injection in select injection wells in the 200 Series wells, particularly in the vicinity of well 04GW504D, would be beneficial in sustaining optimal ERD conditions. The 2014 LTM data indicate that iron concentrations remain above the PRG, however, concentrations are expected to continue to decrease as reducing conditions in groundwater return to baseline conditions.

4.5.2.3 300 Series Conclusion

In general, VOC concentrations in the 300 Series Area appear to be somewhat lower than in the upgradient areas of the site. Similar to the 200 Series wells, the TCE and cis-1,2-DCE groundwater concentrations in the 300 Series wells 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 and, to some degree, continues to occur within the 300 Series injection area. Groundwater conditions remain reducing throughout the 300 Series Area. The data suggest that additional substrate injection in select injection wells in the 300 Series wells would be beneficial in sustaining optimal ERD conditions. The 2014 LTM data indicate that iron concentrations remain above the PRG, however, concentrations are expected to continue to decrease as reducing conditions in groundwater return to baseline conditions.

4.5.2.4 Site 46 Conclusions

TCE exceeded the PRGs at Site 46 in two monitoring wells (46GW123D and 46GW134). Monitoring well 46GW123D had the highest detections of COCs compared to the other two monitoring wells. VOC concentration reductions have occurred over this time period at wells 46GW123D and 46GW134. These results suggest that the reductions in VOCs achieved by the upgradient biobarriers are successfully preventing a downgradient expansion of the VOC groundwater plume (**Figure 4-3**). The 2014 LTM data indicate that iron concentrations are below the PRG at Site 46.

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 EISB, groundwater treatment, LUCs, and LTM have been implemented and are 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 EISB 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 concentrations in wells at each of the Site 4 areas indicate TCE concentrations are declining (**Figure 4-2**). 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

ICs at Site 4 include LUCs 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 MDE

concurs 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 4-10**.

Table 4-10. Site 4 Groundwater Optimization

Sampling Event	Groundwater Optimization
December 2013	Based on Decision Rule 2B: • Eliminate VOC analysis for 04GW203, 04GW400, 04GW404, 04GW408, 04GW501D, 04GW501S, 04GW502S, 04GW503S, 04GW504S, 04GW601S, 04GW603D, and 04GW603S. • Analyze total and dissolved arsenic, iron, and manganese at monitoring wells 04GW203, 04GW301, 04GW400, 04GW403, 04GW409, 04GW412, 04GW413, 04GW415, 04GW502S, 04GW502D, 04GW503S, 04GW504S, 04GW601S, 04GW604S, 04GW604D, and 46GW219.
October 2014	Sampling for metals (arsenic, iron, and manganese) should be discontinued until after the next proposed substrate injection. • Monitoring wells 04GW203, 04GW400, 04GW404, 04GW408, 04GW501S, 04GW501D, 04GW502S, 04GW503S, 04GW504S, 04GW601S, 04GW603S, and 04GW603D will be eliminated from sampling until after the next proposed substrate injection.
November 2015	Based on Decision Rule 2B: • Eliminate VOCs analysis from monitoring wells 04GW409 and 04GW415. Because of the metals analyte reduction recommendation in the 2014 LTM Report (CH2M, 2016b), these wells will be eliminated from sampling. • Analyze for dissolved iron at monitoring wells 04GW301, 04GW402, 04GW403, 04GW405, 04GW412, 04GW413, 04GW414, 04GW502D, 04GW503D, 04GW504D, 04GW602S, 04GW602D, 04GW604S, and 04GW604D. • Analyze for TOC and methane in monitoring well 04GW504D. • Sampling for sodium should be discontinued because results are not being used in decision-making.

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

Since land use is not anticipated to change, 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, 1999b). Leaching of VOC contamination in deeper soil to the underlying groundwater has been addressed by treating the deeper soil via SVE and EISB, and is being monitored by groundwater sampling. PRGs established for Site 4 groundwater in the 2005 ROD were revised in 2010 as per *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2010) and presented in **Table 4-2**. 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 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) have been updated since the revised PRGs, and these changes would result in slight changes 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 the information presented as answers to questions A–C above, the remedies for Site 4 are still functioning as intended. Based on evaluation of the LTM data, the following recommendations are provided for the RA for Site 4 groundwater:

- Groundwater sampling should continue on an annual basis. Groundwater optimization should continue to occur based on the decision rules provided in the Site 4 LTM Plan (CH2M, 2011a).
- 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.

It is also recommended that LUC inspections of Site 4/46 be conducted at least once a year, and that documentation of these inspections be included in an annual LUC Inspection Report in accordance with the Site 4/46 LUC RD (CH2M, 2013b). A summary of the annual LUC Inspection Reports should be included in the next Five-Year Review.

4.8 Protectiveness Statement

The remedy for Site 4, consisting of 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
Site 4 Groundwater Sample Parameters and Methods
Third Five-Year Review Report
Former NSWC-White Oak

Monitoring Well	COCs	Biodegradation Indicators and Geochemical Parameters										
	Select VOCs	Total Sodium	Carbon Dioxide	Total Organic Carbon	Metabolic Acids	Dissolved Gases	Alkalinity	Chloride	Sulfate	Nitrate	Nitrite	Sulfide
	SW-846 8260B	SW-846 6020A		SW-846 9060	Lab SOP	RSK-175	EPA 310.2	EPA 300.0				SM4500S-F 21
Source Area												
04GW301	X	X	X	X	X	X	X		X	X	X	X
04GW402	X	X	X	X	X	X	X			X	X	X
04GW403	X	X	X	X	X	X	X		X	X	X	X
04GW405	X						X	X		X	X	X
04GW407	X						X	X		X	X	X
04GW409	X		X	X		X	X		X			X
04GW412	X		X	X		X	X		X			X
04GW413	X	X	X	X	X	X	X		X	X	X	X
04GW414	X	X	X	X	X	X	X			X	X	X
04GW415	X	X	X	X	X	X	X		X	X	X	X
200 Series												
04GW502D	X	X	X	X	X	X	X	X	X	X	X	X
04GW503D	X						X	X		X	X	X
04GW504D	X						X	X		X	X	X
300 Series												
04GW601D	X	X	X	X	X	X	X	X		X	X	X
04GW602S	X	X	X	X	X	X	X	X		X	X	X
04GW602D	X	X	X	X	X	X	X	X		X	X	X
04GW604S	X		X	X		X	X	X	X	X	X	X
04GW604D	X		X	X		X	X	X	X	X	X	X
46GW122	X		X	X		X	X	X	X	X	X	X
46GW123D	X						X	X		X	X	X
46GW134	X						X	X		X	X	X

Notes:
COCs - contaminants of concern
Select VOCs - 1,1,2,2-tetrachloroethane, 1,2-dichloroethane, cis-1,2-dichloroethene, trichloroethene, and vinyl chloride
Metabolic Acids - lactic acid, acetic acid, propionic acid, butyric acid, pyruvic acid
Dissolved Gases - methane, ethane, ethene

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW301										
Sample ID	**CLEAN WO PRGs Site 04**	004GW301-1008	004GW301-0210	004GW301P-0210	004GW301-0510	004GW301-0810	004GW301-1210	004GW301-1211	004GW301-1212	004GW301-1213	004GW301-1014	004GW301-1115
Sample Date		10/30/08	02/03/10	02/03/10	05/12/10	08/25/10	12/01/10	12/08/11	12/12/12	12/12/13	10/08/14	11/03/15
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	**2.4 J**	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	2 U	1 UL	NA
1,1,2,2-Tetrachloroethane	2.4	**49**	**24**	**22**	**5.4**	**3.3**	**2.6**	0.2 U	1 U	2 U	1 UL	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	2 U	1 UL	NA
1,1,2-Trichloroethane	--	**5**	**2.5 J**	**2.2 J**	**1.2 J**	**1 J**	**0.9 J**	0.2 U	1 U	2 U	1 UL	NA
1,1-Dichloroethane	--	**4.4 J**	5 U	5 U	**1 J**	0.5 U	0.5 U	**0.15 J**	1 U	2 U	1 UL	NA
1,1-Dichloroethene	--	**4.7 J**	5 U	5 U	**1.5 J**	**1.4 J**	**0.85 J**	0.2 U	1 U	2 U	1 UL	NA
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	2 U	1 UL	NA
1,2-Dichlorobenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.3 J**	1 U	2 U	1 UL	NA
1,2-Dichloroethane	5	**11**	**12**	**12**	**9.2**	**9.4**	**9.9**	**3.6**	**4 K**	**4.8**	**1.5 L**	**0.89 J**
1,2-Dichloropropane	--	5 U	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	2 U	1 UL	NA
1,3-Dichlorobenzene	--	5 U	5 U	5 U	**0.67 J**	**0.8 J**	**0.72 J**	**0.81 J**	**1.3 K**	2 U	**1.2 L**	NA
1,4-Dichlorobenzene	--	**1.1 J**	5 U	5 U	**1.5 J**	**1.8 J**	**1.6 J**	**1.6**	**3.1 K**	2 U	**2.3 L**	NA
2-Butanone	--	400 R	**570 L**	**580 L**	**2.5 J**	2.5 R	2.5 R	**24**	12 U	25 UJ	12 UJ	NA
2-Hexanone	--	**21 J**	**18**	**18**	**15**	2.5 U	**17**	**2.8 J**	2.5 U	5 U	2.5 UJ	NA
4-Methyl-2-pentanone	--	5 U	5 U	5 U	5 U	1 U	**2.5 J**	4 U	2.5 U	5 UJ	2.5 UL	NA
Acetone	--	**60 L**	**91 L**	**94 L**	**85 L**	**140 L**	**110 L**	**39**	**26 K**	25 U	**5.9 L**	NA
Benzene	--	**3.3 J**	**3.3 J**	**3.1 J**	**3.3 J**	**2.9 J**	**3.2 J**	**1.8**	**2.8 K**	**3.3 J**	**2 L**	NA
Carbon disulfide	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	10 U	5 UL	NA
Chlorobenzene	--	**7**	**6.5**	**6.1**	**7.3**	**5.9**	**5.7**	**5.4**	**11 K**	**5**	**4.2 L**	NA
Chloroethane	--	5 U	5 U	5 U	**4.6 J**	**5.5**	**3.7 J**	**2.1**	**2.8 K**	2 U	**2.3 L**	NA
Chloroform	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	2 U	1 UL	NA
Chloromethane	--	5 U	5 U	5 U	5 U	**0.69 J**	0.5 U	0.3 U	1 U	2 U	1 UL	NA
cis-1,2-Dichloroethene	70	**5,200**	**2,700**	**2,500**	**1,000**	**990**	**1,100**	**180**	**290 K**	**380**	**1.6 L**	**3.4**
Cyclohexane	--	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	2 U	1 UL	NA
Ethylbenzene	--	5 U	**0.93 J**	**0.75 J**	**1.1 J**	**0.52 J**	**0.77 J**	0.5 B	1 U	2 U	**0.79 L**	NA
Isopropylbenzene	--	5 U	**0.59 J**	5 U	**1.2 J**	**0.82 J**	**0.79 J**	**0.53 J**	1 U	2 U	1 UL	NA
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	2 U	4 U	NA	NA
Methyl acetate	--	5 U	5 U	5 U	5 U	1 U	**6.2**	**1.3 J**	1 U	2 U	1 UL	NA
Methylcyclohexane	--	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	2 U	1 UL	NA
Methylene chloride	--	5 U	**3.9 J**	**3.9 J**	**2.1 J**	**1.9 J**	1.7 B	1 U	5 U	10 U	5 UL	NA
Methyl-tert-butyl ether (MTBE)	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	2 U	1 UL	NA
o-Xylene	--	NA	NA	NA	NA	NA	NA	NA	**1.3 K**	**1.8 J**	NA	NA
Styrene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	2 U	1 UL	NA
Toluene	--	5 U	**1.4 J**	**1.2 J**	**1.3 J**	1.2 B	**1.2 J**	0.67 B	2 B	**2.2 J**	**1.1 L**	NA
trans-1,2-Dichloroethene	--	**32**	**11**	**9.4**	**14**	**6.4**	**5.5**	**2.6**	**1.9 K**	**1.6 J**	1 UL	NA
Trichloroethene	5	**33**	**15**	**14**	**5.6**	**2.4 J**	**3.7 J**	**0.31 J**	1 U	2 U	1 UL	**0.38 J**
Vinyl chloride	2	**120**	**200**	**180**	**150**	**130**	**160 J**	**42**	**38 K**	**95**	**2 J**	**1.5**
Xylene, total	--	**3.9 J**	**6.4**	**5.9**	**7.8**	**4.5 J**	**5.2**	2.7 B	**1.3 K**	4 U	**2.4 L**	NA
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
No Detections												
Total Metals (UG/L)												
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**16.5 J**	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	**122,000**	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1,490**	NA
Sodium	--	NA	NA	NA	NA	NA	NA	**48,200**	**36,800**	**24,000**	**20,400 J**	**21,200**
Dissolved Metals (UG/L)												
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7.56 J**	NA
Iron, Dissolved	11,000	**85,300**	**204,000**	**214,000**	**213,000**	**148,000**	**188,000**	**202,000**	**172,000**	**165,000**	**120,000**	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1,510**	NA
Sodium, Dissolved	--	**29,100**	**83,600**	**86,100**	**63,500**	**61,800**	**54,900**	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	**110**	**470**	**460**	**430 L**	**360**	**320**	**58.9**	**68**	**47**	0.1 U	**0.031 J**

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Station ID		04GW301										
Sample ID	**CLEAN WO PRGs Site 04**	004GW301-1008	004GW301-0210	004GW301P-0210	004GW301-0510	004GW301-0810	004GW301-1210	004GW301-1211	004GW301-1212	004GW301-1213	004GW301-1014	004GW301-1115
Sample Date		10/30/08	02/03/10	02/03/10	05/12/10	08/25/10	12/01/10	12/08/11	12/12/12	12/12/13	10/08/14	11/03/15
Chemical Name												
Alkalinity (mg/l)	--	**170**	**630**	**640**	**40**	**400**	**550**	**424**	**110**	**250**	**220**	**165**
Butyrate (mg/l)	--	5 U	**51**	**49**	**42**	**34**	**36**	**1.49**	0.1 U	0.1 U	0.1 U	0.05 U
Carbon dioxide (mg/l)	--	**84**	**0.55**	**0.663**	**125**	**90.2**	**69**	**320**	**724 D**	**702 D**	**388 D**	**280**
Chemical oxygen demand (mg/l)	--	**190**	**1,700**	**1,700**	**1,200**	**1,000**	**770**	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	**26**	**26**	**21**	**20**	**15.9**	**13.9**	NA	NA	NA	NA
Ethane (mg/l)	--	0.0012 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	**0.0039**	**0.0063**	**0.0163**	**0.00924**	**0.0108**	**0.0085**
Ethene (mg/l)	--	**0.014**	**0.018**	0.0016 U	**0.028**	**0.0096**	**0.055**	**0.011**	**0.014**	**0.0108**	**0.00841**	**0.0012 J**
Lactic Acid (mg/l)	--	NA	5 U	5 U	1.9 B	2 U	2 U	NA	0.2 U	0.2 U	0.2 U	NA
Methane (mg/l)	--	**5.9**	**8.9 J**	**0.084 J**	**6.9**	**6**	**39**	**7.6**	**26.8 D**	**8.07 D**	**4.71 D**	**9.2**
Nitrate (mg/l)	--	0.13 U	**0.0081 J**	**0.0081 J**	0.041 B	0.042 U	**0.12**	0.25 U	0.21 U	0.21 U	0.21 U	**5.52**
Nitrite (mg/l)	--	0.13 U	**0.074 J**	**0.072 J**	**0.13 J**	**0.15**	**0.1**	0.25 U	0.07 U	0.07 U	0.07 U	0.05 U
Propionate (mg/l)	--	5 U	NA	NA	NA	NA	NA	**6.43**	NA	NA	NA	0.05 U
Propionic Acid (mg/l)	--	NA	**270**	**270**	**140**	**98**	**75**	NA	**2.6**	**2.4**	0.1 U	NA
Pyruvate (mg/l)	--	5 U	5 U	5 U	5 U	5 U	5 U	**0.222**	0.1 U	0.1 U	0.1 U	0.05 U
Sulfate (mg/l)	--	**7.5**	0.14 B	0.2 B	0.21 B	**0.75 J**	1.7 B	NA	NA	NA	**110 D**	**15**
Sulfide (mg/l)	--	0.03 U	0.03 U	0.03 U	0.03 UL	0.03 U	**0.14**	1 U	**1.4**	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	**61**	**470**	**560**	**410**	**320**	**270**	**64**	**76**	**58**	**23**	**12.2**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Former NSWC-White Oak

Station ID		04GW402										
Sample ID	**CLEAN WO PRGs Site 04**	004GW402-1008	004GW402-0210	004GW402-0510	004GW402-0810	004GW402-1110	004GW402-1211	004GW402-1212	004GW402-1213	004GW402-1014	004GW402-1115	004GW402P-1115
Sample Date		10/30/08	02/03/10	05/13/10	08/25/10	11/30/10	12/07/11	12/11/12	12/11/13	10/07/14	11/03/15	11/03/15
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	NA
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	1 U	1 U	1 U	0.2 U	1 U	1 U	1 U	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	NA	NA
1,1,2-Trichloroethane	--	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	NA	NA
1,1-Dichloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	**0.37 J**	1 U	1 U	1 U	NA	NA
1,1-Dichloroethene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	NA
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	NA	NA
1,2-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	NA
1,2-Dichloroethane	5	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	**0.4 J**	**0.39 J**
1,2-Dichloropropane	--	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	NA	NA
1,3-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	**3.9**	NA	NA
1,4-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	**3.9**	NA	NA
2-Butanone	--	**13 L**	5 R	5 U	2.5 R	2.5 R	4 U	12 U	12 UJ	12 U	NA	NA
2-Hexanone	--	5 U	5 U	5 U	2.5 U	2.5 U	4 U	2.5 U	2.5 U	2.5 U	NA	NA
4-Methyl-2-pentanone	--	5 U	5 U	5 U	1 U	1 U	4 U	2.5 U	2.5 UJ	2.5 U	NA	NA
Acetone	--	**19 L**	5 R	5 R	2.5 R	2.5 R	5 U	12 U	12 U	5.9 B	NA	NA
Benzene	--	**1.2 J**	5 U	**0.59 J**	**0.6 J**	0.5 U	0.39 B	**0.8 K**	**1.2 J**	**3.3**	NA	NA
Carbon disulfide	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	NA	NA
Chlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	**0.5 J**	**0.82 K**	1 U	**7.5**	NA	NA
Chloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	**3.8 J**	NA	NA
Chloroform	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	NA
Chloromethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	NA	NA
cis-1,2-Dichloroethene	70	20 B	**27**	**5.9**	**7.3 J**	**6**	**20**	**41 K**	**15**	**2.6**	**53**	**47**
Cyclohexane	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UJ	NA	NA
Ethylbenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	NA
Isopropylbenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	NA
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	2 U	2 U	NA	NA	NA
Methyl acetate	--	5 U	5 U	5 U	1 U	1 U	0.5 U	1 U	1 U	1 UJ	NA	NA
Methylcyclohexane	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	NA	NA
Methylene chloride	--	5 U	5 U	5 U	0.5 U	0.5 U	1 U	5 U	5 U	4.9 B	NA	NA
Methyl-tert-butyl ether (MTBE)	--	5 U	5 U	5 U	**0.55 J**	**0.62 J**	**0.72 J**	1 U	1 U	1 UJ	NA	NA
o-Xylene	--	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	NA	NA
Styrene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA	NA
Toluene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.15 B	1 U	1 U	**0.99 J**	NA	NA
trans-1,2-Dichloroethene	--	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	**0.75 J**	NA	NA
Trichloroethene	5	1.8 B	5 U	5 U	0.5 U	**0.72 J**	**0.7 J**	1 U	1 U	1 U	**0.13 J**	**0.11 J**
Vinyl chloride	2	**6.7**	**6.4**	**14**	**16**	**16 J**	18 B	**22 K**	**9.4**	**4.3**	**53**	**56**
Xylene, total	--	5 U	5 U	5 U	1 U	1 U	0.4 U	3 U	2 U	2 U	NA	NA
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
No Detections												
Total Metals (UG/L)												
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	**19,300**	**20,100**	**19,700**	**14,800**	**13,000**	NA
Dissolved Metals (UG/L)												
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**95,500**	**57,300**	**42,700**	**44,300**	**32,300**	**27,200**	**21,900**	**37,600**	**78,600**	NA	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	**27,700**	**15,900**	**16,800**	**21,000**	**19,200**	NA	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	**81**	5 U	5 UL	**1.7 J**	0.5 U	0.05 U	0.1 U	**0.27**	**1.7**	**0.036 J**	NA

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Former NSWC-White Oak

Station ID		04GW402										
Sample ID	**CLEAN WO PRGs Site 04**	004GW402-1008	004GW402-0210	004GW402-0510	004GW402-0810	004GW402-1110	004GW402-1211	004GW402-1212	004GW402-1213	004GW402-1014	004GW402-1115	004GW402P-1115
Sample Date		10/30/08	02/03/10	05/13/10	08/25/10	11/30/10	12/07/11	12/11/12	12/11/13	10/07/14	11/03/15	11/03/15
Chemical Name												
Alkalinity (mg/l)	--	**390**	**190**	**300**	**150**	**100**	**95.9**	**100**	**120**	**220**	**162**	NA
Butyrate (mg/l)	--	5 U	5 U	5 U	1 U	1 U	0.05 U	0.1 U	0.1 U	0.1 U	0.05 U	NA
Carbon dioxide (mg/l)	--	**150**	**0.499**	**109**	**65.7**	**48.7**	**150**	**301 D**	**218 D**	**368 E**	**130**	NA
Chemical oxygen demand (mg/l)	--	**150**	**27**	**24**	**35**	**29**	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	**21**	**26**	**24**	**20.3**	**24.4**	NA	NA	NA	NA	NA
Ethane (mg/l)	--	**0.0022**	0.0012 U	0.0012 U	0.0013 U	0.0012 U	**0.0013 J**	**0.00255**	**0.00515**	**0.104**	**0.085**	NA
Ethene (mg/l)	--	**0.052**	**0.037**	**0.026**	**0.021**	**0.021**	**0.031**	**0.0347**	**0.0213**	**0.0587**	**0.028**	NA
Lactic Acid (mg/l)	--	NA	5 U	5 U	2 U	2 U	NA	0.2 U	0.2 U	0.2 U	NA	NA
Methane (mg/l)	--	**5.3**	**4**	**3.5**	**4**	**7.6**	**3.7**	**6.53 D**	**1.74 D**	**16.1 D**	**7.7**	NA
Nitrate (mg/l)	--	0.13 U	0.13 U	**1.7**	0.042 U	**0.096 J**	**0.0606 J**	0.21 U	0.21 U	0.21 U	**0.0595 J**	NA
Nitrite (mg/l)	--	0.13 U	0.13 U	0.13 U	0.042 U	**0.057 J**	0.05 U	0.07 U	0.07 U	0.07 U	0.05 U	NA
Propionate (mg/l)	--	**22**	NA	NA	NA	NA	0.05 U	NA	NA	NA	0.05 U	NA
Propionic Acid (mg/l)	--	NA	5 U	5 U	0.5 U	0.5 U	NA	0.1 U	0.1 U	0.1 U	NA	NA
Pyruvate (mg/l)	--	5 U	5 U	5 U	5 U	5 U	0.05 U	**0.01 J**	0.1 U	0.1 U	0.05 U	NA
Sulfate (mg/l)	--	5 U	**16**	**34**	**44**	**59.4**	NA	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	0.03 U	0.03 U	0.03 UL	0.03 U	**0.056**	1 U	1 U	1 U	1 U	1 U	NA
Total organic carbon (TOC) (mg/l)	--	**47**	7 B	**7.7 J**	**6.3 J**	5.4 B	**3.97**	**6.4**	**6.6**	**11**	**6.64**	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW403											
Sample ID	**CLEAN WO PRGs Site 04**	004GW403-1008	004GW403-0210	004GW403-0510	004GW403-0810	004GW403-1110	004GW403-1211	004GW403-1212	004GW403P-1212	004GW403-1213	004GW403P-1213	004GW403-1014	004GW403-1115
Sample Date		10/30/08	02/02/10	05/12/10	08/23/10	11/30/10	12/06/11	12/12/12	12/12/12	12/12/13	12/12/13	10/08/14	11/02/15
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,1-Trichloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	1 U	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	1 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
1,1,2-Trichloroethane	--	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,1-Dichloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	**0.15 J**	1 U	1 U	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
1,2-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,2-Dichloroethane	5	**3.4 J**	**0.63 J**	**0.94 J**	**1.1 J**	0.5 U	**0.9 J**	**0.93 K**	**0.81 K**	1 U	1 U	1 U	0.2 U
1,2-Dichloropropane	--	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,3-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	**0.13 J**	1 U	1 U	**1.4 J**	**1.6 J**	**1.1 J**	NA
1,4-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	**0.24 J**	**1.1 K**	**0.99 K**	**1.8 J**	**2**	**1.7 J**	NA
2-Butanone	--	**20 L**	5 U	5 U	2.5 R	2.5 R	4 U	12 U	12 U	12 UJ	12 UJ	12 UJ	NA
2-Hexanone	--	**3.5 J**	5 U	5 U	2.5 U	2.5 U	4 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 UJ	NA
4-Methyl-2-pentanone	--	5 U	5 U	5 U	1 U	1 U	4 U	2.5 U	2.5 U	2.5 UJ	2.5 UJ	2.5 U	NA
Acetone	--	**34 L**	5 R	**7 L**	4.4 B	**3.5 L**	5 U	12 U	12 U	12 U	12 U	12 U	NA
Benzene	--	5 U	5 U	**0.5 J**	**0.55 J**	**0.58 J**	0.61 B	**0.93 K**	**0.98 K**	**1.2 J**	**1.2 J**	**1.2 J**	NA
Carbon disulfide	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	**1.7 J**	**1 J**	**0.78 J**	**0.7 J**	0.5 U	**0.87 J**	**2.1 K**	**2.2 K**	**3.7**	**3.9**	**3.7**	NA
Chloroethane	--	5 U	**0.79 J**	5 U	**1.9 J**	**1.2 J**	**1.6**	1 U	1 U	**1.2 J**	1 U	**6.3**	NA
Chloroform	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
Chloromethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	**130**	**2.5 J**	**1.8 J**	**2.2 J**	**1.5 J**	**0.74 J**	**4.5 K**	**0.92 K**	**1.2 J**	**1 J**	**9.9**	**6.2**
Cyclohexane	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
Ethylbenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.11 B	1 U	1 U	1 U	1 U	1 U	NA
Isopropylbenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U	2 U	NA	NA
Methyl acetate	--	5 U	5 U	5 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U	NA
Methylcyclohexane	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
Methylene chloride	--	5 U	**0.92 J**	5 U	0.5 U	0.5 U	1 U	5 U	5 U	5 U	5 U	5 U	NA
Methyl-tert-butyl ether (MTBE)	--	**1.7 J**	**1.2 J**	**1.4 J**	**1.2 J**	**1 J**	**0.74 J**	1 U	1 U	1 U	1 U	1 U	NA
o-Xylene	--	NA	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U	NA	NA
Styrene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	1 U	NA
Toluene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.25 B	1 U	1 U	**0.89 J**	**0.73 J**	1 U	NA
trans-1,2-Dichloroethene	--	**2.2 J**	5 U	5 U	1 U	1 U	**0.12 J**	1 U	1 U	1 U	1 U	1 U	NA
Trichloroethene	5	**2.5 J**	**0.81 J**	5 U	**0.89 J**	**0.67 J**	**0.38 J**	1 U	1 U	1 U	1 U	1 U	0.2 U
Vinyl chloride	2	**18**	**1.5**	**1.3**	**1.5**	**1.4 J**	**0.46 J**	**2.1 K**	1 U	**0.79 J**	**1.2 J**	**18 J**	0.2 U
Xylene, total	--	5 U	5 U	5 U	1 U	1 U	0.3 B	3 U	3 U	2 U	2 U	2 U	NA
Semivolatile Organic Compounds (UG/L)													
No Detections													
Explosives (UG/L)													
No Detections													
Total Metals (UG/L)													
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20 U	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**81,500**	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6,660**	NA
Sodium	--	NA	NA	NA	NA	NA	**22,900**	**18,900**	NA	**18,500**	NA	**17,600 J**	**17,100**
Dissolved Metals (UG/L)													
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20 U	NA
Iron, Dissolved	11,000	**99,700**	**74,000**	**76,200**	**60,600**	**53,200**	**69,800**	**77,900**	**77,600**	**84,700**	**86,300**	**77,500**	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6,490**	NA
Sodium, Dissolved	--	**34,400**	**30,800**	**33,100**	**31,400**	**30,400**	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	**64**	**15**	**39 L**	**21**	**0.86 J**	0.05 U	0.1 U	NA	0.1 U	NA	0.1 U	**0.053 J**

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW403											
Sample ID	**CLEAN WO PRGs Site 04**	004GW403-1008	004GW403-0210	004GW403-0510	004GW403-0810	004GW403-1110	004GW403-1211	004GW403-1212	004GW403P-1212	004GW403-1213	004GW403P-1213	004GW403-1014	004GW403-1115
Sample Date		10/30/08	02/02/10	05/12/10	08/23/10	11/30/10	12/06/11	12/12/12	12/12/12	12/12/13	12/12/13	10/08/14	11/02/15
Chemical Name													
Alkalinity (mg/l)	--	**350**	**310**	**330**	**240**	**210**	**189**	**190**	NA	**180**	NA	**180**	**190**
Butyrate (mg/l)	--	5 U	5 U	5 U	1 U	1 U	0.05 U	0.1 U	NA	0.1 U	NA	0.1 U	0.05 U
Carbon dioxide (mg/l)	--	**140**	**0.541**	**102**	**54.3**	**36.8**	**130**	**296 D**	NA	**325 D**	NA	**80.5 JD**	**120**
Chemical oxygen demand (mg/l)	--	**130**	**44**	**96**	**53**	**30**	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	**24**	**27**	**24**	**22**	**19.8**	NA	NA	NA	NA	NA	NA
Ethane (mg/l)	--	**0.0018**	**0.0017**	0.0012 U	0.0013 U	**0.0014**	**0.0052**	**0.00556**	NA	**0.00557**	NA	**0.00801**	**0.019**
Ethene (mg/l)	--	**0.018**	**0.017**	**0.02**	**0.014**	**0.034**	**0.01**	0.00271 U	NA	0.00271 U	NA	**0.0063**	**0.0022**
Lactic Acid (mg/l)	--	NA	5 U	5 U	**1.6 J**	2 U	NA	0.2 U	NA	0.2 U	NA	0.2 U	NA
Methane (mg/l)	--	**5.6**	**7.3**	**7**	**6.3**	**33**	**11**	**21.4 D**	NA	**4.58 D**	NA	**9.11 D**	**6.4**
Nitrate (mg/l)	--	0.13 U	0.13 U	0.015 B	0.042 U	0.072 U	0.25 U	0.21 U	NA	0.21 U	NA	0.21 U	**0.055 J**
Nitrite (mg/l)	--	0.13 U	0.13 U	0.13 U	0.042 U	**0.06 J**	0.25 U	0.07 U	NA	0.07 U	NA	0.07 U	0.05 U
Propionate (mg/l)	--	**18**	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA	0.05 U
Propionic Acid (mg/l)	--	NA	**11**	**15**	**1.3 J**	0.5 U	NA	0.1 U	NA	0.1 U	NA	0.1 U	NA
Pyruvate (mg/l)	--	5 U	5 U	5 U	**1.6 J**	5 U	0.05 U	**0.013 J**	NA	0.1 U	NA	0.1 U	0.05 U
Sulfate (mg/l)	--	**11**	**13**	**5 J**	**15**	**18**	NA	NA	NA	NA	NA	**120 D**	**127**
Sulfide (mg/l)	--	0.03 U	0.03 U	0.03 UL	0.03 U	0.03 U	1 U	1 U	NA	1 U	NA	1 U	**5.72**
Total organic carbon (TOC) (mg/l)	--	**41**	**17**	**30**	**11**	8.1 B	**6.61**	**8.9**	NA	**7.9**	NA	**6.9**	**6.9**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW405													
Sample ID	**CLEAN WO PRGs Site 04**	004GW405-1008	004GW405P-1008	004GW405-0210	004GW405P-0210	004GW405-0510	004GW405-0810	004GW405-1210	004GW405-1211	004GW405-1212	004GW405P-1212	004GW405-1213	004GW405-1014	004GW405P-1014	004GW405-1115
Sample Date		10/28/08	10/28/08	02/05/10	02/05/10	05/13/10	08/25/10	12/03/10	12/08/11	12/13/12	12/13/12	12/13/13	10/10/14	10/10/14	11/05/15
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1,1-Trichloroethane	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.77 J**	**0.69 K**	**0.68 K**	1 U	1 U	1 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
1,1,2-Trichloroethane	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	**0.43 J**	1 U	1 U	1 U	1 U	1 U	NA
1,1-Dichloroethane	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.1 J**	1 U	1 U	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
1,2-Dichlorobenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,2-Dichloroethane	5	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.55 J**	1 U	1 U	1 U	1 U	1 U	0.2 U
1,2-Dichloropropane	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,3-Dichlorobenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
1,4-Dichlorobenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
2-Butanone	--	5 R	5 R	5 R	5 R	5 U	2.5 R	2.5 R	4 U	12 U	12 U	12 UJ	12 U	12 U	NA
2-Hexanone	--	5 U	5 U	5 U	5 U	5 U	2.5 U	2.5 U	4 U	2.5 U	2.5 U	2.5 U	2.5 UJ	2.5 UJ	NA
4-Methyl-2-pentanone	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	4 U	2.5 U	2.5 U	2.5 UJ	2.5 U	2.5 U	NA
Acetone	--	**39 L**	**37 L**	5 R	5 R	**5.6 L**	2.5 R	2.5 R	5 U	12 U	12 U	12 U	12 U	13 B	NA
Benzene	--	**1.5 J**	**1.4 J**	5 U	5 U	**0.77 J**	**0.51 J**	**0.6 J**	**2.2**	**2.5 K**	**2.4 K**	**1.3 J**	1 U	1 U	NA
Carbon disulfide	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
Chloroethane	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
Chloroform	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
Chloromethane	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	**220**	**220**	5 U	5 U	**1.3 J**	**3.1 J**	4.9 B	**24**	**32 K**	**31 K**	**11**	**3**	**3.7 K**	**3.2**
Cyclohexane	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
Ethylbenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
Isopropylbenzene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U	NA	NA	NA
Methyl acetate	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U	NA
Methylcyclohexane	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	1 U	NA
Methylene chloride	--	1.1 B	1.1 B	5 U	5 U	5 U	0.5 U	0.5 U	1 U	5 U	5 U	5 U	5 U	5 U	NA
Methyl-tert-butyl ether (MTBE)	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
o-Xylene	--	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	1 U	NA	NA	NA
Styrene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	1 U	NA
Toluene	--	5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	1 U	NA
trans-1,2-Dichloroethene	--	**1.4 J**	**1.2 J**	5 U	5 U	5 U	1 U	1 U	**0.85 J**	**1.1 K**	**0.73 K**	1 U	1 U	1 U	NA
Trichloroethene	5	**1.8 J**	**1.6 J**	5 U	5 U	5 U	0.5 U	**0.61 J**	**1.3**	**1.6 K**	**1.3 K**	**1.5 J**	**1.3 J**	**1.5 K**	**1.1**
Vinyl chloride	2	**19**	**19**	1 U	1 U	1 U	**1.8**	**5.9**	**19**	**16 K**	**16 K**	**4.7**	**1.6 J**	**1.9 J**	**1.1**
Xylene, total	--	5 U	5 U	5 U	5 U	5 U	1 U	1 U	0.4 U	3 U	3 U	2 U	2 U	2 U	NA
Semivolatile Organic Compounds (UG/L)															
No Detections															
Explosives (UG/L)															
No Detections															
Total Metals (UG/L)															
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)															
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**131,000**	NA	**134,000**	**136,000**	**94,800**	**64,700**	**54,500**	**49,800**	**38,000**	**37,900**	**36,300**	**37,900**	**36,600**	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	**9,010**	NA	**7,730**	**8,040**	**8,400**	**7,360**	**5,970**	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**															
Acetate (mg/l)	--	**160**	NA	**1.5 J**	**1.2 J**	5 UL	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Former NSWC-White Oak

Station ID		04GW405														
Sample ID	**CLEAN WO PRGs Site 04**	004GW405-1008	004GW405P-1008	004GW405-0210	004GW405P-0210	004GW405-0510	004GW405-0810	004GW405-1210	004GW405-1211	004GW405-1212	004GW405P-1212	004GW405-1213	004GW405-1014	004GW405P-1014	004GW405-1115
Sample Date		10/28/08	10/28/08	02/05/10	02/05/10	05/13/10	08/25/10	12/03/10	12/08/11	12/13/12	12/13/12	12/13/13	10/10/14	10/10/14	11/05/15
Chemical Name															
Alkalinity (mg/l)	--	**240**	NA	**180**	**150**	**130**	**180**	**100**	**84.9**	**67**	NA	**56**	**75**	NA	**48.7**
Butyrate (mg/l)	--	**13**	NA	5 U	5 U	5 U	1 U	1 U	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide (mg/l)	--	**95**	NA	**0.811**	**0.682**	**104**	**62.1**	**26.9**	NA	NA	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	**430**	NA	**39**	**37**	**28**	**25**	20 U	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	**8.2**	**8.2**	**12**	**7.5**	**7**	**8.4**	**6.6**	NA	**7**	**6.3**	NA	**7.16**
Ethane (mg/l)	--	0.0012 U	NA	**0.0016**	**0.0015**	**0.0018**	**0.002**	**0.0052**	NA	NA	NA	NA	NA	NA	NA
Ethene (mg/l)	--	0.0015 U	NA	0.0015 U	0.0015 U	0.0015 U	0.0016 U	**0.0056**	NA	NA	NA	NA	NA	NA	NA
Lactic Acid (mg/l)	--	NA	NA	4.1 B	5 U	5 U	2 U	2 U	NA	NA	NA	NA	NA	NA	NA
Methane (mg/l)	--	**10**	NA	**15**	**16**	**8.9**	**6.3**	**41**	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	0.13 U	NA	**0.018 L**	**0.015 L**	0.026 B	0.042 U	0.072 U	0.1 U	0.21 U	NA	0.21 U	0.21 U	NA	**0.0522 J**
Nitrite (mg/l)	--	0.13 U	NA	0.13 UL	0.13 UL	0.13 U	0.042 U	**0.072 J**	0.1 U	0.07 U	NA	0.07 U	0.07 U	NA	0.05 U
Propionate (mg/l)	--	**25**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	5 U	5 U	5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	5 U	NA	**1.5 J**	**1.5 J**	**4.6 J**	**12**	**17.5**	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	0.03 U	NA	0.03 U	0.03 U	0.03 UL	0.03 U	**0.061**	1 U	**0.46 J**	NA	1 U	1 U	NA	1 U
Total organic carbon (TOC) (mg/l)	--	**120**	NA	**11**	**11**	**7 J**	**2.9 J**	**2.5 J**	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Station ID		04GW407											
Sample ID	**CLEAN WO PRGs Site 04**	004GW407-1008	004GW407-0210	004GW407-0510	004GW407P-0510	004GW407-0810	004GW407-1210	004GW407-1211	004GW407-1212	004GW407-1213	004GW407-1014	004GW407P-1014	004GW407-1115
Sample Date		10/29/08	02/03/10	05/12/10	05/12/10	08/24/10	12/01/10	12/08/11	12/13/12	12/13/13	10/09/14	10/09/14	11/04/15
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,1-Trichloroethane	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	NA
1,1,2,2-Tetrachloroethane	2.4	**14**	1 U	1 U	**1.8**	**0.93 J**	**1.1**	**0.2 J**	1 U	1 U	1 U	1 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	NA
1,1,2-Trichloroethane	--	**1.7 J**	5 U	5 U	5 U	1 U	1 U	**0.11 J**	1 U	1 U	1 U	1 U	NA
1,1-Dichloroethane	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.13 J**	1 U	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	**20**	**4.9 J**	**1.5 J**	**2.1 J**	**1.3 J**	**1 J**	**0.14 J**	1 U	1 U	1 U	1 U	NA
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	1 U	NA
1,2-Dichlorobenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	NA
1,2-Dichloroethane	5	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.35 J**	1 U	1 U	1 U	1 U	**0.13 J**
1,2-Dichloropropane	--	5 U	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	NA
1,3-Dichlorobenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.21 J**	1 U	1 U	1 U	1 U	NA
1,4-Dichlorobenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.19 J**	1 U	1 U	1 U	1 U	NA
2-Butanone	--	80 R	5 R	5 U	5 U	2.5 R	2.5 R	4 U	12 U	12 UJ	12 UJ	12 UJ	NA
2-Hexanone	--	5 U	5 U	5 U	5 U	2.5 UL	2.5 U	4 U	2.5 U	2.5 U	2.5 U	2.5 U	NA
4-Methyl-2-pentanone	--	5 U	5 U	5 U	5 U	1 U	1 U	4 U	2.5 U	2.5 UJ	2.5 U	2.5 U	NA
Acetone	--	80 R	5 R	5 R	5 R	2.5 R	2.5 R	5 U	12 U	12 U	12 U	12 U	NA
Benzene	--	**1.3 J**	**1.4 J**	**1 J**	**0.99 J**	**1.1 J**	**1.4 J**	1.3 B	**1.8 K**	**1.4 J**	1 U	1 U	NA
Carbon disulfide	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	**1.3 J**	5 U	**0.62 J**	**0.56 J**	**0.57 J**	**0.61 J**	**0.48 J**	1 U	**0.78 J**	1 U	1 U	NA
Chloroethane	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	**1.8 J**	**3.6**	**2.8**	NA
Chloroform	--	**7.1**	**5.2**	3.4 B	3.1 B	**2.6 J**	2.3 B	0.39 B	1 U	1 U	1 U	1 U	NA
Chloromethane	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 UJ	1 UJ	NA
cis-1,2-Dichloroethene	70	**460**	**490**	**270**	**250**	**190**	**160**	**27**	**6.5 K**	**3.4**	**2.6**	**3.4**	**10**
Cyclohexane	--	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	NA
Ethylbenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	NA
Isopropylbenzene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	NA
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	NA	NA	NA
Methyl acetate	--	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U	1 U	1 U	1 UJ	1 UJ	NA
Methylcyclohexane	--	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	1 U	NA
Methylene chloride	--	5 U	5 U	**0.85 J**	**0.55 J**	0.77 B	1.4 B	1 B	5 U	5 U	5 U	5 U	NA
Methyl-tert-butyl ether (MTBE)	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	NA
o-Xylene	--	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	NA	NA
Styrene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	NA
Toluene	--	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	1 U	NA
trans-1,2-Dichloroethene	--	**1 J**	5 U	5 U	5 U	1 U	1 U	**0.42 J**	1 U	1 U	1 U	1 U	NA
Trichloroethene	5	**2,600**	**980**	**410**	**400**	**260 L**	**200 L**	**38**	**14 K**	**9.8**	**5.3**	**5.6**	**4**
Vinyl chloride	2	**5.5**	**14**	**9.8**	**11**	**31**	**45 J**	**7.6**	**1.6 K**	1 U	**1.6 J**	**1.8 J**	**21**
Xylene, total	--	5 U	5 U	5 U	5 U	1 U	1 U	0.4 U	3 U	2 U	2 U	2 U	NA
Semivolatile Organic Compounds (UG/L)													
No Detections													
Explosives (UG/L)													
No Detections													
Total Metals (UG/L)													
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)													
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**5,410**	**3,750**	**1,720**	**1,910**	**1,740**	**1,570**	**2,020**	**1,480**	**6,820**	**934**	**957**	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	**8,430**	9,000 B	**8,270**	**8,620**	**7,890**	**8,050**	NA	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	5 U	5 U	5 UL	5 UL	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Station ID		04GW407											
Sample ID	**CLEAN WO PRGs Site 04**	004GW407-1008	004GW407-0210	004GW407-0510	004GW407P-0510	004GW407-0810	004GW407-1210	004GW407-1211	004GW407-1212	004GW407-1213	004GW407-1014	004GW407P-1014	004GW407-1115
Sample Date		10/29/08	02/03/10	05/12/10	05/12/10	08/24/10	12/01/10	12/08/11	12/13/12	12/13/13	10/09/14	10/09/14	11/04/15
Chemical Name													
Alkalinity (mg/l)	--	**250**	**89**	**860 J**	**85 J**	**150**	**130**	**179**	**240**	**200**	**160**	NA	**121**
Butyrate (mg/l)	--	5 U	5 U	5 U	5 U	1 U	1 U	NA	NA	NA	NA	NA	NA
Carbon dioxide (mg/l)	--	**100**	**0.53**	**89.7**	**82.9**	**57.2**	**46.2**	NA	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	**30**	21 U	20 U	20 U	20 U	20 U	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	**12**	**13**	**12**	**11**	**10.9**	**12.5**	**9.4**	**8.7**	**7.8**	NA	**9.89**
Ethane (mg/l)	--	0.0012 U	0.0012 U	0.0012 U	0.0013 U	0.0013 U	**0.002**	NA	NA	NA	NA	NA	NA
Ethene (mg/l)	--	0.0015 U	**0.0032**	**0.0051**	**0.0054**	**0.022**	**0.13**	NA	NA	NA	NA	NA	NA
Lactic Acid (mg/l)	--	NA	2.1 B	5 U	5 U	2 U	2 U	NA	NA	NA	NA	NA	NA
Methane (mg/l)	--	**0.0079**	**0.28**	**0.33**	**0.35**	**0.91**	**5.3**	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	0.13 U	**0.0076 J**	0.067 B	**0.62**	0.042 U	0.072 U	**0.0595 J**	0.21 U	0.21 U	0.21 U	NA	**0.0519 J**
Nitrite (mg/l)	--	0.13 U	0.13 U	0.13 U	0.13 U	0.042 U	0.062 U	0.05 U	0.07 U	0.07 U	0.07 U	NA	0.05 U
Propionate (mg/l)	--	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	5 U	5 U	5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	5 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**52**	**49**	**52**	**52**	**50**	**56.9**	NA	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	0.03 U	0.03 U	0.03 UL	0.03 UL	0.03 U	0.03 U	1 U	1 U	1 U	1 U	NA	1 U
Total organic carbon (TOC) (mg/l)	--	10 U	4.1 B	**5.8 J**	**4.4 J**	**2.9 J**	**5.4 J**	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Station ID		04GW409										04GW412			
Sample ID	**CLEAN WO PRGs Site 04**	004GW409-1008	004GW409-0210	004GW409-0510	004GW409-0810	004GW409-1210	004GW409-1211	004GW409-1212	004GW409-1213	004GW409-1014	004GW409-1115	004GW412-1008	004GW412-0210	004GW412-0510	004GW412-0810
Sample Date		10/28/08	02/05/10	05/12/10	08/25/10	12/03/10	12/08/11	12/13/12	12/16/13	10/10/14	11/04/15	10/28/08	02/01/10	05/11/10	08/25/10
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1,1-Trichloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	1 U	1 U	1 U	**0.14 J**	1 U	1 U	1 U	0.2 U	**1.4**	**0.84 J**	**1.4**	**2.2**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	1 U
1,1,2-Trichloroethane	--	5 U	5 U	5 U	1 U	1 U	**0.3 J**	1 U	1 U	1 U	NA	5 U	5 U	5 U	1 U
1,1-Dichloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
1,1-Dichloroethene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	**2.4 J**	**0.67 J**	**0.81 J**	**0.68 J**
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
1,2-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
1,2-Dichloroethane	5	5 U	5 U	5 U	0.5 U	0.5 U	**0.78 J**	1 U	1 U	1 U	0.2 U	5 U	**0.61 J**	5 U	0.5 U
1,2-Dichloropropane	--	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	1 U
1,3-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
1,4-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	**0.5 J**	5 U	0.5 U
2-Butanone	--	5 R	5 R	5 U	2.5 R	2.5 R	4 U	12 U	12 UJ	12 U	NA	5 R	5 U	5 U	2.5 R
2-Hexanone	--	5 U	5 U	5 U	2.5 U	2.5 U	4 U	2.5 U	2.5 U	2.5 UJ	NA	5 U	5 U	5 U	2.5 U
4-Methyl-2-pentanone	--	5 U	5 U	5 U	1 U	1 U	4 U	2.5 U	2.5 UJ	2.5 U	NA	5 U	5 U	5 U	1 U
Acetone	--	5 R	**14 L**	5 R	3.3 B	2.5 R	5 U	12 U	12 U	12 U	NA	5 R	5 R	5 R	2.5 R
Benzene	--	**1.3 J**	**2 J**	**1.7 J**	**1.2 J**	**1 J**	**1.8**	**2.1 K**	**1.2 J**	1 U	NA	5 U	**0.63 J**	**0.76 J**	**0.54 J**
Carbon disulfide	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	NA	5 U	5 U	5 U	0.5 U
Chlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	**1 J**	**0.93 J**	**0.51 J**
Chloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
Chloroform	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	**5.4**	**1.9 J**	3.4 B	**6.8**
Chloromethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
cis-1,2-Dichloroethene	70	**270**	**12**	**5.7**	**4.4 J**	2.1 B	**2.3**	**3.6 K**	**0.92 J**	1 U	**0.53 J**	**280**	**140**	**230**	**210**
Cyclohexane	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	1 U
Ethylbenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
Isopropylbenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	2 U	2 U	NA	NA	NA	NA	NA	NA
Methyl acetate	--	5 U	5 U	5 U	1 U	1 U	0.5 U	1 U	1 U	1 U	NA	5 U	**2.3 J**	5 U	1 U
Methylcyclohexane	--	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	1 U
Methylene chloride	--	2 B	5 U	5 U	0.5 U	0.5 U	1 U	5 U	5 U	5 U	NA	5 U	1.9 B	**2.7 J**	**1.3 J**
Methyl-tert-butyl ether (MTBE)	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
o-Xylene	--	NA	NA	NA	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA
Styrene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
Toluene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	0.5 U
trans-1,2-Dichloroethene	--	5 U	5 U	**1.4 J**	**0.67 J**	1 U	**0.82 J**	**0.92 K**	1 U	1 U	NA	5 U	**0.88 J**	**0.77 J**	**0.74 J**
Trichloroethene	5	**16**	5 U	5 U	0.5 U	0.5 U	**0.67 J**	1 U	1 U	1 U	**0.22 J**	**430**	**74**	**170**	**420**
Vinyl chloride	2	**13**	**2.9**	**1.9**	**1.5**	**0.82 J**	**3.2**	**2.4 K**	**0.96 J**	1 U	**0.38 J**	**5.2**	**24**	**81**	**150**
Xylene, total	--	5 U	5 U	5 U	1 U	1 U	0.4 U	3 U	2 U	2 U	NA	5 U	5 U	5 U	1 U
Semivolatile Organic Compounds (UG/L)															
No Detections															
Explosives (UG/L)															
No Detections															
Total Metals (UG/L)															
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	**7.19 J**	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	94,200 B	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	**1,350**	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)															
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	20 U	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**80,200**	**170,000**	**151,000**	**128,000**	**110,000**	**105,000**	**102,000**	**89,700**	**89,500**	NA	**3,660**	**77,300**	**61,000**	**55,400**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	**1,300**	NA	NA	NA	NA	NA
Sodium, Dissolved	--	**8,760**	**8,210**	**7,730**	**7,500**	**7,100**	NA	NA	NA	NA	NA	**8,370**	**6,480**	**5,320**	**5,590**
Wet Chemistry* (see note below)**															
Acetate (mg/l)	--	**48**	**28**	**11 L**	**4.1 J**	**0.87 J**	NA	NA	NA	NA	NA	5 U	**75**	**50 L**	**2 J**

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW409										04GW412			
Sample ID	**CLEAN WO PRGs Site 04**	004GW409-1008	004GW409-0210	004GW409-0510	004GW409-0810	004GW409-1210	004GW409-1211	004GW409-1212	004GW409-1213	004GW409-1014	004GW409-1115	004GW412-1008	004GW412-0210	004GW412-0510	004GW412-0810
Sample Date		10/28/08	02/05/10	05/12/10	08/25/10	12/03/10	12/08/11	12/13/12	12/16/13	10/10/14	11/04/15	10/28/08	02/01/10	05/11/10	08/25/10
Chemical Name															
Alkalinity (mg/l)	--	**220**	**250**	**380**	**200**	**120**	NA	NA	NA	**70**	**47.6**	**150**	**240**	**220**	**280**
Butyrate (mg/l)	--	5 U	5 U	5 U	1 U	1 U	NA	NA	NA	NA	NA	5 U	5 U	5 U	1 U
Carbon dioxide (mg/l)	--	**120**	**0.703**	**65.1**	**52.6**	**38.3**	NA	NA	NA	**122 JD**	**100**	**62**	**0.345**	**46.1**	**41.7**
Chemical oxygen demand (mg/l)	--	**78**	**63**	**49**	**43**	**33**	NA	NA	NA	NA	NA	**22**	**93**	**70**	**27**
Chloride (mg/l)	--	NA	**9**	**13**	**8.7**	**7.4**	NA	NA	NA	NA	NA	NA	**12**	**13**	**10**
Ethane (mg/l)	--	0.0012 U	0.0012 U	0.0012 U	0.0013 U	**0.0012**	NA	NA	NA	0.00196 U	6.40E-04 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
Ethene (mg/l)	--	0.0015 U	**0.0058**	**0.0038**	**0.0041**	**0.0051**	NA	NA	NA	0.00271 U	6.00E-04 U	0.0016 U	**0.19**	**0.11**	**0.082**
Lactic Acid (mg/l)	--	NA	5 U	5 U	2 U	2 U	NA	NA	NA	NA	NA	NA	1.6 B	5 U	2 U
Methane (mg/l)	--	**1.6**	**18**	**7.1**	**7.4**	**46**	NA	NA	NA	**6.13 D**	**8.7**	**0.037**	**2.5**	**2.7**	**1.2**
Nitrate (mg/l)	--	0.13 U	0.13 UL	0.014 B	0.042 U	0.072 U	NA	NA	NA	NA	NA	**0.3**	**0.014 J**	0.035 B	0.042 U
Nitrite (mg/l)	--	0.13 U	0.13 UL	0.13 U	0.042 U	**0.066 J**	NA	NA	NA	NA	NA	0.13 U	0.13 U	0.13 U	0.042 U
Propionate (mg/l)	--	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA
Propionic Acid (mg/l)	--	NA	5 U	5 U	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	**2.4 J**	5 U	0.5 U
Pyruvate (mg/l)	--	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
Sulfate (mg/l)	--	**13**	**1.5 J**	**1.6 J**	**2.2 J**	3 B	NA	NA	NA	**52**	**69.1**	**46**	**7.8**	**6.9**	**5.4**
Sulfide (mg/l)	--	0.03 U	0.03 U	0.03 UL	0.03 U	0.03 U	NA	NA	NA	1 U	1 U	0.03 U	0.03 U	0.03 UL	0.03 U
Total organic carbon (TOC) (mg/l)	--	**22**	**17**	**11**	**4.9 J**	**3.7 J**	NA	NA	NA	**2.5**	**2.72**	10 U	**34**	**23**	**4.1 J**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW412							04GW413						
Sample ID	**CLEAN WO PRGs Site 04**	004GW412P-0810	004GW412-1210	004GW412-1211	004GW412-1212	004GW412-1213	004GW412-1014	004GW412-1115	004GW413-1008	004GW413-0210	004GW413-0510	004GW413-0810	004GW413-1210	004GW413P-1210	004GW413-1211
Sample Date		08/25/10	12/03/10	12/08/11	12/13/12	12/11/13	10/08/14	11/04/15	10/29/08	02/03/10	05/13/10	08/24/10	12/03/10	12/03/10	12/07/11
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1,1-Trichloroethane	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	**5.7**	5 UJ	5 U	**1.8 J**	0.5 U	**2.9 J**	**1.3 J**
1,1,2,2-Tetrachloroethane	2.4	**2.7**	**1.5**	0.2 U	1 U	1 U	1 UL	0.2 U	**270 J**	**180 J**	**260 J**	**220**	**270 J**	**240 J**	**97**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	0.3 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	1 U	1 U	1 U	**0.42 J**
1,1,2-Trichloroethane	--	1 U	1 U	0.2 U	1 U	1 U	1 UL	NA	**8.2**	**5.1 J**	**7.8**	**6.6**	**8**	**7.3**	**4.2 J**
1,1-Dichloroethane	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	**0.52 J**	**0.53 J**	**0.54 J**
1,1-Dichloroethene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	**100**	**37 J**	**83**	**76**	**88**	**78**	**74 J**
1,2,4-Trichlorobenzene	--	0.5 U	0.5 U	0.3 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	**0.28 J**
1,2-Dichlorobenzene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	0.2 U
1,2-Dichloroethane	5	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	**0.13 J**	5 U	5 UJ	**3.6 J**	**2.9 J**	**4.9 J**	**4.8 J**	**5.2 J**
1,2-Dichloropropane	--	1 U	1 U	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	1 U	**1.3 J**	**1.1 J**	**0.34 J**
1,3-Dichlorobenzene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	0.2 U
1,4-Dichlorobenzene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	**0.17 J**
2-Butanone	--	2.5 R	2.5 R	4 U	12 U	12 UJ	12 UJ	NA	2,000 R	5 R	5 U	2.5 R	2.5 R	2.5 R	4 U
2-Hexanone	--	2.5 U	2.5 U	4 U	2.5 U	2.5 U	2.5 UJ	NA	5 U	5 UJ	**4.1 J**	2.5 U	**6.3**	**5.1**	**4.7 J**
4-Methyl-2-pentanone	--	1 U	1 U	4 U	2.5 U	2.5 UJ	2.5 UL	NA	**4.5 J**	5 UJ	**5.6**	1 U	**6.7**	**7.1**	**5.8 J**
Acetone	--	2.5 R	2.5 R	**9 J**	12 U	12 U	**5.1 L**	NA	**21 L**	5 R	**28 L**	**27 L**	**30 L**	**26 L**	**35 J**
Benzene	--	**0.54 J**	**0.72 J**	0.17 B	**2.6 K**	**1.7 J**	**0.97 L**	NA	**150**	**28 J**	**80**	**72**	**100**	**89**	**54 J**
Carbon disulfide	--	0.5 U	0.5 U	0.5 U	5 U	5 U	5 UL	NA	**6.5**	5 UJ	**0.78 J**	**2.3 J**	0.5 U	0.5 U	0.5 U
Chlorobenzene	--	0.5 U	**0.52 J**	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	**1 J**	**1.5 J**	**1.2 J**	**0.99 J**	**1.4 J**
Chloroethane	--	0.5 U	0.5 U	0.3 U	1 U	1 U	**1.4 L**	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	0.3 U
Chloroform	--	**6**	4.5 B	0.13 B	**1.3 K**	1 U	1 UL	NA	4.3 B	5 UJ	1.6 B	**1.5 J**	2.6 B	2.2 B	1.1 B
Chloromethane	--	0.5 U	0.5 U	0.3 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	0.3 U
cis-1,2-Dichloroethene	70	**210**	**84**	**2.1**	**28 K**	**11**	**5.4 L**	**8.5**	**53,000**	**27,000**	**72,000**	**57,000**	**51,000**	**50,000**	**34,000**
Cyclohexane	--	1 U	1 U	0.3 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	1 U	1 U	1 U	**0.57 J**
Ethylbenzene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	**10**	**1.9 J**	**6.9**	**7.6**	**7.6**	**6.8**	**5.2 J**
Isopropylbenzene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	**2.6 J**	5 UJ	**1.5 J**	**1.6 J**	**1.5 J**	**1.5 J**	**1.3 J**
m- and p-Xylene	--	NA	NA	NA	2 U	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	--	1 U	1 U	0.5 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	1 U	**6.4**	**7.4**	**3.3 J**
Methylcyclohexane	--	1 U	1 U	0.3 U	1 U	1 U	1 UL	NA	**1.2 J**	5 UJ	5 U	1 U	1 U	1 U	**0.5 J**
Methylene chloride	--	**1.2 J**	0.92 B	1 U	5 U	5 U	5 UL	NA	5 U	5 UJ	5 U	1.1 B	1.6 B	1.4 B	1.2 B
Methyl-tert-butyl ether (MTBE)	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	5 UJ	5 U	0.5 U	0.5 U	0.5 U	0.2 U
o-Xylene	--	NA	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--	0.5 U	0.5 U	0.5 U	1 U	1 U	1 UL	NA	**1.3 J**	5 UJ	5 U	0.5 U	**0.57 J**	**0.55 J**	**0.27 J**
Toluene	--	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	**12**	**2.7 J**	**8.9**	**9.1**	**11**	**9.9**	7.1 B
trans-1,2-Dichloroethene	--	1 U	1 U	**0.11 J**	**0.82 K**	1 U	1 UL	NA	**8.4**	**15 J**	**28**	**22**	**17**	**12**	**170**
Trichloroethene	5	**450**	**540**	**5.4**	**54 K**	**12**	**6.4 L**	**5.8**	**19,000**	**57 J**	**500**	**1,100**	**380 J**	**370 J**	**20 J**
Vinyl chloride	2	**130**	**32**	**0.85 J**	**8.4 K**	**4.3**	**3.2 J**	**4.1**	**74**	**330**	**920**	**1,900**	**2,400**	**2,400**	4,500 B
Xylene, total	--	1 U	1 U	0.4 U	3 U	2 U	2 UL	NA	**32**	**5.5 J**	**20**	**24**	**22**	**21**	**13 J**
Semivolatile Organic Compounds (UG/L)															
No Detections															
Explosives (UG/L)															
No Detections															
Total Metals (UG/L)															
Arsenic	--	NA	NA	NA	NA	NA	20 U	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	**81,300**	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	**3,040**	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**24,900**
Dissolved Metals (UG/L)															
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	20 U	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**52,200**	**53,100**	**13,900**	**71,300**	**63,600**	**76,600**	NA	NA	**91,300**	**111,000**	**119,000**	**132,000**	**133,000**	**149,000**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	**2,890**	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	**5,510**	**5,760**	NA	NA	NA	NA	NA	NA	**28,400**	**34,500**	**42,800**	**37,700**	**38,000**	NA
Wet Chemistry* (see note below)**															
Acetate (mg/l)	--	NA	**6.6**	NA	NA	NA	NA	NA	**18**	**95**	**120 L**	**150**	**170**	NA	**96.1**

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW412							04GW413						
Sample ID	**CLEAN WO PRGs Site 04**	004GW412P-0810	004GW412-1210	004GW412-1211	004GW412-1212	004GW412-1213	004GW412-1014	004GW412-1115	004GW413-1008	004GW413-0210	004GW413-0510	004GW413-0810	004GW413-1210	004GW413P-1210	004GW413-1211
Sample Date		08/25/10	12/03/10	12/08/11	12/13/12	12/11/13	10/08/14	11/04/15	10/29/08	02/03/10	05/13/10	08/24/10	12/03/10	12/03/10	12/07/11
Chemical Name															
Alkalinity (mg/l)	--	NA	**150**	NA	NA	NA	**99**	**69.3**	NA	**150**	**350**	**180**	**200**	NA	**193**
Butyrate (mg/l)	--	NA	1 U	NA	NA	NA	NA	NA	5 U	**11**	**10**	**12**	**15**	NA	**2.71**
Carbon dioxide (mg/l)	--	NA	**21.7**	NA	NA	NA	**271 E**	**84**	NA	**0.518**	**88.3**	**89.5**	**49.3**	NA	**300**
Chemical oxygen demand (mg/l)	--	NA	**38**	NA	NA	NA	NA	NA	NA	**390**	**390**	**310**	**490**	NA	NA
Chloride (mg/l)	--	NA	**10**	NA	NA	NA	NA	NA	NA	**52**	**66**	**69**	**73.9**	NA	**47.2**
Ethane (mg/l)	--	NA	**0.0013**	NA	NA	NA	**0.0141**	**0.023**	0.0012 U	0.0012 U	0.0013 U	0.0013 U	**0.012**	NA	**0.0018 J**
Ethene (mg/l)	--	NA	**0.23**	NA	NA	NA	**0.0171**	**0.0033**	**0.0079**	**0.0024**	**0.045**	**0.042**	**0.087**	NA	**0.36**
Lactic Acid (mg/l)	--	NA	2 U	NA	NA	NA	NA	NA	NA	5 U	5 U	2 U	2 U	NA	NA
Methane (mg/l)	--	NA	**4.2**	NA	NA	NA	**5.51 D**	**3.5**	**4.3**	**0.45**	**6.9**	**4.6**	**29**	NA	**1.9**
Nitrate (mg/l)	--	NA	0.072 U	NA	NA	NA	NA	NA	NA	0.13 U	0.022 B	**0.073 J**	0.072 U	NA	0.25 U
Nitrite (mg/l)	--	NA	0.062 U	NA	NA	NA	NA	NA	NA	0.13 U	0.13 U	0.042 U	0.062 U	NA	0.25 U
Propionate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	**5.96**
Propionic Acid (mg/l)	--	NA	0.5 U	NA	NA	NA	NA	NA	NA	**17**	**26**	**23**	**29**	NA	NA
Pyruvate (mg/l)	--	NA	5 U	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U	5 U	NA	**0.131**
Sulfate (mg/l)	--	NA	**12**	NA	NA	NA	**31**	**40.5**	NA	0.24 B	**0.59 J**	**1.6 J**	1.8 B	NA	NA
Sulfide (mg/l)	--	NA	**0.077**	NA	NA	NA	1 U	**1.2**	NA	0.03 U	0.03 UL	0.03 U	**0.28**	NA	1 U
Total organic carbon (TOC) (mg/l)	--	NA	8.7 B	NA	NA	NA	**2.4**	**3.71**	NA	**83**	**110**	**110**	**130**	NA	**90.4**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW413				04GW414									
Sample ID	**CLEAN WO PRGs Site 04**	004GW413-1212	004GW413-1213	004GW413-1014	004GW413-1115	004GW414-1008	004GW414P-1008	004GW414-0210	004GW414-0510	004GW414-0810	004GW414-1210	004GW414-1211	004GW414-1212	004GW414-1213	004GW414-1014
Sample Date		12/11/12	12/12/13	10/07/14	11/04/15	10/30/08	10/30/08	02/04/10	05/12/10	08/24/10	12/01/10	12/08/11	12/12/12	12/11/13	10/08/14
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1,1-Trichloroethane	--	**1.9 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
1,1,2,2-Tetrachloroethane	2.4	**67 K**	1,000 U	1,000 U	**17**	**42**	**60**	**1.9**	1 U	**1.3**	1 U	0.2 U	1 U	1 U	1 UL
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1,000 U	1,000 U	NA	5 U	**1.6 J**	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UL
1,1,2-Trichloroethane	--	**2.8 K**	1,000 U	1,000 U	NA	**1.4 J**	**2.1 J**	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 UL
1,1-Dichloroethane	--	**1.4 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
1,1-Dichloroethene	--	**120 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	**2.2 K**	1 U	1 UL
1,2,4-Trichlorobenzene	--	1 U	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 UL
1,2-Dichlorobenzene	--	1 U	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
1,2-Dichloroethane	5	**7.2 K**	1,000 U	1,000 U	**4.6**	5 U	5 U	5 U	5 U	**3.9 J**	**8**	**1.3**	**3.4 K**	1 U	1 UL
1,2-Dichloropropane	--	**0.98 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 UL
1,3-Dichlorobenzene	--	1 U	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
1,4-Dichlorobenzene	--	1 U	1,000 U	1,000 U	NA	**1.2 J**	**1.5 J**	5 U	5 U	0.5 U	0.5 U	**0.1 J**	1 U	1 U	1 UL
2-Butanone	--	**19 K**	12,000 UJ	12,000 U	NA	**11 L**	**16 L**	**26 L**	5 U	2.5 R	2.5 R	**3.7 J**	12 U	12 UJ	12 UJ
2-Hexanone	--	2.5 U	2,500 U	2,500 U	NA	**7 J**	**11 J**	**13**	5 U	2.5 U	**12**	4 U	2.5 U	2.5 U	2.5 UJ
4-Methyl-2-pentanone	--	**4 K**	2,500 UJ	2,500 U	NA	5 U	5 U	**4.1 J**	5 U	1 U	**2.8 J**	4 U	2.5 U	2.5 UJ	2.5 UL
Acetone	--	34 B	12,000 U	5,200 B	NA	**17 L**	**23 L**	**84 L**	**27 L**	**210 L**	**170 L**	**24**	**44 K**	12 U	**6.6 L**
Benzene	--	**140 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	**0.69 J**	**0.67 J**	0.62 B	**2.4 K**	**1.6 J**	1 UL
Carbon disulfide	--	5 U	5,000 U	5,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 UL
Chlorobenzene	--	**2.3 K**	1,000 U	1,000 U	NA	**1.8 J**	**2.3 J**	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
Chloroethane	--	1 U	1,000 U	1,000 UJ	NA	5 U	5 U	5 U	5 U	**1.3 J**	**1.7 J**	**2.3**	**2.8 K**	1 U	1 UL
Chloroform	--	**1.6 K**	1,000 U	1,000 U	NA	5 U	5 U	**1.5 J**	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
Chloromethane	--	1 U	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	**0.55 J**	0.5 U	0.3 U	1 U	1 U	1 UL
cis-1,2-Dichloroethene	70	**90,000 K**	**47,000**	**8,000 K**	**22,000**	**30**	**35**	**8**	**30**	**24**	**23**	**12**	**390 K**	**5.7**	1 UL
Cyclohexane	--	1 U	1,000 U	1,000 UJ	NA	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UL
Ethylbenzene	--	**12 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
Isopropylbenzene	--	**1.6 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
m- and p-Xylene	--	**27 K**	2,000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	NA
Methyl acetate	--	1 U	1,000 U	1,000 UJ	NA	5 U	5 U	5 U	5 U	1 U	**3.9 J**	**0.74 J**	1 U	1 U	1 UL
Methylcyclohexane	--	1 U	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UL
Methylene chloride	--	5 U	5,000 U	6,300 B	NA	5 U	5 U	5 U	**0.54 J**	1.5 B	1.2 B	1 U	5 U	5 U	5 UL
Methyl-tert-butyl ether (MTBE)	--	1 U	1,000 U	1,000 UJ	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL
o-Xylene	--	**11 K**	1,000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1 U	NA
Styrene	--	1 U	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 UL
Toluene	--	**16 K**	1,000 U	1,000 U	NA	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.2 B	1 U	1 U	**1.2 L**
trans-1,2-Dichloroethene	--	**220 J**	1,000 U	1,000 U	NA	**10**	**14**	5 U	5 U	**2.3 J**	**2 J**	**1.9**	**4.5 K**	**2.4**	1 UL
Trichloroethene	5	**4.2 K**	1,000 U	1,000 U	**1.9**	**9.5**	**12**	**5.2**	**3.4 J**	**1.6 J**	**1.7 J**	**0.23 J**	1 U	1 U	1 UL
Vinyl chloride	2	**9,600 K**	**20,000**	**7,600 K**	**8,300**	**3.2**	**5.1**	1 U	**1.4**	**5.3**	**5.1 J**	**4.8**	**340 K**	**120**	**1.3 J**
Xylene, total	--	**38 K**	2,000 U	2,000 U	NA	5 U	5 U	5 U	5 U	1 U	1 U	0.3 B	3 U	2 U	**1.8 L**
Semivolatile Organic Compounds (UG/L)															
No Detections															
Explosives (UG/L)															
No Detections															
Total Metals (UG/L)															
Arsenic	--	NA	NA	**27.5 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	**187,000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	**1,840**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**24,800**	**24,100**	**18,300 J**	**21,900**	NA	NA	NA	NA	NA	NA	**24,900**	**10,600**	**14,000**	**13,000**
Dissolved Metals (UG/L)															
Arsenic, Dissolved	--	NA	NA	**25.2 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**190,000**	**191,000**	**186,000**	NA	NA	NA	**94,100**	**67,500**	**273,000**	**164,000**	**145,000**	**157,000**	**70,900**	**133,000**
Manganese, Dissolved	--	NA	NA	**1,830**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	**31,800**	**25,300**	**33,900**	**25,700**	NA	NA	NA	NA
Wet Chemistry* (see note below)**															
Acetate (mg/l)	--	**190**	**150**	**60**	**52.8**	NA	NA	**150**	**150 L**	**520**	**170**	**43.5**	**52**	**1.8**	**10**

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW413				04GW414									
Sample ID	**CLEAN WO PRGs Site 04**	004GW413-1212	004GW413-1213	004GW413-1014	004GW413-1115	004GW414-1008	004GW414P-1008	004GW414-0210	004GW414-0510	004GW414-0810	004GW414-1210	004GW414-1211	004GW414-1212	004GW414-1213	004GW414-1014
Sample Date		12/11/12	12/12/13	10/07/14	11/04/15	10/30/08	10/30/08	02/04/10	05/12/10	08/24/10	12/01/10	12/08/11	12/12/12	12/11/13	10/08/14
Chemical Name															
Alkalinity (mg/l)	--	**190**	**210**	**160**	**175**	NA	NA	**250**	**250**	**520**	**320**	**238**	**180**	**67**	**120**
Butyrate (mg/l)	--	**11**	0.1 U	**1.2**	**0.634**	NA	NA	**32**	**18**	**97**	**36**	**3.07**	0.1 U	0.1 U	0.1 U
Carbon dioxide (mg/l)	--	**560 D**	**592 D**	**571 D**	**330**	NA	NA	**0.681**	**76**	**91.5**	**85.4**	**290**	**575 D**	**340 D**	**331 D**
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	NA	NA	**370**	**360**	**1,700**	**890**	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	NA	NA	NA	NA	**9.9**	**9.5**	**12**	**6.6**	**2.67**	NA	NA	NA
Ethane (mg/l)	--	**0.00974**	**0.0332**	**0.171**	**0.082**	0.0012 U	NA	0.0012 U	0.0013 U	0.0013 U	0.0012 U	**0.0084**	**0.00443**	**0.00821**	**0.00463**
Ethene (mg/l)	--	**0.112**	**0.289 D**	**0.684 D**	**0.26**	**0.0069**	NA	0.0015 U	0.0016 U	**0.0029**	**0.0028**	**0.0041**	**0.0427**	**0.034**	**0.00661**
Lactic Acid (mg/l)	--	0.2 U	0.2 U	0.2 U	NA	NA	NA	5 U	2.5 B	2 U	2 U	NA	0.2 U	0.2 U	0.2 U
Methane (mg/l)	--	**6.95 D**	**4.04 D**	**7.9 D**	**4.6**	**3.4**	NA	**3.6**	**3.3**	**4**	**9.8**	**6.3**	**23.4 D**	**2.94 D**	**10.7 D**
Nitrate (mg/l)	--	0.21 U	0.21 U	0.21 U	**0.0837 J**	NA	NA	**0.0064 J**	0.008 B	0.042 U	0.072 U	0.25 U	0.21 U	0.21 U	0.21 U
Nitrite (mg/l)	--	0.07 U	0.07 U	0.07 U	0.05 U	NA	NA	**0.024 J**	**0.0051 J**	0.042 U	**0.051 J**	0.25 U	0.07 U	0.07 U	0.07 U
Propionate (mg/l)	--	NA	NA	NA	**1.58**	NA	NA	NA	NA	NA	NA	**5.68**	NA	NA	NA
Propionic Acid (mg/l)	--	**3.4**	**3.3**	**1.8**	NA	NA	NA	**76**	**15**	**110**	**57**	NA	**5.7**	0.1 U	**0.1**
Pyruvate (mg/l)	--	0.1 U	0.1 U	0.1 U	0.05 U	NA	NA	5 U	5 U	5 U	5 U	**0.16**	**0.012 J**	0.1 U	0.1 U
Sulfate (mg/l)	--	NA	NA	**0.29 J**	**6.02**	NA	NA	**0.39 J**	**0.57 J**	**0.97 J**	1.1 B	NA	NA	NA	NA
Sulfide (mg/l)	--	1 U	**0.46 J**	1 U	**3.84**	NA	NA	0.03 U	0.03 UL	0.03 U	**0.084**	1 U	1 U	**0.46 J**	1 U
Total organic carbon (TOC) (mg/l)	--	**130 D**	**160 D**	**110 D**	**93.4**	NA	NA	**200**	**100**	**490**	**240**	**50.7**	**87**	**20**	**23**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID		04GW414		04GW415									
Sample ID	**CLEAN WO PRGs Site 04**	004GW414-1115	004GW414P-1115	004GW415-0210	004GW415-0510	004GW415-0810	004GW415-1110	004GW415-1211	004GW415-1212	004GW415-1213	004GW415-1014	004GW415-1115	004GW415P-1115
Sample Date		11/03/15	11/03/15	02/03/10	05/12/10	08/23/10	11/30/10	12/07/11	12/14/12	12/12/13	10/08/14	11/03/15	11/03/15
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,1-Trichloroethane	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
1,1,2,2-Tetrachloroethane	2.4	0.2 U	0.2 U	**3.8**	**4.1**	**3.4**	**1.3**	**0.14 J**	1 U	1 U	1 UL	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	NA	NA	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UL	NA	NA
1,1,2-Trichloroethane	--	NA	NA	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 UL	NA	NA
1,1-Dichloroethane	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
1,1-Dichloroethene	--	NA	NA	5 U	**0.85 J**	**1.1 J**	0.5 U	**0.64 J**	1 U	1 U	1 UL	NA	NA
1,2,4-Trichlorobenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 UL	NA	NA
1,2-Dichlorobenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
1,2-Dichloroethane	5	**0.2 J**	**0.18 J**	5 U	5 U	0.5 U	0.5 U	**0.93 J**	1 U	1 U	1 UL	0.2 U	0.2 U
1,2-Dichloropropane	--	NA	NA	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U	1 UL	NA	NA
1,3-Dichlorobenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
1,4-Dichlorobenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
2-Butanone	--	NA	NA	**44 L**	5 U	2.5 R	2.5 R	**9.8 J**	12 U	12 UJ	12 UJ	NA	NA
2-Hexanone	--	NA	NA	**3.1 J**	**2.5 J**	2.5 U	2.5 U	**8.6 J**	2.5 U	2.5 U	2.5 UJ	NA	NA
4-Methyl-2-pentanone	--	NA	NA	5 U	5 U	1 U	1 U	4 U	2.5 U	2.5 UJ	2.5 UL	NA	NA
Acetone	--	NA	NA	**56 L**	**37 L**	13 B	**54 L**	**62**	**25 K**	39 B	**66 L**	NA	NA
Benzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.29 B	1 U	1 U	1 UL	NA	NA
Carbon disulfide	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 UL	NA	NA
Chlorobenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
Chloroethane	--	NA	NA	5 U	5 U	0.5 U	0.5 U	**0.76 J**	1 U	1 U	1 UL	NA	NA
Chloroform	--	NA	NA	**3.3 J**	1.9 B	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
Chloromethane	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U	1 UL	NA	NA
cis-1,2-Dichloroethene	70	**0.5 J**	**0.7 J**	**34**	**8.6**	**110**	**110**	**170**	**28 K**	**1.2 J**	**1.3 L**	**0.5 J**	**0.49 J**
Cyclohexane	--	NA	NA	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UL	NA	NA
Ethylbenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.13 B	1 U	1 U	1 UL	NA	NA
Isopropylbenzene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	NA	NA	NA
Methyl acetate	--	NA	NA	5 U	5 U	1 U	**5.6**	**2.3**	1 U	1 U	1 UL	NA	NA
Methylcyclohexane	--	NA	NA	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U	1 UL	NA	NA
Methylene chloride	--	NA	NA	5 U	5 U	**0.74 J**	0.63 B	1 U	5 U	5 U	5 UL	NA	NA
Methyl-tert-butyl ether (MTBE)	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U	1 UL	NA	NA
o-Xylene	--	NA	NA	NA	NA	NA	NA	NA	0.6 B	**0.92 J**	NA	NA	NA
Styrene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 UL	NA	NA
Toluene	--	NA	NA	5 U	5 U	0.5 U	0.5 U	0.17 B	1 U	**1.7 J**	1 UL	NA	NA
trans-1,2-Dichloroethene	--	NA	NA	5 U	5 U	**1.7 J**	**1.4 J**	**1.3**	1 U	1 U	1 UL	NA	NA
Trichloroethene	5	0.2 U	0.2 U	**5.3**	**4.3 J**	**3.2 J**	**1.8 J**	**0.64 J**	**1.3 K**	1 U	1 UL	0.2 U	0.2 U
Vinyl chloride	2	**0.48 J**	**0.57 J**	1 U	**22**	**74**	**35 J**	36 B	**2.8 K**	1 U	**0.87 J**	0.2 U	0.2 U
Xylene, total	--	NA	NA	5 U	5 U	1 U	1 U	0.96 B	3 U	2 U	2 UL	NA	NA
Semivolatile Organic Compounds (UG/L)													
No Detections													
Explosives (UG/L)													
No Detections													
Total Metals (UG/L)													
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**24.1 J**	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	**96,500**	NA	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	303 B	NA	NA
Sodium	--	**5,790**	NA	NA	NA	NA	NA	**20,600**	NA	NA	**16,100 J**	**17,600**	NA
Dissolved Metals (UG/L)													
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**25.1 J**	NA	NA
Iron, Dissolved	11,000	NA	NA	**52,000**	**68,300**	**89,400**	**122,000**	**92,500**	NA	NA	**86,100**	NA	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**295 J**	NA	NA
Sodium, Dissolved	--	NA	NA	12,300 B	**16,600**	**8,050**	**11,600**	NA	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	**0.299**	NA	**110**	**110 L**	**200**	**280**	**77.5**	NA	NA	**69**	**0.081 J**	NA

TABLE 4-4
Historical Constituents Detected in Groundwater at Site 4 - Source Area, 50 Series, and 100 Series
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Former NSWC-White Oak

Station ID		04GW414		04GW415									
Sample ID	**CLEAN WO PRGs Site 04**	004GW414-1115	004GW414P-1115	004GW415-0210	004GW415-0510	004GW415-0810	004GW415-1110	004GW415-1211	004GW415-1212	004GW415-1213	004GW415-1014	004GW415-1115	004GW415P-1115
Sample Date		11/03/15	11/03/15	02/03/10	05/12/10	08/23/10	11/30/10	12/07/11	12/14/12	12/12/13	10/08/14	11/03/15	11/03/15
Chemical Name													
Alkalinity (mg/l)	--	**79.2**	NA	**110**	**120**	**210**	**320**	**153**	NA	NA	**110**	**87.3**	NA
Butyrate (mg/l)	--	0.05 U	NA	**21**	**21**	**32**	**34**	**4.96**	NA	NA	**1.6**	0.05 U	NA
Carbon dioxide (mg/l)	--	**270**	NA	**0.567**	**50.9**	**41.8**	**44.4**	**220**	NA	NA	**198 JD**	**180**	NA
Chemical oxygen demand (mg/l)	--	NA	NA	**560**	**490**	**480**	**680**	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	**9.6**	**13**	**7.7**	**5.7**	**5.73**	NA	NA	NA	NA	NA
Ethane (mg/l)	--	**0.0087**	NA	0.0012 U	0.0013 U	0.0013 U	0.0012 U	6.40E-04 U	NA	NA	**0.00467**	**0.0021**	NA
Ethene (mg/l)	--	**0.006**	NA	0.0015 U	**0.0043**	**0.0041**	**0.0029**	**0.0018 J**	NA	NA	0.00271 U	6.00E-04 U	NA
Lactic Acid (mg/l)	--	NA	NA	5 U	5 U	2 U	2 U	NA	NA	NA	0.2 U	NA	NA
Methane (mg/l)	--	**7.3**	NA	**2**	**7.8**	**5.1**	**17**	**5.9**	NA	NA	**9.21 D**	**6**	NA
Nitrate (mg/l)	--	**0.0676 J**	NA	0.13 U	0.013 B	0.042 U	**0.092 J**	0.25 U	NA	NA	0.21 U	**1.88**	NA
Nitrite (mg/l)	--	0.05 U	NA	**0.012 J**	**0.009 J**	0.042 U	**0.052 J**	0.25 U	NA	NA	0.07 U	0.05 U	NA
Propionate (mg/l)	--	0.05 U	NA	NA	NA	NA	NA	**9.06**	NA	NA	NA	0.05 U	NA
Propionic Acid (mg/l)	--	NA	NA	**120**	**59**	**21**	**23**	NA	NA	NA	**2.5**	NA	NA
Pyruvate (mg/l)	--	0.05 U	NA	5 U	5 U	5 U	5 U	**0.278**	NA	NA	**0.05 J**	0.05 U	NA
Sulfate (mg/l)	--	NA	NA	0.19 B	**1.2 J**	0.5 U	**1.1**	NA	NA	NA	**0.42 J**	**1.58**	NA
Sulfide (mg/l)	--	1 U	NA	0.03 U	0.03 UL	0.03 U	**0.056**	1 U	NA	NA	1 U	1 U	NA
Total organic carbon (TOC) (mg/l)	--	**12.1**	NA	**120**	**130**	**130**	**160**	**105**	NA	NA	**63**	**15.1**	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW502D									
Sample ID		004GW502D-0209	004GW502D-0210	004GW502DP-0210	004GW502D-0510	004GW502DP-0510	004GW502D-0810	004GW502DP-0810	004GW502D-1210	004GW502D-1211	004GW502D-1212
Sample Date		02/04/09	02/04/10	02/04/10	05/10/10	05/10/10	08/26/10	08/26/10	12/02/10	12/09/11	12/14/12
Chemical Name											
Volatile Organic Compounds (UG/L)											
1,1,1-Trichloroethane	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U
1,1,2,2-Tetrachloroethane	2.4	**18**	**10**	**10**	**9.3**	**10**	**4**	**4.9**	**2.5**	**0.91 J**	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	**1.9 J**	5 U	5 U	13 U	13 U	1 U	1 U	1 U	0.3 U	1 U
1,1,2-Trichloroethane	--	**1.3 J**	5 U	5 U	13 U	13 U	1 U	1 U	1 U	**0.18 J**	1 U
1,1-Dichloroethane	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	**0.35 J**	1 U
1,1-Dichloroethene	--	**7.9**	**3.5 J**	**2.7 J**	**2 J**	**3.2 J**	**1.4 J**	**1.7 J**	**2 J**	**2.7**	**1.6 K**
1,2,4-Trichlorobenzene	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	0.3 U	1 U
1,2-Dichlorobenzene	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	**0.14 J**	1 U
1,2-Dichloroethane	5	5 U	**5.7**	**5.8**	**4.8 J**	**5.3 J**	**5 J**	**4.7 J**	**4.3 J**	**6**	**3.9 K**
1,2-Dichloropropane	--	5 U	5 U	5 U	13 U	13 U	1 U	1 U	1 U	**0.14 J**	1 U
1,3-Dichlorobenzene	--	5 U	5 U	5 U	13 U	13 U	0.5 U	**0.59 J**	0.5 U	**0.31 J**	1 U
1,4-Dichlorobenzene	--	**1.1 J**	5 U	5 U	13 U	13 U	**1 J**	**1.1 J**	**1.1 J**	**1.1**	**2.5 K**
2-Butanone	--	5 R	**63 L**	**65 L**	13 U	13 U	2.5 R	2.5 R	2.5 R	**9 J**	12 U
Acetone	--	5 R	5 R	5 R	13 R	**12 L**	6 B	2.5 R	**6.6 L**	9.2 B	**8.5 K**
Benzene	--	**3.8 J**	**5.2**	**5.1**	**5 J**	**5.1 J**	**5.7**	**6.2**	**5**	**7.3**	**10 K**
Chlorobenzene	--	**2.6 J**	**3.2 J**	**3.1 J**	**2.4 J**	**2.5 J**	**3.3 J**	**3.4 J**	**3.5 J**	**5.9**	**12 K**
Chloroethane	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	**1.1**	**1.2 K**
Chloroform	--	**2.4 J**	**1.9 J**	**2 J**	**1.5 J**	**1.4 J**	**0.84 J**	**0.61 J**	0.5 U	0.2 U	1 U
Chloromethane	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	**0.2 J**	1 U
cis-1,2-Dichloroethene	70	**420**	**580**	**550**	280 B	**290**	**310**	**350**	**410**	**510**	**290 K**
Isopropylbenzene	--	5 U	5 U	5 U	13 U	13 U	0.5 U	0.5 U	0.5 U	**0.16 J**	1 U
Methyl acetate	--	5 U	5 U	5 U	13 U	13 U	1 U	1 U	**12**	**4.5**	1 U
Methylene chloride	--	2.7 B	3.1 B	3.2 B	3.1 B	4.2 B	**2.9 J**	**2.9 J**	1.8 B	0.86 B	5 U
Tetrachloroethene	--	5 U	5 U	5 U	13 U	13 U	1 U	1 U	1 U	0.2 U	1 U
trans-1,2-Dichloroethene	--	**1.6 J**	**3.1 J**	**3.3 J**	**3.9 J**	**3.2 J**	**5.1**	**5.6**	**3.6 J**	**9.7**	**8 K**
Trichloroethene	5	**1,100**	**310**	**300**	**260**	**280**	**85**	**100**	**55**	**39**	**47 K**
Vinyl chloride	2	**44**	**44**	**44**	**51**	**41**	**64**	**71**	**53**	**78**	**36 K**
Semivolatile Organic Compounds (UG/L)											
No Detections											
Explosives (UG/L)											
Perchlorate	15	0.2 U	0.2 U	0.2 U	**0.03 J**	0.2 U	0.2 U	0.2 U	0.1 U	1 U	NA
Total Metals (UG/L)											
Iron	11,000	**23,500**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**13,300**	NA	NA	NA	NA	NA	NA	NA	**21,300**	**15,800**
Dissolved Metals (UG/L)											
Iron, Dissolved	11,000	NA	**214,000**	**196,000**	**287,000**	**287,000**	**281,000**	**289,000**	**271,000**	**276,000**	**225,000**
Sodium, Dissolved	--	NA	**38,100**	**37,700**	**57,700**	**55,900**	**42,800**	**44,300**	**33,800**	NA	NA
Wet Chemistry* (see note below)**											
Acetate (mg/l)	--	5 U	**290 K**	**260 K**	**390**	**400**	**450**	NA	**500**	**301**	**280**
Alkalinity (mg/l)	--	**120**	**400**	**420**	**450**	**470**	**160**	NA	**510**	**350**	**300**
Butyrate (mg/l)	--	5 U	**26**	**24**	**26**	**31**	**24**	NA	**16**	**7.99**	**2.7**
Carbon dioxide (mg/l)	--	**96**	**0.939**	**0.602**	**134**	**148**	**71.5**	NA	**41.1**	**150**	**384 D**
Chemical oxygen demand (mg/l)	--	NA	**780**	**880**	**1,100**	**1,200**	**1,100**	NA	**850**	NA	NA

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW502D									
Sample ID		004GW502D-0209	004GW502D-0210	004GW502DP-0210	004GW502D-0510	004GW502DP-0510	004GW502D-0810	004GW502DP-0810	004GW502D-1210	004GW502D-1211	004GW502D-1212
Sample Date		02/04/09	02/04/10	02/04/10	05/10/10	05/10/10	08/26/10	08/26/10	12/02/10	12/09/11	12/14/12
Chemical Name											
Chloride (mg/l)	--	**15**	**19**	**18**	**21**	**21**	**18**	NA	**14.3**	**13.7**	**13**
Ethane (mg/l)	--	**0.012**	**0.012**	**0.011**	**0.0036**	**0.0046**	**0.0043**	NA	**0.0049**	**0.015**	**0.0703**
Ethene (mg/l)	--	**0.048**	**0.069**	**0.059**	**0.058**	**0.068**	**0.13**	NA	**0.064**	**0.16**	**0.24**
Methane (mg/l)	--	**0.71**	**4.2**	**4.1**	**4.2**	**3.3**	**7**	NA	**33**	**12**	**31.5 D**
Nitrate (mg/l)	--	0.13 U	**0.017 J**	**0.0036 J**	0.0096 B	0.0098 B	0.042 U	NA	0.072 U	0.25 U	0.21 U
Nitrite (mg/l)	--	0.13 U	0.13 UL	0.13 UL	**0.032 J**	**0.033 J**	0.042 U	NA	**0.05 J**	0.25 U	0.07 U
Propionate (mg/l)	--	5 U	NA	NA	NA	NA	NA	NA	NA	**27.1**	NA
Propionic Acid (mg/l)	--	NA	**120 K**	**110 K**	**230**	**230**	**120**	NA	**56**	NA	**1.8**
Pyruvate (mg/l)	--	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	**0.307**	**0.01 J**
Sulfate (mg/l)	--	**42**	**2.4 J**	**2.6 J**	**3.2 J**	**3.4 J**	**2.7 J**	NA	**14.5**	NA	NA
Sulfide (mg/l)	--	0.03 UL	**0.13**	0.03 U	0.03 U	0.03 U	0.03 U	NA	0.03 U	1 U	**3.8**
Total organic carbon (TOC) (mg/l)	--	10 U	**190**	**210**	**370**	**370**	**310**	NA	**240**	**189**	**130 D**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW502D			04GW503D						
Sample ID		004GW502D-1213	004GW502D-1014	004GW502D-1115	004GW503D-0209	004GW503D-0210	004GW503D-0510	004GW503D-0810	004GW503D-1210	004GW503D-1211	004GW503DP-1211
Sample Date		12/16/13	10/14/14	11/04/15	02/05/09	02/01/10	05/10/10	08/26/10	12/02/10	12/09/11	12/09/11
Chemical Name											
Volatile Organic Compounds (UG/L)											
1,1,1-Trichloroethane	--	1 U	1 U	NA	5 U	5 U	13 U	0.5 U	0.5 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	**0.29 J**	**11 J**	**9.2**	**8.3**	**8**	**4.5**	**3.3**	**3.5**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	NA	5 U	**0.65 J**	13 U	1 U	1 U	**0.19 J**	**0.18 J**
1,1,2-Trichloroethane	--	1 U	1 U	NA	5 U	5 U	13 U	1 U	**0.61 J**	**0.45 J**	**0.44 J**
1,1-Dichloroethane	--	1 U	1 U	NA	5 U	5 U	13 U	0.5 U	0.5 U	**0.15 J**	**0.15 J**
1,1-Dichloroethene	--	1 U	1 U	NA	**1.6 J**	**1.3 J**	13 U	**1.8 J**	**1.5 J**	**0.69 J**	**0.72 J**
1,2,4-Trichlorobenzene	--	1 U	1 U	NA	5 U	5 U	13 U	0.5 U	0.5 U	0.3 U	0.3 U
1,2-Dichlorobenzene	--	1 U	1 U	NA	5 UJ	5 U	13 U	0.5 U	0.5 U	0.2 U	0.2 U
1,2-Dichloroethane	5	**1.2 J**	**2.8**	**2.7**	5 U	**1.3 J**	13 U	0.5 U	0.5 U	**1.3**	**1.3**
1,2-Dichloropropane	--	1 U	1 U	NA	5 U	5 U	13 U	1 U	1 U	**0.33 J**	**0.33 J**
1,3-Dichlorobenzene	--	1 U	**0.84 J**	NA	5 UJ	5 U	13 U	0.5 U	0.5 U	0.2 U	0.2 U
1,4-Dichlorobenzene	--	**2**	**2.7**	NA	5 UJ	5 U	13 U	0.5 U	0.5 U	**0.13 J**	**0.12 J**
2-Butanone	--	12 UJ	12 UL	NA	5 R	**12**	**6.2 J**	2.5 R	2.5 R	4 U	4 U
Acetone	--	11 B	**8.1 J**	NA	5 R	5 R	13 R	2.5 R	2.5 R	5 U	5 U
Benzene	--	**6.3**	**6.3**	NA	**4.6 J**	**5.6**	**5.8 J**	**5.6**	**4.9 J**	**4.2**	**4.3**
Chlorobenzene	--	**8.8**	**9.2**	NA	5 U	**0.97 J**	13 U	**0.93 J**	**0.67 J**	**0.43 J**	**0.43 J**
Chloroethane	--	1 U	1 U	NA	5 U	5 U	13 U	0.5 U	0.5 U	0.3 U	0.3 U
Chloroform	--	1 U	1 U	NA	**1.4 J**	**1.5 J**	13 U	**1.3 J**	0.5 U	0.77 B	0.86 B
Chloromethane	--	1 U	1 U	NA	5 U	5 U	13 U	0.5 U	0.5 U	0.3 U	0.3 U
cis-1,2-Dichloroethene	70	**9.8**	**120**	**15**	**78**	**110**	**210**	**280**	**320**	**110**	**110**
Isopropylbenzene	--	1 U	1 U	NA	5 U	5 U	13 U	0.5 U	0.5 U	0.2 U	0.2 U
Methyl acetate	--	1 U	1 UJ	NA	5 U	5 U	13 U	1 U	1 U	0.5 U	0.5 U
Methylene chloride	--	5 U	5 U	NA	1.5 B	1.6 B	13 U	**1.9 J**	2.1 B	1.3 B	1.4 B
Tetrachloroethene	--	1 U	1 U	NA	5 U	**0.65 J**	13 U	1 U	1 U	**0.24 J**	**0.28 J**
trans-1,2-Dichloroethene	--	**8.5**	**13**	NA	5 U	**0.57 J**	13 U	**0.81 J**	**0.92 J**	**1**	**1.1**
Trichloroethene	5	**5.4**	**18**	**26**	**630**	**500**	**400**	**410**	**210**	**230**	**230**
Vinyl chloride	2	**3.3**	**34**	**8.1**	**14**	**15**	**14**	**22**	**23**	**19**	**20**
Semivolatile Organic Compounds (UG/L)											
No Detections											
Explosives (UG/L)											
Perchlorate	15	NA	NA	NA	**0.16 J**	**0.07 J**	**0.07 J**	**0.05 J**	0.1 U	1 U	1 U
Total Metals (UG/L)											
Iron	11,000	NA	101,000 B	NA	**29,200**	NA	NA	NA	NA	NA	NA
Sodium	--	**13,000**	**7,190 K**	**11,700**	**7,310**	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)											
Iron, Dissolved	11,000	**132,000**	**115,000 J**	NA	NA	**13,300**	**17,400**	**14,500**	**48,500**	**48,800**	**49,200**
Sodium, Dissolved	--	NA	NA	NA	NA	**9,480**	**10,600**	**10,600**	**10,100**	NA	NA
Wet Chemistry* (see note below)**											
Acetate (mg/l)	--	**53**	**24**	**9.91**	5 U	5 U	5 U	0.5 U	**1.6 J**	NA	NA
Alkalinity (mg/l)	--	**160**	**130**	**79**	**54**	**35**	**50**	**440**	**130**	**105**	NA
Butyrate (mg/l)	--	0.1 U	0.1 U	**0.118**	5 U	5 U	5 U	1 U	1 U	NA	NA
Carbon dioxide (mg/l)	--	**257 D**	**218 E**	**62**	**83**	**0.452**	**97.1**	**35.9**	**39.1**	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	20 U	21 U	**23**	**33**	NA	NA

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW502D			04GW503D						
Sample ID		004GW502D-1213	004GW502D-1014	004GW502D-1115	004GW503D-0209	004GW503D-0210	004GW503D-0510	004GW503D-0810	004GW503D-1210	004GW503D-1211	004GW503DP-1211
Sample Date		12/16/13	10/14/14	11/04/15	02/05/09	02/01/10	05/10/10	08/26/10	12/02/10	12/09/11	12/09/11
Chemical Name											
Chloride (mg/l)	--	**12**	**12**	**15.7**	**11**	**12**	**14**	**10**	**10.4**	**12**	NA
Ethane (mg/l)	--	**0.0655**	**0.0984**	**0.1**	**0.016**	0.0013 U	0.0012 U	0.0013 U	**0.012**	NA	NA
Ethene (mg/l)	--	**0.0224**	**0.0801**	**0.063**	**0.0066**	**0.0031**	**0.0017**	**0.0018**	**0.079**	NA	NA
Methane (mg/l)	--	**8.85 D**	**7.05 D**	**12**	**0.11**	**0.13**	**0.1**	**0.6**	**41**	NA	NA
Nitrate (mg/l)	--	0.21 U	0.21 U	**0.0538 J**	0.13 U	**0.021 J**	0.016 B	0.042 U	**0.098 J**	0.1 U	NA
Nitrite (mg/l)	--	0.07 U	0.07 U	0.05 U	0.13 U	0.13 U	0.13 U	0.042 U	0.062 U	0.1 U	NA
Propionate (mg/l)	--	NA	NA	**0.233**	5 U	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	0.1 U	**0.11**	NA	NA	5 U	5 U	0.5 U	0.5 U	NA	NA
Pyruvate (mg/l)	--	0.1 U	0.1 U	0.05 U	5 U	5 U	5 U	5 U	5 U	NA	NA
Sulfate (mg/l)	--	NA	**1.5 J**	**2.8**	**8.7**	**20**	**20**	**17**	**5.8**	NA	NA
Sulfide (mg/l)	--	1 U	1 U	1 U	0.03 UL	0.03 U	0.03 U	0.03 U	**0.037**	1 U	NA
Total organic carbon (TOC) (mg/l)	--	**32**	**16**	**8.07**	10 U	10 U	**5.6 J**	4.1 B	3.6 B	NA	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW503D					04GW504D				
Sample ID		004GW503D-1212	004GW503DP-1212	004GW503D-1213	004GW503D-1014	004GW503D-1115	004GW504D-0209	004GW504DP-0209	004GW504D-0210	004GW504D-0510	004GW504D-0810
Sample Date		12/14/12	12/14/12	12/13/13	10/09/14	11/04/15	02/04/09	02/04/09	02/04/10	05/10/10	08/26/10
Chemical Name											
Volatile Organic Compounds (UG/L)											
1,1,1-Trichloroethane	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
1,1,2,2-Tetrachloroethane	2.4	**3.1 K**	**3 K**	**1.7 J**	1 U	**0.42 J**	**18**	**18**	**10**	**13**	**8.9**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	1 U	1 U	NA	**1.7 J**	**1.2 J**	**1.6 J**	5 U	**1.2 J**
1,1,2-Trichloroethane	--	1 U	1 U	1 U	1 U	NA	**1.3 J**	**1.4 J**	5 U	**0.74 J**	1 U
1,1-Dichloroethane	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
1,1-Dichloroethene	--	**1.1 K**	**0.94 K**	1 U	1 U	NA	**6.8**	**5.9**	**2.8 J**	**0.84 J**	**1.9 J**
1,2,4-Trichlorobenzene	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
1,2-Dichlorobenzene	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
1,2-Dichloroethane	5	**1.2 K**	**1.1 K**	**0.87 J**	1 U	**0.47 J**	5 U	5 U	**9.5**	**8.4**	**7.6**
1,2-Dichloropropane	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	1 U
1,3-Dichlorobenzene	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
1,4-Dichlorobenzene	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	**1.4 J**	**1 J**
2-Butanone	--	12 U	12 U	12 UJ	12 UJ	NA	5 R	5 R	**46 L**	5 U	2.5 R
Acetone	--	12 U	12 U	12 U	12 U	NA	5 R	5 R	5 R	5 R	5.7 B
Benzene	--	**4.7 K**	**4.8 K**	**2.8**	**2.2**	NA	**2.4 J**	**2.3 J**	**4.9 J**	**4.6 J**	**5.1**
Chlorobenzene	--	1 U	1 U	1 U	1 U	NA	**1.8 J**	**1.5 J**	**2.3 J**	**2 J**	**1.8 J**
Chloroethane	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
Chloroform	--	1.2 B	1.1 B	**0.87 J**	1 U	NA	**2.5 J**	**2.4 J**	**3.8 J**	**2 J**	**1.8 J**
Chloromethane	--	1 U	1 U	1 U	1 UJ	NA	5 U	5 U	5 U	5 U	0.5 U
cis-1,2-Dichloroethene	70	**100 K**	**110 K**	**61**	**44**	**18**	**460**	**440**	**260**	**170**	**220**
Isopropylbenzene	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	0.5 U
Methyl acetate	--	1 U	1 U	1 U	1 UJ	NA	5 U	5 U	5 U	5 U	**0.68 J**
Methylene chloride	--	5 U	5 U	5 U	5 U	NA	2.6 B	2.3 B	**3.6 J**	5.3 B	**5 J**
Tetrachloroethene	--	1 U	1 U	1 U	1 U	NA	5 U	5 U	5 U	5 U	1 U
trans-1,2-Dichloroethene	--	**1.3 K**	**1.4 K**	**1 J**	**0.81 J**	NA	**1.5 J**	**1.4 J**	**5.8**	**4.5 J**	**5.8**
Trichloroethene	5	**250 K**	**260 K**	**110**	**74**	**34**	**570**	**540**	**340**	**180**	**220**
Vinyl chloride	2	**14 K**	**15 K**	**7.2**	**5.1**	**2.8**	**44**	**39**	**59**	**36**	**91**
Semivolatile Organic Compounds (UG/L)											
No Detections											
Explosives (UG/L)											
Perchlorate	15	NA	NA	NA	NA	NA	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Total Metals (UG/L)											
Iron	11,000	NA	NA	NA	NA	NA	**41,700**	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	**11,600**	NA	NA	NA	NA
Dissolved Metals (UG/L)											
Iron, Dissolved	11,000	**42,300**	**42,900**	**39,000**	**35,400**	NA	NA	NA	**89,000**	**148,000**	**190,000**
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**32,600**	**34,600**	**33,300**
Wet Chemistry* (see note below)**											
Acetate (mg/l)	--	NA	NA	NA	NA	NA	5 U	NA	**40 K**	**180**	**320**
Alkalinity (mg/l)	--	**120**	NA	**90**	**93**	**91**	**76**	NA	**290**	**440**	**350**
Butyrate (mg/l)	--	NA	NA	NA	NA	NA	5 U	NA	5 U	**0.97 J**	**4.3 J**
Carbon dioxide (mg/l)	--	NA	NA	NA	NA	NA	**150**	NA	**0.669**	**94.1**	**55**
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	**130**	**420**	**480**

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW503D					04GW504D				
Sample ID		004GW503D-1212	004GW503DP-1212	004GW503D-1213	004GW503D-1014	004GW503D-1115	004GW504D-0209	004GW504DP-0209	004GW504D-0210	004GW504D-0510	004GW504D-0810
Sample Date		12/14/12	12/14/12	12/13/13	10/09/14	11/04/15	02/04/09	02/04/09	02/04/10	05/10/10	08/26/10
Chemical Name											
Chloride (mg/l)	--	**9.3**	NA	**9.8**	**9.8**	**13.7**	**16**	NA	**17**	**20**	**16**
Ethane (mg/l)	--	NA	NA	NA	NA	NA	**0.014**	NA	**0.0036**	**0.0057**	**0.0056**
Ethene (mg/l)	--	NA	NA	NA	NA	NA	**0.034**	NA	**0.099**	**0.083**	**0.099**
Methane (mg/l)	--	NA	NA	NA	NA	NA	**0.3**	NA	**1.7**	**2.8**	**11**
Nitrate (mg/l)	--	0.21 U	NA	0.21 U	0.21 U	**0.0551 J**	0.13 U	NA	**0.018 J**	0.031 B	0.042 U
Nitrite (mg/l)	--	0.07 U	NA	0.07 U	0.07 U	0.05 U	0.13 U	NA	0.13 UL	**0.022 J**	0.042 U
Propionate (mg/l)	--	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	**38 K**	**110**	**69**
Pyruvate (mg/l)	--	NA	NA	NA	NA	NA	5 U	NA	5 U	5 U	5 U
Sulfate (mg/l)	--	NA	NA	NA	NA	NA	**47**	NA	**7**	**1.1 J**	**1 J**
Sulfide (mg/l)	--	1 U	NA	1 U	1 U	1 U	0.03 UL	NA	0.03 U	0.03 U	0.03 U
Total organic carbon (TOC) (mg/l)	--	NA	NA	NA	NA	NA	10 U	NA	**40**	**140**	**160**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW504D						
Sample ID		004GW504D-1210	004GW504DP-1210	004GW504D-1211	004GW504D-1212	004GW504D-1213	004GW504D-1014	004GW504D-1115
Sample Date		12/02/10	12/02/10	12/08/11	12/14/12	12/16/13	10/14/14	11/03/15
Chemical Name								
Volatile Organic Compounds (UG/L)								
1,1,1-Trichloroethane	--	0.5 U	0.5 U	**0.14 J**	1 U	1 UL	10 U	NA
1,1,2,2-Tetrachloroethane	2.4	**13**	**13**	**19**	**40 K**	**18 L**	**21**	**15**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	**1.6 J**	**1.6 J**	**2.3**	**5.9 K**	**2.1 L**	10 U	NA
1,1,2-Trichloroethane	--	1 U	1 U	**1.1**	**1.9 K**	1 UL	10 U	NA
1,1-Dichloroethane	--	**0.52 J**	**0.55 J**	**0.54 J**	**0.81 K**	**0.76 L**	10 U	NA
1,1-Dichloroethene	--	**2.5 J**	**2.5 J**	**2.7**	**4.8 K**	**2.7 L**	10 U	NA
1,2,4-Trichlorobenzene	--	0.5 U	0.5 U	**0.2 J**	1 U	1 UL	10 U	NA
1,2-Dichlorobenzene	--	0.5 U	0.5 U	**0.15 J**	1 U	1 UL	10 U	NA
1,2-Dichloroethane	5	**13**	**13**	**12**	**19 K**	**11 L**	10 U	**5**
1,2-Dichloropropane	--	1 U	1 U	**0.58 J**	1 U	1 UL	10 U	NA
1,3-Dichlorobenzene	--	0.5 U	0.5 U	**0.41 J**	1 U	1 UL	10 U	NA
1,4-Dichlorobenzene	--	**1.5 J**	**1.6 J**	**1.5**	**2 K**	**2.1 L**	10 U	NA
2-Butanone	--	2.5 R	2.5 R	4 U	12 U	12 UJ	120 UJ	NA
Acetone	--	2.5 R	**3.1 L**	5 U	12 U	12 UL	120 U	NA
Benzene	--	**6.8**	**6.5**	**7**	**14 K**	**9.5 L**	**7.1 J**	NA
Chlorobenzene	--	**2.6 J**	**2.6 J**	**3.6**	**7.6 K**	**7.2 L**	10 U	NA
Chloroethane	--	0.5 U	0.5 U	0.3 U	1 U	1 UL	10 U	NA
Chloroform	--	2.9 B	3.1 B	2.6 B	4.4 B	**1.8 L**	10 U	NA
Chloromethane	--	0.5 U	0.5 U	0.3 U	1 U	1 UL	10 U	NA
cis-1,2-Dichloroethene	70	**300**	**330**	**220**	**260 K**	**170 L**	**180**	**170**
Isopropylbenzene	--	0.5 U	0.5 U	**0.2 J**	1 U	1 UL	10 U	NA
Methyl acetate	--	**3.8 J**	**4.6 J**	0.5 U	1 U	1 UL	10 UJ	NA
Methylene chloride	--	6.5 B	6.2 B	2.4 B	5 U	5 UL	50 U	NA
Tetrachloroethene	--	1 U	1 U	**0.38 J**	1 U	1 UL	10 U	NA
trans-1,2-Dichloroethene	--	**8**	**7.8**	**7.7**	**9.5 K**	**13 L**	**7.7 J**	NA
Trichloroethene	5	**500**	**530**	**940**	**1,600 K**	**1,000**	**900**	**800**
Vinyl chloride	2	**150**	**140**	**70**	**65 K**	**40 L**	**24**	**27**
Semivolatile Organic Compounds (UG/L)								
No Detections								
Explosives (UG/L)								
Perchlorate	15	**0.09 J**	**0.09 J**	1 U	NA	NA	NA	NA
Total Metals (UG/L)								
Iron	11,000	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)								
Iron, Dissolved	11,000	**86,800**	**85,700**	**34,300 L**	**18,400**	**26,400**	**23,600**	NA
Sodium, Dissolved	--	**20,300**	**19,800**	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**								
Acetate (mg/l)	--	**84**	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	**180**	NA	**83.8**	**55**	**87**	**94**	**80.6**
Butyrate (mg/l)	--	1 U	NA	NA	NA	NA	NA	NA
Carbon dioxide (mg/l)	--	**38.7**	NA	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	**150**	NA	NA	NA	NA	NA	NA

TABLE 4-5
Historical Constituents Detected in Groundwater at Site 4 - 200 Series
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW504D						
Sample ID		004GW504D-1210	004GW504DP-1210	004GW504D-1211	004GW504D-1212	004GW504D-1213	004GW504D-1014	004GW504D-1115
Sample Date		12/02/10	12/02/10	12/08/11	12/14/12	12/16/13	10/14/14	11/03/15
Chemical Name								
Chloride (mg/l)	--	**14.8**	NA	**14.9**	**11**	**12**	**12**	**17.5**
Ethane (mg/l)	--	**0.0062**	NA	NA	NA	NA	NA	NA
Ethene (mg/l)	--	**0.15**	NA	NA	NA	NA	NA	NA
Methane (mg/l)	--	**9.1**	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	0.072 U	NA	0.1 U	0.21 U	0.21 U	0.21 U	**0.051 J**
Nitrite (mg/l)	--	**0.049 J**	NA	0.1 U	0.07 U	0.07 U	0.07 U	0.05 U
Propionate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	**11**	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	5 U	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**2.9**	NA	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	0.03 U	NA	1 U	**0.62 J**	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	**35**	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW601D										
Sample ID		004GW601D-0909	004GW601D-0210	004GW601D-0510	004GW601D-0810	004GW601D-1110	004GW601D-1211	004GW601DP-1211	004GW601D-1212	004GW601D-1213	004GW601D-1014	004GW601D-1115
Sample Date		09/30/09	02/02/10	05/11/10	08/24/10	11/30/10	12/05/11	12/05/11	12/13/12	12/11/13	10/10/14	11/02/15
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	1 U	1 U	1 U	**0.18 J**	**0.16 J**	1 U	1 U	1 U	**0.26 J**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 U	5 U	5 U	1 U	1 U	0.3 U	0.3 U	1 U	1 U	1 U	NA
1,1,2-Trichloroethane	--	5 U	5 U	5 U	1 U	1 U	**0.43 J**	**0.52 J**	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	0.2 U	1 U	1 U	1 U	NA
1,2-Dichloroethane	5	5 U	5 U	5 U	0.5 U	0.5 U	**1.7**	**1.7**	**2.2 K**	**1.2 J**	1 U	**0.56 J**
1,2-Dichloropropane	--	5 U	5 U	5 U	1 U	1 U	**0.4 J**	**0.39 J**	1 U	1 U	1 U	NA
1,4-Dichlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	0.2 U	1 U	1 U	1 U	NA
2-Butanone	--	5 R	5 U	5 U	2.5 R	2.5 R	4 U	4 U	12 U	12 UJ	12 U	NA
Acetone	--	5 R	5 R	5 R	2.5 R	2.5 R	5 U	5 U	12 U	12 U	**10 J**	NA
Benzene	--	5 U	5 U	5 U	0.5 U	0.5 U	**0.12 J**	**0.12 J**	1 U	1 U	1 U	NA
Carbon disulfide	--	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	0.2 U	1 U	1 U	1 U	NA
Chloroethane	--	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	0.3 U	1 U	1 U	1 U	NA
Chloroform	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	0.2 U	1 U	1 U	1 U	NA
Chloromethane	--	5 U	0.88 B	5 U	0.5 U	0.5 U	0.3 U	0.3 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	5 U	**4.8 J**	**16**	**14 J**	**17**	**13**	**12**	**16 K**	**7.9**	**8.3**	**6.4**
Methyl acetate	--	5 U	**2.2 J**	5 U	1 U	1 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
Methylene chloride	--	2.2 B	**1.3 J**	5 U	0.5 U	0.5 U	1 U	1 U	5 U	5 U	5 U	NA
Methyl-tert-butyl ether (MTBE)	--	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	0.2 U	1 U	1 U	1 U	NA
Toluene	--	5 U	5 U	5 U	0.5 U	0.9 B	**0.12 J**	**0.12 J**	1 U	1 U	1 U	NA
trans-1,2-Dichloroethene	--	5 U	5 U	5 U	1 U	1 U	0.2 U	0.2 U	1 U	1 U	1 U	NA
Trichloroethene	5	5 U	5 U	**1.2 J**	**0.76 J**	**1.3 J**	**6.2**	**6.2**	**37 K**	**21**	**56**	**42**
Vinyl chloride	2	1 U	1 U	1 U	1 U	**0.55 J**	**0.43 J**	**0.4 J**	1 U	1 U	**0.78 J**	**0.3 J**
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	15	**0.03 J**	0.2 U	0.2 U	0.2 U	0.1 U	1 U	1 U	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	**1,420**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	--	**15.5 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	0.16 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	**8,150**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	12.3 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	**1.5 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	--	7.9 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	5,640 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	--	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	**6,270**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	**625**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	--	7.8 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	**17,200**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**15,000**	NA	NA	NA	NA	**20,000**	NA	**17,700**	**19,600**	**19,000**	**16,000**
Vanadium	--	2.5 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	NA	**342**	**1,570**	**1,090**	**953**	**1,830**	**1,900**	**4,020**	**5,330**	**7,240**	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	**24,600**	**37,200**	**34,100**	**39,800**	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Acetate	--	**1.9 J**	**30**	**11 L**	0.5 U	**54**	0.05 U	NA	0.1 U	**0.055 J**	**0.047 J**	0.05 U
Alkalinity	--	**67**	**63**	**70**	**120**	**100**	**65.9**	NA	**63**	**63**	**56**	**53.9**
Butyrate	--	5 U	5 U	5 U	1 U	**5.3**	0.05 U	NA	0.1 U	0.1 U	0.1 U	0.05 U
Carbon dioxide	--	**1.46**	**0.718**	**2.77**	**0.835**	**2.06**	**5.8**	NA	**16**	**21.7**	**31.2**	**18**
Chemical oxygen demand	--	11 B	**37**	20 U	21 U	20 U	NA	NA	NA	NA	NA	NA
Chloride	--	**12**	**11**	**11**	**12**	**11.6**	**9.51**	NA	**8.5**	**10**	**10**	**10.9**
Ethane	--	**0.012**	**0.023**	**0.013**	**0.0053**	**0.0078**	**0.011**	NA	**0.00315**	**0.002**	**0.00617**	**0.008**

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW601D										
Sample ID		004GW601D-0909	004GW601D-0210	004GW601D-0510	004GW601D-0810	004GW601D-1110	004GW601D-1211	004GW601DP-1211	004GW601D-1212	004GW601D-1213	004GW601D-1014	004GW601D-1115
Sample Date		09/30/09	02/02/10	05/11/10	08/24/10	11/30/10	12/05/11	12/05/11	12/13/12	12/11/13	10/10/14	11/02/15
Chemical Name												
Ethene	--	**0.0051**	**0.01**	**0.014**	**0.012**	**0.026**	**0.025**	NA	**0.00964**	**0.00651**	**0.00543**	**0.0017 J**
Lactic Acid	--	5 U	5 U	5 U	2 U	2 U	NA	NA	0.2 U	0.2 U	0.2 U	NA
Methane	--	**0.017**	**0.056**	**0.042**	**0.053**	**0.26**	**0.79**	NA	**0.661 D**	**0.164 D**	**0.232 D**	**0.31**
Nitrate	--	0.13 U	0.13 U	0.13 U	0.042 U	0.072 U	0.05 U	NA	0.21 U	0.21 U	0.21 U	0.05 U
Nitrite	--	0.13 U	0.13 U	0.13 U	0.042 U	**0.051 J**	0.05 U	NA	0.07 U	0.07 U	0.07 U	0.05 U
Propionate	--	NA	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	0.05 U
Propionic Acid	--	5 U	5 U	5 U	0.5 U	**7.1**	NA	NA	0.1 U	0.1 U	0.1 U	NA
Pyruvate	--	5 U	5 U	5 U	5 U	5 U	0.05 U	NA	**0.013 J**	0.1 U	0.1 U	0.05 U
Sulfate	--	**14**	**13**	**32**	**14**	**4.4**	NA	NA	NA	NA	NA	NA
Sulfide	--	0.03 UL	0.03 U	0.03 UL	0.03 U	**0.059**	1 U	NA	1 U	1 U	1 U	1 U
Total organic carbon (TOC)	--	10 U	**15**	**8.4 J**	**3.3 J**	5 U	**0.932 J**	NA	**2.2**	**1.1**	**0.32 J**	**1.37**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 04	04GW602D										
Sample ID		004GW602D-0909	004GW602D-0210	004GW602DP-0210	004GW602D-0510	004GW602DP-0510	004GW602D-0810	004GW602DP-0810	004GW602D-1110	004GW602D-1211	004GW602D-1212	004GW602D-1213
Sample Date		09/30/09	02/02/10	02/02/10	05/11/10	05/11/10	08/24/10	08/24/10	11/30/10	12/06/11	12/12/12	12/11/13
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	**3 J**	**0.53 J**	**0.52 J**	**1.4**	**1.4**	**1.7**	**1.5**	**0.56 J**	**0.15 J**	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	5 UJ	5 U	5 U	5 U	5 U	1 U	1 U	1 U	0.3 U	1 U	1 U
1,1,2-Trichloroethane	--	5 UJ	5 U	5 U	5 U	5 U	1 U	1 U	1 U	**0.15 J**	1 U	1 U
1,1-Dichloroethene	--	5 UJ	**0.84 J**	**0.85 J**	**3.3 J**	**3.2 J**	**2.2 J**	**1.9 J**	**1.3 J**	**1**	**1.1 K**	1 U
1,2-Dichloroethane	5	5 UJ	**0.56 J**	**0.65 J**	5 U	5 U	**1 J**	**0.81 J**	0.5 U	**0.84 J**	**0.93 K**	1 U
1,2-Dichloropropane	--	5 UJ	5 U	5 U	5 U	5 U	1 U	1 U	1 U	**0.15 J**	1 U	1 U
1,4-Dichlorobenzene	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
2-Butanone	--	5 R	5 U	5 U	5 U	5 U	2.5 R	2.5 R	2.5 R	4 U	12 U	12 UJ
Acetone	--	5 R	5 R	5 R	5 R	5 R	**3.9 L**	**3.4 L**	**4.7 L**	3.3 B	12 U	12 U
Benzene	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
Carbon disulfide	--	5 UJ	**0.51 J**	5 U	5 U	5 U	0.5 U	0.5 U	**1.1 J**	0.5 U	5 U	5 U
Chlorobenzene	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	**0.57 J**	**0.12 J**	1 U	1 U
Chloroethane	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.3 U	1 U	1 U
Chloroform	--	**1.4 J**	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
Chloromethane	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	**0.17 J**	1 U	1 U
cis-1,2-Dichloroethene	70	**29 J**	**62**	**65**	**220**	**230**	**230**	**220**	**220**	**180**	**140 L**	**49**
Methyl acetate	--	5 UJ	**4.8 J**	**4.2 J**	5 U	5 U	1 U	1 U	1 U	0.5 U	1 U	1 U
Methylene chloride	--	5 UJ	**2 J**	**2.1 J**	5 U	5 U	0.5 U	0.5 U	0.5 U	1 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 R	1 U
Toluene	--	5 UJ	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
trans-1,2-Dichloroethene	--	**0.56 J**	5 U	**0.56 J**	**1 J**	**0.71 J**	1 U	**0.72 J**	**0.83 J**	**0.56 J**	1 U	1 U
Trichloroethene	5	**250**	**69**	**73**	**100**	**100**	**110**	**120**	**84**	**61**	**47**	**19**
Vinyl chloride	2	1 UJ	**1.7**	**1.7**	**2.7**	**2.6**	**3.1 J**	**3.7**	**1.8 J**	**2.2**	**4.3**	**2.3**
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	15	**2.7**	**0.29**	**0.3**	**0.1 J**	**0.09 J**	**0.08 J**	**0.09 J**	**0.1 J**	1 U	NA	NA
Total Metals (UG/L)												
Aluminum	--	18 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	--	**33.1 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	**5,340**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	1.1 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	**2.4 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	--	30 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	6,330 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	--	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	**3,900**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	**537**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	--	6.7 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	**5,250**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**24,800**	NA	NA	NA	NA	NA	NA	NA	**11,400**	**10,400**	**12,100**
Vanadium	--	50 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	NA	**108,000**	**108,000**	**86,800**	**86,900**	**67,000**	**65,300**	**51,000**	**88,300**	**71,500**	**79,000**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	**46,400**	**45,400**	**18,600**	**18,600**	**16,000**	**16,000**	**15,000**	NA	NA	NA
Wet Chemistry												
Acetate	--	**2.1 J**	**67**	**68**	**59 L**	**59 L**	**43**	NA	**41**	**26.2**	**12**	**15**
Alkalinity	--	**42**	**250**	**240**	**110**	**120**	**140**	NA	**100**	**64.1**	**61**	**59**
Butyrate	--	5 U	**3.7 J**	**3.7 J**	**17**	**17**	**3.9 J**	NA	**2.2 J**	**1.55**	0.1 U	0.1 U
Carbon dioxide	--	**21**	**0.871**	**0.489**	**29.3**	**34.4**	**35.2**	NA	**30.6**	**98**	**146 E**	**190 D**
Chemical oxygen demand	--	11 B	**610**	**590**	**150**	**140**	**83**	NA	**71**	NA	NA	NA
Chloride	--	**39**	**33**	**34**	**24**	**24**	**25**	NA	**17.9**	**19.5**	**15**	**18**
Ethane	--	**0.0034**	**0.0033**	**0.0035**	**0.0029**	**0.0027**	0.0013 U	NA	0.0012 U	**0.0017 J**	0.00196 U	0.00196 U

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW602D										
Sample ID		004GW602D-0909	004GW602D-0210	004GW602DP-0210	004GW602D-0510	004GW602DP-0510	004GW602D-0810	004GW602DP-0810	004GW602D-1110	004GW602D-1211	004GW602D-1212	004GW602D-1213
Sample Date		09/30/09	02/02/10	02/02/10	05/11/10	05/11/10	08/24/10	08/24/10	11/30/10	12/06/11	12/12/12	12/11/13
Chemical Name												
Ethene	--	**0.0015**	**0.0018**	**0.0019**	0.0016 U	0.0015 U	0.0016 U	NA	0.0015 U	**4.70E-04 J**	**0.00276 J**	**0.00369**
Lactic Acid	--	5 U	5 U	5 U	**3.3 J**	5 U	2 U	NA	2 U	NA	0.2 U	0.2 U
Methane	--	**0.0054**	**0.081**	**0.084**	**0.9**	**0.77**	**3.5**	NA	**0.037**	**13**	**18.2 D**	**5.54 D**
Nitrate	--	**0.39**	0.13 U	0.13 U	0.041 B	0.13 U	**0.031 J**	NA	0.072 U	**0.0568 J**	0.21 U	0.21 U
Nitrite	--	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.042 U	NA	0.062 U	0.05 U	0.07 U	0.07 U
Propionate	--	NA	NA	NA	NA	NA	NA	NA	NA	**1.94**	NA	NA
Propionic Acid	--	5 U	**170**	**170**	**17**	**18**	**3.9 J**	NA	**1.5 J**	NA	0.1 U	0.1 U
Pyruvate	--	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U	0.05 U	**0.014 J**	0.1 U
Sulfate	--	**5.5**	**0.69 J**	**0.76 J**	**2.4 J**	**0.76 J**	**1.1 J**	NA	**2**	NA	NA	NA
Sulfide	--	0.03 UL	0.03 U	0.03 U	0.03 UL	0.03 UL	0.03 U	NA	**0.11**	1 U	1 U	1 U
Total organic carbon (TOC)	--	10 U	**130**	**130**	**47**	**45**	**21**	NA	**19**	**14.4**	**9.9**	**8**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 04	04GW602D			04GW602S							
Sample ID		004GW602DP-1213	004GW602D-1014	004GW602D-1115	004GW602S-0909	004GW602S-0210	004GW602S-0510	004GW602S-0810	004GW602S-1210	004GW602S-1211	004GW602S-1212	004GW602S-1213
Sample Date		12/11/13	10/08/14	11/03/15	09/30/09	02/03/10	05/11/10	08/24/10	12/01/10	12/05/11	12/12/12	12/12/13
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	0.2 U	1 U	1 U	1 U	1 U	1 U	0.2 U	1 U	1 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	NA	5 U	5 U	5 U	1 U	1 U	0.3 U	1 U	1 U
1,1,2-Trichloroethane	--	1 U	1 U	NA	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U
1,1-Dichloroethene	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	**0.17 J**	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U	**0.23 J**	5 U	5 U	5 U	0.5 U	0.5 U	**0.32 J**	1 U	1 U
1,2-Dichloropropane	--	1 U	1 U	NA	5 U	5 U	5 U	1 U	1 U	0.2 U	1 U	1 U
1,4-Dichlorobenzene	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
2-Butanone	--	12 UJ	12 UJ	NA	5 R	5 R	5 U	2.5 R	2.5 R	4 U	12 U	12 UJ
Acetone	--	12 U	12 U	NA	5 R	5 R	5 R	2.5 R	2.5 R	**3 J**	12 U	12 U
Benzene	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	**0.14 J**	1 U	1 U
Carbon disulfide	--	5 U	5 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U
Chlorobenzene	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
Chloroethane	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U
Chloroform	--	1 U	1 U	NA	**0.6 J**	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
Chloromethane	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.3 U	1 U	1 U
cis-1,2-Dichloroethene	70	**45**	**56**	**36**	**46**	**49**	**41**	**39 J**	**33**	**20**	**6.8 K**	**5.1**
Methyl acetate	--	1 U	1 U	NA	5 U	5 U	5 U	1 U	**1.3 J**	0.5 U	1 U	1 U
Methylene chloride	--	5 U	5 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	1 U	5 U	5 U
Methyl-tert-butyl ether (MTBE)	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
Toluene	--	1 U	1 U	NA	5 U	5 U	5 U	0.5 U	0.5 U	0.2 U	1 U	**0.84 J**
trans-1,2-Dichloroethene	--	1 U	1 U	NA	**0.57 J**	5 U	5 U	1 U	1 U	**0.21 J**	1 U	1 U
Trichloroethene	5	**16**	**28**	**12**	**71**	**60**	**24**	**26**	**24**	**11**	**8.2 K**	**9.9**
Vinyl chloride	2	**2.2**	**3.5 J**	**1.3**	**0.68 J**	1 U	1 U	1 U	1 U	**1.7**	1 U	1 U
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	15	NA	NA	NA	**0.33**	0.2 U	0.2 U	**0.07 J**	**0.05 J**	1 U	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	**1,140**	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	**38 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	0.089 B	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	**3,560**	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	NA	3.5 B	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	**2.4 J**	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	10.9 B	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	1,720 B	NA	NA	NA	NA	NA	NA	NA
Lead	--	NA	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	**4,480**	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	**171**	NA	NA	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	4.1 B	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	**1,580**	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	**13,400**	**13,200**	**13,600**	NA	NA	NA	NA	**20,000**	**16,800**	**23,000**
Vanadium	--	NA	NA	NA	2.5 B	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	**79,200**	**81,600**	NA	NA	**24,100**	**17,900**	**27,800**	**27,400**	**31,000**	**20,700**	**5,280**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	15,200 B	**15,400**	**14,100**	**15,100**	NA	NA	NA
Wet Chemistry												
Acetate	--	NA	**9.1**	**1.24**	5 U	**6.1**	**9.1 L**	**36**	**26**	**4.29**	**0.73**	0.1 U
Alkalinity	--	NA	**78**	**71.9**	**25**	**61**	**23**	**100**	**190**	**67.2**	**61**	**31**
Butyrate	--	NA	0.1 U	0.05 U	5 U	5 U	5 U	**2.8 J**	**0.99 J**	0.05 U	0.1 U	0.1 U
Carbon dioxide	--	NA	**197 E**	**79**	**1.38**	**0.484**	**36.9**	**46**	**29.2**	**180**	**268 D**	**210 D**
Chemical oxygen demand	--	NA	NA	NA	20 U	**610**	**400**	**120**	**48**	NA	NA	NA
Chloride	--	NA	**19**	**24.7**	**15**	**18**	**16**	**20**	**23.1**	**33.4**	**29**	**41**
Ethane	--	NA	0.00196 U	**0.0013 J**	**0.0012**	**0.0014**	**0.0022**	0.0013 U	0.0013 U	**5.50E-04 J**	0.00196 U	0.00196 U

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW602D			04GW602S							
Sample ID		004GW602DP-1213	004GW602D-1014	004GW602D-1115	004GW602S-0909	004GW602S-0210	004GW602S-0510	004GW602S-0810	004GW602S-1210	004GW602S-1211	004GW602S-1212	004GW602S-1213
Sample Date		12/11/13	10/08/14	11/03/15	09/30/09	02/03/10	05/11/10	08/24/10	12/01/10	12/05/11	12/12/12	12/12/13
Chemical Name												
Ethene	--	NA	**0.00365**	**0.0017 J**	0.0015 U	0.0015 U	0.0016 U	0.0016 U	0.0016 U	**0.0045**	0.00271 U	0.00271 U
Lactic Acid	--	NA	0.2 U	NA	5 U	5 U	5 U	2 U	2 U	NA	0.2 U	0.2 U
Methane	--	NA	**3.79 D**	**8.4**	**0.0036**	**0.011**	**0.11**	**1.5**	**6.3**	**6.8**	**21.6 D**	**2.99 D**
Nitrate	--	NA	0.21 U	**0.0551 J**	**1.2**	0.13 U	0.0099 B	0.042 U	0.072 U	0.1 U	0.21 U	0.21 U
Nitrite	--	NA	0.07 U	0.05 U	0.13 U	0.13 U	0.13 U	0.042 U	0.062 U	0.1 U	0.07 U	0.07 U
Propionate	--	NA	NA	0.05 U	NA	NA	NA	NA	NA	0.05 U	NA	NA
Propionic Acid	--	NA	0.1 U	NA	5 U	**3.7 J**	**3.4 J**	**0.66 J**	0.5 U	NA	0.1 U	0.1 U
Pyruvate	--	NA	0.1 U	0.05 U	5 U	5 U	5 U	5 U	5 U	0.05 U	**0.017 J**	0.1 U
Sulfate	--	NA	NA	NA	**12**	**1.3 J**	**1.4 J**	**1.3 J**	**4.3**	NA	NA	NA
Sulfide	--	NA	1 U	1 U	0.03 UL	**0.031**	**0.038 L**	0.03 U	**0.17**	**1.67**	**1.6**	1 U
Total organic carbon (TOC)	--	NA	**4.7**	**2.4**	10 U	**32**	**29**	**21**	**13**	**4**	**3.5**	**1.7**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 04	04GW602S		04GW604D								
Sample ID		004GW602S-1014	004GW602S-1115	004GW604D-0909	004GW604D-0210	004GW604D-0510	004GW604D-0810	004GW604D-1210	004GW604DP-1210	004GW604D-1211	004GW604D-1212	004GW604D-1213
Sample Date		10/08/14	11/03/15	09/29/09	02/02/10	05/11/10	08/24/10	12/01/10	12/01/10	12/05/11	12/11/12	12/12/13
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	1 U	0.2 U	1 UJ	**0.96 J**	1 U	**0.64 J**	**0.53 J**	1 U	**0.46 J**	**1.2 K**	**0.81 J**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	NA	5 UJ	5 U	5 U	1 U	1 U	1 U	0.3 U	1 U	1 U
1,1,2-Trichloroethane	--	1 U	NA	5 UJ	5 U	5 U	1 U	1 U	1 U	0.2 U	1 U	1 U
1,1-Dichloroethene	--	1 U	NA	5 UJ	5 U	**0.76 J**	**2.4 J**	**2.3 J**	**2.7 J**	**1.6**	**0.95 K**	1 U
1,2-Dichloroethane	5	1 U	0.2 U	5 UJ	5 U	5 U	**0.73 J**	0.5 U	0.5 U	**2.5**	**1.7 K**	**1.1 J**
1,2-Dichloropropane	--	1 U	NA	5 UJ	5 U	5 U	1 U	1 U	1 U	**0.2 J**	1 U	1 U
1,4-Dichlorobenzene	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	**0.2 J**	1 U	1 U
2-Butanone	--	12 UJ	NA	5 R	5 U	5 U	2.5 R	2.5 R	2.5 R	**2.8 J**	12 U	12 UJ
Acetone	--	12 U	NA	5 R	**11 L**	**18 L**	9.7 B	**5 L**	**5.4 L**	**4 J**	12 U	12 U
Benzene	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	**0.23 J**	1 U	1 U
Carbon disulfide	--	5 U	NA	5 UJ	**5.1**	**1.1 J**	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U
Chlorobenzene	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	**0.34 J**	1 U	1 U
Chloroethane	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	**0.69 J**	1 U	1 U
Chloroform	--	1 U	NA	**1.8 J**	**0.55 J**	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
Chloromethane	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	0.3 U	1 U	1 U
cis-1,2-Dichloroethene	70	**2.1**	**1.6**	**40 J**	**20**	**18**	**250**	**250**	**250**	**190**	**92 K**	**21**
Methyl acetate	--	1 U	NA	5 UJ	**2 J**	5 U	1 U	**7.2**	**7.7**	**0.89 J**	1 U	1 U
Methylene chloride	--	5 U	NA	5 UJ	**3.6 J**	**6.4**	**2.5 J**	2.2 B	2.1 B	1 B	5 U	5 U
Methyl-tert-butyl ether (MTBE)	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	**0.21 J**	1 U	1 U
Toluene	--	1 U	NA	5 UJ	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	1 U	1 U
trans-1,2-Dichloroethene	--	1 U	NA	5 UJ	5 U	5 U	1 U	**0.69 J**	**0.83 J**	**1.7**	**1.5 K**	**0.78 J**
Trichloroethene	5	**4.5**	**3.3**	**320**	**97**	**110**	**20**	**13**	**13**	**27**	**47 K**	**47**
Vinyl chloride	2	1 U	**0.16 J**	1 UJ	1 U	1 U	**5.4 J**	**19 J**	**19 J**	**31**	**9.1 K**	**3.5**
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	15	NA	NA	**1.4**	**0.6**	**0.17 J**	**0.18 J**	**0.19 J**	**0.18 J**	1 U	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	**279**	NA	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	**36.9 J**	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	**4,190**	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	1.9 B	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	**5.5 J**	NA	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	5.4 B	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	**4,320**	NA	NA	NA	NA	NA	NA	NA	NA
Lead	--	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	**5,880**	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	**261**	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	--	NA	NA	5.8 B	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	**2,790**	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**13,300**	**17,800**	**22,800**	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	0.8 B	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	**1,960**	NA	NA	**26,000**	**45,600**	**192,000**	**199,000**	**195,000**	**120,000**	**139,000**	**127,000**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	**79,400**	**55,500**	**32,400**	**24,800**	**25,300**	NA	NA	NA
Wet Chemistry												
Acetate	--	0.1 U	**0.033 J**	**0.85 J**	**42**	**140 L**	**210**	**190**	NA	NA	NA	NA
Alkalinity	--	**34**	**49.3**	**23**	**190**	**420**	**380**	**270**	NA	**157**	**120**	**85**
Butyrate	--	0.1 U	0.05 U	5 U	5 U	**45**	**22**	**2.8 J**	NA	NA	NA	NA
Carbon dioxide	--	**221 E**	**93**	**2.47**	**0.108**	**76.4**	**35.7**	**37.1**	NA	NA	NA	NA
Chemical oxygen demand	--	NA	NA	9.9 B	**98**	**590**	**500**	**590**	NA	NA	NA	NA
Chloride	--	**22**	**38.9**	**34**	**35**	**32**	**31**	**27.7**	NA	**28.9**	**24**	**30**
Ethane	--	0.00196 U	**5.10E-04 J**	**0.0017**	0.0013 U	0.0013 U	0.0013 U	**0.0013**	NA	NA	NA	NA

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW602S		04GW604D								
Sample ID		004GW602S-1014	004GW602S-1115	004GW604D-0909	004GW604D-0210	004GW604D-0510	004GW604D-0810	004GW604D-1210	004GW604DP-1210	004GW604D-1211	004GW604D-1212	004GW604D-1213
Sample Date		10/08/14	11/03/15	09/29/09	02/02/10	05/11/10	08/24/10	12/01/10	12/01/10	12/05/11	12/11/12	12/12/13
Chemical Name												
Ethene	--	0.00271 U	6.00E-04 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U	**0.0044**	NA	NA	NA	NA
Lactic Acid	--	0.2 U	NA	5 U	5 U	3 B	2 U	2 U	NA	NA	NA	NA
Methane	--	**4.87 D**	**5**	**0.003**	**0.0039**	**0.076**	**0.84**	**15**	NA	NA	NA	NA
Nitrate	--	0.21 U	**0.0531 J**	**0.46**	**0.01 J**	0.011 B	0.042 U	0.072 U	NA	**0.12 J**	0.21 U	0.21 U
Nitrite	--	0.07 U	0.05 U	0.13 U	0.13 U	**0.014 J**	**0.039 J**	**0.05 J**	NA	0.1 U	0.07 U	0.07 U
Propionate	--	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid	--	0.1 U	NA	5 U	**2.4 J**	**180**	**140**	**110**	NA	NA	NA	NA
Pyruvate	--	0.1 U	0.05 U	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	NA
Sulfate	--	NA	NA	**14**	**38**	**6.4**	**0.64 J**	1.4 B	NA	NA	NA	NA
Sulfide	--	1 U	1 U	0.03 UL	0.03 U	0.03 UL	0.03 U	0.03 U	NA	1 U	1 U	1 U
Total organic carbon (TOC)	--	**1**	**1.84**	10 U	**33**	**190**	**170**	**140**	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW604D				04GW604S						
Sample ID		004GW604DP-1213	004GW604D-1014	004GW604DP-1014	004GW604D-1115	004GW604S-0909	004GW604SP-0909	004GW604S-0210	004GW604S-0510	004GW604S-0810	004GW604S-1210	004GW604S-1211
Sample Date		12/12/13	10/09/14	10/09/14	11/04/15	09/29/09	09/29/09	02/02/10	05/11/10	08/23/10	12/01/10	12/05/11
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	**1.2 J**	1 U	1 U	**0.44 J**	1 UJ	1 UJ	1 U	1 U	1 U	1 U	**0.15 J**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	1 U	1 U	0.3 U
1,1,2-Trichloroethane	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	1 U	1 U	0.2 U
1,1-Dichloroethene	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	**0.78 J**	5 U	0.5 U	0.5 U	**0.17 J**
1,2-Dichloroethane	5	1 U	1 U	1 U	**0.61 J**	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	**0.19 J**
1,2-Dichloropropane	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	1 U	1 U	0.2 U
1,4-Dichlorobenzene	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	0.2 U
2-Butanone	--	12 UJ	12 UJ	12 UJ	NA	5 R	5 R	5 U	5 U	2.5 R	2.5 R	4 U
Acetone	--	12 U	12 U	12 U	NA	5 R	5 R	5 R	5 R	**660 L**	2.5 R	5 U
Benzene	--	**0.78 J**	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	**0.12 J**
Carbon disulfide	--	5 U	5 U	5 U	NA	5 UJ	5 UJ	5 U	5 U	**1.5 J**	0.5 U	0.5 U
Chlorobenzene	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	0.2 U
Chloroethane	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	0.3 U
Chloroform	--	1 U	1 U	1 U	NA	**0.51 J**	5 UJ	5 U	5 U	0.5 U	0.5 U	0.2 U
Chloromethane	--	1 U	1 UJ	1 UJ	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	0.3 U
cis-1,2-Dichloroethene	70	**26**	**10**	**11**	**8.5**	**29 J**	**26 J**	**15**	**18**	**16**	**42**	**23**
Methyl acetate	--	1 U	1 UJ	1 UJ	NA	5 UJ	5 UJ	5 U	5 U	1 U	**3.7 J**	0.5 U
Methylene chloride	--	5 U	5 U	5 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	1 U
Methyl-tert-butyl ether (MTBE)	--	1 U	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	0.2 U
Toluene	--	**1.3 J**	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	0.5 U	0.5 U	0.2 U
trans-1,2-Dichloroethene	--	**1.2 J**	1 U	1 U	NA	5 UJ	5 UJ	5 U	5 U	1 U	1 U	**0.17 J**
Trichloroethene	5	**58**	**36**	**34**	**29**	**63 J**	**56 J**	**43**	**22**	0.5 U	0.5 U	**0.51 J**
Vinyl chloride	2	**4.2**	**1.5 J**	**1.4 J**	**1.1**	1 UJ	1 UJ	**1.5**	1 U	1 U	**0.59 J**	**1.1**
Semivolatile Organic Compounds (UG/L)												
No Detections												
Explosives (UG/L)												
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	15	NA	NA	NA	NA	**0.33**	**0.32**	0.2 U	**0.1 J**	0.2 U	0.1 U	1 U
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	NA	**5,160 J**	145 B	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	NA	**46.8 J**	**36.5 J**	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	**0.34 J**	5 U	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	**2,950**	**2,650**	NA	NA	NA	NA	NA
Chromium	--	NA	NA	NA	NA	**80.5 J**	9.1 B	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	NA	**2.1 J**	50 U	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	NA	**15.1 J**	**8.3 J**	NA	NA	NA	NA	NA
Iron	11,000	NA	**128,000**	**125,000**	NA	**4,980 J**	**281 J**	NA	NA	NA	NA	NA
Lead	--	NA	NA	NA	NA	**2.4 J**	10 U	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	**4,430**	**4,350**	NA	NA	NA	NA	NA
Manganese	--	NA	**4,560**	**4,460**	NA	**46.4 J**	**32.6 J**	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	NA	**48.6 J**	8.4 B	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	**1,600**	**1,290**	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	**8,710**	**9,530**	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	**17.5 J**	0.37 B	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	**128,000**	**123,000**	**122,000**	NA	NA	NA	**39,300**	**22,000**	**46,000**	**67,500**	**66,400**
Manganese, Dissolved	--	NA	**4,190**	**4,320**	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	**8,760**	**6,390**	**7,140**	**10,400**	NA
Wet Chemistry												
Acetate	--	NA	NA	NA	NA	5 U	5 U	**14**	**24 L**	**80**	**90**	NA
Alkalinity	--	NA	**60**	NA	**59.5**	20 U	20 U	**120**	**66**	**130**	**100**	**87.7**
Butyrate	--	NA	NA	NA	NA	5 U	5 U	**4 J**	5 U	**3.4 J**	**1.6 J**	NA
Carbon dioxide	--	NA	**137 JD**	NA	**85**	**11.5**	**6**	**0.452**	**42.5**	**25.5**	**33.9**	NA
Chemical oxygen demand	--	NA	NA	NA	NA	19 B	9.4 B	**35**	**39**	**130**	**110**	NA
Chloride	--	NA	**31**	NA	**39.3**	**12**	**11**	**12**	**9.9**	**9.4**	**20.2**	**25**
Ethane	--	NA	**0.00905**	NA	**0.0093**	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	NA

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW604D				04GW604S						
Sample ID		004GW604DP-1213	004GW604D-1014	004GW604DP-1014	004GW604D-1115	004GW604S-0909	004GW604SP-0909	004GW604S-0210	004GW604S-0510	004GW604S-0810	004GW604S-1210	004GW604S-1211
Sample Date		12/12/13	10/09/14	10/09/14	11/04/15	09/29/09	09/29/09	02/02/10	05/11/10	08/23/10	12/01/10	12/05/11
Chemical Name												
Ethene	--	NA	**0.00345**	NA	**0.0016 J**	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U	0.0015 U	NA
Lactic Acid	--	NA	NA	NA	NA	5 U	5 U	5 U	5 U	2 U	2 U	NA
Methane	--	NA	**12.1 D**	NA	**15**	**8.20E-04**	**7.80E-04**	**0.0021**	**0.018**	**0.87**	**14**	NA
Nitrate	--	NA	0.21 U	NA	**0.0544 J**	**1.5**	**1.5**	**0.087 J**	0.11 B	**0.07 J**	0.072 U	**0.145 J**
Nitrite	--	NA	0.07 U	NA	0.05 U	0.13 U	0.13 U	0.13 U	0.13 U	0.042 U	**0.091 J**	0.1 U
Propionate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid	--	NA	NA	NA	NA	5 U	5 U	5 U	5 U	**5.2**	0.5 U	NA
Pyruvate	--	NA	NA	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U	NA
Sulfate	--	NA	**5.2**	NA	**7.8**	**10**	**10**	**1.4 J**	**6.3**	**4.4 J**	3.2 B	NA
Sulfide	--	NA	1 U	NA	1 U	0.03 UL	0.03 UL	0.03 U	0.03 UL	0.03 U	**0.082**	1 U
Total organic carbon (TOC)	--	NA	**3.8**	NA	**3.12**	10 U	10 U	**10 J**	**16**	**31**	**35**	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 04	04GW604S				46GW123D				46GW134			
Sample ID		004GW604S-1212	004GW604S-1213	004GW604S-1014	004GW604S-1115	046GW123D-1212	046GW123D-1213	046GW123D-1014	046GW123D-1115	46GW134-1111	46GW134P-1111	46GW134-0212	46GW134-0712
Sample Date		12/11/12	12/13/13	10/09/14	11/05/15	12/10/12	12/11/13	10/07/14	11/05/15	11/30/11	11/30/11	02/28/12	07/27/12
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,2,2-Tetrachloroethane	2.4	1 U	1 U	1 U	0.2 U	**2.9 K**	**2**	**2.7 K**	**1.1**	**1.5**	**1.5**	**1.5**	**1.3 J**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	--	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	NA	NA	NA	NA
1,1-Dichloroethene	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
1,2-Dichloroethane	5	1 U	1 U	1 U	0.2 U	**0.65 K**	1 U	1 U	**0.19 J**	**0.3 J**	**0.28 J**	**0.28 J**	1 U
1,2-Dichloropropane	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
2-Butanone	--	12 U	12 UJ	12 UJ	NA	12 U	12 UJ	12 U	NA	NA	NA	NA	NA
Acetone	--	12 U	12 U	12 U	NA	12 U	12 U	6.7 B	NA	NA	NA	NA	NA
Benzene	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	0.2 U	0.2 U	**0.1 J**	1 U
Carbon disulfide	--	5 U	5 U	5 U	NA	5 U	5 U	5 UL	NA	NA	NA	NA	NA
Chlorobenzene	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
Chloroethane	--	1 U	1 U	1 U	NA	1 U	1 U	1 UJ	NA	NA	NA	NA	1 U
Chloroform	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
Chloromethane	--	1 U	1 U	1 UJ	NA	1 U	1 U	1 U	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	70	**8.2 K**	**4.6**	1 U	**0.41 J**	**13 K**	**8.8**	**6.2 L**	**5.8**	**7.5**	**7.6**	**6.7**	**6**
Methyl acetate	--	1 U	1 U	1 UJ	NA	1 U	1 U	1 UJ	NA	NA	NA	NA	NA
Methylene chloride	--	5 U	5 U	5 U	NA	5 U	5 U	8.9 B	NA	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	--	1 U	1 U	1 U	NA	1 U	1 U	1 UJ	NA	NA	NA	NA	NA
Toluene	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	0.2 U	0.2 U	0.3 B	1 U
trans-1,2-Dichloroethene	--	1 U	1 U	1 U	NA	1 U	1 U	1 UL	NA	NA	NA	NA	NA
Trichloroethene	5	**11 K**	**8.1**	1 U	**0.85 J**	**93 K**	**47**	**46 L**	**38**	**38**	**39**	**37**	**35**
Vinyl chloride	2	1 U	1 U	1 U	0.2 U	1 U	1 U	1 U	**0.13 J**	**0.29 J**	**0.29 J**	**0.22 J**	1 U
Semivolatile Organic Compounds (UG/L)													
No Detections													
Explosives (UG/L)													
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.245 J**
Perchlorate	15	NA	NA	NA	NA	NA	NA	NA	NA	1 U	1.76 B	**1.22 J**	**1.5**
Total Metals (UG/L)													
Aluminum	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	**12,000**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	**153**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	**6,040**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)													
Iron, Dissolved	11,000	**60,200**	**47,100**	**12,200**	NA	64.5 B	256 B	**26.4 K**	NA	40 U	42.7 B	40 U	24.7 B
Manganese, Dissolved	--	NA	NA	152 B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry													
Acetate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity	--	**55**	**49**	**40**	**13.4**	**19**	**28**	**26**	**27.8**	NA	NA	NA	NA
Butyrate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide	--	NA	NA	**107 JD**	**150**	NA	NA	NA	NA	NA	NA	NA	NA
Chemical oxygen demand	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	--	**28**	**36**	**6.8**	**11.4**	**15**	**17**	**13**	**20.1**	NA	NA	NA	NA
Ethane	--	NA	NA	0.00196 U	6.40E-04 U	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	04GW604S				46GW123D				46GW134			
Sample ID		004GW604S-1212	004GW604S-1213	004GW604S-1014	004GW604S-1115	046GW123D-1212	046GW123D-1213	046GW123D-1014	046GW123D-1115	46GW134-1111	46GW134P-1111	46GW134-0212	46GW134-0712
Sample Date		12/11/12	12/13/13	10/09/14	11/05/15	12/10/12	12/11/13	10/07/14	11/05/15	11/30/11	11/30/11	02/28/12	07/27/12
Chemical Name													
Ethene	--	NA	NA	0.00271 U	6.00E-04 U	NA	NA	NA	NA	NA	NA	NA	NA
Lactic Acid	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane	--	NA	NA	**6.36 D**	**4.2**	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	--	0.21 U	0.21 U	0.21 U	**0.0642 J**	**0.31 J**	**0.29 J**	**0.55 J**	**0.396**	NA	NA	NA	NA
Nitrite	--	0.07 U	0.07 U	0.07 U	0.05 U	0.07 U	**0.037 J**	0.07 U	0.05 U	NA	NA	NA	NA
Propionate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	--	NA	NA	**14**	**17.4**	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	NA
Total organic carbon (TOC)	--	NA	NA	**1.5**	**1.59**	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	46GW134					46GW219		
Sample ID		046GW134-1212	046GW134-1213	046GW134P-1213	046GW134-1014	046GW134-1115	046GW219-1212	046GW219-1213	046GW219-1014
Sample Date		12/10/12	12/09/13	12/09/13	10/07/14	11/05/15	12/11/12	12/11/13	10/08/14
Chemical Name									
Volatile Organic Compounds (UG/L)									
1,1,2,2-Tetrachloroethane	2.4	**1.2 K**	**0.8 J**	**0.65 J**	1 U	**0.32 J**	**26 K**	**16**	**20**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	--	1 U	1 U	1 U	1 U	NA	**3 K**	5 U	5 U
1,1,2-Trichloroethane	--	1 U	1 U	1 U	1 U	NA	**1.1 K**	5 U	5 U
1,1-Dichloroethene	--	1 U	1 U	1 U	1 U	NA	**3.6 K**	5 U	5 U
1,2-Dichloroethane	5	1 U	1 U	1 U	1 U	**0.19 J**	**2.6 K**	5 U	5 U
1,2-Dichloropropane	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
1,4-Dichlorobenzene	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
2-Butanone	--	12 U	12 UJ	12 UJ	12 U	NA	12 U	62 UJ	62 UJ
Acetone	--	12 U	12 U	12 U	9.7 B	NA	12 U	62 U	62 U
Benzene	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
Carbon disulfide	--	5 U	5 U	5 U	5 U	NA	5 U	25 U	25 U
Chlorobenzene	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
Chloroethane	--	1 U	1 U	1 U	1 UJ	NA	1 U	5 U	5 U
Chloroform	--	1 U	1 U	1 U	1 U	NA	**1.6 K**	5 U	5 U
Chloromethane	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
cis-1,2-Dichloroethene	70	**6.2 K**	**4.1**	**4.2**	**3.6**	**4.2**	**110 K**	**63**	**78**
Methyl acetate	--	1 U	1 U	1 U	1 UJ	NA	1 U	5 U	5 U
Methylene chloride	--	5 U	5 U	5 U	5.7 B	NA	5 U	25 U	25 U
Methyl-tert-butyl ether (MTBE)	--	1 U	1 U	1 U	1 UJ	NA	1 U	5 U	5 U
Toluene	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
trans-1,2-Dichloroethene	--	1 U	1 U	1 U	1 U	NA	1 U	5 U	5 U
Trichloroethene	5	**42 K**	**25**	**24**	**20**	**18**	**800 K**	**300**	**550**
Vinyl chloride	2	1 U	1 U	1 U	1 U	**0.21 J**	**0.97 K**	5 U	5 U
Semivolatile Organic Compounds (UG/L)									
No Detections									
Explosives (UG/L)									
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA
Perchlorate	15	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)									
Aluminum	--	NA	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	**2,230**
Lead	--	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	NA	NA	**233**
Nickel	--	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)									
Iron, Dissolved	11,000	43.4 B	**159**	**123**	**24.1 J**	NA	**4,140**	**3,200**	**2,420**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**224**
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry									
Acetate	--	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity	--	**76**	**88**	NA	**86**	**96.9**	**18**	**16**	**14**
Butyrate	--	NA	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide	--	NA	NA	NA	NA	NA	NA	NA	**170**
Chemical oxygen demand	--	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	--	**16**	**19**	NA	**18**	**23.9**	**22**	**25**	**25**
Ethane	--	NA	NA	NA	NA	NA	NA	NA	0.00196 U

TABLE 4-6.

Historical Constituents Detected in Groundwater at Site 4 - 300 Series

Third Five-Year Review Report

Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 04**	46GW134					46GW219		
Sample ID		046GW134-1212	046GW134-1213	046GW134P-1213	046GW134-1014	046GW134-1115	046GW219-1212	046GW219-1213	046GW219-1014
Sample Date		12/10/12	12/09/13	12/09/13	10/07/14	11/05/15	12/11/12	12/11/13	10/08/14
Chemical Name									
Ethene	--	NA	NA	NA	NA	NA	NA	NA	0.00271 U
Lactic Acid	--	NA	NA	NA	NA	NA	NA	NA	NA
Methane	--	NA	NA	NA	NA	NA	NA	NA	**0.71 D**
Nitrate	--	**0.19 J**	**0.21 J**	NA	**0.33 J**	**0.131**	**0.15 J**	**0.12 J**	**0.1 J**
Nitrite	--	0.07 U	0.07 U	NA	0.07 U	0.05 U	0.07 U	0.07 U	0.07 U
Propionate	--	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid	--	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate	--	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	--	NA	NA	NA	NA	NA	NA	NA	**29**
Sulfide	--	1 U	1 U	NA	1 U	1 U	1 U	**0.46 J**	1 U
Total organic carbon (TOC)	--	NA	NA	NA	NA	NA	NA	NA	**1**

Notes:

Shading indicates exceedance of Site 04 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

E - Concentration exceeds calibration range of GC/MS instrument (Organic) OR Value is estimated due to matrix interferences (Inorganic)

J - Estimated

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

UG/L - Micrograms per liter

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 4-1 - Site 4 Map - 11X17.mxd9/22/2016CGauthier_ch2mhillen

04GW202
04GW201
04GW10
04GW49D
04GW11A
04GW11
04GW101
04GW401
04GW301
04GW49S
04GW103
04GW48
04GW203
04GW15
04GW109
04GW12
Source Area Injection Wells
04GW414
04GW413
04GW52
04GW13
04GW415
04GW403
04GW402
04GW102
04GW404
04GW105
04GW50
04GW302
04GW104
04GW106
04GW110
04GW79
100 Series Injection Wells
04GW406
04GW407
Site 13
04GW400
04GW410
04GW51S
04GW107
04GW408
04GW411
04GW412
04GW81D
04GW82
04GW405
04GW100
200 Series Injection Wells
04GW80
04GW81S
04GW409
04GW502S
04GW200
04GW501D
Site 7
04GW108
04GW501S
04GW502D
04GW503S
04GW503D
04GW504D
04GW504S
Coffman Road
300 Series Injection Wells
04GW603D
04GW603S
04GW602D
04GW602S
04GW604D
04GW604S
04GW601D
04GW601S
Site 4/46
46GW126
46GW128
U.S. Army Adelphi Laboratory Center Property
46GW219
46GW134
46GW123D

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- 2015 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- Site Boundary
- Former NSWC - White Oak Facility Boundary

N

0 100 200 Feet

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

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R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 4-2 - Site 4 GW Potentiometric Surface Map.mxd10/12/2016CGauthier_ch2mhillen

04GW202
04GW201
04GW203
250.06
04GW49D
04GW11A
04GW11
04GW10
04GW101
04GW401
04GW49S
04GW301
294.76
04GW15
Source Area Injection Wells
04GW109
04GW48
04GW12
04GW103
04GW102
04GW413
250.29
04GW52
04GW414
250.5
04GW403
248.08
04GW402
249.62
04GW404
248.47
248
04GW104
04GW13
04GW105
04GW50
04GW302
04GW408
246.84
04GW106
04GW110
04GW415
251.34
04GW79
100 Series Injection Wells
04GW406
04GW407
246.89
04GW400
246.55
04GW51S
04GW410
04GW107
04GW405
246.93
04GW409
246.75
04GW411
04GW81D
04GW82
04GW412
246.6
04GW100
200 Series Injection Wells
04GW80
04GW81S
04GW200
04GW501D*
245.55
04GW108
04GW501S
245.56
04GW503S
245.46
04GW502D*
245.51
244
04GW502S
245.5
04GW503D*
245.46
04GW603D*
239.91
04GW504S
245.33
300 Series Injection Wells
04GW504D*
245.29
04GW602D*
238.96
04GW602S
239.77
Coffman Road
04GW601D*
239.62
240
04GW603S
240.25
04GW604S
239.92
04GW604D*
237.96
46GW126
46GW128
U.S. Army Adelphi Laboratory Center Property
236
46GW219
232
228
224
46GW134
220.99
46GW123D*
220.03

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
220.03 Groundwater Elevation above mean sea level

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- 2015 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

N

0 100 200 Feet

Figure 4-2
Site 4 Potentiometric Surface Map and LTM Locations – November 2, 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

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\\brookside\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\WhiteOak\MapFiles\678268_Third_FYR\Figure 4-3 - Site 4 TCE_Plume.mxd3/28/2017CBOWMAN

TCE (µg/L)		
Well	Baseline	2015 LTM
04GW50	11 B	NS
04GW203	ND	NS
04GW301	33	0.38 J
04GW400	1.8 B	NS
04GW402	1.8 B	0.13 J
04GW403	2.5 J	ND
04GW404	2.3 B	NS
04GW405	1.8 J	1.1
04GW407	2,600	4
04GW408	5.7 B	NS
04GW409	16	0.22 J
04GW412	430	5.8
04GW413	19,000	1.9
04GW414	12	ND
04GW415	NS	ND
04GW501D	27	NS
04GW501S	5.8	NS
04GW502D	1,100	26
04GW502S	ND	NS
04GW503D	630	34
04GW503S	15	NS
04GW504D	570	800
04GW504S	180	NS
04GW601D	ND	42
04GW601S	47 J	NS
04GW602D	250	12
04GW602S	71	3.3
04GW603D	9.3 J	NS
04GW603S	ND	NS
04GW604D	320	29
04GW604S	63 J	0.85 J
46GW123D	NA	38
46GW134	NA	18
46GW219	NA	550*

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

Value below each monitoring well ID refers to the concentration of TCE 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.

*Monitoring well 46GW219 was not sampled in 2015, therefore, the 2014 results are shown

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

Legend

- 2015 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- Site Boundary
- Former NSWC - White Oak Facility Boundary

TCE Plume Boundaries

- 2015 above PRG (5 µg/L)
- Baseline above PRG (5 µg/L)

N

0 100 200 Feet

Figure 4-3
Site 4 TCE Plume Boundary - November 2, 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

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SECTION 5

Site 5/13 – Open Burn Area and Oil Sludge Disposal Area

5.1 Site Chronology

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

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

Date	Key Events and Milestones
1984	Both Sites 5 and 13 were identified as IRP sites during NEESA IAS.
1990	An RFA was conducted at NSWC White Oak by Kearney/Centaur Division. 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	Malcolm-Pirnie completed an RFA review for the Navy that evaluated the applicability of the general recommendations of the RFA to each individual SWMU. Site 5 and 13 were identified as sites of low to moderate priority based upon potential risk.
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.
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.
2003	An RFI was conducted on the soil at Sites 5 and 13 in 2003. The RFI concluded that there were no risks presented by the Site 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, 2003a). The FS included the evaluation of remedial alternatives for Site 13 groundwater.
August 2004	CH2M conducted a baseline groundwater sampling event prior to the RA.
September 30, 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 and monitored natural attenuation with ICs; the selected remedy for Site 5 and 13 soil is NFA.
January-February 2005	Shaw and ARS Technologies, Inc. completed pneumatic fracturing of saprolite and liquid atomized injection of zero-valent iron (ZVI).
February 2005	CH2M performed 5-day post-injection sampling event.
March 2005	CH2M performed 1-month post-injection sampling event.
May 2005	CH2M performed 3-month post-injection sampling event.
August 2005	CH2M performed 6-month post-injection sampling event.
November 2005	CH2M performed 9-month post-injection sampling event.
February 2006	CH2M performed 1-year post-injection sampling event.
October 2006	Shaw installed monitoring wells 13GW300 and 13GW301 within the target remediation zone.
April 2007	CH2M performed 2-year post-injection sampling event.
August 2009	CH2M performed 4-year post-injection sampling event.

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

Date	Key Events and Milestones
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.
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, 2008a).
October-November 2010	CH2M performed 2010 annual LTM sampling for Site 13 and 3-month post-injection performance monitoring for Off-Site 13.
January-February 2011	CH2M performed 2010 annual LTM for Site 13 and 6-month post-injection performance monitoring for Off-Site 13.
April 2011	CH2M performed 9-month post reinjection sampling event for Off-Site 13.
July 2011	CH2M performed 12-month post reinjection sampling event for Off-Site 13.
January 2012	CH2M performed groundwater sampling event for Off-Site 13.
October 2012	CH2M performed annual LTM monitoring for Site 13 and Off-Site 13.
October 2013	CH2M performed annual LTM monitoring for Site 13 and Off-Site 13.
October 2014	CH2M performed annual LTM monitoring for Site 13 and Off-Site 13.
November 2015	CH2M performed annual LTM monitoring for Site 13 and Off-Site 13.

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.

Site 13 is located in the northeastern portion of Former NSWC-White Oak (**Figure 1-2**), along the northern property line between Coffman Road and the Northern Perimeter Road (**Figure 5-1**). The area occupied by Site 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 owned by Percontee, Inc., (Percontee). Percontee historically used its site as a sand and gravel quarry. The property owned by Percontee 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 (Department of the Navy, 1984). A RCRA Facility Assessment (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. Site 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 COCs at Site 5 in soil were PAHs and inorganics (copper, lead, and selenium). The COCs 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 was investigated during the RFI that was conducted in 2002. The results of this investigation indicated that the soil at Site 5 did not pose a risk to potential receptors.

At Site 13, the surface and subsurface soils were found to contain PAHs during the Site Screening Investigation. Additionally, the soil at Site 13 was the focus of additional investigation as part of the 2002 RFI. The RFI sampling and geophysical survey did find elevated concentrations of a few PAHs and metals; however, it 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, 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 separate from Site 4 and 46 and delineated the extent of contamination migrating northwestward from Site 13 onto the property owned by Percontee.

The ROD for soil and groundwater at Sites 5 and 13 was signed in September 2004 (NAVFAC, 2004b). The remedy 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.

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 are provided in **Table 5-2**. The PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs, and the updated values are also presented in **Table 5-2** (CH2M, 2010).

Table 5-2. PRGs for COCs for Sites 5 and 13 Groundwater

COC	Sites 5 and 13 Groundwater PRGs – 2004 ROD (µg/L)	Basis	Updated Groundwater PRG* (µg/L)
1,1,2,2-PCA	3	RB	2.4
PCE	5	MCL	5
TCE	5	MCL	5
cis-1,2-DCE	70	MCL	70
VC	2	MCL	2
RDX (Site 5)	6	RB	6
Iron (dissolved)	4,600	RB	11,000

Notes:

MCL – PRG is the maximum contaminant level drinking water standard

RB – PRG is a site-specific risk-based standard calculated using guidance developed by USEPA Region 3.

* *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland.* October. (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 northeast 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 immediately adjacent to Site 13 to the northwest, west and southwest drops steeply at a grade of approximately 33 percent 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 (**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 surrounding the field to the east, west and south is wooded property owned by the U.S. Government. The property bounding the site to the north is an industrial property owned by Percontee, which historically operated as a sand and gravel quarry. The land overlying the groundwater contaminant plume originating in the Site 13 area and extending west and northwest to West Farm Branch consists of federal land owned by GSA and private property historically operated as a sand and gravel quarry.

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.

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 at this time 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.

5.2.4 History of Contamination

The Sites 5 and 13 groundwater contamination is centered in the area between the historically recognized area of Site 13 and the northern property line of the White Oak facility. The practices that led to this 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 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

During the most recent round of groundwater sampling in November 2015, selected monitoring wells were sampled for select VOCs, explosives, dissolved iron, and natural attenuation parameters including TOC, alkalinity, dissolved gases (methane, ethane, ethene), carbon dioxide, chemical oxygen demand, 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; no COCs 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 were identified as COCs through the leaching-to-groundwater scenario. 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, site-specific risks were estimated for combined Sites 5 and 13 groundwater 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 is assumed the risks from Sites 5 and 13 will be less than those from the entire OU1 area. Also, it is 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. The 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 compounds found in the groundwater at Sites 5 and 13 at concentrations that do not exceed Basewide background levels were excluded as COPCs for Sites 5 and 13 based on the background comparison conducted in the OU1 RI. 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 (dissolved) (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 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; the original PRGs are shown in **Table 5-2**. These PRGs were re-calculated in 2010 for each of the COCs identified for the Site 13 groundwater, based on updated toxicity values, most recent 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 the calculated risk-based PRG for chemicals that do not have MCLs. The revised PRGs are also listed in **Table 5-2**.

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:

- lnstallation of additional wells to define treatment area and establish a groundwater monitoring network
- Performance of a source area pilot test (if necessary)
- lnstallation of injection wells
- Pneumatic fracturing of the saprolite to enhance ZVI distribution
- lnjection of ZVI in the Site 13 target remediation zone
- Groundwater monitoring of baseline and post-injection conditions
- Preparation of annual technical memoranda and 5-year report
- 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^{SM}) 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 5-2**). 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, 2010e).

5.3.3.2 Long-term Monitoring

In accordance with the Final LTM Plan for Sites 5 and 13 Groundwater (AGVIQ/CH2M, 2010e), groundwater sampling has been performed in approximate 12-month intervals since 2012 in order to assess the effectiveness of the RA, and includes assessing the effectiveness of the ZVI injections and the achievement of PRGs, as well as evaluating the need to optimize the LTM approach or to discontinue LTM.

The analytical results from the most recent Site 13 LTM groundwater sampling event conducted in November 2015 are provided in **Table 5-3** and are summarized as follows.

Select VOCs (1,1,2,2-PCA, cis-1,2-DCE, PCE, TCE, and VC) were analyzed in the groundwater of six monitoring wells at Site 13 (05GW01, 13GW01, 13GW04, 13GW204, 13GW206, and 13GW300).

- 1,1,2,2-PCA was detected in groundwater samples from three monitoring wells (13GW01, 13GW204, and 13GW300). Detected concentrations ranged from 1.7 µg/L (13GW204) to 180 µg/L (13GW300). Detections at two monitoring wells (13GW01 and 13GW300) exceeded the PRG (2.4 µg/L).
- PCE was detected in groundwater samples from five monitoring wells (05GW01, 13GW01, 13GW04, 13GW204, and 13GW300). Detected concentrations ranged from 0.3 µg/L (13GW204) to 25 µg/L (13GW01). Detections at 13GW01 and 13GW300 exceeded the PRG (5 µg/L) with concentrations of 25 µg/L and 9.9 µg/L, respectively.
- TCE was detected in groundwater samples from all six monitoring wells analyzed for VOCs. Detected concentrations ranged from 1.4 µg/L (05GW01 and 13GW204) to 200 µg/L (13GW01). Detections at 13GW01, 13GW04, and 13GW300 exceeded the PRG (5 µg/L) with concentrations of 200 µg/L, 7.2 µg/L, and 89 µg/L, respectively.
- Cis-1,2-DCE was detected in groundwater samples from all six monitoring wells analyzed for VOCs. Detected concentrations ranged from 0.28 µg/L (05GW01) to 400 µg/L (13GW01). Detections at four locations (13GW01, 13GW04, 13GW206, and 13GW300) exceeded the PRG (70 µg/L).
- VC was detected in groundwater samples from all monitoring wells except 05GW01. Detected concentrations ranged from 1.4 µg/L (13GW04) to 24 µg/L (13GW300). Detections at 13GW01, 13GW206, and 13GW300 exceeded the PRG (2 µg/L) with concentrations of 11 µg/L, 8.7 µg/L, and 24 µg/L, respectively.

RDX was analyzed in a groundwater sample from one monitoring well, 05GW01. RDX was detected below the PRG (6 µg/L) at a concentration of 3.1 µg/L. RDX concentrations have been below the PRG for three rounds of sampling.

At Site 13, groundwater was analyzed for dissolved iron at three monitoring well locations (05GW01, 13GW204, and 13GW205). Dissolved iron was detected at concentrations of 175 µg/L (05GW01), 9,690 µg/L (13GW204) and 7,830 µg/L (13GW205) and were below the PRG (11,000 µg/L).

Select VOCs (1,1,2,2-PCA, cis-1,2-DCE, PCE, TCE, and VC) were collected from the groundwater at two of the three Off-Site 13 monitoring wells (13GW303 and 13GW304).

- 1,1,2,2-PCA was detected in groundwater samples from both monitoring wells analyzed for VOCs at concentrations of 19 µg/L (13GW303) and 5.9 µg/L (13GW304). Both detections exceeded the PRG (2.4 µg/L).
- PCE was detected in groundwater samples from both monitoring wells analyzed for VOCs at concentrations of 6.1 µg/L (13GW303) and 3.4 µg/L (13GW304). The detected concentration from 13GW303 exceeded the PRG (5 µg/L).

- TCE was detected in groundwater samples from both monitoring wells analyzed for VOCs at concentrations of 15 µg/L (13GW303) and 16 µg/L (13GW304). Both detected concentrations exceeded the PRG (5 µg/L).
- Cis-1,2-DCE was detected in groundwater samples from both monitoring wells analyzed for VOCs at concentrations of 32 µg/L (13GW303) and 28 µg/L (13GW304). Both detected concentrations were below the PRG (70 µg/L).
- VC was reported as detected in groundwater samples from both monitoring wells analyzed for VOCs at estimated concentrations of 0.59 µg/L (13GW303) and 0.73 µg/L (13GW304). Neither detection exceeded the PRG (2 µg/L).

Dissolved iron was analyzed in one monitoring well (13GW302) at Off-Site 13, and was detected at a concentration of 47,800 µg/L. This detection exceeded the PRG of 11,000 µg/L.

At Site 5, RDX was analyzed in a groundwater sample from one monitoring well, 05GW01. RDX was detected below the PRG (6 µg/L) at a concentration of 3.1 µg/L. RDX concentrations have been below the PRG for three rounds of sampling.

5.3.3.3 Operation and Maintenance

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

5.3.3.4 Institutional Control Summary

ICs at Sites 5 and 13 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 (shown on Figure 2-11 in the Sites 5 and 13 ROD [NAVFAC, 2004b]) 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.

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

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 5-4 and 5-5**).

Table 5-4. Protectiveness Determination/Statement from the 2012 Five-Year Review – Sites 5 and 13

Protectiveness Determination	Protectiveness Statement
Protective	The remedies for the Site 5 Open Burn Area and Site 13 Oil Sludge Disposal Area are protective of human health and ecological receptors based on achieving the RAOs specified in the RODs. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. MNA and Five-Year Reviews help to ensure that the RAs are functioning as intended and that an overall reduction in groundwater contamination is being achieved.

Table 5-5. Status of Recommendations from the 2012 Five-Year Review – Sites 5 and 13

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
No Issues	LTM should continue per the existing LTM plan.	Ongoing	LTM has continued annually at Sites 5 and 13 per the LTM plan (AGVIQ/CH2M, 2010e)	October 2012 October 2013 October 2014 November 2015

5.5 Five-Year Review Process

5.5.1 Document Review

Table 5-6 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 section is provided in the References section.

Table 5-6. Summary of the Sites 5 and 13 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	1999
Final Remedial Investigation of Operable Unit 1	CH2M	2002
RCRA Facility Investigation for Sites 5 and 13	NAVFAC	2003
ROD for Sites 5 and 13 Soil and Groundwater	NAVFAC	2004
NSWC-White Oak First Five-Year Review	JM Waller Associates	2007
Land Use Control Remedial Design for Groundwater in the Offsite Portion of Site 13	CH2M	2008
Final Long-Term Monitoring Plan for Site 13 Groundwater	AGVIQ/CH2M	2010
Former NSWC-White Oak Second Five-Year Review	Tetra Tech	2012
Final Basewide Long-Term Monitoring Report – 2015, Former NSWC-White Oak	CH2M	2017
Final Land Use Control Remedial Design for Site 5 and 13 Groundwater (onsite)	CH2M	2017

5.5.2 Data Review and Evaluation

LTM is being conducted for groundwater at Site 13 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. The Site 13 historical LTM groundwater analytical data collected from 2004 through November 2015 are provided in **Table 5-3,** and trend graphs presenting VOC COC and dissolved iron results for select monitoring wells at Site 13 and Off-Site 13 are provided in **Appendix C-3.1** and **C-3.2**, respectively.

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. 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, 2017a). The ZVI injections previously completed as a component of the groundwater RA for Site 13 appear to have been particularly effective in the Off-Site 13 areas directly impacted by the injections, as demonstrated by decreased concentrations of contaminants in the key wells. However, the concentrations of contaminants at 13GW01 (onsite) appear to be increasing, suggesting decreased impact from the initial ZVI injections and/or migration of contaminants from untreated areas.

Additionally, the current horizontal and vertical extent of VOC contaminant plumes in groundwater are not delineated (**Figures 5-3, 5-4,** and **5-5**). An additional groundwater screening investigation at Site 13 and Off-Site 13

will be conducted in the fall of 2016 to address these data gaps and determine if ZVI remains a feasible option for RA to address offsite plume migration and to develop a plan for further remediation (CH2M, 2016c).

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, LUCs, and LTM, has been implemented and is functioning as intended by reducing contaminant concentrations and restricting exposure to contaminants by human and ecological receptors. However, the current horizontal and vertical extent of VOC contaminant plumes in groundwater has not been fully delineated. An additional groundwater screening investigation at Site 13 and Off-Site 13 will be conducted to address these data gaps and determine if ZVI remains a feasible option for RA to address offsite plume migration and to develop a plan for further remediation (CH2M, 2016c).

The selected remedy for Site 5 and 13 soil is NFA. A removal action was conducted for the soil in 2000 and a risk assessment conducted on post-removal action verification sample results concluded that no unacceptable risks remain at the site soil for any exposure scenario, including a residential use scenario. Further, the soil remaining at the site does not contain contaminants at concentrations that would represent a continuing source of groundwater contamination (NAVFAC, 2004b).

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 some of the Site 13 and Off-Site 13 sampling locations. Additionally, RDX has not been detected above the PRG for three consecutive sampling events. The ZVI injections previously completed as a component of the groundwater RA for Site 13 appear to have been particularly effective in the Off-Site 13 areas directly impacted by the injections, as demonstrated by decreased concentrations of contaminants in the key wells (monitoring wells 13GW302, 13GW303, and 13GW304). However, the concentrations of contaminants at 13GW01 appear to be increasing, suggesting decreased impact from the 2010 ZVI injections and/or migration of contaminants from untreated areas.

No further action was required for soil (NAVFAC, 2004b).

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.

As described in the ROD for Sites 5 and 13 soil, the selected remedy for Sites 5 and 13 soil is NFA; ICs are not required for this medium (NAVFAC, 2004b).

5.6.1.3 Opportunities for Optimization

After the last Five-Year Review, CH2M recommended and implemented several changes to the LTM program for Sites 5 and 13. These changes are summarized in **Table 5-7**.

Table 5-7. Sites 5 and 13 Groundwater Optimization

Sampling Event	Groundwater Optimization
October 2013	Based on Decision Rule 2A: • Eliminate monitoring of wells 04GW110, 13GW202, and 13GW301. Based on Decision Rule 2B: • Eliminate dissolved iron analysis for 13GW303.

Table 5-7. Sites 5 and 13 Groundwater Optimization

Sampling Event	Groundwater Optimization
October 2014	Based on Decision Rule 2A: • Discontinue the monitoring of well 13GW202. Based on Decision Rule 2B: • Eliminate VOCs for 13GW302 and eliminate dissolved iron analysis for 13GW304.
November 2015	Based on Decision Rule 2A: • Discontinue the monitoring of well 05GW01.

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

Since land use is not anticipated to change, 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 per *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2010) and presented in **Table 5-2**. 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 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 changes to the cleanup levels for the three COCs without an MCL (1,1,2,2-PCA, RDX, and iron). 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. However, the current horizontal and vertical extent of VOC contaminant plumes in groundwater should be delineated once again following the first two RAs. (**Figures 5-3, 5-4,** and **5-5**). Additional groundwater screening at Site 13 and Off-Site 13 will be conducted to redefine the horizontal and vertical extent following the previous injections and to determine if data gaps exist and whether ZVI remains a feasible option for RA to address offsite plume migration and to develop a plan for further remediation (CH2M, 2016c).

5.7 Issues, Recommendations, and Follow-up Actions

Based on the information presented as answers to questions A–C above, the remedies for Sites 5 and 13 are still functioning as intended. Based on evaluation of the 2015 LTM data, the following recommendations are provided for the RA for Sites 5 and 13 groundwater:

- 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.
- Groundwater sampling should continue on an annual basis. Groundwater optimization should continue to occur based on the decision rules provided in the Site 13 LTM Plan (AGVIQ/CH2M, 2010e).

Monitoring of well 05GW01 be discontinued since contaminant concentrations in this monitoring well are reduced below PRGs and remained below PRGs for two sampling rounds (Decision Rule 2B in the LTM Plan for Site 13 and Off-Site 13 Groundwater [AGVIQ/CH2M, 2010e]).

It is recommended that LUC inspections of Off-Site 13 and On-Site 13 be conducted at least once a year, and that documentation of these inspections be included in an annual LUC Inspection Report in accordance with the Off-Site 13 and On-Site 13 LUC RDs (CH2M, 2008b). A summary of the annual LUC Inspection Reports should be

included in the next Five-Year Review. In addition, further characterization and evaluation of Site 13 and Off-Site 13 groundwater should be conducted to optimize additional remedial activities.

5.8 Protectiveness Statement

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
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	05GW01										
Sample ID		005GW0010804	005GW0010805	005GW9010805	005GW001-0206	005GW901-0206	005GW0010407	005GW001-0809	005GW001P-0809	005GW01-1110	005GW01P-1110	005GW01-0711
Sample Date		08/04/04	08/24/05	08/24/05	02/16/06	02/16/06	04/04/07	08/14/09	08/14/09	11/09/10	11/09/10	07/27/11
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylene, total	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (UG/L)												
2-Amino-4,6-dinitrotoluene	--	2 U	**0.22**	**0.25 J**	0.16 U	0.16 U	0.2 UL	**0.13 J**	**0.13 J**	0.12 U	0.12 U	0.12 U
HMX	--	**48**	**29**	**25**	**31**	**32**	**24 L**	**19 J**	**22 J**	**19**	**18**	**20**
RDX	6	**63**	**33**	**31**	**39**	**37**	**27 L**	**12**	**14**	**13**	**13**	**14**
Total Metals (UG/L)												
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lactic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	05GW01										
Sample ID		005GW0010804	005GW0010805	005GW9010805	005GW001-0206	005GW901-0206	005GW0010407	005GW001-0809	005GW001P-0809	005GW01-1110	005GW01P-1110	005GW01-0711
Sample Date		08/04/04	08/24/05	08/24/05	02/16/06	02/16/06	04/04/07	08/14/09	08/14/09	11/09/10	11/09/10	07/27/11
Chemical Name												
Methane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	05GW01								13GW01			
Sample ID		005GW01P-0711	05GW01-1012	05GW01-1013	05GW01P-1013	05GW01-1014	05GW01P-1014	05GW01-1115	05GW01P-1115	013GW0010804	13GW0010205	013GW0010305	013GW0010505
Sample Date		07/27/11	10/17/12	10/22/13	10/22/13	10/20/14	10/20/14	11/12/15	11/12/15	08/04/04	02/17/05	03/10/05	05/09/05
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,2,2-Tetrachloroethane	2.4	NA	**1.7 J**	1 U	1 U	1 U	1 U	0.2 U	0.2 U	**74**	**97**	**170**	**79**
1,1,2-Trichloroethane	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	5 U	10 U	10 U	10 U
1,1-Dichloroethane	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	5 U	10 U	10 U	10 U
1,1-Dichloroethene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	5 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 UJ	10 U
1,2-Dichlorobenzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
1,2-Dichloroethane	--	NA	1 UL	1 U	1 U	1 U	1 U	NA	NA	5 U	10 U	10 U	10 U
1,2-Dichloropropane	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
1,3-Dichlorobenzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
1,4-Dichlorobenzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
2-Butanone	--	NA	12 U	12 U	12 U	12 U	12 U	NA	NA	NA	10 U	10 U	10 U
2-Hexanone	--	NA	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	NA	NA	NA	10 U	10 U	10 U
Acetone	--	NA	12 U	12 U	12 U	12 UJ	12 UJ	NA	NA	NA	10 U	10 UJ	10 U
Benzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
Carbon disulfide	--	NA	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	10 U	10 U	10 U
Chlorobenzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
Chloroethane	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	5 U	10 U	10 U	10 U
Chloroform	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
Chloromethane	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	5 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	70	NA	**0.74 J**	1 U	1 U	1 U	1 U	**0.28 J**	**0.25 J**	**47**	**10**	**9 J**	**4 J**
Cyclohexane	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
Ethylbenzene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
Tetrachloroethene	5	NA	**3.3**	**3.5**	**3.6**	**3.4**	**3.9**	**4.3**	**4.5**	**6.8**	**11**	**14**	**7 J**
Toluene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	10 U	10 U	10 U
trans-1,2-Dichloroethene	--	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	**8.1**	**4 J**	**3 J**	**2 J**
Trichloroethene	5	NA	**1.5 J**	**1.5 J**	**1.2 J**	**1.3 J**	**1.3 J**	**1.4**	**1.4**	**41**	**46**	**57**	**22**
Vinyl chloride	2	NA	1 U	1 U	1 U	1 U	1 U	0.2 U	0.2 U	5 U	10 U	10 U	10 U
Xylene, total	--	NA	NA	2 U	2 U	2 U	2 U	NA	NA	NA	10 U	10 U	10 U
Explosives (UG/L)													
2-Amino-4,6-dinitrotoluene	--	0.12 U	0.371 U	0.355 U	0.351 U	0.367 U	0.344 U	NA	NA	NA	NA	NA	NA
HMX	--	**20**	**18.6 L**	**9.99**	**9.95**	**10.2**	**8.92**	NA	NA	NA	NA	NA	NA
RDX	6	**15 L**	**12.3 L**	**3.98**	**4.08**	**5.03**	**4.19**	**2.9**	**3.1**	NA	NA	NA	NA
Total Metals (UG/L)													
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	**38.8**	62.1 B	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	**5,330**	NA	NA	NA
Dissolved Metals (UG/L)													
Iron, Dissolved	11,000	NA	**253**	**2,680**	**406**	**36.9 K**	**39.2**	**175 J**	**163 J**	**531**	NA	NA	37.1 B
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	NA	**28**	**32**	NA	**29**	NA	**26**	NA	**55 J**	**86**	**85**	**110**
Carbon dioxide (mg/l)	--	NA	**203 D**	**161**	NA	**165**	NA	**130**	NA	**100**	**100**	**130**	**140**
Chemical oxygen demand (mg/l)	--	NA	**15 J**	**16 J**	NA	**14 J**	NA	**20.5**	NA	10 U	20 U	20 U	21 U
Chloride (mg/l)	--	NA	**6.1**	**3.7 J**	NA	**3.8 J**	NA	**3.3**	NA	**18.5**	**16**	**19**	**9.8**
Ethane (mg/l)	--	NA	0.00196 U	0.00196 U	NA	0.00196 U	NA	6.40E-04 U	NA	**5.00E-05**	**0.026**	0.027 U	5.00E-04 U
Ethene (mg/l)	--	NA	0.00271 U	0.00271 U	NA	0.00271 U	NA	6.00E-04 U	NA	**1.80E-04**	**0.035**	0.036 U	5.00E-04 U
Lactic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 13	05GW01								13GW01			
Sample ID		005GW01P-0711	05GW01-1012	05GW01-1013	05GW01P-1013	05GW01-1014	05GW01P-1014	05GW01-1115	05GW01P-1115	013GW0010804	13GW0010205	013GW0010305	013GW0010505
Sample Date		07/27/11	10/17/12	10/22/13	10/22/13	10/20/14	10/20/14	11/12/15	11/12/15	08/04/04	02/17/05	03/10/05	05/09/05
Chemical Name													
Methane (mg/l)	--	NA	9.64E-04 U	9.64E-04 U	NA	9.64E-04 U	NA	**5.70E-04 J**	NA	**0.0026**	**0.014**	0.014 U	5.00E-04 U
Nitrate (mg/l)	--	NA	**0.61 J**	**0.67 J**	NA	**0.55 J**	NA	**0.584**	NA	**0.74**	**0.89**	**1**	**0.95 L**
Nitrite (mg/l)	--	NA	0.044 U	0.07 U	NA	0.07 U	NA	0.05 U	NA	NA	**0.14**	**0.24**	**0.12**
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6.2**	**6.1**	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	**83**	**70**	NA	**71**	NA	**78.8**	NA	**90.3**	**70**	**74**	**61**
Sulfide (mg/l)	--	NA	1 U	1 U	NA	1 U	NA	1 U	NA	1 U	0.03 U	**0.032**	0.03 U
Total organic carbon (TOC) (mg/l)	--	NA	**4**	**1.5**	NA	**0.69 J**	NA	**2.38**	NA	**2**	10 U	10 U	10 U

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW01											
Sample ID		013GW0010805	013GW001-1105	013GW001-0206	013GW0010407	013GW001-0809	013GW01-1110	013GW01P-1110	013GW01-0711	13GW01-1012	13GW01-1013	13GW01-1014	13GW01-1115
Sample Date		08/25/05	11/10/05	02/15/06	04/06/07	08/13/09	11/10/10	11/10/10	07/29/11	10/18/12	10/23/13	10/20/14	11/12/15
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,2,2-Tetrachloroethane	2.4	**97**	**110**	**46**	**36**	**30**	**150**	**190**	**110**	**21**	**71**	**73**	**160**
1,1,2-Trichloroethane	--	10 U	10 U	10 U	2 U	5 U	**1.6**	**1.1**	**0.79 J**	1 U	1 U	2 U	NA
1,1-Dichloroethane	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
1,1-Dichloroethene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	**1 J**	1 U	2 U	NA
1,2,4-Trichlorobenzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
1,2-Dichlorobenzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
1,2-Dichloroethane	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
1,2-Dichloropropane	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
1,3-Dichlorobenzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
1,4-Dichlorobenzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
2-Butanone	--	10 U	10 U	10 U	2 U	5 R	2.5 U	2.5 U	2.5 U	12 U	12 U	25 U	NA
2-Hexanone	--	10 U	10 U	10 U	2 U	5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	5 U	NA
Acetone	--	10 U	10 U	10 U	2 U	5 R	2.5 U	2.5 U	4.3 B	12 U	12 U	25 UJ	NA
Benzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
Carbon disulfide	--	10 U	10 U	10 U	2 U	0.82 B	0.5 U	0.5 U	0.5 U	5 U	5 U	10 U	NA
Chlorobenzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
Chloroethane	--	10 U	10 U	10 U	2 U	5 U	1 U	1 U	1 U	1 U	1 U	2 U	NA
Chloroform	--	10 U	10 U	10 U	2 U	5 U	**0.36 J**	0.5 U	0.5 U	1 U	1 U	2 U	NA
Chloromethane	--	10 U	10 U	10 U	2 U	5 U	1 U	1 U	1 U	1 U	1 U	2 U	NA
cis-1,2-Dichloroethene	70	**190**	**120**	**5 J**	**41**	**220**	**48**	**69**	**220**	**1,100**	**180**	**240**	**400**
Cyclohexane	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
Ethylbenzene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
Tetrachloroethene	5	**6**	**10**	**6**	**5**	**9.3**	**27**	**19**	**12**	**26**	**7.9**	**13**	**25**
Toluene	--	10 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA
trans-1,2-Dichloroethene	--	**39**	**26**	**2 J**	**8**	**60**	**14**	**18**	**41**	**230**	**42**	**59**	NA
Trichloroethene	5	**99**	**94**	**19**	**30**	**120**	**100**	**86**	**130**	**530**	**83**	**120**	**200**
Vinyl chloride	2	**2**	2 U	2 U	2 U	**7.8**	**0.38 J**	**0.79 J**	**4.1**	**32**	**3.1**	**6.2**	**11**
Xylene, total	--	10 U	10 U	10 U	2 U	5 U	1.5 U	1.5 U	1.5 U	NA	2 U	4 U	NA
Explosives (UG/L)													
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	NA	NA	NA	NA	0.359 U	NA	NA	NA
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	0.359 U	NA	NA	NA
RDX	6	NA	NA	NA	NA	NA	NA	NA	NA	**0.255 J**	NA	NA	NA
Total Metals (UG/L)													
Iron	11,000	NA	NA	NA	NA	945 B	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)													
Iron, Dissolved	11,000	**112**	17.7 B	41.4 B	72.6 B	NA	87.1 B	85.3 B	100 B	NA	NA	NA	NA
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	NA	NA	NA	NA	5 U	NA	NA	**0.051 J**	NA	NA	NA	NA
Alkalinity (mg/l)	--	**70**	**70**	NA	**110**	**97**	**74**	NA	**80**	**30**	**100**	**100**	**54.5**
Carbon dioxide (mg/l)	--	**76**	**150**	**280**	**44**	**5.9**	**150**	NA	**110**	**159**	**107**	**132**	**81**
Chemical oxygen demand (mg/l)	--	20 U	20 U	20 U	20 U	9.3 B	10 U	NA	**15 J**	**35 J**	**12 J**	**9.4 J**	**8.17 J**
Chloride (mg/l)	--	**42**	**36**	**20 K**	**13**	**37**	**29**	NA	**53**	**140 D**	**29**	**32**	**76.2**
Ethane (mg/l)	--	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	0.0012 U	0.002 U	NA	0.002 U	0.00196 U	0.00196 U	0.00196 U	**4.50E-04 J**
Ethene (mg/l)	--	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	0.0015 U	**0.0015 J**	NA	0.002 U	**0.00232 J**	0.00271 U	0.00271 U	**5.20E-04 J**
Lactic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	**0.18**	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW01											
Sample ID		013GW0010805	013GW001-1105	013GW001-0206	013GW0010407	013GW001-0809	013GW01-1110	013GW01P-1110	013GW01-0711	13GW01-1012	13GW01-1013	13GW01-1014	13GW01-1115
Sample Date		08/25/05	11/10/05	02/15/06	04/06/07	08/13/09	11/10/10	11/10/10	07/29/11	10/18/12	10/23/13	10/20/14	11/12/15
Chemical Name													
Methane (mg/l)	--	6.70E-04 B	5.00E-04 U	5.00E-04 U	0.002 U	0.0016 B	**0.0018 J**	NA	**0.0025 J**	**0.00326**	9.64E-04 U	9.64E-04 U	**0.052**
Nitrate (mg/l)	--	**0.88**	**1.4 J**	**2 L**	**1.3 L**	**0.58**	**0.66**	NA	0.025 U	**0.058 J**	**0.5 J**	**0.38 J**	**0.349**
Nitrite (mg/l)	--	**0.093**	0.025 UJ	0.025 R	0.025 UL	0.13 U	NA	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U
pH (ph)	--	NA	**6**	NA	**6.7 J**	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	1.00E-03 U	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	**0.05**	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	NA	NA	NA	5 U	NA	NA	0.15 U	NA	NA	NA	NA
Sulfate (mg/l)	--	**56**	**58**	**95 K**	**42**	**35**	**47**	NA	**30**	**8.6**	**33**	**32**	**37.2**
Sulfide (mg/l)	--	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	**0.9 J**	NA	0.8 U	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	10 U	10 U	10 U	10 U	10 U	**1.3**	NA	**1.1**	**1.6**	**1.2**	**2.3**	**2.06**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW04										
Sample ID		013GW0040804	013GW004-0206	013GW900-0206	013GW0040407	013GW004-0809	013GW04-1110	013GW04-0711	13GW04-1012	13GW04-1013	13GW04-1014	13GW04-1115
Sample Date		08/04/04	02/15/06	02/15/06	04/06/07	08/13/09	11/10/10	07/28/11	10/15/12	10/23/13	10/21/14	11/12/15
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	4 U	2 U	2 U	2 U	1 U	0.5 U	0.5 U	1 U	1 U	1 U	0.2 U
1,1,2-Trichloroethane	--	4 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,1-Dichloroethane	--	4 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	4 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,2,4-Trichlorobenzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,2-Dichlorobenzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,2-Dichloroethane	--	4 U	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,2-Dichloropropane	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,3-Dichlorobenzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
1,4-Dichlorobenzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
2-Butanone	--	NA	10 U	10 U	2 U	5 R	2.5 U	2.5 U	12 U	12 U	12 U	NA
2-Hexanone	--	NA	10 U	10 U	2 U	5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	NA
Acetone	--	NA	10 U	10 U	2 U	5 R	2.5 U	10 B	12 U	**15 J**	12 UJ	NA
Benzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
Carbon disulfide	--	NA	10 U	10 U	2 U	0.96 B	0.5 U	0.5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
Chloroethane	--	4 U	10 U	10 U	2 U	5 U	1 U	1 U	1 U	1 U	1 U	NA
Chloroform	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
Chloromethane	--	4 U	10 U	10 U	2 U	5 U	1 U	1 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	**57**	**59**	**54**	**58**	**110**	**130**	**130**	**110**	**110**	**96**	**130**
Cyclohexane	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
Ethylbenzene	--	NA	10 U	10 U	2 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U	NA
Tetrachloroethene	5	4 U	2 U	2 U	2 U	**0.81 J**	**0.76 J**	**0.47 J**	1 U	1 U	1 U	**0.78 J**
Toluene	--	NA	10 U	10 U	2 U	5 U	0.28 B	0.5 U	1 U	1 U	1 U	NA
trans-1,2-Dichloroethene	--	**7.1**	**17**	**16**	**17**	**17**	**15**	**17**	**14**	**13**	**9.4**	NA
Trichloroethene	5	**7**	**8**	**9**	**7**	**11**	**8.2**	**7.3**	**11**	**6.5**	**6.1**	**7.2**
Vinyl chloride	2	4 U	**17**	**16**	**12**	**2.6**	**3.8**	**11**	**2.3**	**1.4 J**	**0.95 J**	**1.4**
Xylene, total	--	NA	10 U	10 U	2 U	5 U	1.5 U	1.5 U	NA	2 U	2 U	NA
Explosives (UG/L)												
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	NA	NA	NA	0.363 U	NA	NA	NA
HMX	--	NA	NA	NA	NA	NA	NA	NA	0.363 U	NA	NA	NA
RDX	6	NA	NA	NA	NA	NA	NA	NA	0.363 U	NA	NA	NA
Total Metals (UG/L)												
Iron	11,000	NA	NA	NA	NA	1,720 B	NA	NA	NA	NA	NA	NA
Sodium	--	**10,400**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	35.3 B	**2,090**	**2,090**	**2,550**	NA	**1,930**	**2,340**	NA	NA	NA	NA
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	NA	NA	NA	NA	5 U	NA	**0.078**	NA	NA	NA	NA
Alkalinity (mg/l)	--	**66 J**	NA	NA	**54**	**56**	**50**	**51**	**49**	**51**	**44**	**45.9**
Carbon dioxide (mg/l)	--	**8.8**	**38**	**37**	10 U	**0.59**	**10**	**11**	**16.7**	**12.6**	**11.9**	**9.9**
Chemical oxygen demand (mg/l)	--	10 U	20 U	20 U	20 U	5.3 B	**3.9 J**	**4.1 J**	18 U	**18 J**	19 U	**16.4**
Chloride (mg/l)	--	**11.1**	**28 K**	**29 K**	**25**	**36**	**23**	**24**	**19**	**20**	**24**	**33.3**
Ethane (mg/l)	--	**1.90E-05**	5.00E-04 U	5.00E-04 U	1.00E-03 U	0.0012 U	0.002 U	0.002 U	0.00196 U	0.00196 U	0.00196 U	6.40E-04 U
Ethene (mg/l)	--	**2.20E-04**	**0.0058**	**0.0062**	**0.013**	0.0015 U	**0.0012 J**	**0.0017 J**	**0.00147 J**	0.00271 U	0.00271 U	**7.90E-04 J**
Lactic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	**0.35**	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW04										
Sample ID		013GW0040804	013GW004-0206	013GW900-0206	013GW0040407	013GW004-0809	013GW04-1110	013GW04-0711	13GW04-1012	13GW04-1013	13GW04-1014	13GW04-1115
Sample Date		08/04/04	02/15/06	02/15/06	04/06/07	08/13/09	11/10/10	07/28/11	10/15/12	10/23/13	10/21/14	11/12/15
Chemical Name												
Methane (mg/l)	--	**0.0026**	**0.08**	**0.047**	**0.049**	0.0019 B	**0.11**	**0.16**	**0.0965**	**0.109 D**	**0.0209**	**0.045**
Nitrate (mg/l)	--	0.024 B	0.025 R	0.025 R	0.025 UL	**0.57**	0.025 U	**0.067**	0.21 U	0.21 U	0.21 U	**0.046 J**
Nitrite (mg/l)	--	NA	0.025 R	0.025 R	0.025 UL	0.13 U	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U
pH (ph)	--	NA	NA	NA	**7.1 J**	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	1.00E-03 U	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	NA	NA	NA	5 U	NA	0.15 U	NA	NA	NA	NA
Sulfate (mg/l)	--	**9**	**17 K**	**18 K**	10 B	**35**	**9.1**	**8.8**	**8.3**	**8.8**	**9.1**	**8.92**
Sulfide (mg/l)	--	1 U	0.03 U	0.03 U	0.03 U	0.03 U	0.8 U	**2.2**	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	0.3 B	10 U	10 U	10 U	10 U	**3.6**	**0.28 J**	**0.45 J**	**0.42 J**	0.64 U	**1.76**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW204										
Sample ID		013GW2040804	13GW2040205	013GW2040305	013GW2040505	013GW2040805	013GW204-1105	013GW204-0206	013GW2040407	013GW2040407P	013GW204-0809	013GW204-1110
Sample Date		08/05/04	02/17/05	03/10/05	05/09/05	08/24/05	11/10/05	02/16/06	04/05/07	04/05/07	08/17/09	11/11/10
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	**100**	**50**	**110**	**73 L**	**140**	**120**	**22**	**8**	**9**	**3**	**3.6**
1,1,2-Trichloroethane	--	5 U	10 U	10 U	10 R	**1 J**	10 U	10 U	2 U	2 U	5 U	0.5 U
1,1-Dichloroethane	--	5 U	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
1,1-Dichloroethene	--	5 U	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
1,2,4-Trichlorobenzene	--	NA	10 U	**1 J**	**1 L**	10 U	10 U	**2 J**	2 U	2 U	5 U	0.5 U
1,2-Dichlorobenzene	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
1,2-Dichloroethane	--	5 U	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
1,2-Dichloropropane	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
1,3-Dichlorobenzene	--	NA	10 U	**1 J**	**2 L**	10 U	10 U	**3 J**	**1 J**	**1 J**	**1.7 J**	**0.32 J**
1,4-Dichlorobenzene	--	NA	10 U	**1 J**	**2 L**	10 U	10 U	**2 J**	**1 J**	**1 J**	**1.3 J**	0.5 U
2-Butanone	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 R	2.5 U
2-Hexanone	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	2.5 U
Acetone	--	NA	10 U	10 UJ	10 R	10 U	10 UJ	10 U	2 U	2 U	5 R	2.5 U
Benzene	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
Carbon disulfide	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	0.66 B	0.5 U
Chlorobenzene	--	NA	**1 J**	**1 J**	**3 L**	**1 J**	10 U	**4 J**	**3**	**2**	**3.3 J**	0.5 U
Chloroethane	--	5 U	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	1 U
Chloroform	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
Chloromethane	--	5 U	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	1 U
cis-1,2-Dichloroethene	70	**12**	**8 J**	**7 J**	**5 L**	**21**	**35**	**5 J**	**6**	**5**	**5.3**	**24**
Cyclohexane	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
Ethylbenzene	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
Tetrachloroethene	5	**5.4**	**3 J**	**4 J**	**2 L**	**10**	**9**	**2**	2 U	**1 J**	5 U	**0.59 J**
Toluene	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	0.5 U
trans-1,2-Dichloroethene	--	**4.4 J**	**4 J**	**2 J**	**2 L**	**11**	**26**	**2 J**	**4**	**3**	**2.1 J**	**6.9**
Trichloroethene	5	**28**	**18**	**28**	**14 L**	**38**	**43**	**7**	**5**	**5**	**2.3 J**	**6.5**
Vinyl chloride	2	5 U	**3 J**	**2 J**	**2 L**	**8**	**19**	**7**	**3**	**2**	**2**	**8.1**
Xylene, total	--	NA	10 U	10 U	10 R	10 U	10 U	10 U	2 U	2 U	5 U	1.5 U
Explosives (UG/L)												
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Iron	11,000	NA	**33,200**	**32,900**	NA	NA	NA	NA	NA	NA	**22,100 J**	NA
Sodium	--	**31,800**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	**14,300**	NA	NA	**42,700**	**13,400**	**11,200**	**29,800**	**23,100**	**23,500**	NA	**9,490**
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA
Alkalinity (mg/l)	--	**150 J**	**340**	**250**	**380**	**130**	**100**	NA	**330**	NA	**510**	**60**
Carbon dioxide (mg/l)	--	**120**	**200**	**79**	**170**	**140**	**180**	**350**	**140**	NA	**10.5**	**110**
Chemical oxygen demand (mg/l)	--	**15.7**	**36**	**27**	**40**	21 U	21 U	**39**	**50 K**	NA	**49**	**12 J**
Chloride (mg/l)	--	**35.1**	**48**	**41**	**50**	**29**	**31**	**57 K**	**61**	NA	**35**	**22**
Ethane (mg/l)	--	**2.30E-04**	**0.14**	0.14 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	**7.20E-04 J**	NA	0.0012 U	0.002 U
Ethene (mg/l)	--	**2.10E-04**	**0.18**	0.18 U	5.00E-04 U	5.00E-04 U	**0.0041**	5.00E-04 U	1.00E-03 U	NA	0.0015 U	0.002 U
Lactic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Station ID	**CLEAN WO PRGs Site 13**	13GW204										
Sample ID		013GW2040804	13GW2040205	013GW2040305	013GW2040505	013GW2040805	013GW204-1105	013GW204-0206	013GW2040407	013GW2040407P	013GW204-0809	013GW204-1110
Sample Date		08/05/04	02/17/05	03/10/05	05/09/05	08/24/05	11/10/05	02/16/06	04/05/07	04/05/07	08/17/09	11/11/10
Chemical Name												
Methane (mg/l)	--	**0.87**	**1.5**	**2.2**	**0.72**	**0.19**	**0.48**	**0.87**	**1.8**	NA	**0.73**	**0.53**
Nitrate (mg/l)	--	**0.43**	**0.12**	**0.33**	**0.18 L**	**0.36**	0.44 B	**0.19 L**	**0.092**	NA	0.037 B	0.025 U
Nitrite (mg/l)	--	NA	**0.23**	**0.61**	0.025 U	**0.064**	0.025 UJ	0.025 R	0.025 U	NA	0.13 U	NA
pH (ph)	--	NA	**6.5**	**6.8**	NA	NA	**6**	NA	**6.7 J**	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	1.00E-03 U	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA
Sulfate (mg/l)	--	**54.6**	**90**	**80**	**87**	**32**	**35**	**120 K**	**42**	NA	**25**	**22**
Sulfide (mg/l)	--	1 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	NA	0.03 U	0.8 U
Total organic carbon (TOC) (mg/l)	--	**6**	**14**	**10**	**18**	10 U	10 U	**15**	**15**	NA	**13**	**5.1**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW204						13GW205				
Sample ID		013GW204-0711	13GW204-1012	13GW204P-1012	13GW204-1013	13GW204-1014	13GW204-1115	013GW2050804	013GW205-0206	013GW2050407	013GW205-0809	013GW205-1110
Sample Date		07/27/11	10/17/12	10/17/12	10/22/13	10/20/14	11/13/15	08/04/04	02/16/06	04/05/07	08/17/09	11/11/10
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	**2.6**	**1.1 J**	**2.3**	**2.4**	**2**	**1.7**	1 U	2 U	2 U	1 U	0.5 UJ
1,1,2-Trichloroethane	--	0.5 U	1 U	1 U	1 U	1 U	NA	1 U	10 U	2 U	5 U	0.5 UJ
1,1-Dichloroethane	--	0.5 U	1 U	1 U	1 U	1 U	NA	1 U	10 U	2 U	5 U	0.5 UJ
1,1-Dichloroethene	--	0.5 U	1 U	1 U	1 U	1 U	NA	1 U	10 U	2 U	5 U	0.5 UJ
1,2,4-Trichlorobenzene	--	0.5 U	1 U	1 U	1 U	1 U	NA	NA	10 U	2 U	5 U	0.5 UJ
1,2-Dichlorobenzene	--	**0.24 J**	1 U	1 U	1 U	1 U	NA	NA	10 U	2 U	5 U	0.5 UJ
1,2-Dichloroethane	--	0.5 U	1 U	1 U	1 U	1 U	NA	1 U	10 U	2 U	5 U	0.5 UJ
1,2-Dichloropropane	--	0.5 U	1 U	1 U	1 U	1 UL	NA	NA	10 U	2 U	5 U	0.5 UJ
1,3-Dichlorobenzene	--	**2.1**	1 U	1 U	1 U	**1.2 J**	NA	NA	10 U	2 U	5 U	0.5 UJ
1,4-Dichlorobenzene	--	**2.3**	**1 J**	**0.94 J**	1 U	**1.9 J**	NA	NA	10 U	2 U	5 U	0.5 UJ
2-Butanone	--	2.5 U	12 U	12 U	12 U	12 UJ	NA	NA	10 U	2 U	5 R	2.5 UJ
2-Hexanone	--	2.5 U	2.5 U	2.5 U	2.5 U	2.5 UJ	NA	NA	10 U	2 U	5 U	2.5 UJ
Acetone	--	2.5 U	12 U	12 U	12 U	12 U	NA	NA	10 U	2 U	5 R	2.5 UJ
Benzene	--	**0.41 J**	1 U	1 U	1 U	1 U	NA	NA	10 U	2 U	5 U	0.5 UJ
Carbon disulfide	--	0.5 U	5 U	5 U	5 U	5 U	NA	NA	10 U	2 U	0.7 B	0.5 UJ
Chlorobenzene	--	**4.9**	**1.8 J**	**1.5 J**	**2.8**	**5.4 L**	NA	NA	10 U	2 U	5 U	0.5 UJ
Chloroethane	--	1 U	1 U	1 U	1 U	1 U	NA	1 U	10 U	2 U	5 U	1 UJ
Chloroform	--	0.5 U	1 U	1 U	1 U	1 U	NA	NA	10 U	2 U	5 U	0.5 UJ
Chloromethane	--	1 U	1 U	1 U	1 U	1 UJ	NA	1 U	10 U	2 U	5 U	1 UJ
cis-1,2-Dichloroethene	70	**11**	**14**	**18**	**17**	**14**	**6.9**	**0.88 J**	10 U	2 U	5 U	0.5 UJ
Cyclohexane	--	0.5 U	1 U	1 U	1 U	1 UJ	NA	NA	10 U	2 U	5 U	0.5 UJ
Ethylbenzene	--	0.5 U	1 U	1 U	1 U	1 U	NA	NA	10 U	2 U	5 U	0.5 UJ
Tetrachloroethene	5	**0.58 J**	1 U	1 U	1 U	1 U	**0.3 J**	1 U	2 U	2 U	5 U	0.5 UJ
Toluene	--	0.5 U	1 U	1 U	1 U	1 U	NA	NA	10 U	2 U	5 U	0.5 UJ
trans-1,2-Dichloroethene	--	**2.4**	**2.1**	**2.7**	**2.4**	**2.2**	NA	1 U	10 U	2 U	5 U	0.5 UJ
Trichloroethene	5	**3.2**	**2.2 J**	**3.4 J**	**3.2**	**4.1**	**1.4**	1 U	2 U	2 U	5 U	0.5 UJ
Vinyl chloride	2	**3.9**	**7.8**	**7.4**	**4.4**	**2.9**	**1.6**	1 U	2 U	2 U	1 U	1 UJ
Xylene, total	--	1.5 U	NA	NA	2 U	2 U	NA	NA	10 U	2 U	5 U	1.5 UJ
Explosives (UG/L)												
2-Amino-4,6-dinitrotoluene	--	NA	0.375 U	0.359 U	NA	NA	NA	NA	NA	NA	NA	NA
HMX	--	NA	0.375 U	0.359 U	NA	NA	NA	NA	NA	NA	NA	NA
RDX	6	NA	0.375 U	0.359 U	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	**17,400 J**	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	**24,600**	**17,600**	**16,900**	**10,300**	**13,500**	**9,690**	**12,400**	**12,300**	**13,400**	NA	**18,900**
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	**0.11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	**180**	**89**	NA	**74**	**80**	**129**	NA	NA	NA	NA	**120**
Carbon dioxide (mg/l)	--	**110**	**192 D**	NA	**171**	**182**	**110**	NA	**280**	NA	NA	**120**
Chemical oxygen demand (mg/l)	--	**28**	**17 J**	NA	**18 J**	**14 J**	**36.9**	NA	20 U	NA	NA	**11 J**
Chloride (mg/l)	--	**21**	**27**	NA	**17**	**15**	**25.8**	NA	**39 K**	NA	NA	**62**
Ethane (mg/l)	--	0.002 U	0.00196 U	NA	0.00196 U	0.00196 U	**5.50E-04 J**	NA	5.00E-04 U	NA	NA	0.002 U
Ethene (mg/l)	--	0.002 U	**0.00174 J**	NA	0.00271 U	0.00271 U	6.00E-04 U	NA	5.00E-04 U	NA	NA	0.002 U
Lactic Acid (mg/l)	--	**0.34**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Station ID	**CLEAN WO PRGs Site 13**	13GW204						13GW205				
Sample ID		013GW204-0711	13GW204-1012	13GW204P-1012	13GW204-1013	13GW204-1014	13GW204-1115	013GW2050804	013GW205-0206	013GW2050407	013GW205-0809	013GW205-1110
Sample Date		07/27/11	10/17/12	10/17/12	10/22/13	10/20/14	11/13/15	08/04/04	02/16/06	04/05/07	08/17/09	11/11/10
Chemical Name												
Methane (mg/l)	--	**2.4**	**0.839 D**	NA	**0.386 D**	**0.573 D**	**0.93**	NA	**0.079**	NA	NA	**0.27**
Nitrate (mg/l)	--	0.025 U	0.21 U	NA	0.21 U	0.21 U	**0.0457 J**	NA	**0.047 L**	NA	NA	0.025 U
Nitrite (mg/l)	--	NA	0.044 U	NA	0.07 U	0.07 U	0.05 U	NA	0.025 R	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	**0.064**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	0.15 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**29**	**20**	NA	**18**	**19**	**23.8**	NA	**210 K**	NA	NA	**68**
Sulfide (mg/l)	--	0.8 U	1 U	NA	1 U	1 U	1 U	NA	0.03 U	NA	NA	0.8 U
Total organic carbon (TOC) (mg/l)	--	**7.9**	**3.1**	NA	**3.4**	**3.7**	**7.76**	NA	10 U	NA	NA	**5.7**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW205					13GW206						
Sample ID		013GW205-0711	13GW205-1012	13GW205-1013	13GW205-1014	13GW205-1115	013GW2060804	13GW2060205	013GW2060305	013GW2060505	013GW2060805	013GW206-1105	013GW206-0206
Sample Date		07/27/11	10/17/12	10/22/13	10/20/14	11/13/15	08/05/04	02/17/05	03/10/05	05/09/05	08/25/05	11/10/05	02/15/06
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,2,2-Tetrachloroethane	2.4	0.5 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	6 U	6 U	10 U
1,1,2-Trichloroethane	--	0.5 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	30 U	30 U	50 U
1,1-Dichloroethane	--	0.5 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	30 U	30 U	50 U
1,1-Dichloroethene	--	0.5 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	30 U	30 U	50 U
1,2,4-Trichlorobenzene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 UJ	10 R	30 U	30 U	50 U
1,2-Dichlorobenzene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
1,2-Dichloroethane	--	0.5 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	30 U	30 U	50 U
1,2-Dichloropropane	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	**1 L**	30 U	30 U	50 U
1,3-Dichlorobenzene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
1,4-Dichlorobenzene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
2-Butanone	--	2.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
2-Hexanone	--	2.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Acetone	--	8.7 B	NA	NA	NA	NA	NA	10 U	10 UJ	10 R	30 U	30 UJ	50 U
Benzene	--	0.5 U	NA	NA	NA	NA	NA	**1 J**	**2 J**	**1 L**	30 U	30 U	50 U
Carbon disulfide	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Chlorobenzene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Chloroethane	--	1 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	30 U	30 U	50 U
Chloroform	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Chloromethane	--	1 U	NA	NA	NA	NA	17 U	10 U	10 U	10 R	30 U	30 U	50 U
cis-1,2-Dichloroethene	70	**0.72 J**	NA	NA	NA	NA	**320**	**380**	**540**	**530 L**	**520**	**540**	**490**
Cyclohexane	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Ethylbenzene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Tetrachloroethene	5	0.5 U	NA	NA	NA	NA	17 U	10 U	10 U	**2 L**	6 U	6 U	10 U
Toluene	--	0.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
trans-1,2-Dichloroethene	--	**0.28 J**	NA	NA	NA	NA	**19**	**43**	**41**	**68 L**	**63**	**79**	**57**
Trichloroethene	5	0.5 U	NA	NA	NA	NA	**9.5 J**	**20**	**24**	**40 L**	**35**	**45**	**30**
Vinyl chloride	2	**0.26 J**	NA	NA	NA	NA	17 U	**11**	**8 J**	**9 J**	6 U	6 U	**17**
Xylene, total	--	1.5 U	NA	NA	NA	NA	NA	10 U	10 U	10 R	30 U	30 U	50 U
Explosives (UG/L)													
2-Amino-4,6-dinitrotoluene	--	NA	0.367 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMX	--	NA	0.367 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	6	NA	0.367 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)													
Iron	11,000	NA	NA	NA	NA	NA	NA	**3,990**	**1,660**	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	**17,400**	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)													
Iron, Dissolved	11,000	**25,900**	**16,300**	**19,100**	**22,200**	**7,830**	14.4 U	NA	NA	**394**	58.8 B	204 B	**809**
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	**0.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	**110**	**120**	**110**	**74**	**83.9**	**73 J**	**46**	**23**	**22**	**30**	20 U	NA
Carbon dioxide (mg/l)	--	**130**	**176**	**183 D**	**168 D**	**90**	**8.5**	**33**	**36**	**51**	**36**	**170**	**360**
Chemical oxygen demand (mg/l)	--	**15**	**17 J**	**21 J**	**16 J**	**10.3**	10 U	**44**	21 U	20 U	20 U	20 U	20 U
Chloride (mg/l)	--	**49**	**49**	**36**	**25**	**22.1**	**60.2**	**63**	**67**	**74**	**85**	**81**	**150 K**
Ethane (mg/l)	--	0.002 U	0.00196 U	0.00196 U	0.00196 U	6.40E-04 U	**3.20E-05**	**0.026**	0.027 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U
Ethene (mg/l)	--	0.002 U	0.00271 U	0.00271 U	0.00271 U	6.00E-04 U	**0.0018**	**0.035**	0.036 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	**8.90E-04**
Lactic Acid (mg/l)	--	**0.52**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Station ID	CLEAN WO PRGs Site 13	13GW205					13GW206						
Sample ID		013GW205-0711	13GW205-1012	13GW205-1013	13GW205-1014	13GW205-1115	013GW2060804	13GW2060205	013GW2060305	013GW2060505	013GW2060805	013GW206-1105	013GW206-0206
Sample Date		07/27/11	10/17/12	10/22/13	10/20/14	11/13/15	08/05/04	02/17/05	03/10/05	05/09/05	08/25/05	11/10/05	02/15/06
Chemical Name													
Methane (mg/l)	--	**0.34**	**1.11 D**	**0.424 D**	**0.224 D**	**0.11**	**6.70E-04**	**0.014**	0.014 U	**0.0019**	0.0014 B	**0.0017**	**0.0022**
Nitrate (mg/l)	--	0.025 U	0.21 U	0.21 U	0.21 U	**0.0465 J**	**0.16**	**0.45**	**0.55**	**0.24 L**	**0.059**	**3.6 J**	**0.99 L**
Nitrite (mg/l)	--	NA	0.044 U	0.07 U	0.07 U	0.05 U	NA	**0.074**	**0.053**	0.025 U	0.025 U	0.025 UJ	0.025 R
pH (ph)	--	NA	NA	NA	NA	NA	NA	**6.4**	**6.1**	NA	NA	**5**	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	**0.06**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	0.15 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**59**	**36**	**54**	**49**	**39.6**	**28.8**	**28**	**23**	**29**	**21**	**19**	**50 K**
Sulfide (mg/l)	--	0.8 U	1 U	1 U	1 U	1 U	1 U	0.03 U	**0.031**	0.03 U	0.03 U	0.03 U	0.03 U
Total organic carbon (TOC) (mg/l)	--	**4.2**	**4.4**	**4.1**	**2.9**	**4.73**	**1**	**11**	10 U	10 U	10 U	10 U	10 U

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW206								
Sample ID		013GW2060407	013GW206-0809	013GW206-1110	013GW206-0711	013GW206P-0711	13GW206-1012	13GW206-1013	13GW206-1014	13GW206-1115
Sample Date		04/05/07	08/17/09	11/10/10	07/27/11	07/27/11	10/15/12	10/23/13	10/21/14	11/12/15
Chemical Name										
Volatile Organic Compounds (UG/L)										
1,1,2,2-Tetrachloroethane	2.4	8 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	0.2 U
1,1,2-Trichloroethane	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,1-Dichloroethane	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,1-Dichloroethene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,2,4-Trichlorobenzene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,2-Dichlorobenzene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,2-Dichloroethane	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,2-Dichloropropane	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,3-Dichlorobenzene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
1,4-Dichlorobenzene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
2-Butanone	--	8 U	5 R	2.5 U	2.5 U	2.5 U	12 U	12 U	62 U	NA
2-Hexanone	--	8 U	5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	12 U	NA
Acetone	--	8 U	5 R	2.5 U	5.9 B	17 B	12 U	12 U	62 UJ	NA
Benzene	--	8 U	5 U	0.5 U	**0.33 J**	**0.28 J**	**0.72 J**	1 U	5 U	NA
Carbon disulfide	--	8 U	0.7 B	0.5 U	0.5 U	0.5 U	5 U	5 U	25 U	NA
Chlorobenzene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
Chloroethane	--	8 U	5 U	**0.92 J**	1 U	1 U	**1.5 J**	**4.3**	5 U	NA
Chloroform	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
Chloromethane	--	8 U	5 U	1 U	1 U	1 U	1 U	1 U	5 U	NA
cis-1,2-Dichloroethene	70	**340**	**240**	**310**	**340**	**350**	**280**	**400**	**270**	**270**
Cyclohexane	--	8 U	5 U	0.5 U	**0.34 J**	0.5 U	1 U	1 U	5 U	NA
Ethylbenzene	--	8 U	5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	5 U	NA
Tetrachloroethene	5	8 U	5 U	**0.47 J**	0.5 U	0.5 U	1 U	1 U	5 U	0.2 U
Toluene	--	8 U	5 U	0.27 B	0.5 U	0.5 U	1 U	1 U	5 U	NA
trans-1,2-Dichloroethene	--	**28**	**16**	**15**	**13**	**13**	**8.7**	**12**	**7.1 J**	NA
Trichloroethene	5	**18**	**7.1**	**7.6**	**4.8**	**3.7**	**3.8**	**3.4**	5 U	**2.5**
Vinyl chloride	2	8 U	**2.1**	**7.3**	**20**	**20**	**13**	**13**	**14**	**8.7**
Xylene, total	--	8 U	5 U	1.5 U	1.5 U	1.5 U	NA	2 U	10 U	NA
Explosives (UG/L)										
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	NA	0.34 U	NA	NA	NA
HMX	--	NA	NA	NA	NA	NA	0.34 U	NA	NA	NA
RDX	6	NA	NA	NA	NA	NA	0.34 U	NA	NA	NA
Total Metals (UG/L)										
Iron	11,000	NA	**8,750 J**	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)										
Iron, Dissolved	11,000	**4,720**	NA	**6,150**	**6,990**	**6,820**	NA	NA	NA	NA
Wet Chemistry* (see note below)**										
Acetate (mg/l)	--	NA	5 U	NA	**0.082**	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	**25**	**39**	**22**	**20**	NA	**28**	**27**	**30**	**35.4**
Carbon dioxide (mg/l)	--	**76**	**5.25**	**58**	**40**	NA	**56.6**	**50.3**	**59.5**	**38**
Chemical oxygen demand (mg/l)	--	20 U	13 B	**3.9 J**	**4.1 J**	NA	**10 J**	**16 J**	**7.2 J**	6 U
Chloride (mg/l)	--	**81**	**79**	**86**	**86**	NA	**88**	**77**	**88**	**86.8**
Ethane (mg/l)	--	1.00E-03 U	0.0012 U	0.002 U	**0.0015 J**	NA	**0.00236**	0.00196 U	**0.00403**	**0.0029**
Ethene (mg/l)	--	1.00E-03 U	0.0015 U	**0.0018 J**	**0.0053 J**	NA	**0.00495**	0.00271 U	**0.00176 J**	**6.10E-04 J**
Lactic Acid (mg/l)	--	NA	NA	NA	**0.24**	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW206								
Sample ID		013GW2060407	013GW206-0809	013GW206-1110	013GW206-0711	013GW206P-0711	13GW206-1012	13GW206-1013	13GW206-1014	13GW206-1115
Sample Date		04/05/07	08/17/09	11/10/10	07/27/11	07/27/11	10/15/12	10/23/13	10/21/14	11/12/15
Chemical Name										
Methane (mg/l)	--	**0.0022**	0.0013 B	**0.021**	**0.16**	NA	**0.277**	**0.12 D**	**0.407 D**	**0.42**
Nitrate (mg/l)	--	**1.5**	**0.52**	**0.11**	**0.071**	NA	0.21 U	0.21 U	0.21 U	0.05 U
Nitrite (mg/l)	--	0.025 U	0.13 U	NA	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U
pH (ph)	--	**5.8 J**	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	1.00E-03 U	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	NA	**0.059**	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	5 U	NA	0.15 U	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**29**	**26**	**35**	**24**	NA	**16**	**18**	**43**	**49.9**
Sulfide (mg/l)	--	0.03 U	0.03 U	0.8 U	0.8 U	NA	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	10 U	10 U	**1.7**	**0.75 J**	NA	**0.7 J**	**0.55 J**	0.64 U	**1.41**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW300								13GW302		
Sample ID		013GW3000407	013GW300-1110	013GW300-0711	013GW300P-0711	13GW300-1012	13GW300-1013	13GW300-1014	13GW300-1115	013GW302-0510	013GW302-1010	013GW302-0211
Sample Date		04/04/07	11/11/10	07/28/11	07/28/11	10/17/12	10/23/13	10/21/14	11/12/15	05/26/10	10/26/10	02/01/11
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	2 U	**93**	**88**	**86**	**220**	**210**	**64**	**180**	**3.2**	**0.47 J**	**0.89 J**
1,1,2-Trichloroethane	--	2 U	**3.3**	**5.4**	**5.4**	**9.1**	**9.4**	**3 J**	NA	**0.92 J**	0.5 U	0.5 U
1,1-Dichloroethane	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	**0.22 J**	0.5 U
1,1-Dichloroethene	--	2 U	**1.3**	**3**	**2.6**	**3.4**	**4.6**	**2.7 J**	NA	5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
1,2-Dichloroethane	--	**2**	**2.1**	**4**	**4**	**2.4**	**3.5**	**2.4 J**	NA	5 U	0.5 U	0.5 U
1,2-Dichloropropane	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
1,3-Dichlorobenzene	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
1,4-Dichlorobenzene	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
2-Butanone	--	2 U	2.5 U	2.5 U	2.5 U	12 U	12 U	25 U	NA	5 U	2.5 U	2.5 U
2-Hexanone	--	2 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	5 U	NA	5 U	2.5 U	2.5 U
Acetone	--	2 U	2.5 U	4.7 B	8.5 B	12 U	12 U	25 UJ	NA	5 R	2.5 U	2.5 U
Benzene	--	2 U	**0.29 J**	**0.36 J**	**0.36 J**	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
Carbon disulfide	--	2 U	0.5 U	0.5 U	0.5 U	5 U	5 U	10 U	NA	5 U	0.5 U	0.5 U
Chlorobenzene	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
Chloroethane	--	2 U	1 U	1 U	1 U	1 U	1 U	2 U	NA	5 U	1 U	1 U
Chloroform	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
Chloromethane	--	2 U	1 U	1 U	1 U	1 U	1 U	2 U	NA	5 U	1 U	1 U
cis-1,2-Dichloroethene	70	**47**	**68**	**110**	**100**	**110**	**130**	**140**	**110**	**9**	**3.7**	**8.5**
Cyclohexane	--	2 U	0.5 U	**0.45 J**	**0.36 J**	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
Ethylbenzene	--	2 U	0.5 U	0.5 U	0.5 U	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
Tetrachloroethene	5	2 U	**4.6**	**3.2**	**2.8**	**9.8**	**6.3**	**3.9 J**	**9.9**	5 U	0.5 U	0.5 U
Toluene	--	**3**	0.5 U	**0.3 J**	**0.41 J**	1 U	1 U	2 U	NA	5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	--	**6**	**110**	**120**	**120**	**120**	**160**	**110**	NA	**4.4 J**	**1.9**	**2.8**
Trichloroethene	5	**5**	**28**	**39**	**35**	**77**	**80**	**72**	**89**	**2.9 J**	**1.3**	**2.1**
Vinyl chloride	2	**4**	**41**	**66**	**64**	**42**	**35**	**36**	**24**	**1.9**	**0.58 J**	**1.4 J**
Xylene, total	--	2 U	1.5 U	1.5 U	1.5 U	NA	2 U	4 U	NA	5 U	1.5 U	1.5 U
Explosives (UG/L)												
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	0.337 U	NA	NA	NA	NA	NA	NA
HMX	--	NA	NA	NA	NA	0.337 U	NA	NA	NA	NA	NA	NA
RDX	6	NA	NA	NA	NA	0.337 U	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	37.1 B	**10,500**	**13,400**	**13,500**	NA	NA	NA	NA	**52,000**	**60,700**	**56,500**
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	NA	NA	**0.082**	NA	NA	NA	NA	NA	5 U	NA	**0.036 J**
Alkalinity (mg/l)	--	**35**	**60**	**58**	NA	**47**	**48**	**40**	**32.6**	**88**	**70**	**78**
Carbon dioxide (mg/l)	--	10 U	**38**	**35**	NA	**96.9**	**76.9**	**60.7**	**59**	**63.5**	**120**	**100**
Chemical oxygen demand (mg/l)	--	20 U	10 U	**7 J**	NA	**22 J**	**7.4 J**	**22 J**	**16.4**	**21**	**7.5 J**	**15 J**
Chloride (mg/l)	--	**47**	**64**	**66**	NA	**55**	**56**	**48**	**53.2**	**36**	**57**	**40**
Ethane (mg/l)	--	**0.0082**	**0.024**	**0.021**	NA	**0.00884**	**0.00966**	**0.0133**	**0.023**	0.0012 U	0.002 U	0.002 U
Ethene (mg/l)	--	**0.0068**	**0.084**	**0.087**	NA	**0.0307**	**0.0195**	**0.04**	**0.015**	0.0015 U	0.002 U	0.002 U
Lactic Acid (mg/l)	--	NA	NA	**0.33**	NA	NA	NA	NA	NA	**3 J**	NA	**0.18 M**

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW300								13GW302		
Sample ID		013GW3000407	013GW300-1110	013GW300-0711	013GW300P-0711	13GW300-1012	13GW300-1013	13GW300-1014	13GW300-1115	013GW302-0510	013GW302-1010	013GW302-0211
Sample Date		04/04/07	11/11/10	07/28/11	07/28/11	10/17/12	10/23/13	10/21/14	11/12/15	05/26/10	10/26/10	02/01/11
Chemical Name												
Methane (mg/l)	--	**0.44**	**3.2**	**2.4**	NA	**1.17 D**	**0.865 D**	**0.815 D**	**1.5**	**0.049**	**0.22**	**0.059**
Nitrate (mg/l)	--	0.025 U	0.025 U	0.025 U	NA	0.21 U	0.21 U	0.21 U	0.05 U	0.0085 B	0.025 U	0.025 U
Nitrite (mg/l)	--	0.025 U	NA	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U	NA	NA	NA
pH (ph)	--	**9.6 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	**0.003**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	**0.053**	NA	NA	NA	NA	NA	5 U	NA	0.05 U
Pyruvate (mg/l)	--	NA	NA	0.15 U	NA	NA	NA	NA	NA	**5.1**	NA	0.15 U
Sulfate (mg/l)	--	5 U	0.5 U	**0.55 J**	NA	**0.66 J**	**0.75 J**	**1.1 J**	**1.02**	**60**	**74**	**72**
Sulfide (mg/l)	--	0.03 UL	0.8 U	0.8 U	NA	1 U	1 U	1 U	1 U	0.03 U	0.8 U	0.8 U
Total organic carbon (TOC) (mg/l)	--	10 U	**1**	**0.43 J**	NA	**1.5**	**0.91 J**	**1.6**	**1.1**	10 U	**4.2**	**3.3**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 13	13GW302								13GW303		
Sample ID		013GW302P-0211	013GW302-0411	013GW302-0711	013GW302-0112	13GW302-1012	13GW302-1013	13GW302-1014	13GW302-1115	013GW303-0510	013GW303-1010	013GW303-0111
Sample Date		02/01/11	04/29/11	07/29/11	01/26/12	10/16/12	10/24/13	10/20/14	11/13/15	05/26/10	10/26/10	01/31/11
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,2,2-Tetrachloroethane	2.4	**1**	**3.8 J**	**1.2**	**3**	1 U	1 U	1 U	NA	**8.5**	**90 K**	**180 J**
1,1,2-Trichloroethane	--	0.5 U	**1 J**	**0.33 J**	**0.52 J**	1 U	1 U	1 U	NA	5 U	**2 K**	**2.8 J**
1,1-Dichloroethane	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.5 U	0.5 UJ
1,1-Dichloroethene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.5 U	0.5 UJ
1,2,4-Trichlorobenzene	--	0.5 U	0.5 UJ	0.5 U	0.3 U	1 U	1 U	1 U	NA	5 U	0.5 U	0.5 UJ
1,2-Dichlorobenzene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.15 B	0.5 UJ
1,2-Dichloroethane	--	0.5 U	0.5 UJ	0.5 U	**0.12 J**	1 U	1 U	1 U	NA	5 U	**0.36 K**	0.5 UJ
1,2-Dichloropropane	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	0.5 U	0.5 UJ
1,3-Dichlorobenzene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.5 U	0.5 UJ
1,4-Dichlorobenzene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.5 U	0.5 UJ
2-Butanone	--	2.5 U	2.5 UJ	2.5 U	4 U	12 U	12 U	12 UJ	NA	5 R	2.5 U	2.5 UJ
2-Hexanone	--	2.5 U	2.5 UJ	2.5 U	4 U	2.5 U	2.5 U	2.5 UJ	NA	5 U	2.5 U	2.5 UJ
Acetone	--	2.5 U	2.5 UJ	5.6 B	5 U	12 U	12 U	12 U	NA	**7.8 L**	2.5 U	2.5 UJ
Benzene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	**1.6 K**	0.5 UJ
Carbon disulfide	--	0.5 U	0.5 UJ	0.5 U	0.5 U	5 U	5 U	5 U	NA	5 U	0.5 U	0.5 UJ
Chlorobenzene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 UL	NA	5 U	0.5 U	0.5 UJ
Chloroethane	--	1 U	1 UJ	1 U	0.3 U	1 U	1 U	1 U	NA	5 U	1 U	1 UJ
Chloroform	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.5 UJ	0.5 UJ
Chloromethane	--	1 U	1 UJ	1 U	0.3 U	1 U	1 U	1 UJ	NA	5 U	1 U	1 UJ
cis-1,2-Dichloroethene	70	**8.5**	**18 J**	**8.1**	**17**	**6.1**	**6.3**	**4.4**	NA	**210**	**380**	**330**
Cyclohexane	--	0.5 U	0.5 UJ	0.5 U	0.3 U	1 U	1 U	1 UJ	NA	5 U	**0.5 K**	0.5 UJ
Ethylbenzene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.5 U	0.5 UJ
Tetrachloroethene	5	0.5 U	0.5 UJ	0.5 U	**0.37 J**	1 U	1 U	1 U	NA	**1.3 J**	**11 K**	**15 J**
Toluene	--	0.5 U	0.5 UJ	0.5 U	0.2 U	1 U	1 U	1 U	NA	5 U	0.85 B	0.5 UJ
trans-1,2-Dichloroethene	--	**2.9**	**4.9 J**	**2.8**	**3.4**	**1.8 J**	**1.8 J**	**0.96 J**	NA	**11**	**61 K**	**49 J**
Trichloroethene	5	**2.1**	**4.8 J**	**2.3**	**3.4**	**1.9 J**	**1.6 J**	**1.1 J**	NA	**12**	**67 K**	**73 J**
Vinyl chloride	2	**1.4 J**	**2 J**	**1.1 J**	**1.4**	**0.83 J**	1 U	1 U	NA	**7.1**	**7.6 K**	**5.9 J**
Xylene, total	--	1.5 U	1.5 UJ	1.5 U	0.4 U	NA	2 U	2 U	NA	5 U	1.5 U	1.5 UJ
Explosives (UG/L)												
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	0.359 U	NA	NA	NA	NA	NA	NA
HMX	--	NA	NA	NA	NA	0.359 U	NA	NA	NA	NA	NA	NA
RDX	6	NA	NA	NA	NA	0.359 U	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	11,000	**56,000**	**41,000**	**54,100**	**29,500**	**48,900**	**52,400**	**50,100**	**47,800**	**1,550**	**7,680**	**9,620**
Wet Chemistry* (see note below)**												
Acetate (mg/l)	--	NA	NA	**0.58**	NA	NA	NA	NA	NA	5 U	NA	**0.039 J**
Alkalinity (mg/l)	--	NA	**51**	**65**	**48.6**	**78**	**99**	**62**	**80.2**	**28**	**27**	**16**
Carbon dioxide (mg/l)	--	NA	NA	**120**	**100**	**235**	**183 D**	**207 D**	**130**	**17.4**	**66**	**58**
Chemical oxygen demand (mg/l)	--	NA	**11 J**	**18**	**28.1**	**22 J**	**25 J**	**25 J**	**8.22 J**	**42**	10 U	10 U
Chloride (mg/l)	--	NA	**39**	**58**	**30.2**	**35**	**33**	**21**	**34**	**66**	**70**	**63**
Ethane (mg/l)	--	NA	0.002 U	0.002 U	6.40E-04 U	0.00196 U	0.00196 U	0.00196 U	6.40E-04 U	0.0012 U	**0.0025 J**	**0.0011 J**
Ethene (mg/l)	--	NA	0.002 U	0.002 U	6.00E-04 U	0.00271 U	0.00271 U	0.00271 U	6.00E-04 U	0.0015 U	**0.0021 J**	**0.0013 J**
Lactic Acid (mg/l)	--	NA	NA	**0.18**	NA	NA	NA	NA	NA	5 U	NA	0.18 B

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW302								13GW303		
Sample ID		013GW302P-0211	013GW302-0411	013GW302-0711	013GW302-0112	13GW302-1012	13GW302-1013	13GW302-1014	13GW302-1115	013GW303-0510	013GW303-1010	013GW303-0111
Sample Date		02/01/11	04/29/11	07/29/11	01/26/12	10/16/12	10/24/13	10/20/14	11/13/15	05/26/10	10/26/10	01/31/11
Chemical Name												
Methane (mg/l)	--	NA	**0.24**	**0.32**	**0.16**	**0.37**	**0.0764 D**	**0.103 D**	**0.16**	**7.20E-04**	**0.038**	**0.031**
Nitrate (mg/l)	--	NA	0.025 U	**0.46**	**0.0255 J**	0.21 U	0.21 U	0.21 U	**0.0557 J**	0.04 B	0.025 U	0.025 U
Nitrite (mg/l)	--	NA	NA	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	NA	**0.069**	NA	NA	NA	NA	NA	5 U	NA	0.05 U
Pyruvate (mg/l)	--	NA	NA	0.15 U	NA	NA	NA	NA	NA	5 U	NA	0.15 U
Sulfate (mg/l)	--	NA	**40**	**54**	**39**	**52**	**77**	**87**	**76.5**	**8.4**	**2.1**	**0.39 J**
Sulfide (mg/l)	--	NA	0.8 U	0.8 U	1 U	1 U	1 U	1 U	1 U	0.03 U	0.8 U	0.8 U
Total organic carbon (TOC) (mg/l)	--	NA	**3.2**	**3.2**	**3.06**	**3.9**	**3.2**	**3.5**	**3**	**59**	**1.8**	**0.46 J**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW303						
Sample ID		013GW303-0411	013GW303-0711	013GW303-0112	13GW303-1012	13GW303-1013	13GW303-1014	13GW303-1115
Sample Date		04/29/11	07/26/11	01/25/12	10/18/12	10/24/13	10/20/14	11/12/15
Chemical Name								
Volatile Organic Compounds (UG/L)								
1,1,2,2-Tetrachloroethane	2.4	**220 J**	**210**	**120**	**120**	**75**	**31**	**19**
1,1,2-Trichloroethane	--	**5.3**	**5.5 J**	**4.3**	**3.9**	**3.6**	**1.6 J**	NA
1,1-Dichloroethane	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
1,2,4-Trichlorobenzene	--	0.5 U	0.5 UJ	0.3 U	1 U	1 U	1 U	NA
1,2-Dichlorobenzene	--	**0.22 J**	0.5 UJ	**0.21 J**	1 U	1 U	1 U	NA
1,2-Dichloroethane	--	**0.69 J**	0.5 UJ	**1.3**	**0.83 J**	**1.3 J**	**1.3 J**	NA
1,2-Dichloropropane	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
1,3-Dichlorobenzene	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
1,4-Dichlorobenzene	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
2-Butanone	--	2.5 U	2.5 UJ	4 U	12 U	12 U	12 U	NA
2-Hexanone	--	2.5 U	2.5 UJ	4 U	2.5 U	2.5 U	2.5 U	NA
Acetone	--	2.5 U	2.5 UJ	5 U	12 U	12 U	12 UJ	NA
Benzene	--	0.5 U	0.5 UJ	**0.25 J**	1 U	1 U	1 U	NA
Carbon disulfide	--	0.5 U	0.5 UJ	0.5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
Chloroethane	--	1 U	1 UJ	0.3 U	1 U	1 U	1 U	NA
Chloroform	--	0.34 B	0.5 UJ	0.2 B	1 U	1 U	1 U	NA
Chloromethane	--	1 U	1 UJ	0.3 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	**82**	**48 J**	**34**	**69**	**56**	**41**	**32**
Cyclohexane	--	0.5 U	0.5 UJ	0.3 U	1 U	1 U	1 U	NA
Ethylbenzene	--	0.5 U	0.5 UJ	0.2 U	1 U	1 U	1 U	NA
Tetrachloroethene	5	**14**	**12 J**	**11**	**12**	**14**	**9.8**	**6.1**
Toluene	--	0.5 U	0.5 UJ	0.18 B	1 U	1 U	1 U	NA
trans-1,2-Dichloroethene	--	**18**	**7.7 J**	**8.2**	**16**	**17**	**15**	NA
Trichloroethene	5	**57**	**39 J**	**28**	**39**	**29**	**20**	**15**
Vinyl chloride	2	1 U	1 UJ	**0.38 J**	1 U	1 U	1 U	**0.59 J**
Xylene, total	--	1.5 U	1.5 UJ	**0.35 J**	NA	2 U	2 U	NA
Explosives (UG/L)								
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	0.359 UJ	NA	NA	NA
HMX	--	NA	NA	NA	**0.967 J**	NA	NA	NA
RDX	6	NA	NA	NA	**1.91 J**	NA	NA	NA
Total Metals (UG/L)								
Iron	11,000	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)								
Iron, Dissolved	11,000	**1,520**	61 B	**944**	**25.5 J**	**181**	NA	NA
Wet Chemistry* (see note below)**								
Acetate (mg/l)	--	NA	**0.042 J**	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	**12**	**5.9**	**6.15**	**10**	**8.1 J**	**8.1 J**	5 U
Carbon dioxide (mg/l)	--	NA	**70**	**82**	**111**	**92.5**	**69.2**	**56**
Chemical oxygen demand (mg/l)	--	10 U	**3.8 J**	**14**	**54**	**7.4 J**	**12 J**	6 U
Chloride (mg/l)	--	**58**	**60**	**57.8**	**54**	**50**	**46**	**41.2**
Ethane (mg/l)	--	0.002 U	0.002 U	**0.0089**	0.00196 U	0.00196 U	**0.00746**	**0.012**
Ethene (mg/l)	--	0.002 U	0.002 U	6.00E-04 U	0.00271 U	0.00271 U	0.00271 U	6.00E-04 U
Lactic Acid (mg/l)	--	NA	**0.1**	NA	NA	NA	NA	NA

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW303						
Sample ID		013GW303-0411	013GW303-0711	013GW303-0112	13GW303-1012	13GW303-1013	13GW303-1014	13GW303-1115
Sample Date		04/29/11	07/26/11	01/25/12	10/18/12	10/24/13	10/20/14	11/12/15
Chemical Name								
Methane (mg/l)	--	**0.0052 J**	**0.013**	**0.4**	**0.0208**	**0.335 D**	**1.02 D**	**1.4**
Nitrate (mg/l)	--	**0.018 J**	**0.019 J**	**0.128**	0.21 U	0.21 U	0.21 U	**0.0458 J**
Nitrite (mg/l)	--	NA	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	NA	**0.055**	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	NA	0.15 U	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**0.78 J**	**1 J**	**0.917**	**0.53 J**	**0.47 J**	**0.42 J**	**0.598**
Sulfide (mg/l)	--	0.8 U	**0.92 J**	1 U	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	**0.35 J**	**0.4 J**	**0.633 J**	**1.6**	**0.37 J**	0.64 U	**1.29**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Basewide Long-term Monitoring Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 13	13GW304											
Sample ID		013GW304-0510	013GW304P-0510	013GW304-1010	013GW304-0111	013GW304-0411	013GW304-0711	013GW304-0112	013GW304P-0112	13GW304-1012	13GW304-1013	13GW304-1014	13GW304-1115
Sample Date		5/26/2010	05/26/10	10/26/10	01/31/11	04/28/11	07/26/11	01/25/12	01/25/12	10/18/12	10/24/13	10/21/14	11/12/15
Chemical Name													
Volatile Organic Compounds (UG/L)													
1,1,2,2-Tetrachloroethane	2.4	**230**	**210**	**160**	**180 L**	**61 J**	**12 L**	**14**	**15**	**7.7**	**29**	**7.9**	**5.9**
1,1,2-Trichloroethane	--	**5.1**	**5 J**	**5.9**	**5.7**	**4.5**	0.5 UL	**1.7**	**1.8**	1 U	1 U	1 U	NA
1,1-Dichloroethane	--	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
1,1-Dichloroethene	--	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
1,2,4-Trichlorobenzene	--	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 UL	0.3 U	0.3 U	1 U	1 U	1 U	NA
1,2-Dichlorobenzene	--	5 U	5 U	0.5 U	0.5 U	0.5 UJ	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
1,2-Dichloroethane	--	5 U	5 U	0.5 U	0.5 U	**1.2**	0.5 UL	**2.2**	**2.1**	1 U	1 U	1 U	NA
1,2-Dichloropropane	--	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
1,3-Dichlorobenzene	--	5 U	5 U	0.5 U	0.5 U	0.5 UJ	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
1,4-Dichlorobenzene	--	5 U	5 U	0.5 U	0.5 U	0.5 UJ	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
2-Butanone	--	5 R	**9.5 L**	2.5 U	2.5 U	**11**	**3.5 L**	4 U	4 U	12 U	12 U	12 U	NA
2-Hexanone	--	5 U	5 U	2.5 U	2.5 U	**1.7 J**	2.5 UL	4 U	4 U	2.5 U	2.5 U	2.5 U	NA
Acetone	--	5 R	5 R	3.5 B	2.5 U	16 B	10 B	4.2 B	2.6 B	12 U	12 U	12 UJ	NA
Benzene	--	5 U	5 U	**1.2**	0.5 U	**0.53 J**	**0.73 L**	**0.37 J**	**0.39 J**	1 U	1 U	1 U	NA
Carbon disulfide	--	5 U	5 U	**0.31 J**	0.5 U	0.5 U	**0.38 L**	0.5 U	0.5 U	5 U	5 U	5 U	NA
Chlorobenzene	--	5 U	5 U	0.5 U	0.5 U	0.5 UJ	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
Chloroethane	--	5 U	5 U	1 U	1 U	1 U	1 UL	0.3 U	0.3 U	1 U	1 U	1 U	NA
Chloroform	--	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 UL	0.2 U	0.2 U	1 U	1 U	1 U	NA
Chloromethane	--	5 U	5 U	**1 J**	1 U	**1.9 J**	1 UL	0.3 U	0.3 U	1 U	1 U	1 U	NA
cis-1,2-Dichloroethene	70	**67**	**80**	**73**	**70**	**20**	**61 L**	**16**	**15**	**170**	**120**	**32**	**28**
Cyclohexane	--	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 UL	0.3 U	0.3 U	1 U	1 U	1 U	NA
Ethylbenzene	--	5 U	5 U	**0.28 J**	0.5 U	**0.44 J**	0.5 UL	**0.3 J**	**0.33 J**	1 U	1 U	1 U	NA
Tetrachloroethene	5	**6.5**	**7.8**	**9.5**	**14**	**3.9**	**5.2 L**	**2.5**	**2.4**	**1 J**	**6.7**	**1.4 J**	**3.4**
Toluene	--	5 U	5 U	1.5 B	0.5 U	0.68 B	0.47 B	0.46 B	0.45 B	1 U	1 U	1 U	NA
trans-1,2-Dichloroethene	--	**20**	**23**	**25**	**26**	**7.8**	**38 L**	**7.3**	**6.8**	**54**	**46**	**13**	NA
Trichloroethene	5	**39**	**44**	**40**	**50**	**14**	**17 L**	**5.6**	**5.8**	**19**	**41**	**13**	**16**
Vinyl chloride	2	**1.3**	**1.8**	**0.61 J**	**0.47 J**	1 U	**2.6 L**	**0.63 J**	**0.57 J**	**3.2**	**2.2**	1 U	**0.73 J**
Xylene, total	--	5 U	5 U	**0.88 J**	1.5 U	**0.29 J**	1.5 UL	**0.78 J**	**0.75 J**	NA	2 U	2 U	NA
Explosives (UG/L)													
2-Amino-4,6-dinitrotoluene	--	NA	NA	NA	NA	NA	NA	NA	NA	0.363 U	NA	NA	NA
HMX	--	NA	NA	NA	NA	NA	NA	NA	NA	0.363 U	NA	NA	NA
RDX	6	NA	NA	NA	NA	NA	NA	NA	NA	0.363 U	NA	NA	NA
Total Metals (UG/L)													
Iron	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)													
Iron, Dissolved	11,000	**1,460**	**1,700**	**25,600**	**20,300**	**14,400**	**23,400 J**	**12,400**	**12,600**	**6,640**	**2,610**	**2,540**	NA
Wet Chemistry* (see note below)**													
Acetate (mg/l)	--	5 U	NA	NA	**7.1**	NA	**7.3**	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	20 U	NA	**32**	**28**	**4.5 J**	**24**	5 U	NA	**12**	**7.7 J**	**6.4 J**	5 U
Carbon dioxide (mg/l)	--	**18.4**	NA	**66**	**73**	NA	**47**	**32**	NA	**179 Q**	**156**	**59**	**73**
Chemical oxygen demand (mg/l)	--	20 U	NA	**7.5 J**	**8 J**	**57**	**19**	**18**	NA	**56**	**21 J**	**38**	6 U
Chloride (mg/l)	--	**79**	NA	**65**	**59**	**92**	**52**	**87.6**	NA	**53**	**47**	**33**	**34.5**
Ethane (mg/l)	--	0.0013 U	NA	**0.018**	**0.022**	**0.023**	**0.0029 J**	**0.037**	NA	**0.00154 J**	0.00196 U	0.00196 U	**0.012**
Ethene (mg/l)	--	0.0016 U	NA	**0.0029 J**	**0.0094 J**	**0.006 J**	**0.0019 J**	**0.004**	NA	0.00271 U	0.00271 U	0.00271 U	**1.00E-03 J**
Lactic Acid (mg/l)	--	5 U	NA	NA	0.11 B	NA	**0.074 J**	NA	NA	NA	NA	NA	NA
Methane (mg/l)	--	**0.0021**	NA	**0.02**	**0.1**	**0.23**	**0.12**	**1.6**	NA	**0.233 D**	**0.293 D**	9.64E-04 U	**1.1**
Nitrate (mg/l)	--	0.022 B	NA	0.025 U	0.025 U	0.025 U	0.05 U	0.05 U	NA	0.21 U	0.21 U	0.21 U	0.05 U

TABLE 5-3
Historical Constituents Detected in Groundwater at Sites 5 and 13
Basewide Long-term Monitoring Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 13**	13GW304											
Sample ID		013GW304-0510	013GW304P-0510	013GW304-1010	013GW304-0111	013GW304-0411	013GW304-0711	013GW304-0112	013GW304P-0112	13GW304-1012	13GW304-1013	13GW304-1014	13GW304-1115
Sample Date		5/26/2010	05/26/10	10/26/10	01/31/11	04/28/11	07/26/11	01/25/12	01/25/12	10/18/12	10/24/13	10/21/14	11/12/15
Chemical Name													
Nitrite (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	0.044 U	0.07 U	0.07 U	0.05 U
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Propionic Acid (mg/l)	--	5 U	NA	NA	**0.26**	NA	0.05 U	NA	NA	NA	NA	NA	NA
Pyruvate (mg/l)	--	5 U	NA	NA	0.15 U	NA	0.15 U	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**3.1 J**	NA	**0.48 J**	**0.63 J**	0.5 U	**0.56 J**	**0.246 J**	NA	**0.48 J**	**0.26 J**	**1 J**	**1.21**
Sulfide (mg/l)	--	0.03 U	NA	0.8 U	0.8 U	**6.4 J**	0.8 U	1 U	NA	1 U	1 U	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	10 U	NA	**6.2**	**4.6**	**5**	**4.4**	**2.6**	NA	**22**	**0.6 J**	**1.6**	**2.02**

Notes:

Shading indicates exceedance of Site 13 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
M - Duplicate injection precision criteria not met
Q - Dioxins only: Estimated Maximum Possible Concentration (EMPC)
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 5-1 - Sites 5 and 13 Map - Letter.mxd10/12/2016CGauthier_ch2mhillen



Legend

- 2015 Long Term Montoring Well
- 2015 Bedrock Long Term Monitoring Well
- Montoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary

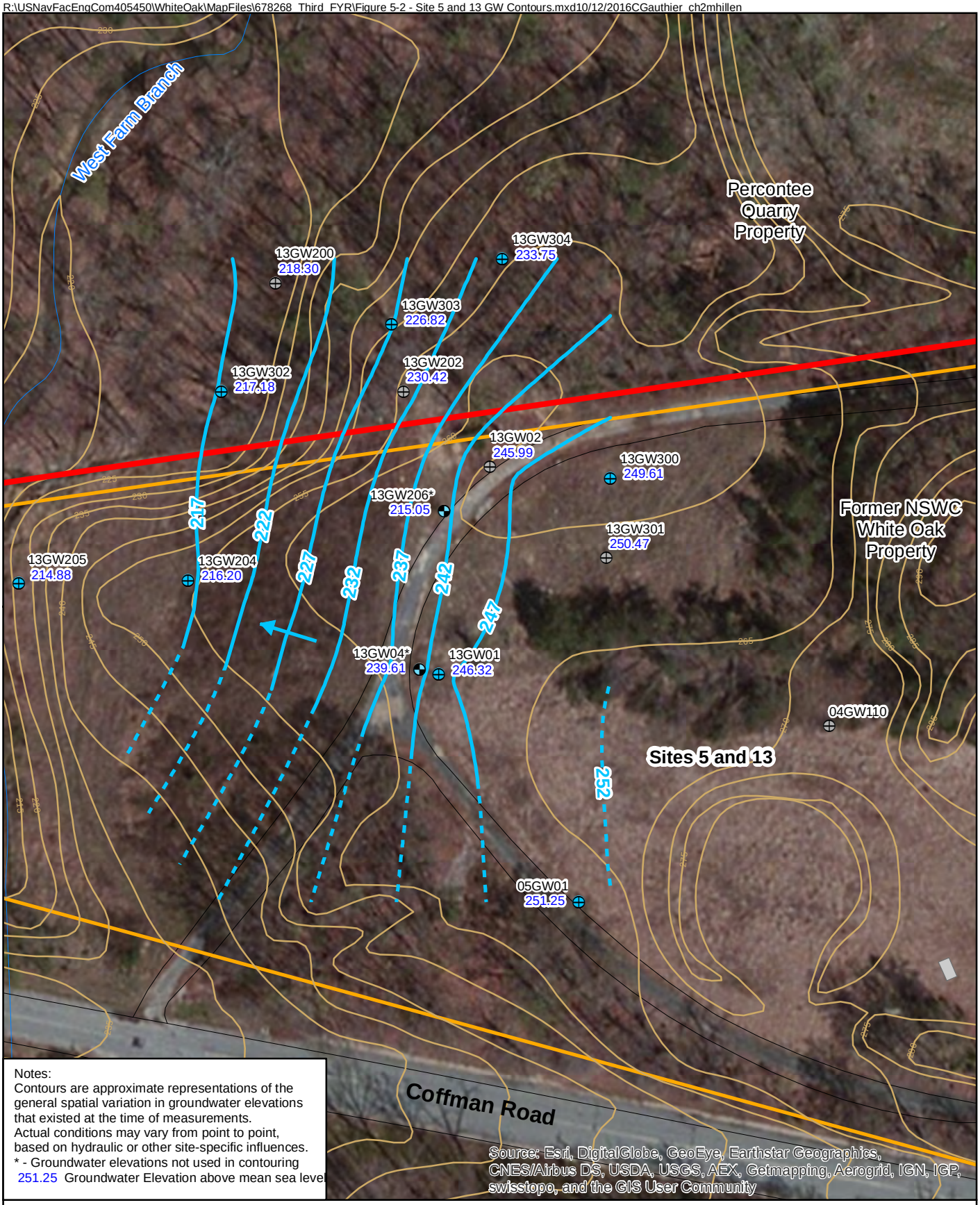
N

0 40 80 Feet

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

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 5-2 - Site 5 and 13 GW Contours.mxd10/12/2016CGauthier_ch2mhillen



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
251.25 Groundwater Elevation above mean sea level

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- 2015 Long Term Montoring Well
- 2015 Bedrock Long Term Monitoring Well
- Montoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

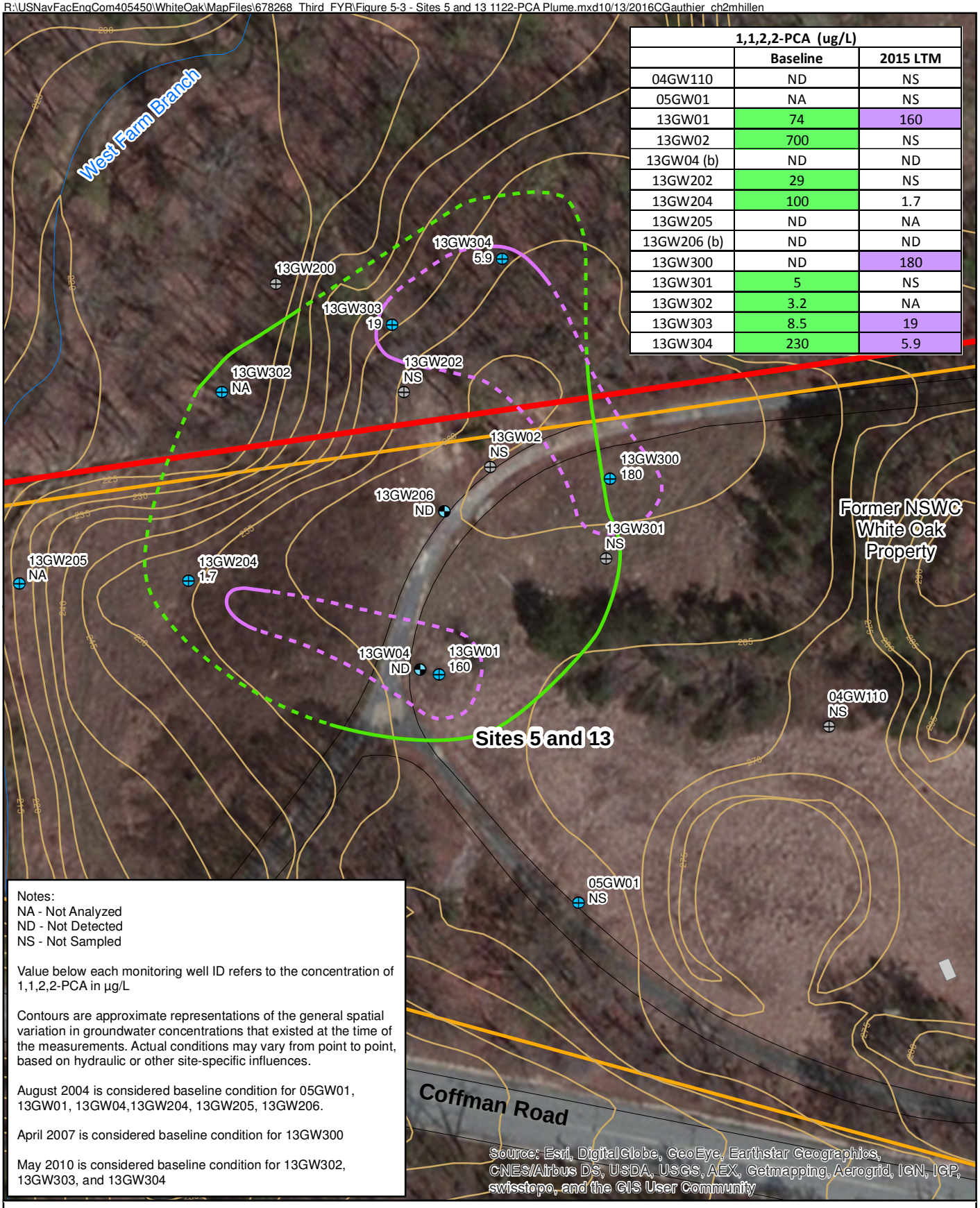
N

0 40 80 Feet

Figure 5-2
Sites 5 and 13 Potentiometric Surface Map and LTM Locations - November 9, 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 5-3 - Sites 5 and 13 1122-PCA Plume.mxd10/13/2016CGauthier_ch2mhillen



1,1,2,2-PCA (ug/L)		
	Baseline	2015 LTM
04GW110	ND	NS
05GW01	NA	NS
13GW01	74	160
13GW02	700	NS
13GW04 (b)	ND	ND
13GW202	29	NS
13GW204	100	1.7
13GW205	ND	NA
13GW206 (b)	ND	ND
13GW300	ND	180
13GW301	5	NS
13GW302	3.2	NA
13GW303	8.5	19
13GW304	230	5.9

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

Value below each monitoring well ID refers to the concentration of 1,1,2,2-PCA 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.

August 2004 is considered baseline condition for 05GW01, 13GW01, 13GW04,13GW204, 13GW205, 13GW206.

April 2007 is considered baseline condition for 13GW300

May 2010 is considered baseline condition for 13GW302, 13GW303, and 13GW304

Legend

- 2015 Long Term Montoring Well
- 2015 Bedrock Long Term Monitoring Well
- Montoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary

1,1,2,2-PCA Plume Boundaries

- 2015 above PRG (2.4 µg/L)
- Baseline above PRG (2.4 µg/L)

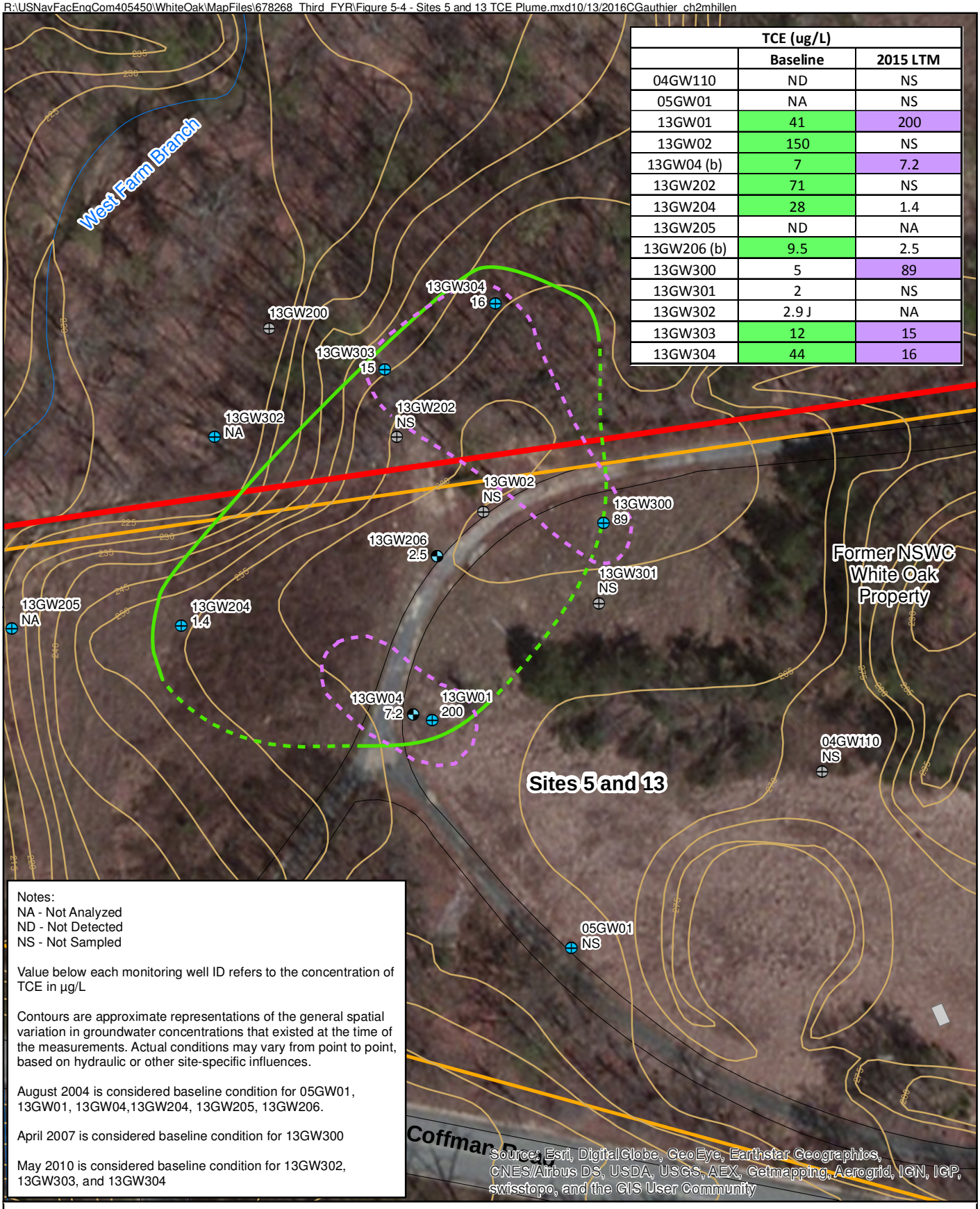
N

0 40 80 Feet

Figure 5-3
Sites 5 and 13 1,1,2,2-PCA Plume Boundary - November 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 5-4 - Sites 5 and 13 TCE Plume.mxd10/13/2016CGauthier_ch2mhillen



TCE (ug/L)		
	Baseline	2015 LTM
04GW110	ND	NS
05GW01	NA	NS
13GW01	41	200
13GW02	150	NS
13GW04 (b)	7	7.2
13GW202	71	NS
13GW204	28	1.4
13GW205	ND	NA
13GW206 (b)	9.5	2.5
13GW300	5	89
13GW301	2	NS
13GW302	2.9 J	NA
13GW303	12	15
13GW304	44	16

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

Value below each monitoring well ID refers to the concentration of TCE 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.

August 2004 is considered baseline condition for 05GW01, 13GW01, 13GW04,13GW204, 13GW205, 13GW206.

April 2007 is considered baseline condition for 13GW300

May 2010 is considered baseline condition for 13GW302, 13GW303, and 13GW304

Legend

- 2015 Long Term Monitoring Well
- 2015 Bedrock Long Term Monitoring Well
- Montoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary

TCE Plume Boundaries

- 2015 above PRG (5 µg/L)
- Baseline above PRG (5 µg/L)

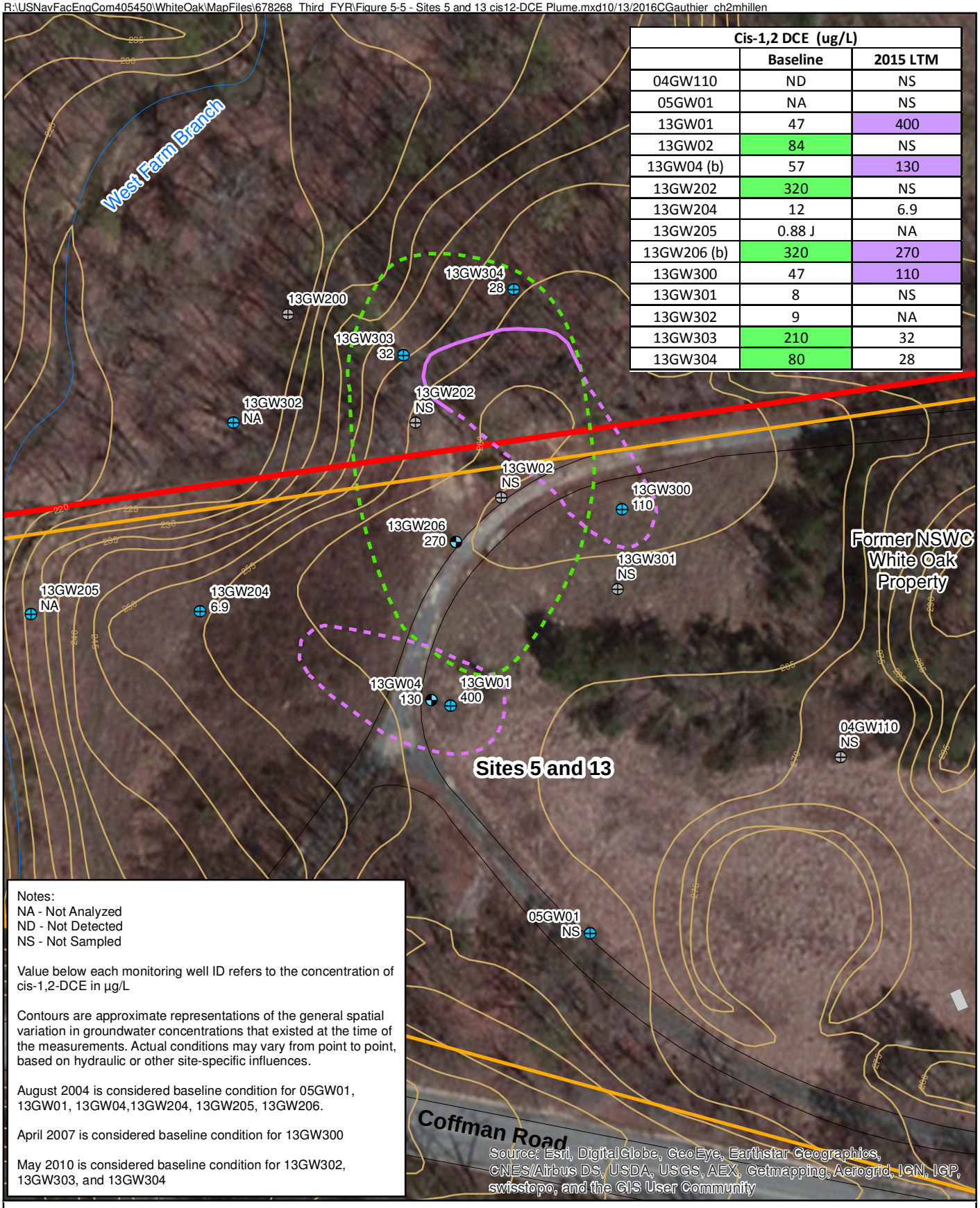
N

0 40 80 Feet

Figure 5-4
Sites 5 and 13 TCE Plume Boundary - November 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 5-5 - Sites 5 and 13 cis12-DCE Plume.mxd10/13/2016CGauthier_ch2mhillen



Cis-1,2 DCE (ug/L)		
	Baseline	2015 LTM
04GW110	ND	NS
05GW01	NA	NS
13GW01	47	400
13GW02	84	NS
13GW04 (b)	57	130
13GW202	320	NS
13GW204	12	6.9
13GW205	0.88 J	NA
13GW206 (b)	320	270
13GW300	47	110
13GW301	8	NS
13GW302	9	NA
13GW303	210	32
13GW304	80	28

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.

August 2004 is considered baseline condition for 05GW01, 13GW01, 13GW04,13GW204, 13GW205, 13GW206.

April 2007 is considered baseline condition for 13GW300

May 2010 is considered baseline condition for 13GW302, 13GW303, and 13GW304

Legend

- 2015 Long Term Montoring Well
- 2015 Bedrock Long Term Monitoring Well
- Montoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary

cis-1,2-DCE Plume Boundaries

- 2015 above PRG (70 µg/L)
- Baseline above PRG (70 µg/L)

N

0 40 80 Feet

Figure 5-5
Sites 5 and 13 cis-1,2-DCE Plume Boundary - November 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

SECTION 6

Site 7 – Ordnance Burn Area

6.1 Site Chronology

A chronology of major events for Site 7 is provided in **Table 6-1**.

Table 6-1. Key Events and Milestones for Site 7

Date	Key Events and Milestones
1948-1968	Site 7 at NSWC-White Oak was used to dispose of waste ordinance materials including various types of explosives.
1984	Site 7 was identified as a Navy IRP site in 1984.
November 1990	RFA (Kearney/Centaur Division) identified SWMU 13, which is associated with Site 7.
October 1992	An RFI (Malcom Pirnie, 1992) performed at Site 7, showing soil contaminants might affect groundwater.
1995	NSWC-White Oak selected for closure under the BRAC.
September 1999	An RFI (Tetra Tech, 2000a) completed at Site 7 concluded there were unacceptable risks from exposure to contaminated soil and groundwater.
November 2002	Burial and burning pit area (Source Area soil) excavated from 6 to 14 feet bgs and replaced with clean fill and vegetable-oil-saturated mulch.
2003	CH2M completed the FS report for OU1. The recommended alternative for groundwater at Site 7 was enhanced anaerobic bioremediation (CH2M, 2003a).
August 2004	CH2M conducts Baseline Sampling Event for groundwater prior to the RA (i.e., injection of sodium lactate) to establish baseline conditions to determine effectiveness of the RA.
September 29, 2004	Site 7 ROD finalized.
January-March, 2005	Shaw installs injection wells 07IW01 through 07IW19.
March 2005	Shaw injects 323 gallons of 60 percent sodium lactate and 45,600 gallons of chase water.
March 2005	CH2M performs 5-Day Post-Injection Sampling Event.
April 2005	CH2M performs 1-Month Post-Injection Sampling Event.
June 2005	CH2M performs 3-Month Post-Injection Sampling Event.
September 2005	CH2M performs 6-Month Post-Injection Sampling Event.
December 2005	CH2M performs 9-Month Post-Injection Sampling Event.
March 2006	CH2M performs 1-Year Post-Injection Sampling Event.
October 2006	Shaw installs three new injection wells (07IW20, 07IW21, and 07IW22) and one new monitoring well (07GW300).
November 2006	Shaw conducts EOS Pilot Test No. 1. A total of 4,860 gallons of EOS solution (EOS [a commercial emulsified vegetable oil product] and water mixture) were injected during the pilot test.
December 2006	Shaw conducts EOS Pilot Test No. 2. A total of 3,291 gallons of EOS solution were injected during the pilot test.
April 2007	CH2M performs 3-Month Post-EOS-Injection Sampling Event.
August 2007	CH2M performs 6-Month Post-EOS-Injection Sampling Event.
December 2008	CH2M performs 2008 Annual Post-EOS-Injection Sampling Event.

Table 6-1. Key Events and Milestones for Site 7

Date	Key Events and Milestones
September 2010	CH2M performs 2010 Annual Post-EOS-Injection Sampling Event.
July 2012	CH2M performs 2012 Annual Post-EOS-Injection Sampling Event.
January 2013	CH2M performs 2013 Annual Post-EOS-Injection Sampling Event.
January 2014	CH2M performs 2014 Annual Post-EOS-Injection Sampling Event.
October 2014	CH2M performs close-out round of sampling.

EOS = emulsified oil substrate

6.2 Background

6.2.1 Description and History

Site 7 is located in the northeast corner of Former NSWC-White Oak (**Figure 1-2**). Also known as the Ordnance Burn Area, Site 7 consists of a large shallow ditch approximately 20 feet wide and 400 feet long that reportedly was used to dispose of waste ordnance compounds between 1948 and 1968. Wastes disposed at this site included various types of explosives, primarily nitroaromatic and nitroaliphatic compounds, which were placed in the ditch and ignited. It has been reported that approximately 33,000 pounds of explosives were burned at Site 7 for more than 20 years. The intent of the disposal operations was to burn all of the waste residue, so that no solid wastes remained in the ditch. However, investigations indicate that soil and groundwater were affected by site operations, and that some wastes remain.

The source of the contaminated groundwater associated with Site 7 coincides with the historic area of explosive residue burning. Between November 2002 and January 2003, this source was removed when approximately 3,600 tons of soil contaminated with explosives were excavated from the site as part of a time-critical removal action. The area of excavation measured 400 feet long by 20 feet wide on average (**Figure 6-1**). The depth of soil excavation ranged from 4 feet bgs to approximately 12 feet bgs. The objective of the excavation was to remove all soil that may either represent a source of groundwater contamination or pose an unacceptable risk that would prevent future unrestricted use of the property.

Following the removal action, verification sampling was conducted to confirm the removal of the contaminated soil to levels protective of human health and the environment. The resulting risk assessment concluded that the soil remaining at the site no longer poses an unacceptable human health or ecological risk nor does it represent a source of contamination to the underlying groundwater or nearby surface water (NAVFAC, 2004c). The results of the removal action and risk assessment are presented in the Post Removal Action Report for Site 7 (Tetra Tech, 2003d).

As part of the removal action site restoration, the excavation was backfilled with sand and a 2-foot layer of mulch. Approximately 2,000 gallons of vegetable oil were also mixed into the mulch and sand. The purpose of this action was to help stimulate the anaerobic bioremediation of any explosive compounds that may have been present in the subsurface soil and underlying groundwater.

As detailed in the Site 7 ROD (NAVFAC, 2004c), the contaminants detected in the groundwater at the Site 7 source area included five explosives, perchlorate and TCE. Of these eight contaminants, five were identified as COCs during the BHHRA for groundwater presented in the OU1 RI report (CH2M, 2002). The PRGs developed for groundwater and presented in the Site 7 ROD are provided in **Table 6-2.** The PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs, and the updated values are also presented in **Table 6-2** (CH2M, 2010).

Table 6-2. PRGs for COCs for Site 7 Groundwater Included in the Site 7 ROD – 2004

COC	Groundwater PRG for Site 7 Attainment Area – 2004 ROD (µg/L)	Updated Groundwater PRG* (µg/L)
2-amino-4,6 DNT	0.75	9.9
4-amino-4,6 DNT	0.75	9.9
2,4,6-TNT	1.9	2.5
RDX	30	15
TCE	5	5
Perchlorate	-	15

Note:

* As per Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland (CH2M, 2010).

6.2.2 Physical Characteristics

Site 7 consists of a slightly depressed swale. The rest of the area adjacent to the swale is relatively flat with a gentle eastward slope. Located just east of Site 7 is a dry swale leading south into Floral Drive stream, which runs along the eastern boundary of the former White Oak property and Floral Drive. The Floral Drive stream, which is southeast of Site 7, flows south into Paint Branch.

The subsurface geology of Site 7 consists primarily of Coastal Plain deposits, which are silty sand, sand, and gravel underlain by clayey sand with gravel or silt. The Coastal Plain deposits are approximately 50 to 75 feet thick through Site 7, and are underlain with saprolite of the Wissahickon Formation. The saprolite grades from a micaceous silt or silty sand with varying amounts of clay and schist fragments to a severely weathered schist with relict structure. It varies in thickness from 5 to 55 feet (and possibly greater). The competent bedrock is a gneiss and begins at approximately 80 to 130 feet bgs.

The depth to groundwater is approximately 40 feet bgs, increasing from north to south across the site from approximately 36 to 55 feet bgs. The aquifer is approximately 25 feet thick. The site geology is silty sand/sand and gravel underlain by clayey sand with gravel or silt. Coastal Plain sediments are underlain with saprolite. Data from well 07GW201, screened in the saprolite, indicates that contamination is present only in the groundwater in the Coastal Plain sediments. Groundwater flow is to the southeast and south with the hydraulic gradient estimated at 0.006 foot per foot (CH2M, 2002) (**Figure 6-2**). The hydraulic conductivity in the Coastal Plain deposits was estimated at 6.6 feet per day from slug tests performed at the site wells. Using an effective porosity of 0.25, an average groundwater flow rate of 59 feet per year is assumed. Groundwater surface elevations range from 221.28 to 248.74 feet amsl (NAVFAC, 2004a).

6.2.3 Land and Resource Uses

Site 7 consists of a slightly depressed 20-foot by 400-foot swale and the area adjacent to the swale is either cleared or covered by woodland or grass. Site 7 is located north of Coffman Road and the fenced area that contains Buildings 501, 506, and 508. GSA, which owns the property, has no immediate plans to use Site 7. For the purposes of the risk assessment, the site was evaluated assuming the possibility of future residential use.

Groundwater at Site 7, and throughout the Former NSWC-White Oak, is not used as a potable water source at this time 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. For the purposes of the site risk assessment, the groundwater was evaluated as a potential residential drinking water source (NAVFAC, 2004a).

6.2.4 History of Contamination

As summarized in the Site 7 ROD (NAVFAC, 2004c), the source of contamination at Site 7 was explosive compounds residue within the upper 14 feet of soil in the Burn Area.

Prior to the removal action, the contamination in the soil had resulted in groundwater contamination via leaching from the source area soil to the water table approximately 40 feet below the ground surface. Detectable levels of contamination in the groundwater had migrated approximately 1,500 feet to where groundwater discharges into a surface water stream. Contaminant concentrations above risk-based-levels in the groundwater extended less than 600 feet from the source area. While site-related explosives compounds were found in the receiving surface water stream, the concentrations were below risk-based screening levels for all applicable exposure routes. No site-related contaminants were detected in sediments in the dry drainage swale that receives any and all surface water runoff from the Site 7 burn area (NAVFAC, 2004c).

As detailed in the Site 7 ROD (NAVFAC, 2004c), the contaminants in the groundwater at the Site 7 source area consist of five explosives, perchlorate and TCE. These compounds and their maximum concentrations detected in the Site 7 area between 1999 and 2003 are as follows:

- 2-amino-4,6-DNT – 140 µg/L
- 4-amino-2,6-DNT – 210 µg/L
- 2,4,6-TNT – 410 µg/L
- HMX – 500 µg/L
- RDX – 1,300 µg/L
- Perchlorate – 29 µg/L
- TCE-17 µg/L

The area of greatest contamination in the groundwater coincides with the historic area of explosive residue burning and documented soil contamination at Site 7. At the time the Site 7 ROD was signed, this area was approximately 240 feet wide (perpendicular to groundwater flow) and 10 to 20 feet long (parallel to groundwater flow). The width of the head of the plume was estimated based on the presence of contaminated soil found during the 2002 removal action and the 2003 groundwater data from wells 07GW200 and 07GW202, both of which showed no contamination.

6.2.5 Site Risks

The summary of site risks is based on the information presented in the Site 7 ROD (NAVFAC, 2004c) and previous Five-Year Review Report (Tetra Tech, 2012). Both ecological and human health baseline risk assessments were conducted to evaluate risks from Site 7 contaminants. The ERA was conducted on a facility-wide basis, and results as they relate to Site 7 are discussed here. HHRAs were conducted separately for Site 7 soil (in the Post-Removal Action Report for Site 7, [Tetra Tech, 2003d]) and the Site 7 groundwater (in the 2014 Basewide Long-term Monitoring Report [CH2M, 2016a]).

No site-related contaminants were detected in the sediment in the dry swale that connects the Site 7 area to the Floral Drive stream or in the Floral Drive stream sediments themselves, therefore no risk evaluation was conducted for human or ecological receptors for this media. While RDX and HMX were detected in the surface water in the Floral Drive stream, they were not found to be present above the risk-based screening levels for human health or ecological risk, and therefore, risks to receptors were not evaluated for surface water.

6.2.5.1 Human Health Risk Assessment

The HHRA for soil was conducted for the soil that remained at Site 7 after the November 2002 removal action. The soil HHRA evaluated noncarcinogenic hazards and carcinogenic hazards associated with exposure to soil by future industrial workers, maintenance workers, construction workers, adult recreational user, adolescent trespasser, daycare-center child, and 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

future site use. The HHRA for soil demonstrated that noncarcinogenic hazards and carcinogenic risks for all receptors were within target USEPA levels.

A Human Health Risk Screening (HHRS) evaluation was performed for Site 7 groundwater using data from the most recent groundwater monitoring event in October 2014. The site COCs were either not detected or were all below the site remediation goals. To confirm the objectives of the remediation have been met, the data were evaluated in HHRS and the results indicate there are no unacceptable risks to potential future receptors for potable use of groundwater.

6.2.5.2 Ecological Assessment

As summarized in the Site 7 ROD (NAVFAC, 2004c), the Navy conducted a facility-wide BERA at Former NSWC-White Oak. The procedures followed in conducting the BERA are outlined in the April 2001 final report. The BERA consisted of screening all soil, surface water, and sediment data collected at the facility against applicable ecological risk-based screening criteria. This data included soil data from Site 7 as well as sediment and surface water data from the Floral Drive stream. The BERA concluded that there was no risk from Site 7 soil prior to the 2002 removal action. The subsequent removal action, conducted to address potential risks to human receptors, has further mitigated the potential impact of the site contaminants on ecological receptors. The BERA also concluded that the sediment and surface water in the Floral Drive stream does not present unacceptable risks. As groundwater exposure is not associated with ecological receptors, Site 7 groundwater poses no ecological risks.

6.3 Response Action Summary

6.3.1 Basis for Remedial Action

Based on the results of previous investigations, RA was warranted to protect human health from actual or threatened releases of VOC and explosives constituents in the groundwater at Site 7; NFA was needed to address soil contamination.

6.3.2 Response Actions

6.3.2.1 Selected Remedy for Site 7

The Site 7 RAOs for groundwater identified in the ROD were as follows:

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

Meeting these objectives for Site 7 is based primarily upon achieving the PRGs; the original PRGs are shown in **Table 6-2**. These PRGs were recalculated in 2010 for each of the COCs identified for the Site 7 groundwater, based on updated toxicity values, most recent risk assessment methodology, and combined risks from the COCs in the Site 7 area groundwater (CH2M, 2010). The PRGs established were the MCL (for those compounds that have MCLs) and the calculated risk-based PRG for chemicals that do not have MCLs. The revised PRGs are also listed in **Table 6-2**.

To achieve the RAOs, the selected remedy for Site 7 groundwater, “Alternative 4: Enhanced Anaerobic Bioremediation,” comprised the following components:

- Performance of a source area pilot test to evaluate full scale implementation
- Installation of injection wells and injection of electron donor into the TRZ
- Groundwater monitoring of baseline and post-injection conditions
- Preparation of a Five-Year Review report
- Implementation of ICs until PRGs are met

6.3.3 Status of Implementation

6.3.3.1 Enhanced Anaerobic Bioremediation (sodium lactate injection)

An initial injection of sodium lactate was completed in March 2005. The sodium lactate electron donor was exhausted approximately 6 months after the injection at Site 7. In November and December 2006, an EVO and lactate substrate (EOS and water mixture) was injected into Site 7 during two Site 4 pilot tests. Because Site 7 has similar geology to Site 4 and had a monitoring well and injection well network to utilize for the test, the tests were conducted to aid in the calculation of EOS dosage and injectate volume necessary to achieve the target radius of influence during the Site 4 remedial implementation, as well as for the Site 7 reinjection of electron donor, in the Coastal Plain aquifer formation. Details associated with the injection activities can be found in the *Close-out Report for Site 7 Sodium Lactate Injection, Former NSWC-White Oak, Silver Spring, Maryland* (Shaw, 2005a) and the technical memorandum *Site 4 EOS® Pilot Test at Site 7, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2007).

6.3.3.2 Long-term Monitoring

Annual monitoring was conducted from December 2008 through January 2014. The January 2014 data showed RDX slightly above its PRG of 15 µg/L in well 07GW15 (16.2 µg/L). Since this was the only well sampled at Site 7 and the concentration of RDX in 07GW15 was close to the PRG, close-out sampling in accordance with the Site 7 LTM Plan Decision Rule 3B was recommended.

During the close-out round of groundwater sampling at Site 7, conducted in October 2014, eight monitoring wells identified in Table 3-3 of the Site 7 LTM Plan (CH2M, 2004a) were sampled for VOCs, explosives, and perchlorate. The analytical results from this sampling event are provided in **Table 6-3** and summarized below.

Volatile Organic Compound Results

VOCs were not detected in the groundwater from the eight monitoring wells sampled at Site 7.

Explosives Results

- 2,4,6-trinitrotoluene was not detected in the groundwater from the eight monitoring wells sampled at Site 7.
- 2-amino-4,6-DNT was detected in one groundwater sample from monitoring well, 07GW105, at a concentration of 0.591 µg/L. The detected concentration was below the PRG (9.9 µg/L).
- 4-amino-2,6-DNT was detected in one groundwater sample from monitoring well, 07GW105, at a concentration of 0.688 µg/L. The detected concentration was below the PRG (9.9 µg/L).
- RDX was detected in groundwater samples from four monitoring wells (07GW08, 07GW105, 46GW205, 46GW206). Detected concentrations ranged from 0.575 µg/L (07GW08) to 9.98 µg/L (46GW105), which were below the PRG of 15 µg/L.

Perchlorate Results

Perchlorate was detected in groundwater samples from four monitoring wells (07GW105, 07GW203, 46GW205, 46GW206). Detected concentrations ranged from 0.937 µg/L (46GW206) to 1.28 µg/L (46GW205), which were below the PRG of 15 µg/L.

In summary, the groundwater analytical results of the close-out round of sampling indicated that the concentrations of COCs in all eight Site 7 wells were below their respective PRGs.

6.3.3.3 Operation and Maintenance

There are no O&M activities currently associated with Site 7.

6.3.3.4 Institutional Control Summary

ICs at Site 7 include LUCs to:

- Ensure no withdrawal of groundwater from within the restricted area shown on Figure 2-8 of the Site 7 ROD (NAVFAC, 2004c).
- Ensure no aquifer use for drinking purposes 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 maintain the integrity of any current or future remedial equipment or remedial monitoring operation in the restricted area.
- Ensure adequate notification of pertinent use restrictions to current and potential future property owners.

ICs will be maintained until the concentration of hazardous substances in the groundwater are at such levels to allow for unrestricted use and exposure. The LUC RD for Site 7 was finalized in 2009 (CH2M, 2009b).

6.4 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 6-4 and 6-5**).

Table 6-4. Protectiveness Determination/Statement from the 2012 Five-Year Review – Site 7

Protectiveness Determination	Protectiveness Statement
Protective	The remedy for the Ordnance Burn Area is protective of the human health and ecological receptors based on achieving the RAOs specified in the RODs. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Groundwater monitoring and five-year reviews help to ensure that the RAs are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

Table 6-5. Status of Recommendations from the 2012 Five-Year Review – Site 7

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
No issues were identified	(not applicable)	(not applicable)	(not applicable)	(not applicable)

The previous Five-Year Review (Tetra Tech, 2012) did not identify any issues and concluded that the remedy was functioning as intended by the ROD and is protective of human health and the environment. The implementation of LUCs and routine site inspections has continued since the last review.

6.5 Five-Year Review Process

6.5.1 Document Review

Table 6-6 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 section is given in the References section.

Table 6-6. Summary of the Site 7 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
Remedial Investigation Report, Dahlgren Division Detachment	Malcolm Pirnie	1992
Basewide Ecological Risk Assessment for NSWC-White Oak	Tetra Tech	2001
ROD for Site 7 Soil and Groundwater	NAVFAC	2004
Final Long-Term Monitoring Plan for Site 4 Groundwater	CH2M	2011
Memorandum Re: Perchlorate Remediation Goal	NAVFAC	2006
Former NSWC-White Oak First Five-Year Review	JM Waller Associates	2007
Former NSWC-White Oak Second Five-Year Review	Tetra Tech	2012
Final Basewide Long-Term Monitoring Report – October 2014	CH2M	2016

6.5.2 Data Review and Evaluation

LTM has been conducted for groundwater at Site 7 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. The Site 7 historical LTM groundwater analytical data collected from 2004 (baseline) through October 2014 are provided in **Table 6-3**, and the most recent trend graph presenting explosives COC results for a monitoring well at Site 7 is provided in **Appendix C-4**.

No COCs exceeded their respective PRGs for Site 7. An HHRS evaluation was performed for Site 7 (CH2M, 2016a) and the results indicate there are no unacceptable risks to potential future receptors for potable use of groundwater.

6.6 Technical Assessment

This section presents the answers to the three questions defined for the Technical Assessment for Site 7.

6.6.1 Question A – Is the Remedy Functioning as Designed?

6.6.1.1 Remedial Action Performance

The review of documents and site inspection show that the selected remedy has been implemented to date, ICs and groundwater monitoring are functioning as intended by the ROD. The enhanced bioremediation injections were implemented and have performed well with contaminant levels measured at concentrations below PRGs in all wells. The ICs in the form of groundwater use restrictions are responsible for protecting human receptors from any direct contact with contact or ingestion of groundwater. Groundwater monitoring activities concluded in 2014, and no COCs exceeded the PRGs. Based on the current HHRS evaluation for Site 7, there are no unacceptable risks to potential future receptors for potable use of groundwater (CH2M, 2016a).

6.6.1.2 Implementation of Institutional Controls and Other Measures

ICs at Site 7 include LUCs to ensure no withdrawal of groundwater, ensure no aquifer use for drinking purposes until the PRGs are met, minimize potentially adverse health and environmental effects of work or development in the restricted area, and to maintain the integrity of any current or future remedial equipment or remedial monitoring operation in the restricted area. These ICs have been effectively implemented to date.

As described in the ROD for Site 7 soil, the selected remedy for Site 7 soil is NFA; ICs are not required for this medium (NAVFAC, 2004c).

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 is not anticipated to change, the exposure assumptions and RAOs developed at the time of remedy selection are still valid. PRGs established for Site 7 groundwater in the 2004 ROD were revised in 2010 as per *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2010) and presented in **Table 6-2**. 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 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) have been updated since the revised PRGs, and these changes would result in slight changes to the cleanup levels for the COCs without an MCL (2-amino-4,6-DNT, 4-amino-2,6-DNT, 2,4,6-TNT, and RDX). The most recent concentrations of all COCs were below the updated PRGs. Cleanup levels have been met at Site 7 and risks associated with groundwater are within acceptable levels.

6.6.3 Question C – Has any other information come to light that could question the protectiveness of the remedy?

No additional information has surfaced that questions the protectiveness of the remedy. The ICs and long term groundwater monitoring have been effective in protecting human receptors from any direct contact with or ingestion of groundwater. Groundwater concentrations are now below PRGs and there are no unacceptable risks associated with exposure to (including potable use of) groundwater.

6.7 Issues, Recommendations, and Follow-up Actions

The remedy for groundwater is enhanced anaerobic bioremediation and LUCs protective of human health and the environment. Long-term monitoring was conducted to monitor the effects of the in situ treatment. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy in this area.

Final close-out sampling was conducted in October 2014, with analytical results showing no COCs exceeding the PRGs.

Per rule 3B from the Site 7 LTM Plan (Section 3.4.4 of the LTM Plan for Site 7 Groundwater [CH2M, 2004c]), the following recommendation is made for Site 7:

- Based on the Human Health Risk Screening evaluation, there are no unacceptable risks to potential future receptors for potable use of groundwater. The concentrations of all COCs are below the PRGs at the site. Based on the groundwater results and risk screening, Site 7 is recommended for closure.

A Remedial Action Completion Report is currently being prepared by the Navy to close out Site 7. Upon closure, the LUCs will be removed from the site.

6.8 Protectiveness Statement

The remedy for the Site 7 – Ordnance Burn Area is protective of the human health and ecological receptors based on the results that the in situ groundwater treatment has now reduced the concentrations of COCs to achieve the RAOs specified in the ROD. Interim LUCs have been effective in preventing usage of groundwater as a potable water supply while COC concentrations were above the PRGs and have also restricted activities within the site boundaries that could potentially disturb the remedial equipment. Groundwater monitoring has concluded, and risk screenings showed no unacceptable risks for the residential potable use of groundwater. Site 7 is recommended for closure, which would include the removal of the LUC restrictions.

TABLE 6-3
Historical Constituents Detected in Groundwater at Site 7
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	White Oak Site 7 PRGs	04GW100							07GW08				07GW08			
Sample ID		004GW1000804	004GW1000804a	004GW1000905	004GW100-0306	004GW1000507	004GW100-1208	004GW100-1014	007GW0080804	007GW0080804a	007GW0080305	007GW0080405	007GW9000405	007GW0080605	007GW0080905	007GW008-1205
Sample Date		08/05/04	08/05/04	09/21/05	03/07/06	05/21/07	12/16/08	10/17/14	08/05/04	08/05/04	03/11/05	04/05/05	04/05/05	06/09/05	09/21/05	12/12/05
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	--	**3.4**	NA	**7**	2 U	2 U	1 U	1 U	1 U	NA	10 U	10 U	10 U	10 U	2 U	2 U
2-Butanone	--	NA	NA	10 U	10 U	2 U	5 R	12 UJ	NA	NA	10 U	**4 J**	10 U	10 U	10 U	10 U
Acetone	--	NA	NA	10 U	10 U	2 UJ	5 R	12 U	NA	NA	**680 J**	**200 J**	**180 J**	**99 J**	**7 J**	10 U
Chloroform	--	NA	NA	10 U	10 U	2 U	5 U	1 U	NA	NA	**2 J**	**1 J**	**1 J**	10 U	10 U	10 U
cis-1,2-Dichloroethene	--	1 U	NA	10 U	10 U	2 U	5 U	1 U	1 U	NA	10 U	10 U	10 U	10 U	10 U	10 U
Methyl acetate	--	NA	NA	10 U	10 U	2 U	5 U	1 UJ	NA	NA	10 U	**12**	**13**	10 U	10 U	10 U
Methyl-tert-butyl ether (MTBE)	--	NA	NA	**2 J**	10 U	2 U	5 U	1 U	NA	NA	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	5	**22**	NA	**45**	**3**	2 U	5 U	1 U	1 U	NA	10 U	10 U	10 U	10 U	2 U	2 U
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
1,3,5-Trinitrobenzene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
1,3-Dinitrobenzene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
2,4,6-Trinitrotoluene	2.5	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	**29**	NA	**19**	**1.5 L**	**1.8 L**	0.16 U	**7.3**	**32**
2,4-Dinitrotoluene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	**0.57**	**0.2 L**	**0.24 L**	0.16 U	**0.44**	**0.55 J**
2,6-Dinitrotoluene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
2-Amino-4,6-dinitrotoluene	9.9	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	**20**	NA	**32**	**11 L**	**11 L**	**5.6 J**	**25 J**	**61**
2-Nitrotoluene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	**0.54 J**	0.16 U	0.18 U
3-Nitrotoluene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
4-Amino-2,6-dinitrotoluene	9.9	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	**23**	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
4-Nitrotoluene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	**2.8 J**	0.16 U	0.18 U
HMX	--	**0.14 J**	NA	0.18 U	**0.68**	NA	NA	0.379 U	**96**	NA	**82**	**86 L**	**96 L**	**30 J**	**55**	**120**
Nitrobenzene	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
Perchlorate	15	1 U	**0.93**	NA	NA	NA	NA	0.1 U	**2.3**	**2.6**	NA	NA	NA	NA	NA	NA
RDX	15	0.5 U	NA	0.18 U	**1.9 J**	NA	NA	0.379 U	**190**	NA	**140**	**120 L**	**130 L**	**38**	**120**	**300**
Tetryl	--	0.2 U	NA	0.18 U	0.22 U	NA	NA	0.379 U	5 U	NA	0.44 U	**0.17 L**	**0.18 L**	0.16 U	0.16 U	0.18 U
Total Metals (UG/L)																
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**7,750**	NA	**9,310**	NA	NA	NA	NA	3,880 B	NA	**92,500**	**33,500**	**42,300**	**35,000**	**12,400**	**9,730**
Dissolved Metals (UG/L)																
Iron, Dissolved	--	49.4 B	NA	NA	NA	69.4 B	NA	NA	27.5 B	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)																
Acetate	--	**1 J**	NA	NA	NA	NA	NA	NA	1 U	NA	**1**	**18**	**25**	1 U	NA	NA
Alkalinity	--	**23 J**	NA	**29**	NA	NA	NA	NA	**15 J**	NA	**72**	**60**	**77**	**100**	**31**	NA
Butyrate	--	1 U	NA	NA	NA	NA	NA	NA	1 U	NA	**1**	1 U	1 U	1 U	NA	NA
Carbon dioxide	--	**92**	NA	**120**	**200**	NA	NA	NA	**68**	NA	**170**	**370**	**390**	**110**	**180**	**110 J**
Chemical oxygen demand	--	10 U	NA	20 U	20 U	NA	NA	NA	9.5 B	NA	**280**	**110**	**110**	20 U	20 U	20 U
Chloride	--	**11.4**	NA	**10**	**14 L**	NA	NA	NA	**6.2**	NA	**16**	9.4 B	9.6 B	**9**	**7.5**	**6.8**
Ethane	--	5.00E-06 U	NA	5.00E-04 U	5.00E-04 U	NA	NA	NA	5.00E-06 U	NA	0.027 U	0.026 U	0.026 U	5.00E-04 U	5.00E-04 U	5.00E-04 U
Ethene	--	5.00E-06 U	NA	5.00E-04 U	5.00E-04 U	NA	NA	NA	5.00E-06 U	NA	0.036 U	0.035 U	0.035 U	5.00E-04 U	5.00E-04 U	5.00E-04 U
Lactic Acid	--	25 U	NA	NA	NA	NA	NA	NA	25 U	NA	**300 K**	1 U	1 U	1 U	NA	NA
Methane	--	**3.90E-04**	NA	5.00E-04 U	5.00E-04 U	NA	NA	NA	**5.30E-04**	NA	0.014 U	0.014 U	0.014 U	5.00E-04 U	5.00E-04 U	**0.0026**
Nitrate	--	**0.71**	NA	**0.58**	**0.46 L**	NA	NA	NA	**1.1**	NA	**0.096**	**0.16 L**	**0.1 L**	**1.1**	**0.5**	**1.8**
Nitrate/Nitrite	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.33**	**0.24**	NA	NA	NA
Nitrite	--	NA	NA	0.025 U	0.025 U	NA	NA	NA	NA	NA	0.025 U	**0.27 L**	**0.21 L**	**1.8**	0.025 U	0.025 U
pH (pH units)	--	NA	NA	**5.7**	NA	NA	NA	NA	NA	NA	**5.9**	NA	NA	NA	**5.5**	NA
Proprionic Acid	--	1 U	NA	NA	NA	NA	NA	NA	1 U	NA	**1**	**13**	**30**	1 U	NA	NA
Pyruvate	--	10 U	NA	NA	NA	NA	NA	NA	10 U	NA	**15**	**2.8**	**3**	1 U	NA	NA
Sulfate	--	**29.1**	NA	**21**	**43 L**	NA	NA	NA	**20.6**	NA	**27**	**28**	**29**	**23**	**22**	**22**
Sulfide	--	1 U	NA	0.03 U	0.03 U	NA	NA	NA	1 U	NA	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Total organic carbon (TOC)	--	**2**	NA	10 U	10 U	NA	NA	NA	**2**	NA	**93**	**49**	**48**	10 U	10 U	10 U

Notes:

Shading indicates exceedance of PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

Q - Lab qualifier; estimated result, one or more QC criteria recovered outside acceptance limits

R - Rejected result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

UQ - Lab qualifier; analyte not detected, quantitation limit may be inaccurate due to one or more QC criteria recovered outside acceptance limits

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 6-3
Historical Constituents Detected in Groundwater at Site 7
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	White Oak Site 7 PRGs	07GW08							07GW103							
Sample ID		007GW008P-1205	007GW008-0306	007GW008P-0306	007GW0080407	007GW008-0807	007GW008-1208	07GW08-1014	007GW1030804	007GW1030804a	007GW1030905	007GW103-1205	007GW103-0306	007GW103-0807	007GW103-1208	007GW103-0910
Sample Date		12/12/05	03/07/06	03/07/06	04/04/07	08/13/07	12/18/08	10/17/14	08/06/04	08/06/04	09/21/05	12/12/05	03/08/06	08/13/07	12/18/08	09/15/10
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	--	2 U	2 U	2 U	NA	NA	NA	1 U	1 U	NA	2 U	2 U	2 U	NA	NA	NA
2-Butanone	--	10 U	10 U	10 U	NA	NA	NA	12 UJ	NA	NA	10 U	10 U	10 U	NA	NA	NA
Acetone	--	10 U	10 U	**8 J**	NA	NA	NA	12 U	NA	NA	10 U	10 U	10 U	NA	NA	NA
Chloroform	--	10 U	10 U	10 U	NA	NA	NA	1 U	NA	NA	**2 J**	**2 J**	10 U	NA	NA	NA
cis-1,2-Dichloroethene	--	10 U	10 U	10 U	NA	NA	NA	1 U	1 U	NA	10 U	10 U	10 U	NA	NA	NA
Methyl acetate	--	10 U	10 U	10 U	NA	NA	NA	1 UJ	NA	NA	10 U	10 U	10 U	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	--	10 U	10 U	10 U	NA	NA	NA	1 U	NA	NA	10 U	10 U	10 U	NA	NA	NA
Trichloroethene	5	2 U	2 U	2 U	NA	NA	NA	1 U	1 U	NA	2 U	2 U	2 U	NA	NA	NA
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
1,3,5-Trinitrobenzene	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
1,3-Dinitrobenzene	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
2,4,6-Trinitrotoluene	2.5	0.14 U	**48**	**44**	0.2 UL	0.2 U	1.9 U	0.357 U	**2.5**	NA	**0.83**	0.15 U	**0.24**	0.2 U	1.9 U	0.12 U
2,4-Dinitrotoluene	--	0.14 U	**0.89 J**	**0.82 J**	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
2,6-Dinitrotoluene	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
2-Amino-4,6-dinitrotoluene	9.9	0.14 U	**63**	**59**	0.2 UL	0.2 U	0.5 U	0.357 U	**3**	NA	**1.3 J**	0.15 U	**1.5 J**	0.2 U	0.5 U	0.12 U
2-Nitrotoluene	--	0.14 U	**0.43 J**	**0.42 J**	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
3-Nitrotoluene	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
4-Amino-2,6-dinitrotoluene	9.9	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	0.75 U	0.357 U	**3.7**	NA	0.2 U	0.15 U	0.2 U	0.2 U	0.75 U	0.12 U
4-Nitrotoluene	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
HMX	--	**1.7**	**150**	**140**	**2.5 L**	**0.54 J**	1 UL	**2.8**	**17**	NA	**13**	0.15 U	**24**	0.2 U	1 UL	**0.16 J**
Nitrobenzene	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
Perchlorate	15	NA	NA	NA	NA	NA	NA	0.1 U	1 U	**0.24**	NA	NA	NA	NA	NA	0.25 U
RDX	15	**5.2**	**350**	**330**	**3.1 L**	0.2 U	6 U	**0.575 J**	**11**	NA	**11**	0.15 U	**9.7**	0.2 U	6 U	0.12 U
Tetryl	--	0.14 U	0.2 U	0.2 U	0.2 UL	0.2 U	1 U	0.357 U	0.6 U	NA	0.2 U	0.15 U	0.2 U	0.2 U	1 U	0.12 U
Total Metals (UG/L)																
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**11,000**	**13,700 J**	**13,200 J**	**13,800**	NA	**9,170**	NA	NA	NA	**8,700**	**9,960**	**5,600 J**	NA	**7,040**	NA
Dissolved Metals (UG/L)																
Iron, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)																
Acetate	--	NA	NA	NA	**70**	**85**	**63**	NA	NA	NA	NA	NA	NA	**40**	**7.6**	NA
Alkalinity	--	NA	NA	NA	**130**	**170**	NA	NA	NA	NA	**21**	NA	NA	**130**	NA	NA
Butyrate	--	NA	NA	NA	**11**	**8.9**	5 U	NA	NA	NA	NA	NA	NA	1 U	5 U	NA
Carbon dioxide	--	**140 J**	**210**	**220**	**310**	**270**	**200**	NA	NA	NA	**150**	**150 J**	**150**	**150**	**140**	**130**
Chemical oxygen demand	--	20 U	20 U	20 U	NA	NA	NA	NA	NA	NA	21 U	20 U	20 U	NA	NA	NA
Chloride	--	**7.2**	**9.4 L**	**7.3 L**	**6.9**	**6.6**	**6.5**	NA	NA	NA	**6.4**	**7.3**	**5 L**	**7.4**	**5.8**	**12**
Ethane	--	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	**1.20E-04 J**	0.0012 U	NA	NA	NA	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	0.0012 U	0.002 U
Ethene	--	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	1.00E-03 U	0.0015 U	NA	NA	NA	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	0.0015 U	0.002 U
Lactic Acid	--	NA	NA	NA	1 U	1 U	5 U	NA	NA	NA	NA	NA	NA	1 U	5 U	NA
Methane	--	**0.0025**	5.00E-04 U	5.00E-04 U	**0.081**	**2.3**	**11**	NA	NA	NA	5.00E-04 U	5.00E-04 U	5.00E-04 U	**5.3**	**14**	**10**
Nitrate	--	**1.9**	**1.4 L**	**1.3 L**	**0.058**	0.025 UJ	0.13 U	NA	NA	NA	**1**	**1.3**	**1.7 L**	0.025 UJ	0.13 U	0.04 U
Nitrate/Nitrite	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	--	0.025 U	0.025 U	0.025 U	0.025 U	0.025 UJ	0.13 U	NA	NA	NA	0.025 U	0.025 U	0.025 U	0.025 UJ	0.13 U	0.034 B
pH (pH units)	--	NA	NA	NA	**5.9 J**	**6.1**	NA	NA	NA	NA	**5.5**	NA	NA	**6.2**	NA	NA
Proprionic Acid	--	NA	NA	NA	**34**	**8.4**	5 U	NA	NA	NA	NA	NA	NA	**2**	5 U	NA
Pyruvate	--	NA	NA	NA	1 U	1 U	5 U	NA	NA	NA	NA	NA	NA	1 U	5 U	NA
Sulfate	--	**22**	**23 L**	**23 L**	5 U	5 U	5 U	NA	NA	NA	**14**	**20**	**17**	5 U	5 U	**18**
Sulfide	--	0.03 U	0.03 U	0.03 U	0.03 UL	0.03 U	0.03 R	NA	NA	NA	0.03 U	0.03 U	0.03 U	0.03 U	0.03 R	0.75 U
Total organic carbon (TOC)	--	10 U	10 U	10 U	**79**	**46.6**	**29**	NA	NA	NA	10 U	10 U	10 U	**33.6**	**31 J**	**3.5**

Notes:

Shading indicates exceedance of PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

Q - Lab qualifier; estimated result, one or more QC criteria recovered outside acceptance limits

R - Rejected result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

UQ - Lab qualifier; analyte not detected, quantitation limit may be inaccurate due to one or more QC criteria recovered outside acceptance limits

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 6-3
Historical Constituents Detected in Groundwater at Site 7
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**White Oak Site 7 PRGs**	07GW103			07GW104								07GW104		
Sample ID		007GW103P-0910	07GW103-1014	007GW103P-1014	007GW1040804	007GW1040804a	007GW1040305	007GW1040405	007GW1040605	007GW104P0605	007GW1040905	007GW104-1205	007GW104-0306	007GW1040407	007GW104-1208
Sample Date		09/15/10	10/17/14	10/17/14	08/05/04	08/05/04	03/11/05	04/05/05	06/09/05	06/09/05	09/21/05	12/12/05	03/07/06	04/04/07	12/17/08
Chemical Name															
Volatile Organic Compounds (UG/L)															
1,1,2,2-Tetrachloroethane	--	NA	1 U	1 UL	1 U	NA	10 U	10 R	10 U	10 U	2 U	2 U	2 U	NA	NA
2-Butanone	--	NA	12 UJ	12 UJ	NA	NA	10 U	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA
Acetone	--	NA	12 U	12 UL	NA	NA	**3 J**	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA
Chloroform	--	NA	1 U	1 UL	NA	NA	**2 J**	**2 L**	**1 J**	**1 J**	**2 J**	10 U	1 B	NA	NA
cis-1,2-Dichloroethene	--	NA	1 U	1 UL	1 U	NA	10 U	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA
Methyl acetate	--	NA	1 UJ	1 UJ	NA	NA	10 U	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA
Methyl-tert-butyl ether (MTBE)	--	NA	1 U	1 UL	NA	NA	10 U	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA
Trichloroethene	5	NA	1 U	1 UL	1 U	NA	10 U	10 R	10 U	10 U	2 U	2 U	2 U	NA	NA
Semivolatile Organic Compounds (UG/L)															
No Detections															
Explosives (UG/L)															
1,3,5-Trinitrobenzene	--	0.12 U	0.351 U	0.386 U	3 U	NA	**2.7 J**	**4.4 L**	0.13 U	0.12 U	**3.5 J**	0.1 U	0.2 U	0.4 UJ	1 U
1,3-Dinitrobenzene	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	1 U
2,4,6-Trinitrotoluene	2.5	0.12 U	0.351 U	0.386 U	**29**	NA	**160**	**170 L**	**38**	**28**	**180**	0.1 U	**180**	0.4 UJ	1.9 U
2,4-Dinitrotoluene	--	0.12 U	0.351 U	0.386 U	3 U	NA	**0.99**	**1.2 L**	**0.61**	**0.37**	**0.88 J**	0.1 U	**1 J**	0.4 UJ	1 U
2,6-Dinitrotoluene	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	1 U
2-Amino-4,6-dinitrotoluene	9.9	0.12 U	0.351 U	0.386 U	**17**	NA	**61**	**78 L**	**25**	**18**	**79**	0.1 U	**83**	0.4 UJ	0.5 U
2-Nitrotoluene	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	**0.62 J**	0.1 U	**0.54 J**	0.4 UJ	1 U
3-Nitrotoluene	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	1 U
4-Amino-2,6-dinitrotoluene	9.9	0.12 U	0.351 U	0.386 U	**21**	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	0.75 U
4-Nitrotoluene	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	1 U
HMX	--	0.12 U	**0.552**	**0.516 J**	**70**	NA	**81**	**110 L**	**73**	**47**	**84**	**0.35**	**150**	**19 J**	1 UL
Nitrobenzene	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	1 U
Perchlorate	15	0.25 U	0.1 U	0.1 U	1 U	**0.62**	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	15	0.12 U	0.351 U	0.386 U	**120**	NA	**230**	**300 L**	**110**	**75**	**270**	**0.54**	**380**	0.4 UJ	6 U
Tetryl	--	0.12 U	0.351 U	0.386 U	3 U	NA	0.34 U	**0.16 L**	0.13 U	0.12 U	0.18 UJ	0.1 U	0.2 U	0.4 UJ	1 U
Total Metals (UG/L)															
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	**41,900**	NA	**5,850**	**6,920**	**19,900**	**18,400**	**7,240**	**11,500**	**17,800 J**	**22,200**	**22,600**
Dissolved Metals (UG/L)															
Iron, Dissolved	--	NA	NA	NA	42.4 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)															
Acetate	--	NA	NA	NA	1 U	NA	**1**	1 U	1 U	1 U	NA	NA	NA	**91**	**71**
Alkalinity	--	NA	NA	NA	**24 J**	NA	20 U	20 U	20 U	20 U	20 U	NA	NA	**210**	NA
Butyrate	--	NA	NA	NA	1 U	NA	**1**	1 U	1 U	1 U	NA	NA	NA	**32**	5 U
Carbon dioxide	--	NA	NA	NA	**72**	NA	**80**	**120**	**20**	**21**	**150**	**150 J**	**150**	**750**	**120**
Chemical oxygen demand	--	NA	NA	NA	10 U	NA	20 U	20 U	20 U	20 U	20 U	20 U	**35**	NA	NA
Chloride	--	NA	NA	NA	**5**	NA	**7.1**	7.1 B	**6.8**	**6.7**	**8.3**	**9.5**	**37 L**	**8.1**	**4.9**
Ethane	--	NA	NA	NA	5.00E-06 U	NA	0.027 U	0.027 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	**0.0017**	0.0012 U
Ethene	--	NA	NA	NA	5.00E-06 U	NA	0.036 U	0.036 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	1.00E-03 U	0.0015 U
Lactic Acid	--	NA	NA	NA	25 U	NA	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	5 U
Methane	--	NA	NA	NA	**4.20E-04**	NA	0.014 U	0.014 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	0.002 U	**7.7**
Nitrate	--	NA	NA	NA	**1.6**	NA	**1.4**	**2.1 L**	**9**	**9.1**	**1.6**	**1.3**	**1.7 L**	0.025 U	0.13 U
Nitrate/Nitrite	--	NA	NA	NA	NA	NA	NA	**2.3**	NA	NA	NA	NA	NA	NA	NA
Nitrite	--	NA	NA	NA	NA	NA	**0.15**	**0.049 L**	0.46 B	**0.92**	**0.25**	0.025 U	0.025 U	0.025 U	0.13 U
pH (pH units)	--	NA	NA	NA	NA	NA	**5.4**	NA	NA	NA	**5.2**	NA	NA	**5.8 J**	NA
Proprionic Acid	--	NA	NA	NA	1 U	NA	**1**	1 U	1 U	1 U	NA	NA	NA	**42**	5 U
Pyruvate	--	NA	NA	NA	10 U	NA	**2.9**	**2.7**	1 U	1 U	NA	NA	NA	1 U	5 U
Sulfate	--	NA	NA	NA	**102**	NA	**8.6**	19 B	**28**	**30**	**13**	**13**	**17 L**	12 B	5 U
Sulfide	--	NA	NA	NA	1 U	NA	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 UL	**0.04 L**
Total organic carbon (TOC)	--	NA	NA	NA	**2**	NA	10 U	**46**	10 U	10 U	10 U	10 U	10 U	**190**	1,000 U

Notes:

Shading indicates exceedance of PRGs

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NA - Not analyzed

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MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 6-3
Historical Constituents Detected in Groundwater at Site 7
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**White Oak Site 7 PRGs**	07GW104		07GW105								07GW105	07GW105			
Sample ID		007GW104-0910	07GW104-1014	007GW1050804	007GW1050804a	007GW1050905	007GW105-1205	007GW105-0306	007GW105-1208	007GW105-0910	07GW105-0712	07GW105P-0712	07GW105-0113	07GW105P-0113	07GW105-0114	07GW105-1014
Sample Date		09/17/10	10/17/14	08/06/04	08/06/04	09/21/05	12/12/05	03/08/06	12/18/08	09/15/10	07/23/12	07/23/12	01/14/13	01/14/13	01/27/14	10/17/14
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	--	NA	1 U	1 U	NA	2 U	2 U	2 U	NA	NA	1 U	1 U	1 U	1 U	NA	1 UL
2-Butanone	--	NA	12 UJ	NA	NA	10 U	10 U	10 U	NA	NA	12 U	12 U	12 U	12 U	NA	12 UJ
Acetone	--	NA	12 U	NA	NA	10 U	10 U	10 U	NA	NA	12 U	12 U	12 U	12 U	NA	12 UL
Chloroform	--	NA	1 U	NA	NA	10 U	10 U	10 U	NA	NA	1 U	1 U	1 U	1 U	NA	1 UL
cis-1,2-Dichloroethene	--	NA	1 U	1 U	NA	10 U	10 U	10 U	NA	NA	1 U	1 U	1 U	1 U	NA	1 UL
Methyl acetate	--	NA	1 UJ	NA	NA	10 U	10 U	10 U	NA	NA	1 U	1 U	1 U	1 U	NA	1 UJ
Methyl-tert-butyl ether (MTBE)	--	NA	1 U	NA	NA	10 U	10 U	10 U	NA	NA	1 U	1 U	1 U	1 U	NA	1 UL
Trichloroethene	5	NA	1 U	1 U	NA	2 U	2 U	2 U	NA	NA	1 U	1 U	1 U	1 U	NA	1 UL
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
1,3,5-Trinitrobenzene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
1,3-Dinitrobenzene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
2,4,6-Trinitrotoluene	2.5	0.12 U	0.347 U	**1.5**	NA	0.18 U	0.2 U	0.2 U	1.9 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
2,4-Dinitrotoluene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
2,6-Dinitrotoluene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
2-Amino-4,6-dinitrotoluene	9.9	0.12 U	0.347 U	**0.97**	NA	**2.1 J**	**3.5**	**2.8 J**	**0.58**	0.12 U	**1.24**	**1.21**	**0.855**	**0.836**	NA	**0.591**
2-Nitrotoluene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
3-Nitrotoluene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
4-Amino-2,6-dinitrotoluene	9.9	0.12 U	0.347 U	**0.8**	NA	0.18 U	0.2 U	0.2 U	**0.66 J**	0.12 U	**1.38**	**1.32**	**0.884**	**0.861**	NA	**0.688**
4-Nitrotoluene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
HMX	--	**3.1**	**0.383 J**	**3.8**	NA	**9.4**	**16**	**18**	**15 L**	**5.3**	**20.5**	**19.8**	**16**	**15.7**	NA	**9.23 K**
Nitrobenzene	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
Perchlorate	15	NA	0.1 U	**3**	**3.3**	NA	NA	NA	NA	NA	**1.64**	**1.69**	**0.97**	**1.03**	NA	**1.13**
RDX	15	0.12 U	0.347 U	**14**	NA	**26**	**38**	**36**	**23**	**7.6**	**28.7**	**27.8**	**21.7**	**21.4**	**16.2**	**9.98 K**
Tetryl	--	0.12 U	0.347 U	0.4 U	NA	0.18 U	0.2 U	0.2 U	1 U	0.12 U	0.34 U	0.346 U	0.393 U	0.351 U	NA	0.344 U
Total Metals (UG/L)																
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2,520**	NA	NA	NA
Sodium	--	NA	NA	NA	NA	**6,200**	**6,050**	**7,370 J**	**6,240**	NA	**6,980**	NA	**7,450**	NA	NA	NA
Dissolved Metals (UG/L)																
Iron, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)																
Acetate	--	NA	NA	NA	NA	NA	NA	NA	5 U	NA	0.1 U	NA	**0.085 J**	NA	NA	NA
Alkalinity	--	NA	NA	NA	NA	20 U	NA	NA	NA	NA	**15**	NA	**18**	NA	NA	NA
Butyrate	--	NA	NA	NA	NA	NA	NA	NA	5 U	NA	0.1 U	NA	0.1 U	NA	NA	NA
Carbon dioxide	--	**290**	NA	NA	NA	**200**	**200 J**	**250**	**93**	**150**	**190**	NA	**166 D**	NA	NA	NA
Chemical oxygen demand	--	NA	NA	NA	NA	20 U	21 U	20 U	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	--	**6.3**	NA	NA	NA	**8.3**	**8.6**	**9.1 L**	**11**	**14**	**15**	NA	**15 Q**	NA	NA	NA
Ethane	--	0.002 U	NA	NA	NA	5.00E-04 U	5.00E-04 U	5.00E-04 U	0.0012 U	0.002 U	0.00196 U	NA	0.00196 U	NA	NA	NA
Ethene	--	0.002 U	NA	NA	NA	5.00E-04 U	5.00E-04 U	5.00E-04 U	0.0015 U	0.002 U	0.00271 U	NA	0.00271 U	NA	NA	NA
Lactic Acid	--	NA	NA	NA	NA	NA	NA	NA	5 U	NA	0.2 U	NA	0.2 U	NA	NA	NA
Methane	--	**14**	NA	NA	NA	5.00E-04 U	5.00E-04 U	5.00E-04 U	**5.4**	**7.3**	**9.43**	NA	**4.04 D**	NA	NA	NA
Nitrate	--	0.04 U	NA	NA	NA	**4.1**	**3.9**	**2.7 L**	0.13 U	0.04 U	**0.94 J**	NA	**0.47 J**	NA	NA	NA
Nitrate/Nitrite	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	--	**0.041 J**	NA	NA	NA	0.025 U	0.025 U	0.025 U	0.13 U	**0.12**	0.044 U	NA	0.07 UQ	NA	NA	NA
pH (pH units)	--	NA	NA	NA	NA	**5.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Proprionic Acid	--	NA	NA	NA	NA	NA	NA	NA	5 U	NA	0.1 U	NA	0.1 U	NA	NA	NA
Pyruvate	--	NA	NA	NA	NA	NA	NA	NA	5 U	NA	0.1 U	NA	**0.011 J**	NA	NA	NA
Sulfate	--	**1.3**	NA	NA	NA	**18**	**18**	**17**	**9.9**	**20**	**16**	NA	**17**	NA	NA	NA
Sulfide	--	0.75 U	NA	NA	NA	0.03 U	0.03 U	0.03 U	0.03 R	0.75 U	1 U	NA	1 U	NA	NA	NA
Total organic carbon (TOC)	--	**36**	NA	NA	NA	10 U	10 U	10 U	**3.6 J**	**1.7**	**1.2**	NA	**1.1**	NA	NA	NA

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TABLE 6-3
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Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**White Oak Site 7 PRGs**	07GW200			07GW202					07GW202		07GW203				
Sample ID		007GW2000804	007GW2000804a	007GW2000305	007GW2020804	007GW2020804a	007GW2020305	007GW2020407	007GW202-0807	007GW202-1208	007GW202-0910	007GW9000804	007GW9000804a	007GW2030804	007GW2030804a	007GW2030305
Sample Date		08/06/04	08/06/04	03/11/05	08/06/04	08/06/04	03/11/05	04/03/07	08/14/07	12/16/08	09/14/10	08/02/04	08/02/04	08/05/04	08/05/04	03/11/05
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	--	1 U	NA	10 U	**12**	NA	**3 J**	2 U	2 U	1 U	NA	1 U	NA	1 U	NA	10 U
2-Butanone	--	NA	NA	10 U	NA	NA	10 U	2 U	2 UJ	5 R	NA	NA	NA	NA	NA	10 U
Acetone	--	NA	NA	10 UJ	NA	NA	10 UJ	2 U	2 U	5 R	NA	NA	NA	NA	NA	**5 J**
Chloroform	--	NA	NA	10 U	NA	NA	10 U	2 U	2 U	5 U	NA	NA	NA	NA	NA	**2 J**
cis-1,2-Dichloroethene	--	1 U	NA	10 U	**12**	NA	10 U	2 U	2 U	5 U	NA	1 U	NA	1 U	NA	10 U
Methyl acetate	--	NA	NA	10 U	NA	NA	10 U	2 U	2 U	5 U	NA	NA	NA	NA	NA	10 U
Methyl-tert-butyl ether (MTBE)	--	NA	NA	10 U	NA	NA	10 U	2 U	2 U	5 U	NA	NA	NA	NA	NA	10 U
Trichloroethene	5	1 U	NA	10 U	**86**	NA	**14**	2 U	2 U	5 U	NA	1 U	NA	1 U	NA	10 U
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
1,3,5-Trinitrobenzene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	**0.49 J**	NA	**0.39 J**	NA	0.4 U
1,3-Dinitrobenzene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
2,4,6-Trinitrotoluene	2.5	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	**3.6 L**	**1**	1.9 U	0.12 U	**4.5**	NA	**4.3**	NA	**4.1**
2,4-Dinitrotoluene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
2,6-Dinitrotoluene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
2-Amino-4,6-dinitrotoluene	9.9	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	**1.2 L**	**0.53**	**0.18 J**	0.12 U	**3.6**	NA	**3.4**	NA	**3.9**
2-Nitrotoluene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
3-Nitrotoluene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
4-Amino-2,6-dinitrotoluene	9.9	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	**1.8 L**	**0.94 J**	**0.3 J**	0.12 U	**4.1**	NA	**3.8**	NA	0.4 U
4-Nitrotoluene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
HMX	--	0.5 U	NA	0.24 U	0.5 U	NA	**0.19 J**	**5.8 L**	**2.9 J**	**0.88 L**	**0.48 J**	**40**	NA	**39**	NA	**6.8**
Nitrobenzene	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
Perchlorate	15	**2**	**2.3**	NA	**1.9**	**1.9**	NA	NA	NA	NA	NA	**5.2**	**4.9**	**4.6**	**4.9**	NA
RDX	15	**0.23 J**	NA	0.24 U	0.5 U	NA	**0.16 J**	**13 L**	**6.8**	**2.1 J**	**0.92**	**33**	NA	**32**	NA	**14**
Tetryl	--	0.2 U	NA	0.24 U	0.2 U	NA	0.2 U	0.2 UL	0.2 U	1 U	0.12 U	1 U	NA	1 U	NA	0.4 U
Total Metals (UG/L)																
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	**5,680**	NA	NA	**11,000**	NA	NA	NA	NA	NA	NA	**7,780**	NA	**40,100**
Dissolved Metals (UG/L)																
Iron, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1,130**	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)																
Acetate	--	NA	NA	**1**	NA	NA	**1**	NA	1 U	NA	NA	NA	NA	1 U	NA	**1**
Alkalinity	--	NA	NA	20 U	NA	NA	20 U	NA	**34**	NA	NA	NA	NA	**15 J**	NA	**38**
Butyrate	--	NA	NA	**1**	NA	NA	**1**	NA	1 U	NA	NA	NA	NA	1 U	NA	**1**
Carbon dioxide	--	NA	NA	**100**	NA	NA	**56**	NA	**350**	NA	**160**	NA	NA	**38**	NA	**220**
Chemical oxygen demand	--	NA	NA	20 U	NA	NA	21 U	NA	NA	NA	NA	NA	NA	9.2 B	NA	**100**
Chloride	--	NA	NA	**8.3**	NA	NA	**12**	NA	**18**	NA	**19**	NA	NA	**12**	NA	**13**
Ethane	--	NA	NA	0.027 U	NA	NA	0.027 U	NA	1.00E-03 U	NA	0.002 U	NA	NA	**0.0011**	NA	0.027 U
Ethene	--	NA	NA	0.036 U	NA	NA	0.036 U	NA	1.00E-03 U	NA	0.002 U	NA	NA	**0.0014**	NA	0.036 U
Lactic Acid	--	NA	NA	1 U	NA	NA	1 U	NA	1 U	NA	NA	NA	NA	**25 J**	NA	**120 K**
Methane	--	NA	NA	0.014 U	NA	NA	0.014 U	NA	**0.0012 J**	NA	**1.00E-03 J**	NA	NA	**0.0029**	NA	0.014 U
Nitrate	--	NA	NA	**2.7**	NA	NA	**0.75**	NA	**1.3**	NA	**0.89**	NA	NA	**1.2**	NA	**0.68**
Nitrate/Nitrite	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	--	NA	NA	**0.16**	NA	NA	**0.25**	NA	0.025 U	NA	0.0079 B	NA	NA	NA	NA	**0.15**
pH (pH units)	--	NA	NA	**5.2**	NA	NA	**5.7**	NA	**5.3**	NA	NA	NA	NA	NA	NA	**5.5**
Proprionic Acid	--	NA	NA	**1**	NA	NA	**1**	NA	1 U	NA	NA	NA	NA	1 U	NA	**1**
Pyruvate	--	NA	NA	**3**	NA	NA	**3**	NA	1 U	NA	NA	NA	NA	10 U	NA	**3**
Sulfate	--	NA	NA	**13**	NA	NA	**38**	NA	**59**	NA	**47 L**	NA	NA	**26.7**	NA	**29**
Sulfide	--	NA	NA	0.03 U	NA	NA	0.03 U	NA	0.03 U	NA	0.75 U	NA	NA	1 U	NA	0.03 U
Total organic carbon (TOC)	--	NA	NA	10 U	NA	NA	10 U	NA	**1.31**	NA	**1.9**	NA	NA	0.4 B	NA	**28**

Notes:

Shading indicates exceedance of PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

Q - Lab qualifier; estimated result, one or more QC criteria recovered outside acceptance limits

R - Rejected result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

UQ - Lab qualifier; analyte not detected, quantitation limit may be inaccurate due to one or more QC criteria recovered outside acceptance limits

MG/L - Milligrams per liter

UG/L - Micrograms per liter

TABLE 6-3
Historical Constituents Detected in Groundwater at Site 7
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Former NSWC-White Oak

Station ID	White Oak Site 7 PRGs	07GW203			07GW203	07GW203							46GW205			
Sample ID		007GW2030405	007GW2030605	007GW2030905	007GW203P0905	007GW203-1205	007GW203-0306	007GW2030407	007GW2030407P	007GW203-0807	007GW203-1208	07GW203-1014	046GW2050804	046GW2050804a	046GW205-0306	046GW205-1208
Sample Date		04/05/05	06/09/05	09/21/05	09/21/05	12/12/05	03/08/06	04/03/07	04/03/07	08/14/07	12/18/08	10/17/14	08/05/04	08/05/04	03/07/06	12/16/08
Chemical Name																
Volatile Organic Compounds (UG/L)																
1,1,2,2-Tetrachloroethane	--	10 R	10 U	2 U	2 U	2 U	2 U	NA	NA	NA	NA	1 U	1 U	NA	2 U	1 U
2-Butanone	--	10 R	10 U	**3 J**	**3 J**	10 U	10 U	NA	NA	NA	NA	12 UJ	NA	NA	10 U	5 R
Acetone	--	**12 L**	**26 J**	**43 J**	**36 J**	**9 J**	10 U	NA	NA	NA	NA	12 U	NA	NA	10 U	5 R
Chloroform	--	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	1 U	NA	NA	10 U	5 U
cis-1,2-Dichloroethene	--	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	1 U	1 U	NA	10 U	5 U
Methyl acetate	--	10 R	**3 J**	10 U	10 U	10 U	10 U	NA	NA	NA	NA	1 UJ	NA	NA	10 U	5 U
Methyl-tert-butyl ether (MTBE)	--	10 R	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	1 U	NA	NA	10 U	5 U
Trichloroethene	5	10 R	10 U	2 U	2 U	2 U	2 U	NA	NA	NA	NA	1 U	1 U	NA	2 U	5 U
Semivolatile Organic Compounds (UG/L)																
No Detections																
Explosives (UG/L)																
1,3,5-Trinitrobenzene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	**0.63 J**	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
1,3-Dinitrobenzene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
2,4,6-Trinitrotoluene	2.5	**6.1 L**	**0.19 J**	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1.9 U	0.367 U	**0.13 J**	NA	0.2 U	1.9 U
2,4-Dinitrotoluene	--	**0.18 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
2,6-Dinitrotoluene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
2-Amino-4,6-dinitrotoluene	9.9	**14 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	0.5 U	0.367 U	**0.57**	NA	**0.41 J**	**0.28 J**
2-Nitrotoluene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
3-Nitrotoluene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
4-Amino-2,6-dinitrotoluene	9.9	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	**1.7 J**	**1.6 J**	0.2 U	0.75 U	0.367 U	**0.38**	NA	0.2 U	**0.18 J**
4-Nitrotoluene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
HMX	--	**27 L**	**4.5 J**	**1.7 J**	**0.69 J**	0.16 U	**4.5 J**	**1.5 J**	0.2 UJ	0.2 U	1 UL	0.367 U	**3.9**	NA	**3.3**	**5.1 L**
Nitrobenzene	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	**0.23 J**
Perchlorate	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.18**	**3.9**	**4.3**	NA	NA
RDX	15	**66 L**	**4.9**	**0.62 J**	**0.37 J**	0.16 U	**1.4**	0.2 UJ	**7.4 J**	0.2 U	6 U	0.367 U	**6.8**	NA	**6**	**3 J**
Tetryl	--	**0.16 L**	0.16 U	0.18 U	0.18 U	0.16 U	0.2 U	0.2 UJ	0.2 UJ	0.2 U	1 U	0.367 U	0.2 U	NA	0.2 U	1 U
Total Metals (UG/L)																
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	**18,900**	**28,800**	**34,900**	**29,600**	**27,600**	**21,500 J**	**17,000**	NA	NA	**8,210**	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)																
Iron, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)																
Acetate	--	**1.9**	**21**	NA	NA	NA	NA	**63**	**64**	**89**	5 U	NA	NA	NA	NA	NA
Alkalinity	--	**30**	**110**	**91**	**93**	NA	NA	**190**	NA	**180**	NA	NA	NA	NA	NA	NA
Butyrate	--	1 U	1 U	NA	NA	NA	NA	**15**	**14**	**3.2**	5 U	NA	NA	NA	NA	NA
Carbon dioxide	--	**140**	**120**	**95**	**95**	**76 J**	**130**	**370**	NA	**360**	**190**	NA	NA	NA	NA	NA
Chemical oxygen demand	--	**31**	**53**	**23**	**24**	20 U	**33**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	--	**11**	**13**	**11**	**10**	**11**	**10 L**	**9.9**	NA	**11**	**10**	NA	NA	NA	NA	NA
Ethane	--	0.026 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	**0.0024**	NA	1.00E-03 U	0.0012 U	NA	NA	NA	NA	NA
Ethene	--	0.035 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	5.00E-04 U	**0.0011**	NA	1.00E-03 U	0.0015 U	NA	NA	NA	NA	NA
Lactic Acid	--	1 U	1 U	NA	NA	NA	NA	14 B	14 B	1 U	5 U	NA	NA	NA	NA	NA
Methane	--	0.014 U	**1.00E-03**	**0.0014**	**1.00E-03**	**0.0052**	**0.023**	**0.28**	NA	**8.6**	**25**	NA	NA	NA	NA	NA
Nitrate	--	**0.6 L**	**1.5**	**0.33**	**0.32**	**0.49**	**0.33 L**	0.025 U	NA	0.025 U	0.13 U	NA	NA	NA	NA	NA
Nitrate/Nitrite	--	**0.74**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	--	**0.038 L**	**1.3**	0.025 U	0.025 U	**0.092**	0.025 U	0.025 U	NA	0.025 U	0.13 U	NA	NA	NA	NA	NA
pH (pH units)	--	NA	NA	**6.3**	**6.3**	NA	NA	**6 J**	NA	**6**	NA	NA	NA	NA	NA	NA
Proprionic Acid	--	1 U	**10**	NA	NA	NA	NA	**41**	**40**	**45**	5 U	NA	NA	NA	NA	NA
Pyruvate	--	**2.6**	1 U	NA	NA	NA	NA	1 U	1 U	1 U	5 U	NA	NA	NA	NA	NA
Sulfate	--	23 B	**18**	**11**	**10**	**12**	**13**	5 U	NA	5 U	5 U	NA	NA	NA	NA	NA
Sulfide	--	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 UL	NA	0.03 U	0.03 R	NA	NA	NA	NA	NA
Total organic carbon (TOC)	--	**15**	**13**	10 U	10 U	10 U	10 U	**100**	NA	**92.6**	100 U	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of PRGs
Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
Q - Lab qualifier; estimated result, one or more QC criteria recovered outside acceptance limits
R - Rejected result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
UQ - Lab qualifier; analyte not detected, quantitation limit may be inaccurate due to one or more QC criteria recovered outside acceptance limits
MG/L - Milligrams per liter
UG/L - Micrograms per liter

TABLE 6-3
Historical Constituents Detected in Groundwater at Site 7
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**White Oak Site 7 PRGs**	46GW205		46GW206			
Sample ID		046GW205P-1208	46GW205-1014	046GW206-0306	046GW206-1208	046GW206-0910	46GW206-1014
Sample Date		12/16/08	10/17/14	03/06/06	12/16/08	09/15/10	10/17/14
Chemical Name							
Volatile Organic Compounds (UG/L)							
1,1,2,2-Tetrachloroethane	--	NA	1 U	**2**	1 U	0.5 U	1 U
2-Butanone	--	NA	12 UJ	10 U	5 R	2.5 U	12 UJ
Acetone	--	NA	12 U	10 U	5 R	2.5 U	12 U
Chloroform	--	NA	1 U	10 U	5 U	0.5 U	1 U
cis-1,2-Dichloroethene	--	NA	1 U	**2 J**	5 U	0.5 U	1 U
Methyl acetate	--	NA	1 UJ	10 U	5 U	0.75 U	1 UJ
Methyl-tert-butyl ether (MTBE)	--	NA	1 U	10 U	5 U	0.5 U	1 U
Trichloroethene	5	NA	1 U	**18**	**1.9 J**	**1**	1 U
Semivolatile Organic Compounds (UG/L)							
No Detections							
Explosives (UG/L)							
1,3,5-Trinitrobenzene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
1,3-Dinitrobenzene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
2,4,6-Trinitrotoluene	2.5	1.9 U	0.347 U	**0.55**	1.9 U	0.12 U	0.377 U
2,4-Dinitrotoluene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
2,6-Dinitrotoluene	--	**0.18 J**	0.347 U	0.2 U	1 U	0.12 U	0.377 U
2-Amino-4,6-dinitrotoluene	9.9	**0.33 J**	0.347 U	**0.92 J**	**0.56**	0.12 U	0.377 U
2-Nitrotoluene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
3-Nitrotoluene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
4-Amino-2,6-dinitrotoluene	9.9	**0.22 J**	0.347 U	0.2 U	**0.49 J**	0.12 U	0.377 U
4-Nitrotoluene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
HMX	--	**5.4 L**	**3.03**	**4.1**	**3.5 L**	**1.6**	**0.654**
Nitrobenzene	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
Perchlorate	15	NA	**1.28**	NA	NA	**1.9**	**0.937**
RDX	15	**3.2 J**	**1.44**	**7.1**	**5 J**	**2**	**0.596**
Tetryl	--	1 U	0.347 U	0.2 U	1 U	0.12 U	0.377 U
Total Metals (UG/L)							
Iron	--	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)							
Iron, Dissolved	--	NA	NA	NA	NA	NA	NA
Wet Chemistry (MG/L, unless noted otherwise)							
Acetate	--	NA	NA	NA	NA	NA	NA
Alkalinity	--	NA	NA	NA	NA	NA	NA
Butyrate	--	NA	NA	NA	NA	NA	NA
Carbon dioxide	--	NA	NA	NA	NA	**160**	NA
Chemical oxygen demand	--	NA	NA	NA	NA	NA	NA
Chloride	--	NA	NA	NA	NA	**14**	NA
Ethane	--	NA	NA	NA	NA	0.002 U	NA
Ethene	--	NA	NA	NA	NA	0.002 U	NA
Lactic Acid	--	NA	NA	NA	NA	NA	NA
Methane	--	NA	NA	NA	NA	**6**	NA
Nitrate	--	NA	NA	NA	NA	**0.23**	NA
Nitrate/Nitrite	--	NA	NA	NA	NA	NA	NA
Nitrite	--	NA	NA	NA	NA	0.033 B	NA
pH (pH units)	--	NA	NA	NA	NA	NA	NA
Proprionic Acid	--	NA	NA	NA	NA	NA	NA
Pyruvate	--	NA	NA	NA	NA	NA	NA
Sulfate	--	NA	NA	NA	NA	**28**	NA
Sulfide	--	NA	NA	NA	NA	0.75 U	NA
Total organic carbon (TOC)	--	NA	NA	NA	NA	1.6 B	NA

Notes:
Shading indicates exceedance of PRGs
Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
Q - Lab qualifier; estimated result, one or more QC criteria recovered outside acceptance limits
R - Rejected result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
UQ - Lab qualifier; analyte not detected, quantitation limit may be inaccurate due to one or more QC criteria recovered outside acceptance limits
MG/L - Milligrams per liter
UG/L - Micrograms per liter

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 6-1 - Site 7 Map.mxd9/23/2016CGauthier_ch2mhillen

Site 7

Site 7
Source Area and
Extent of 2002
Removal Action

Site 4/46

04GW100
07GW101
07GW08
07GW200
07GW104
07PZ42
07GW105
07GW201
07GW203
07GW202
07GW300
07GW102
07GW103
07GW43
46GW205
46GW206

Legend

- 2014 Long Term Monitoring Well
- Monitoring Well
- Injection Wells
- Base Boundary
- Roads
- Perennial
- Intermittent
- Site Boundary

N
W E
S

0 120 240
Feet

Figure 6-1
Site 7 Map
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 6-2 - Site 7 GW Potentiometric Surface Map.mxd10/13/2016CGauthier_ch2mhillen



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.

Legend

- 2014 Long Term Monitoring Well
- Monitoring Well
- Injection Wells
- Former NSWC - White Oak Facility Boundary
- Groundwater Contour - October 6, 2014 (Dashed where inferred)
- Approximate Groundwater Flow Direction
- Roads
- Perennial
- Intermittent
- Buildings and Other Structures
- Site Boundary

N
W E
S

0 120 240
Feet

Note:
245.69 - Groundwater Elevation
*Groundwater elevations not used in contouring

Figure 6-2
Site 7 Groundwater Potentiometric Surface Map and LTM Locations - October 6, 2014
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m:

SECTION 7

Site 9 – Industrial Wastewater Disposal 300 Area

7.1 Site Chronology

A chronology of major events for Site 9 is provided in **Table 7-1**.

Table 7-1. Key Events and Milestones for Site 9

Date	Key Events and Milestones
1946-1995	Site 9 used at NSWC-White Oak to dispose of liquid wastes containing explosive compounds.
1984	Site 9 was identified as a Navy IRP site in an IAS conducted by NEESA.
1987	Confirmation Study Verification Phase conducted, installation of monitoring wells, soil borings, and collection of soil, groundwater, surface water and sediment (Malcolm-Pirnie, April 1987).
1992	Malcolm Pirnie published RI report for investigation activities conducted between 1989 and 1992, that included installation of monitoring wells and collection of surface and subsurface soil, sediment, surface water, groundwater, and ecological data at Site 9.
1995	Site 9 was closed under the BRAC.
October 1996	2 leaching wells were removed, Building 327 underground tank was excavated and follow-up soil and groundwater sampling activities for Removal Action.
1999	RFI conducted at Site 9 concluded Site 9 groundwater contained RDX and TCE, and four rounds of groundwater sampling occurred.
1999-2001	OU1 RI conducted (CH2M, August 2002) for Site 9.
June 2003	FS (CH2M, 2003a) conducted, remedial alternative of enhanced anaerobic bioremediation with ICs and Long Term Monitoring recommended.
July 2003	Pneumatic fracturing and liquid atomized injection of sodium lactate (Pilot Test).
August 2003-August 2004	CH2M performed post-injection sampling events as part of the Pilot Test performance monitoring
September 30, 2004	ROD for Site 9 groundwater and soil signed.
January 2005	Shaw excavated Building 318 sump and underlying soil to the groundwater, and added sodium lactate in excavation before backfill.
March 2005	CH2M performed post-injection sampling event (monitoring well 09GW215 only)
June 2005	CH2M performed post-injection sampling event (monitoring well 09GW215 only)
September 2005	CH2M performed 9-month post-injection (Post-Building 318 excavation) sampling event.
June 2006	CH2M performed 18-month post-injection sampling event.
November 2006	EOS was delivered to the subsurface via monitoring well 09GW215.
May 2007	CH2M performed 6-month post-injection sampling event.
August 2007	CH2M performed 9-month post-injection sampling event.
December 2008	CH2M performed 2008 annual post-injection sampling event.
September 2010	CH2M performed 2010 annual post-injection sampling event.
July 2012	CH2M performed 2012 annual post-injection sampling event.
January 2013	CH2M performed 2013 annual post-injection sampling event.

Table 7-1. Key Events and Milestones for Site 9

Date	Key Events and Milestones
January 2014	CH2M performed 2014 annual post-injection sampling event.
October 2014	CH2M performed 2014 annual post-injection sampling event.
November 2015	CH2M performed 2015 annual post-injection sampling event.

7.2 Background

7.2.1 Description and History

Site 9, also known as the Industrial Wastewater Disposal 300 Area, is located in the southeast portion of Former NSWC-White Oak (**Figure 1-2**). As summarized in the Site 9 ROD (NAVFAC, 2004d), The 300 Area is located between West Farm Branch, (a small southward-flowing tributary of Paint Branch) and the small intermittent stream running along the east side of Isherwood Road (the Isherwood Road stream). The 300 Area extends south from Dahlgren Road to the boundary of the Former NSWC-White Oak. The area occupied by Site 9 is located entirely within property currently owned by the GSA. However, the plume of contaminated groundwater originating on Site 9 extended onto property that has since been transferred to the Army and is now part of the Army's Adelphi Laboratory Center.

Site 9 consists of seventeen former leaching wells, two former leach fields, the former location of an underground wastewater storage tank at Building 327, and a former industrial wastewater collection sump at Building 318, all of which are located within the 300 Area (**Figure 7-1**). Liquid wastes containing explosive compounds, including RDX and HMX, as well as TCE and other chemicals, reportedly were disposed in the leaching wells, were stored in the Building 327 underground storage tank (UST), and handled in the Building 318 sump.

Building 318 was an explosives machining facility that generated wastewater containing explosives compounds such as RDX, HMX, and perchlorate. Wastewater was collected in a system of floor trenches that led to a central collection sump. Facility records indicate that the sump had leaked into the underlying soil in the past, but had subsequently been repaired. However, groundwater samples collected in 2003 in the 300 Area downgradient from Building 318 and the former sump indicate that the sump was the source of groundwater contamination of RDX, perchlorate, and several other explosives compounds.

Two of the 17 leaching wells within Site 9 were excavated in a removal action conducted in October 1996. Four other leaching wells were excavated as a housekeeping measure or were confirmed as having been removed in 2003. No physical evidence of the other leaching wells/fields could be found during IRP activities, and it is assumed that they have been previously removed. Groundwater and soil sampling in the vicinity of each of the 17 former leaching wells and two leach fields did not indicate any contamination above levels that would warrant RA. The Building 327 underground tank was excavated in 1996, and follow-up soil and groundwater sampling did not detect any evidence of a release from the tank.

Groundwater at Site 9 in the vicinity of Building 318 is still subject to LTM and Five-Year Reviews. The requirements for groundwater LTM are specified in the ROD for Site 9 groundwater, signed by USEPA Region 3 and the Navy, and with concurrence by the MDE (NAVFAC, 2004d). The groundwater RA selected in the ROD included enhanced anaerobic bioremediation in the source area of Site 9 with MNA and ICs in the downgradient portions of the plume. Preliminary Remediation Goals were developed and presented in the ROD for Site 9 groundwater (NAVFAC, 2004d) and are listed in **Table 7-2**. Remedial action objectives for soil were to remove soil beneath the Building 318 sump to prevent further impacts to groundwater from RDX; however, no specific PRGs were established.

The groundwater PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs, and the updated values are also presented in **Table 7-2** (CH2M, 2010).

Table 7-2. PRGs for COCs for Site 9 Groundwater

COC	Groundwater PRG for Site 9 – 2004 ROD (µg/L)	Basis	Updated Groundwater PRG* (µg/L)
PCE	5	MCL	5
TCE	5	MCL	5
RDX	15	RB	10
Iron	-	-	11,000
Perchlorate	-	-	15

Notes:

MCL – PRG is the maximum contaminant level drinking water standard

RB – PRG is a site-specific risk-based standard calculated using guidance developed by EPA Region 3.

* CH2M, 2010. Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland. October.

7.2.2 Physical Characteristics

The ground surface at Site 9 slopes generally to the south and southwest toward West Farm Branch, and the maximum difference in elevation is approximately 100 feet Site 9 is bounded by two surface water bodies, West Farm Branch to the west and the small intermittent stream running along the east side of Isherwood Road (the Isherwood Road stream) to the east. Both streams are southward-flowing tributaries of Paint Branch. During rain events, rainfall infiltrates into the surface soil or drains offsite towards West Farm Branch and the Isherwood Road stream.

The geology of the Site 9 area in the vicinity of Building 318 is silty sand and gravel (Coastal Plain sediments) to a depth of approximately 18 feet bgs. The Coastal Plain sediments are underlain by decayed rock (saprolite), which is significantly less permeable to groundwater flow than the Coastal Plain sand and gravel. The saprolite extends to a depth of about 30 to 40 feet where it grades to competent rock consisting of gneiss and schist of the Wissahickon formation. Groundwater flow in the rock occurs in fractures.

Groundwater flow near Building 318 is to the south-southwest (**Figure 7-2**). The depth to groundwater is approximately 20 feet, so the upper portion of the aquifer is entirely in the saprolite. In the downgradient reaches of the historical contaminant plume, as it enters the West Farm Branch valley, the Coastal Plain deposits thin and ultimately disappear.

7.2.3 Land and Resource Use

The area of Site 9 consists of open field and woodlands in the southwest part of OU1. The area surrounding the field to the north, east, and west is wooded property owned by the U.S. government, 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, and downgradient of, Site 9, and throughout the Former NSWC-White Oak, is not used as a potable water source at this time 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 wells without a permit. However, for the purposes of the site risk assessments, Site 9 was evaluated assuming the possibility of residential use for the entire area, including the use of the groundwater as a primary drinking water source (Tetra Tech, 2012).

7.2.4 History of Contamination

7.2.4.1 Groundwater

As summarized in the Site 9 groundwater and soil ROD (NAVFAC, 2004d), groundwater contamination at Site 9 was initially identified in 1999 at a hot spot near well 09GW01, located in the southwest portion of OU1, during the OU1 RI. Elevated levels of RDX and TCE were consistently detected above PRGs at this location. Perchlorate was also detected in the Site 9 groundwater at this location. PCE was detected in only two wells also located near this area. The maximum concentrations of these compounds detected at Site 9, prior to the July 2003 groundwater pilot test and subsequent RA, were:

- TCE – 44 µg/L
- RDX – 310 µg/L
- PCE – 6.5 µg/L
- Perchlorate – 880 µg/L

The majority of maximum concentrations of contaminants in groundwater were detected in samples collected from 1995 to 1998. Baseline sampling conducted in 2003 as part of the groundwater remediation pilot test at Site 9 indicated that the source area of the explosives and perchlorate contamination was approximately 250 feet upgradient (north) of well 09GW01, the originally defined hot spot. Direct-push soil and groundwater samples, as well as three new monitoring wells, defined the source of contamination as the former wastewater collection sump in Building 318. At the beginning of the pilot test, the highest concentrations of the target contaminants RDX (190 µg/L) and perchlorate (250 µg/L) were found in well 09GW214, located 30 feet downgradient of the source sump. TCE was found at a maximum concentration of 11 µg/L in well 09GW205, approximately 225 feet downgradient of the sump.

The upgradient boundary of the target contamination zone is defined by well 09GW212, which is located upgradient of the source at Building 318 and serves as a background monitoring well. Low concentrations of TCE, RDX, and perchlorate initially extended to the south and southwest (downgradient) of the source area to the point at which the groundwater discharges to West Farm Branch.

TCE, RDX, and perchlorate were initially detected at low concentrations in wells within 30 feet of West Farm Branch; however, none of these contaminants have been detected in the surface water in the stream and none have been detected in wells located across the stream. It is not clear whether the Building 318 sump was also the source of the TCE found in the groundwater. The highest concentration of TCE at the site has been located in the area between wells 09GW01 and 09GW57D, and the concentrations of TCE have decreased steadily and significantly since groundwater sampling was first conducted at Site 9 in 1986.

7.2.4.2 Soil

As documented in the Site 9 groundwater and soil ROD (NAVFAC, 2004d), no surface soil samples have been collected at Site 9 because the potential sources of contamination were the leaching wells, a UST, and a building sump, none of which would impact surface soil. In addition, the RFI indicated that there was no evidence of surface soil contamination at the site (Tetra Tech, 2000b).

Removal of two of the Site 9 leaching wells, LW-1 and LW-9, was completed in 1996 (Tetra Tech, 2001b). Elevated levels of PAHs were identified in the subsurface soil prior to the removal action, but post-excavation samples indicated no unacceptable levels of contamination.

The RFI, conducted in 1999, and the follow-up soil sampling in May 2003, did not identify any risks from exposure to Site 9 soil at any of the leaching wells (Tetra Tech, 2004a). The only constituent detected above Region 3 risk-based concentrations (RBCs) and site background concentrations in Site 9 soil was mercury, detected at a maximum concentration of 3.8 milligrams per kilogram (mg/kg) in a soil sample collected in 2003 during the excavation of a drain pipe related to a former leaching well at Building 345. The sample was collected below the pipe at a depth of about four to five feet bgs.

Low concentrations of explosives compounds (RDX at 1,200 mg/kg; HMX at 10,000 mg/kg, 2,4,6- trinitrotoluene at 1,500 mg/kg, 1,3,5-trinitrobenzene at 580 mg/kg, and 4-amino-2,6-dinitrotoluene at 150 mg/kg) and perchlorate (at 1,400 mg/kg) were detected in the soil beneath the former sump at Building 318 during June 2003 sampling event. While these concentrations did not exceed EPA Region 3 RBCs, they may have served as a continuing source of groundwater contamination (CH2M, 2003b). All of these compounds have been detected in the groundwater at the site, but only RDX and perchlorate exceeded groundwater PRGs.

7.2.5 Site Risks

The following summary of risk is based on the summary presented in the Site 9 groundwater and soil ROD (NAVFAC, 2004d) and in the two preceding Five-Year Reviews (JM Waller, 2007; Tetra Tech, 2012). Both ecological and human health baseline risk assessments were conducted to evaluate potential risks from exposure to Site 9 contaminants. The ecological risk assessment was conducted on a facility-wide basis, and results as they relate to Site 9 are discussed in **Section 7.2.5.2**. An HHRA was conducted for Site 9 soil in the *Final RCRA Facility Investigation for Sites 2, 3, 4, 7, 8, 9, and Paint Branch* (Tetra Tech, 2000a) and the *Addendum- Human Health Risk Evaluation for Soil for Site 9 - Industrial Wastewater Disposal Area 300* (Tetra Tech, 2004a). The HHRA for groundwater was conducted on an OU1 wide basis, and included the groundwater beneath Site 9, as presented in the *Remedial lnvestigation for Operable Unit 1* (CH2M, 2002).

No site-related chemicals were detected in the surface water or sediment in West Farm Branch, and therefore, risks to receptors were not evaluated for these media relative to Site 9. Neither sediment nor surface water are considered media of concern for Site 9.

No surface soil samples were collected at Site 9 because the potential sources of contamination were the leaching wells, a UST, and a building sump, none of which would impact surface soil.

7.2.5.1 Human Health Risk Assessment

The soil HHRA evaluated noncarcinogenic hazards and carcinogenic hazards associated with exposure to subsurface soil by potential current and future industrial workers, maintenance/utility workers, construction workers, recreational users, trespassers, daycare-center children, and future child and adult residents. Although residential use is not reasonably anticipated, the future residential use scenario was evaluated to determine whether LUCs would be needed to be protective of all future site use. The HHRA was conducted using subsurface soil from Site 9 collected at the various leaching well and leach field locations in 1995 and 2003. Based on a comparison of the subsurface soil data to the USEPA Region 3 RBCs for residential soil current at the time of the HHRA and background concentrations, only mercury was identified as a COPC for evaluation in the HHRA. The calculated noncarcinogenic hazards and carcinogenic risks for exposure to subsurface soil by all potential receptors were within USEPA target levels.

The concentrations of the constituents detected in subsurface soil were also compared to the USEPA Region 3 soil-to-groundwater soil screening levels (SSLs) based on a dilution and attenuation factor of 1 to evaluate the potential for migration of contaminants from soil to groundwater. TCE, a number of explosives, and six metals (antimony, arsenic, chromium, manganese, selenium, and thallium) were detected in subsurface soils at concentrations that exceeded USEPA Region 3 soil-to-groundwater SSLs. The concentrations of all the inorganics that exceeded the SSLs were within facility background levels, and TCE was detected in only three soil samples and at estimated concentrations (below method quantitation levels). Based on this evaluation, it was considered unlikely that the concentrations of the metals and TCE detected in Site 9 soil adversely impacts groundwater. The samples containing explosives compounds at concentrations above the SSLs for leaching from soil to groundwater were all collected from beneath the Building 318 sump. Because of these exceedances, and because one of these compounds (RDX) is present in the groundwater in excess of USEPA tap water RBCs, it was concluded that the soil beneath the sump may represent a continuing source of groundwater contamination.

Site-specific risks were estimated for Site 9 groundwater using the results of the OU1 wide risk assessment. Site 9 is a subarea of OU1, but many of the COPCs identified for OU1 are not found in the Site 9 groundwater; therefore, it was assumed the risks from Site 9 would be less than those from the entire OU1 area. The COPCs used to

estimate the noncarcinogenic hazards and carcinogenic risks for Site 9 groundwater were selected by identifying those OU1 COPCs that are present at concentrations corresponding to a cancer risk of 5×10^{-6} or above, or an HI of 0.1 or above, were detected in monitoring wells within the Site 9 source area and plume, and were above background levels (inorganics only). The risk levels were selected to ensure that the overall risk from exposure to groundwater at the site does not exceed a carcinogenic risk of 5×10^{-5} or noncarcinogenic HI of 1 (levels within or equal to USEPA's target risk levels). The Site 9 COPCs were PCE, TCE, RDX, perchlorate, and iron.

The groundwater HHRA evaluated noncarcinogenic hazards and carcinogenic hazards associated with exposure to groundwater by current and future industrial workers, child and adult residents, and construction workers. Although residential use is not reasonably anticipated, the future residential use scenario was evaluated to determine whether LUCs would be needed to be protective of future site use. The HHRA identified carcinogenic risks above USEPA acceptable levels for the adult resident under the reasonable maximum exposure scenario and noncarcinogenic hazards to future child and adult residents above USEPA acceptable levels.

The list of groundwater COPCs were reduced to the COCs identified in the ROD based on comparison to PRGs. The list of COCs for groundwater, as listed in Site 9 groundwater and soil ROD, includes PCE, TCE, and RDX (NAVFAC, 2004d). Although perchlorate has been detected in Site 9 groundwater it was not considered a COC and no PRG was established in the ROD. At the time the ROD was prepared there was no established ARAR for perchlorate. Because of those considerations, and since OU1 groundwater is not currently used as a source of drinking water and its use is prohibited through existing regulations and ICs, perchlorate was not considered a COC. However, the ROD indicated that monitoring of perchlorate concentrations in groundwater be performed during the course of the RI and every 5 years the remedy is reviewed to ensure it remains protective of human health and the environment.

7.2.5.2 Ecological Risk Assessment

A BERA was developed for the Former NSWC-White Oak to characterize the potential risks to ecological receptors from site-related chemicals found throughout the facility, including Site 9 (Tetra Tech, 2001b). As documented in the BERA, there are no ecological risk exposure pathways related to soil at Site 9. No surface soil or shallow subsurface soil samples were collected at the site because the nature of any potential release from the Site 9 features would be several feet below the ground surface. As groundwater exposure is not associated with ecological receptors, Site 9 groundwater poses no unacceptable 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 Site 9.

7.3 Response Action Summary

7.3.1 Basis for Remedial Action

The basis for taking action at Site 9 was to address RDX and VOCs, specifically PCE and TCE, contamination in groundwater that posed unacceptable risk, as well as RDX contamination in soil at the site to eliminate its potential to act as a source of contamination to groundwater. The Site 9 groundwater and soil ROD identified enhanced anaerobic bioremediation, LTM, and LUC implementation for groundwater, as well as excavation and offsite disposal for soil in the area of the former Building 318 sump. The Site 9 groundwater and soil ROD also summarized the human health and ecological risks associated with the groundwater and soil (see **Section 7.2.5**). Both the human health and ecological risk assessments concluded that under current conditions, there is no significant risk associated with Site 9 groundwater or soil, as groundwater is not being used as a potable source and there are no ecological receptors exposed to the groundwater.

7.3.2 Response Actions

7.3.2.1 Selected Remedy for Site 9

The ROD for Site 9 groundwater and soil was signed on September 30, 2004 (NAVFAC, 2004d). The ROD summarized the risks to human health and the environment, established RAOs, and defined the selected remedy. The RAOs for Site 9 groundwater as stated in the ROD are:

- 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 (that is, meet the identified PRGs).

The RAO for Site 9 soil as stated in the ROD is as follows:

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

To achieve the RAOs:

- The selected remedy for Site 9 groundwater, "Alternative 4: Enhanced Anaerobic Bioremediation with ICs and Long-Term Monitoring," comprised the following components:
  - Installation of additional wells to define treatment area and to establish an optimum groundwater monitoring network
  - Installation of injection wells and injection of electron donor (sodium lactate) in the Target Remediation Zone
  - Groundwater monitoring of baseline and post-injection conditions
  - LTM of the plume outside of the Target Remediation Zone
  - Preparation of annual technical memoranda and five-year reports
  - Implementation of ICs until PRGs are met
- The selected remedy for Site 9 soil, "Alternative 2: Excavation with Offsite Disposal," was composed of the following component:
  - Excavation of the volume of contaminated soil beneath the sump at Building 318 to the water table or to the extent practicable (roughly 8 to 12 feet), and disposal offsite

7.3.3 Status of Implementation

7.3.3.1 Soil Excavation and Sodium Lactate Injections

In January 2005, the sump area was excavated. As an added measure to treat potential residual RDX in the soil and the shallow groundwater, 110 gallons of sodium lactate and approximately 500 gallons of water were placed into the excavation. The excavation was backfilled and a monitoring well was installed in the former location of the sump (JM Waller, 2007). Groundwater monitoring was completed in March, June, and September 2005 and June 2006.

7.3.3.2 EOS Injection

In November 2006, EOS was delivered to the subsurface via monitoring well 09GW215. Groundwater monitoring was completed at 6 months and 9 months after the delivery into monitoring well 09GW215 and then moved to annual post-injection LTM in December 2008.

7.3.3.3 Long-term Monitoring

In accordance with the Final LTM Plan for Site 9 Groundwater (CH2M, 2005), groundwater sampling has been performed approximately every 12 months in order to assess the effectiveness of the RA, and includes assessing the effectiveness of the EISB of groundwater and the achievement of 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 November 2015, three monitoring wells were sampled for RDX, total and dissolved iron, and natural attenuation parameters including TOC, dissolved gases (methane, ethane, ethene), carbon dioxide, sulfide, sulfate, chloride, nitrate, and nitrite. The analytical results for post RA LTM from 2006 to 2015 are provided in **Table 7-3** and summarized below.

RDX Results

RDX was only analyzed at one location, 09GW01. RDX was detected at a concentration of 12 µg/L, slightly above the PRG of 10 µg/L.

Metals Results

Total and dissolved iron were analyzed in the groundwater of the three wells sampled at Site 9.

- Total iron was detected in groundwater samples from all three monitoring wells at concentrations of 1,840 µg/L (09GW01), 29,900 µg/L (09GW208), and 19,200 µg/L (09GW214). The detections at 09GW208 and 09GW214 exceeded the PRG of 11,000 µg/L.
- Dissolved iron was detected in groundwater samples from all three monitoring wells at concentrations of 1,570 µg/L (09GW01), 19,800 µg/L (09GW208), and 18,400 µg/L (09GW214). The detections at 09GW208 and 09GW214 exceeded the PRG (11,000 µg/L).

Geochemistry Indicators

Geochemistry parameters including dissolved oxygen, nitrate, ferrous iron, sulfate, sulfide, and methane were collected at each monitoring well sampled at Site 9. Groundwater geochemical conditions appear generally anaerobic, most likely under iron-reducing conditions in some portions of the aquifer, based on low dissolved oxygen values (1 mg/L), low levels of nitrate, detection of ferrous iron at concentrations of 2 to 3 mg/L using field test kits, and elevated filtered metal results for iron. Sulfate concentrations were low (less than 4 mg/L) and sulfide was not detected (detection limit of 1 mg/L). Methane concentrations ranged from 0.36 to 3.6 mg/L, indicating that some degree of methanogenesis may be occurring in some portions of the aquifer, such as near monitoring well 09GW214. Anaerobic groundwater conditions are generally favorable for natural biodegradation of RDX.

7.3.3.4 Operation and Maintenance

The only O&M activities currently associated with Site 9 are inspection and maintenance of the monitoring wells.

7.3.3.5 Institutional Control Summary

ICs at Site 9 include LUCs to:

- Ensure no withdrawal of groundwater from within the restricted areas shown on Figure 2-8 of the Site 9 ROD (NAVFAC, 2004d).
- Ensure no aquifer use for drinking purposes 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 maintain the integrity of any current or future remedial equipment or remedial monitoring operation in the restricted area.

- Ensure adequate notification of pertinent use restrictions to current and potential future property owners.

ICs will be maintained until the concentration of hazardous substances in the groundwater are at such levels to allow for unrestricted use and exposure. The LUC RD for Site 9 groundwater was finalized in 2017 (CH2M, 2017c).

As described in the ROD, ICs are not required for soil at Site 9 since exposure to soil does not pose an unacceptable risk to human or ecological receptors (NAVFAC, 2004d).

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 7-4 and 7-5**).

Table 7-4. Protectiveness Determination/Statement from the 2012 Five-Year Review – Site 9

Protectiveness Determination	Protectiveness Statement
Protective	The remedy for the Industrial Wastewater Disposal Area — Site 9 is protective of the human health and ecological receptors based on achieving most of the RAOs specified in the RODs. LUCs have been effective in preventing usage of groundwater as a potable water supply and have also restricted activities within the site boundaries that could potentially disturb the surface of the site. Groundwater treatment through lactate and EOS injections have reduced VOC and explosives concentrations near the source area. Groundwater monitoring and five-year reviews help to ensure that the RAs are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

Table 7-5. Status of Recommendations from the 2012 Five-Year Review – Site 9

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to assess whether electron donor injection continues to decrease concentrations of COCs at Site 9 and whether additional treatment at Site 9 may be warranted.	Groundwater monitoring should be continued to identify whether all the RAOs have been met, but no additional inject is warranted	Ongoing	LTM sampling is being conducted on an annual basis, and groundwater conditions are re-evaluated following each event.	June 2006 December 2008 September 2010 July 2012 January 2013 January 2014 October 2014 November 2015

7.5 Five-Year Review Process

7.5.1 Document Review

Table 7-6 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 section is given in the References section.

Table 7-6. Summary of the Site 9 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	1999
ROD for Site 9	NAVFAC	2004
Memorandum Re: Perchlorate Remediation Goal	NAVFAC	2006
Memorandum Re: Nine-Month Post-Injection/Excavation Groundwater Sampling Results for Site 9	CH2M	2006

Table 7-6. Summary of the Site 9 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
Memorandum Re: Eighteen-Month Post-Injection/Excavation Groundwater Sampling Results for Site 9	CH2M	2006
Former NSWC-White Oak First Five-Year Review	JM Waller Associates	2007
Final Long-Term Monitoring Plan for Site 9 Groundwater	CH2M	2005
Technical Memorandum Re: 2010 Annual Post-Injection Groundwater Sampling Results for Site 9	CH2M	2011
Former NSWC-White Oak Second Five-Year Review	Tetra Tech	2012
Final Basewide Long-Term Monitoring Report – 2015, Former NSWC-White Oak	CH2M	2017
Final Land Use Control Remedial Design for Site 9 Groundwater	CH2M	2017

7.5.2 Data Review and Evaluation

LTM is being conducted for groundwater at Site 9 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. The Site 9 historical LTM groundwater analytical data collected from 2006 (baseline) through November 2015 are provided in **Table 7-3**, and the trend graphs presenting COC results for one monitoring well at Site 49 are provided in **Appendix C-5**.

RDX was analyzed at one location (09GW01) at Site 9 in November 2015 and was detected at 12 µg/L, which is above the PRG of 10 µg/L. All other monitoring wells were eliminated from the monitoring plan for RDX because concentrations have been below the PRG for two or more rounds. From June 2006 to November 2015, RDX concentrations have decreased from 37 µg/L to 12 µg/L. In general, conditions at Site 9 appear to be anaerobic which is favorable for natural biodegradation of RDX.

7.6 Technical Assessment

7.6.1 Question A – Is the remedy functioning as intended by the design?

The Site 9 remedy of enhanced anaerobic bioremediation, LUCs, and LTM for groundwater, as well as excavation and offsite disposal for soil in the area of the former Building 318 sump, 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 Remedial Action Performance

The reduction of RDX concentrations appear to have reached asymptotic levels in monitoring well 09GW01, and any further decrease will likely be very gradual without additional treatment. However, because the concentrations of RDX are relatively low, even implementing additional biological treatment may not have any substantial effect. Based on these RDX concentrations, and the significant reductions below the PRGs of the other Site 9 COCs, and RDX reductions in all other wells, consideration should be given to reevaluating the risk posed by the current groundwater concentrations in accordance with the Site 9 LTM Plan (CH2M, 2005) Decision Rule 3B.

Additionally, monitoring well 09GW215, located in the source area, was included as part of the LTM; however, EOS solution was directly injected into the well in 2006 for the purpose of remediating the groundwater. The monitoring well was sampled several years post-injection; however, due to excess EOS solution in the monitoring well, it was difficult collecting a groundwater sample without EOS solution in it and there was uncertainty of groundwater conditions immediately surrounding the well. Efforts to redevelop the monitoring well and to flush out the EOS substrate were conducted in 2013 but were unsuccessful in flushing out the EOS from the monitoring well. As a result, the well was deemed unusable for groundwater quality monitoring purposes.

7.6.1.2 Implementation of Institutional Controls and Other Measures

ICs at Site 9 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 PRGs are met, minimize potentially adverse health and environmental effects of work or development in the restricted area, and to minimize physical disruption of any remedial equipment or remedial operations in the restricted area.

7.6.1.3 Opportunities for Optimization

After the last Five-Year Review, CH2M recommended and implemented several changes to the LTM program for Site 9. These changes are summarized in **Table 7-7**.

Table 7-7. Site 9 Groundwater Optimization

Sampling Event	Groundwater Optimization
January 2014	• Monitoring will be discontinued at monitoring well 09GW215 as a result of EOS residue. • Analyze for total and dissolved arsenic, iron, and manganese at monitoring wells: 09GW01, 09GW208, 09GW209, 09GW213, and 09GW214. • Analyze for geochemistry parameters (TOC, dissolved gases, carbon dioxide, chloride, nitrate, nitrite, sulfate, and sulfide) at monitoring wells 09GW01, 09GW208, 09GW209, 09GW213, and 09GW214.
October 2014	• Wells 09GW209 and 09GW213 should be removed from monitoring. • The ferrous iron test kit should be eliminated from the field analytical program.

7.6.2 Question B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs used at the time of the remedy selection still valid?

The exposure assumptions and RAOs from the ROD are still valid; however, toxicity data, and therefore the cleanup levels, for some of the COPCs and COCs have changed. The changes have not affected the results of the soil risk assessment, or the protectiveness of the soil remedy, and the groundwater cleanup levels were updated in 2010; those levels are still valid and current. Concentrations of RDX in one well still slightly exceeds the PRGs based on residential use of the groundwater; however, the LUCs eliminate any potential exposure to or use of the groundwater.

7.6.3 Question C – Has any other information come to light that could question the protectiveness of the remedy?

No additional information has surfaced that questions the protectiveness of the remedy. The ICs and long-term groundwater monitoring are effective in protecting human receptors from any direct contact with or ingestion of groundwater.

7.7 Issues, Recommendations, and Follow-up Actions

The remedy for groundwater is enhanced anaerobic bioremediation, LTM and LUCs protective of human health and the environment. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy in this area.

The ICs and long term groundwater monitoring portions of the Site 9 remedy are functioning as intended by restricting exposure to groundwater contaminants by human and ecological receptors. No issues have been identified for either of these two activities.

Based on evaluation of the LTM data, the following recommendations are provided for the RA for Site 9 groundwater:

- Groundwater sampling should continue on an annual basis. Groundwater optimization should continue to occur based on the decision rules provided in the Site 9 LTM Plan (CH2M, 2005).

The presence of EOS in monitoring well 09GW215 currently does not allow representative groundwater monitoring close to the former source area sump. In order to obtain more representative groundwater data on which to base a closeout decision in this area, a new monitoring well will be installed near the former source area and this new well will be sampled as part of the 2016 LTM event.

An artifact of the selected remedy to treat the VOCs and explosives, is the necessary increase in reducing conditions in the aquifer, and a resultant temporary increase in dissolved iron concentrations. While iron concentrations have increased to levels in excess of PRGs, the area of these increases is limited to the immediate vicinity of the injections, and these concentrations would be expected to dissipate once the substrate is used up and less reducing conditions are reestablished. The most recent rounds of sampling have shown decreasing concentrations of iron.

7.8 Protectiveness Statement

The remedy for Site 9 groundwater and soil, consisting of enhanced anaerobic bioremediation, LTM, and LUC implementation for groundwater, as well as excavation and offsite disposal for soil in the area of the former Building 318 sump, is protective of human health and the environment. In January 2005, the sump area was excavated and 110 gallons of sodium lactate and approximately 500 gallons of water were placed into the excavation. The excavation was backfilled and a monitoring well was installed in the former location of the sump (JM Waller, 2007). The objective of the excavation and subsequent sodium lactate treatment was to eliminate a potential ongoing source of groundwater contamination, specifically related to RDX. The reduction in RDX concentrations in the wells immediately downgradient of this excavation, to concentrations below PRGs, indicates that this soil remedy has been protective. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

TABLE 7-3
Historical Constituents Detected in Groundwater at Site 9
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 09**	09GW01											
Sample ID		009GW001-0606	009GW001-0807	009GW001-1208	009GW001-0910	009GW001P-0910	09GW01-0712	09GW01-0113	09GW01-0114	09GW01P-0114	09GW01-1014	09GW01P-1014	09GW01-1115	09GW01P-1115
Sample Date		06/07/06	08/14/07	12/15/08	09/17/10	09/17/10	07/24/12	01/14/13	01/29/14	01/29/14	10/16/14	10/16/14	11/06/15	11/06/15
Chemical Name														
Volatile Organic Compounds (UG/L)														
2-Butanone	--	10 U	2 UJ	5 R	2.5 U	2.5 U	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	--	10 U	2 U	5 R	2.5 U	2.5 U	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	--	10 U	2 U	5 U	**0.47 J**	**0.56 J**	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	5	**4**	**5**	**4.5 J**	**2.9**	**3**	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane (Freon-11)	--	**3 J**	**4**	5 U	**0.69 J**	**0.73 J**	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (UG/L)														
No Detections														
Explosives (UG/L)														
HMX	--	**6.6 J**	**6.3 J**	**6.6 J**	**7.5**	**7.4**	**8.1 K**	**7.67**	**7.24**	**7.23**	NA	NA	NA	NA
Perchlorate	15	**12**	**8.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RDX	10	**37**	**39**	**30**	**29**	**27**	**19**	**25.9**	**19.6**	**19.3**	**8.13 J**	**9.11 J**	**12**	**10**
Total Metals (UG/L)														
Iron	11,000	NA	NA	NA	66.2 B	NA	**78.2**	**1,360**	**30,300**	**28,800**	**2,070 J**	**2,230 J**	**1,690**	**1,840**
Manganese	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**442 J**	**475 J**	NA	NA
Sodium	--	**9,800**	NA	**9,920**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)														
Iron, Dissolved	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2,740 J**	**2,780 J**	**1,570**	**1,490**
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**723 J**	**701 J**	NA	NA
Wet Chemistry* (see note below)**														
Acetate (mg/l)	--	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (mg/l)	--	**26**	**26**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon dioxide (mg/l)	--	**160**	**230**	**99**	**170**	NA	**204**	**170 D**	**180**	NA	**141 D**	NA	**96**	NA
Chemical oxygen demand (mg/l)	--	20 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	**18**	**22**	**19**	**17**	NA	**17**	**16**	**16**	NA	**16**	NA	**18.7**	NA
Methane (mg/l)	--	**0.23**	**0.54**	**0.84**	**2**	NA	**2.62**	**0.79 D**	**0.589**	NA	**0.309 D**	NA	**0.36**	NA
Nitrate (mg/l)	--	**0.36**	**0.47**	**0.22**	**0.23**	NA	**0.34 J**	**0.3 J**	**0.22 J**	NA	**0.12 J**	NA	**0.187**	NA
Nitrite (mg/l)	--	0.025 U	0.025 U	0.13 U	0.04 U	NA	0.044 U	0.07 U	0.07 U	NA	0.07 U	NA	0.05 U	NA
pH (ph)	--	**5.5**	**5.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	5 U	5 U	5 U	**0.45 J**	NA	**1.3 J**	**0.42 J**	**0.71 J**	NA	**0.69 J**	NA	**1.45**	NA
Sulfide (mg/l)	--	0.03 UL	0.03 U	0.03 R	NA	NA	1 U	1 U	1 U	NA	1 U	NA	1 U	NA
Total organic carbon (TOC) (mg/l)	--	**25**	NA	10 U	0.77 B	NA	**0.64 J**	0.66 U	**2**	NA	**0.49 J**	NA	**1.38**	NA

Notes:

Shading indicates exceedance of Site 09 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

UL = The analyte was analyzed for but was not detected. The quantitation limit may be biased low.

MG/L - Milligrams per liter

PH - pH units

UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

TABLE 7-3
Historical Constituents Detected in Groundwater at Site 9
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 09**	09GW208					09GW214				
Sample ID		009GW208-0606	009GW208P-0606	009GW2080507	09GW208-1014	09GW208-1115	009GW214-0606	009GW2140507	009GW2140507P	09GW214-1014	09GW214-1115
Sample Date		06/06/06	06/06/06	05/24/07	10/14/14	11/06/15	06/06/06	05/24/07	05/24/07	10/14/14	11/06/15
Chemical Name											
Volatile Organic Compounds (UG/L)											
2-Butanone	--	**1 J**	10 U	2 U	NA	NA	**4 J**	**8**	2 U	NA	NA
Acetone	--	1 B	10 U	2 UJ	NA	NA	2 B	**37 J**	2 UJ	NA	NA
cis-1,2-Dichloroethene	--	**2 J**	**1 J**	2 U	NA	NA	**1 J**	**2**	2 U	NA	NA
Trichloroethene	5	2 U	2 U	1 B	NA	NA	**2**	2 UJ	1 B	NA	NA
Trichlorofluoromethane (Freon-11)	--	**2 J**	**2 J**	2 U	NA	NA	**10**	2 U	2 U	NA	NA
Semivolatile Organic Compounds (UG/L)											
No Detections											
Explosives (UG/L)											
HMX	--	0.22 U	0.2 U	0.2 U	NA	NA	0.2 U	0.2 U	0.2 U	NA	NA
Perchlorate	15	10 U	10 U	0.2 U	NA	NA	4.9 B	0.2 U	0.2 U	NA	NA
RDX	10	0.22 U	0.2 U	0.2 U	NA	NA	0.2 U	0.2 U	0.2 U	NA	NA
Total Metals (UG/L)											
Iron	11,000	NA	NA	NA	9,700 B	**29,900**	NA	NA	NA	21,800 B	**19,200**
Manganese	--	NA	NA	NA	**5,790**	NA	NA	NA	NA	5,050 B	NA
Sodium	--	**28,300**	**28,300**	**29,800**	NA	NA	**18,300**	**16,500**	NA	NA	NA
Dissolved Metals (UG/L)											
Iron, Dissolved	11,000	NA	NA	NA	**10,500**	**19,800**	NA	NA	NA	**20,800**	**18,400**
Manganese, Dissolved	--	NA	NA	NA	**6,260**	NA	NA	NA	NA	**5,590**	NA
Wet Chemistry* (see note below)**											
Acetate (mg/l)	--	**2.7**	**4**	1 UL	NA	NA	**2.6**	**13 L**	NA	NA	NA
Alkalinity (mg/l)	--	**140**	**190**	**120**	NA	NA	**110**	**110**	NA	NA	NA
Carbon dioxide (mg/l)	--	**190**	**250**	**150**	**158**	**130**	**130**	**130**	NA	**178**	**84**
Chemical oxygen demand (mg/l)	--	20 U	20 U	20 U	NA	NA	20 U	**32**	NA	NA	NA
Chloride (mg/l)	--	**16 L**	**15 L**	**17**	**14**	**13.2**	**10 L**	**11**	NA	**9.5**	**11.6**
Methane (mg/l)	--	**2**	**2.2**	**6**	**0.982 D**	**1.6**	**1.2**	**8.9**	**7.7**	**2.61 D**	**3.6**
Nitrate (mg/l)	--	**0.044 L**	**0.078 L**	0.025 U	0.21 U	**0.0657 J**	**0.17 L**	0.025 U	NA	0.21 U	**0.054 J**
Nitrite (mg/l)	--	**0.029 L**	0.025 UL	0.025 U	0.07 U	0.05 U	0.025 UL	0.025 U	NA	0.07 U	0.05 U
pH (ph)	--	**6.2**	**6.2**	**6.2**	NA	NA	**6.2**	**6.2**	NA	NA	NA
Sulfate (mg/l)	--	5 UL	5 UL	5 U	**2.2 J**	**3.94**	5 UL	5 U	NA	**0.39 J**	**2.17**
Sulfide (mg/l)	--	**0.043 L**	0.03 UL	0.03 U	1 U	1 U	0.03 UL	0.03 U	NA	1 U	1 U
Total organic carbon (TOC) (mg/l)	--	10 U	10 U	**1.41**	**1.3**	**314**	10 U	**4.28**	NA	**0.52 J**	**1.76**

Notes:

Shading indicates exceedance of Site 09 PRGs

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

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UL = The analyte was analyzed for but was not detected. The quantitation limit may be biased low.

MG/L - Milligrams per liter

PH - pH units

UG/L - Micrograms per liter

*** WCHEM data is a mixture of validated and unvalidated data and is thus treated as validated data

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 7-1 - Site 9 Map - Letter.mxd9/23/2016CGauthier_ch2mhillen



Legend

- 2015 Long Term Monitoring Well
- Monitoring Well
- Lactate Injection Boring (2003)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Topographic Contours (ft msl)
- Site Boundary
- Former Buildings and Other Structure

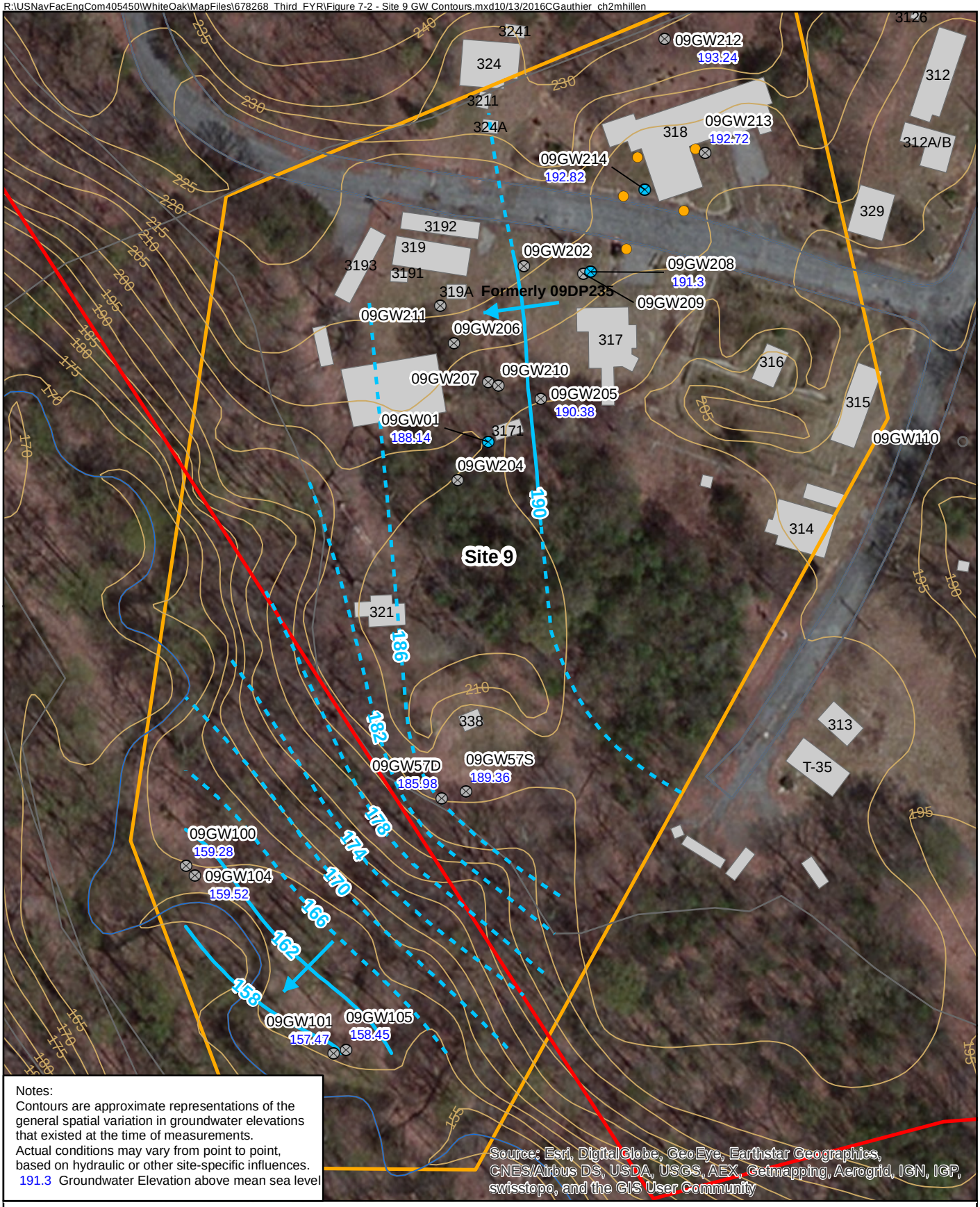
N

0 50 100 Feet

Figure 7-1
Site 9 Map
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 7-2 - Site 9 GW Contours.mxd10/13/2016CGauthier_ch2mhillen



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.
191.3 Groundwater Elevation above mean sea level

Legend

- 2015 Long Term Monitoring Well
- Monitoring Well
- Lactate Injection Boring (2003)
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary
- Former Buildings and Other Structure
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

N

0 50 100 Feet

Figure 7-2
Site 9 Potentiometric Surface Map and LTM Locations - November 6, 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

SECTION 8

Site 11 – Industrial Wastewater Disposal 100 Area

8.1 Site Chronology

A chronology of major events for Site 11 is provided in **Table 8-1.**

Table 8-1. Key Events and Milestones for Site 11

Date	Key Events and Milestones
1984	Site 11 identified as IRP site during NEESA Initial Assessment Study.
1985	Malcolm-Pirnie conducted Confirmation Study entailing soil boring, groundwater monitoring well installation, and sampling (groundwater, surface water, soil, sediment)
October 1992	Malcolm Pirnie published RI report for investigation activities conducted between 1989 and 1992.
1995	NSWC-White Oak selected for closure under BRAC IV.
1995 – April 1996	EA Engineering Science and Technology conducted an Environmental Baseline Survey to establish record of environmental information and condition before property transfer.
1996	Leaching wells and surrounding subsurface soil were removed from Site 11.
2000-2001	An RFI and an RFI addendum focusing on deeper bedrock groundwater contamination were completed by Tetra Tech. These documents identified VOC plumes in Site 11 groundwater.
July 2002	No Further Action ROD for Site 11 soil signed.
April 2004	ROD for Site 11 groundwater signed.
November-December 2004	Shaw installed injection wells and injected 20,570 gallons of an emulsified oil substrate solution and 22,132 gallons of flush water.
June 2008	Tetra Tech performed LTM sampling event.
October 2009	Tetra Tech performed LTM sampling event.
January 2012	Tetra Tech performed LTM sampling event.
March 2013	CH2M performed the 2013 LTM sampling event.
May 2014	CH2M performed the 2014 LTM sampling event.
November 2015	CH2M performed the 2015 LTM sampling event.

Note:
Timeline information from Tetra Tech, 2012.

8.2 Background

8.2.1 Description and History

Site 11, Industrial Wastewater Disposal Area 100, covers approximately 16 acres and is located within the western part of Former NSWC-White Oak (**Figure 1-2)**. Site 11 was formerly a large building complex that was the main administrative area for the Former NSWC-White Oak and also contained various laboratory facilities. Building demolition and construction has since occurred at the site. However, during its period of active use, Site 11 contained fourteen leaching wells, concentrated in ten areas, that were used for disposal of wastewater from laboratory activities. Leaching wells were reportedly used to dispose of an estimated 20,000 gallons of liquid wastes generated by Former NSWC-White Oak between 1951 and 1976 (Tetra Tech, 2012). Acids, metals,

photographic wastes, solvents (including PCE and TCE), and explosive compounds were the reported wastes. These wells have since been abandoned, but at the time the Close-out Report for In Situ Bioremediation at Site 11 was prepared in 2005, it was believed that associated supply lines to several of these wells remained in place (Shaw, 2005b).

In 1996, a removal action was performed to eliminate Site 11 soil, potentially impacted by the former leaching wells. Verification sampling indicated that the removal action was successful, and that no further risk-driving concentrations of constituents remained onsite. Therefore, a ROD for Site 11 soil was signed in 2002, indicating that NFA was needed for soil, and that Five-Year Reviews would not be necessary.

Groundwater at Site 11 is still subject to LTM, and Five-Year Reviews. The requirements for groundwater LTM are specified in the ROD for Site 11 groundwater, signed by USEPA Region 3 and the Navy, and with concurrence by the MDE (Navy Engineering Field Activity Chesapeake, 2004). The groundwater RA selected in the ROD included source removal, hot spot EISB, long-term groundwater monitoring, and LUCs. MCSs were developed and presented in the ROD for Site 11 groundwater (Navy Engineering Field Activity Chesapeake, 2004) and are listed below, in **Table 8-2**.

Table 8-2. Media Cleanup Standards for Site 11 Groundwater included in the Site 11 ROD – 2004

COC	MCS (µg/L)
cis-1,2-DCE	70
1,1-DCE	7
1,2-DCA	5
PCE	5
TCE	5
VC	2
Chloroform	80
Hexavalent Chromium	100

The MCSs (used for Site 11 and SWMU 87) were developed in a similar manner to PRGs (used for Sites 4, 7, 9, 13, and 49) and have similar meaning. This document uses each term as it was presented in its respective site-specific ROD. The active-phase RA involved enhanced in EISB using EOS delivered via pneumatic fracturing with high-pressure nitrogen gas. Injection was performed in 34 injection locations installed in November 2004. Pneumatic injection was performed to enhance the distribution of EOS within the subsurface. After fracturing the subsurface soil matrix, EOS was mixed with water into a solution (1 part EOS mixed with 10 parts water) and injected into the subsurface. Details associated with the injection activities can be found in the Close-out Report for In Situ Bioremediation at Site 11 Shaw, 2005b).

8.2.2 Physical Characteristics

The surficial geology of Site 11 consists of the Upland Sand and Gravel Formation, which exists in the central and southern regions of Site 11, and the saprolite of the Wissahickon Formation, which exists in the northern region. A thin layer of the Upland Sand and Gravel thickens to the south and southeast and varies in thickness from 2 to 30 feet. It consists of brown silt and red-brown, fine to medium sand with some gravel. Clayey silt seams less than 1-foot-thick interbedded with fine gravel occur near the base of the unit. The saprolite of the Wissahickon Formation varies in thickness from approximately 5 to 55 feet. The saprolite grades from a micaceous silt or silty sand with varying amounts of clay and schist fragments to a severely weathered schist. The competent bedrock is a thick gneiss unit beginning at approximately 23 to 47 feet bgs.

Two west-east flowing intermittent streams, located east of Site 11, flow into Paint Branch. One northwest-southeast flowing stream located at the western end of Site 11 discharges offsite and eventually flows into Paint Branch (**Figure 8-1**).

Based on groundwater elevations obtained from nine wells at Site 11 in November 2015, groundwater flow is generally to the east-northeast (**Figure 8-2**).

8.2.3 Land and Resource Use

The majority of the property occupied by Site 11 is open space with a few buildings and paved roads and parking areas. GSA, which owns the property, has plans to use Site 11 for nonresidential purposes. The buildings constructed as part of this development are currently leased to the Food and Drug Administration. Nonetheless, for the purposes of the site assessment, the site was evaluated assuming the possibility of future residential use. 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 wells without a permit.

8.2.4 History of Contamination

The following text, based on the ROD for Site 11 groundwater (Navy Engineering Field Activity Chesapeake, 2004), discusses the initial state of contamination at Site 11, before groundwater RA was conducted.

Historically, CVOCs have been the primary source of contamination at Site 11, due to the disposal of solvents in the leaching wells. At the time of the 2004 ROD, 16 VOCs had been detected at Site 11. Of those, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, PCE, and TCE were detected at concentrations greater than drinking water standards, indicating an unacceptable risk to potential groundwater users. Also of concern at Site 11, perchlorate, an explosives component, was detected at concentrations greater than USEPA's advisory level of 4 µg/L (current value at time ROD was prepared) in many wells, at concentrations ranging from 5 to 130 µg/L. Hexavalent chromium was detected at elevated concentrations in many wells, but it was determined that these concentrations were consistent with background concentrations for Former NSWC-White Oak, and thus, were not site-related.

Treatment injections were performed in November 2004. Comparison of the results from preinjection sampling and the most recent round of sampling indicates that concentrations of groundwater COCs at Site 11 have generally decreased.

8.2.5 Site Risks

8.2.5.1 Human Health Risk Assessment

Various RI activities were undertaken at Site 11 in the 1980s and 1990s, and the data from these investigations were used to conduct an HHRA. The following summary of human health risk is based on the HHRA presented in the Site 11 soil and groundwater RODs (Navy Engineering Field Activity Chesapeake, 2002; Navy Engineering Field Activity Chesapeake, 2004) and in the two preceding Five-Year Reviews (JM Waller Associates, 2007; Tetra Tech, 2012). Note that this HHRA was conducted after the removal action that addressed Site 11 soil (which was conducted in 1996), but before RA was taken for Site 11 groundwater.

COPCs for Site 11 soil were identified using USEPA Region 3 risk-based concentrations for residential soil ingestion, USEPA generic soil screening levels for transfers from soil to air (inhalation), and Basewide background levels for inorganics. These criteria are conservative, because future use of the site is non-residential. The COPCs identified during this process were benzo[a]pyrene, cadmium, mercury, and silver. Non-carcinogenic hazards and carcinogenic risks were evaluated for exposure to Site 11 soil for the following potential human receptors: full-time workers, maintenance/utility workers, construction workers, adult recreational users, adolescent trespassers, daycare center children, and child and adult residents. Non-carcinogenic hazards and carcinogenic risks for all potential exposure scenarios were below USEPA target levels. Therefore, the HHRA concluded that there were no unacceptable risks associated with exposure to Site 11 soil.

Groundwater COPCs were identified using USEPA Region 3 tap water risk-based concentrations (current at the time the HHRA was conducted). These criteria are based on the assumption that groundwater is used for domestic potable purposes. This is a conservative assumption since groundwater at Site 11 is not currently used or expected to be used in the future as a potable water supply.

The following chemicals were identified as COPCs in groundwater:

- Chlorinated VOCs: 1,1-DCE, 1,2-DCA, cis-1,2-DCE, chloroform, PCE, TCE, and VC
- Other VOCs: acetone, benzene
- Inorganic chemicals: arsenic, hexavalent chromium, nitrate, and perchlorate

Non-carcinogenic hazards and carcinogenic risks were evaluated for exposure to Site 11 groundwater for full-time workers, maintenance/utility workers, construction workers, daycare center children, adolescent trespasser, adult recreational users, and hypothetical future adult and child residents. Noncarcinogenic hazards for future construction worker and hypothetical future residential scenarios exceeded USEPA's target level. Carcinogenic risks for future residential receptors also exceeded USEPA's target risk range.

Based on the results of the risk calculations and additional considerations such as comparison of concentrations to MCLs and frequency of detection, the following COPCs were identified as COCs:

- Chlorinated VOCs: 1,1-DCE, 1,2-DCA, cis-1,2-DCE, chloroform, PCE, TCE, and VC
- Inorganic chemicals: hexavalent chromium

MCSs were developed for these COCs, as presented in **Table 8-2**.

8.2.5.2 Ecological Risk Assessment

Because there was essentially no surficial contamination at Site 11, an ERA was deemed unnecessary due to lack of potential receptors, and not performed.

8.3 Remedial Actions

8.3.1 Basis for Remedial Action

Based on the results of previous investigations, and human health and ecological risk considerations, it was determined that NFA was necessary for Site 11 soil, but that RA was necessary for Site 11 groundwater, based on noncarcinogenic hazards and carcinogenic risks associated with potential future construction worker and residential exposure scenarios.

8.3.2 Response Actions

8.3.2.1 Selected Remedy for Site 11

The ROD for Site 11 groundwater was signed on April 8, 2004 (Navy Engineering Field Activity Chesapeake, 2004). The ROD summarized the risks to human health and the environment, established RAOs, and defined the selected remedy. The RAOs for Site 11 groundwater, as stated in the ROD, are the following:

- Prevent human exposure (through ingestion, inhalation, and dermal contact) to groundwater having contaminants at concentrations in excess of MCSs.
- Restore contaminated groundwater quality to MCS levels, taking the known future reuse of the Site 11 area into consideration.
- Comply with contaminant-, location-, and action-specific ARARs, and To Be Considered Criteria, as appropriate.

To achieve these RAOs, the selected remedy comprises the following major components:

- Source removal, as already addressed through the previously undertaken soil removal action.

- "Hot Spot" In situ Bioremediation to encourage the growth of micro-organisms that would augment the biodegradation process
- ICs to prevent withdrawal of groundwater and potable use of the aquifer within a designated area
- Groundwater LTM to assess the progress of biodegradation and potential contaminant migration.

8.3.3 Status of Implementation

8.3.3.1 In-situ Bioremediation

The following information regarding remedy implementation comes from the Post-Closure Report for Site 11 (Tetra Tech, 2005b). In early-mid November 2004, Shaw and a drilling subcontractor, Summit Site Services, installed 34 injection wells, with temporary polyvinyl chloride casing to hold boreholes open for later injection. On November 17, ARS Technologies, Inc., a subcontractor specializing in pneumatic fracturing and subsurface injection, commenced pneumatic fracturing and EOS injection at IW-1 through IW-34. Fracturing was performed in order to increase permeability of the saprolitic bedrock, allowing the injected solutions to migrate further to treat the groundwater. A total of 20,418 gallons of EOS solution and 22,132 gallons of flush water were injected into the subsurface at Site 11. Fracturing and injection were completed on December 17, 2004.

8.3.3.2 Long-term Monitoring

To monitor the effectiveness of the EISB injections, groundwater sampling has been performed periodically since the injections, and is now performed on an annual basis.

During the most recent round of groundwater sampling in November 2015, four monitoring wells (11MW204D, 11MW204S, 11MW205D, 11MW205SR) were sampled for select VOCs (1,1-DCE, 1,2-DCA, chloroform, cis-1,2-DCE, PCE, TCE, and VC), and two monitoring wells (11MW211S and 11MW211D) were sampled for perchlorate (**Figure 8-1).** The analytical results are provided in **Table 8-3** and are summarized below.

Tetrachloroethene

PCE was detected in samples from two of the four monitoring wells at concentrations of 2.7 µg/L (11MW204S) and 1.1 µg/L (11MW204D); neither detection exceeded the MCS (5 µg/L).

Trichloroethene

TCE was detected in groundwater samples from three of the four monitoring wells with detected concentrations ranging from 0.12 µg/L (11MW205D) to 0.66 µg/L (11MW204S). Detected concentrations of TCE did not exceed the MCS (5 µg/L).

Cis-1,2-Dichloroethene

Cis-1,2-DCE was detected in all four monitoring wells but did not exceed the MCS (70 µg/L). Detected concentrations ranged from 0.11 µg/L (11MW205SR) to 1.1 µg/L (11MW204S). Detected concentrations of cis-1,2-DCE did not exceed the MCS (70 µg/L).

1,1-Dichloroethene

1,1-DCE was detected in groundwater samples from all four monitoring wells at concentrations ranging from 1 µg/L (11MW205D) to 7.7 µg/L (11MW205SR). The detected concentration at 11MW205SR slightly exceeded the MCS of 7 µg/L.

1,2-Dichloroethane

1,2-DCA was not detected in the groundwater at Site 11.

Vinyl Chloride

VC was detected in groundwater samples from all four monitoring wells. Detected concentrations ranged from 0.22 µg/L (11MW205D) to 4.5 µg/L (11MW205SR). The detected concentration at 11MW205SR exceeded the MCS (2 µg/L).

Chloroform

Chloroform was detected in groundwater samples from monitoring wells 11MW204S and 11MW204D at concentrations of 0.12 µg/L and 0.15 µg/L, respectively; neither detection approached the MCS (80 µg/L).

Perchlorate

Two monitoring wells, 11MW211S and 11MW211D, were sampled and analyzed for perchlorate in November 2015. Perchlorate was detected at one monitoring well (11MW211S) at a concentration of 0.255 µg/L. A MCS has not been established for Site 11, however, all results over the last 4 years have been below 1 µg/L, which is below the 4 µg/L advisory level cited in the ROD (Navy Engineering Field Activity Chesapeake, 2004) and below the current Interim Drinking Water Health Advisory level for perchlorate of 15 µg/L.

8.3.3.3 Operation and Maintenance

The only O&M activities currently associated with Site 11 are inspection and maintenance of the monitoring wells.

8.3.3.4 Institutional Control Summary

ICs at Site 11 include LUCs to:

- Ensure no withdrawal of groundwater form within the restricted areas shown on Figure 2-8 of the Site 11 ROD (Navy Engineering Field Activity Chesapeake, 2004).
- Prohibit aquifer use for drinking purposes within this area until the MCSs have been met and risks from groundwater use are shown to be reduced to acceptable levels.

The ICs are documented in the LUC RD (NAVFAC, 2009).

As described in the ROD for Site 11 soil, the selected remedy for Site 11 soil is NFA; ICs are not required for this medium (NAVFAC, 2004d).

8.4 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 8-4 and 8-5**).

Table 8-4. Protectiveness Determination/Statement from the 2012 Five-Year Review – Site 11

Protectiveness Determination	Protectiveness Statement
Protective	The remedy for the Industrial Wastewater Disposal 100 Area — Site 11 is protective of the human health and ecological receptors. Monitored natural attenuation is reducing contaminant concentrations in VOC Plumes No. 1 and No. 2, perchlorate plume, and hexavalent chromium plume. Once the LTM well network is complete, monitoring of the other plumes should indicate decreasing contaminant concentrations across the entirety of Site 11. The ICs which prevent usage of groundwater as a potable water supply are protecting human receptors from exposure to groundwater contamination. Groundwater monitoring and five-year reviews help to ensure that the RAs are functioning as intended and that an overall long-term reduction in groundwater contamination is being achieved.

Table 8-5. Status of Recommendations from the 2012 Five-Year Review – Site 11

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Groundwater monitoring has not been consistent due to ongoing construction activities.	Continued monitoring is recommended to evaluate if natural attenuation processes, either biological or physical, will continue to reduce contaminant concentrations to acceptable levels in all plumes within Site 11. Well installation should be coordinated with the continued development of the property. As additional data become available, groundwater elevation and flow mapping should be compiled to further characterize site conditions.	Ongoing	The monitoring well network was completed in April 2014 following the FDA construction. Sampling is being conducted at Site 11 on an annual basis per the LTM plan (Tetra Tech, 2004c), and groundwater conditions are re-evaluated following each event.	March 2013 May 2014 November 2015

8.5 Five-Year Review Process

8.5.1 Document Review

Table 8-6 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 section is given in the References section.

Table 8-6. Summary of the Site 11 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
ROD for Site 11 Soil	Navy Engineering Field Activity Chesapeake	2002
ROD for Site 11 Groundwater	Navy Engineering Field Activity Chesapeake	2004
Post Remedial Action Report	Tetra Tech	2005
Close-out Report for In Situ Bioremediation at Site 11	Shaw	2005
First Five-Year Review	JM Waller Associates	2007
Second Five-Year Review	Tetra Tech	2012
Final Basewide Long-Term Monitoring Report - 2015	CH2M	2017

8.5.2 Data Review and Evaluation

Groundwater monitoring is being conducted to evaluate the continued effectiveness of the RA. Generally, groundwater quality appears to have improved over time since the implementation of the remedy, with decreasing COC concentration trends over the last several years (**Appendix C-6)**. Most notably, the concentration of 1,1-DCE has decreased by 50 percent or more in wells 11MW204D, 11MW204S, and 11MW205SR between 2014-2015 (**Table 8-3)**. Other constituent concentrations have showed more gradual decreases, or remained consistently low.

8.6 Technical Assessment

This section presents the answers to the three questions defined for the technical assessment for Site 11.

8.6.1 Question A – Is the remedy functioning as intended by the ROD?

8.6.1.1 Remedial Action Performance

Long-term monitoring has indicated that groundwater constituent concentrations are decreasing, and fewer analytes are exceeding their respective MCS values. Specifically, during the most recent round of groundwater sampling, in November 2015, six VOCs (PCE, TCE, cis-1,2-DCE, 1,1-DCE, VC, and chloroform) and one explosives component (perchlorate) were detected in groundwater samples at Site 11. Two analytes, 1,1-DCE, and VC, were detected at concentrations exceeding their respective MCSs, and these exceedances occurred in the same well (11MW205SR). Thus, fewer analytes now exceed the MCS compared to pre-injection conditions. Furthermore, COC concentrations have generally declined over the past 4 years of monitoring, especially 1,1-DCE, which has dropped by approximately 50 percent between the last two LTM sampling events (**Appendix C-6**). Thus, the RA appears to be functioning as intended, by aiding the biodegradation of contaminants.

8.6.1.2 Implementation of Land Use Controls and Other Measures

ICs at Site 11 include LUCs to prohibit potable use of groundwater. The Navy and GSA are obligated to ensure the implementation of this use restriction, including ensuring that current and future property owners are aware of this restriction. These LUCs remain in place, and no signs of LUC violations have been observed.

8.6.1.3 Opportunities for Optimization

After the last Five-Year Review, CH2M recommended and implemented several changes to the LTM program for Site 4. These changes are summarized in **Table 8-7**.

Table 8-7. Site 11 Groundwater Optimization

Sampling Event	Groundwater Optimization
January 2012	• Add VOC analysis to monitoring well 11MW210S. • Eliminate natural attenuation and perchlorate parameters at monitoring wells 11MW206S, 11MW207S, and 11MW207D.
March 2013	• Eliminate monitoring wells 11MW201D, 11MW201S, 11MW206S, 11MW207D, 11MW207S, 11MW209D, 11MW209S.
May 2014	• Based on previous sampling results and decision criteria consistent with Sites 4, 7, and 9, eliminate monitoring from 11MW212S, 11MW213D, and 11MW213S
November 2015	• Based on previous sampling results and decision criteria consistent with Sites 4, 7, and 9, eliminate monitoring from 11MW205D, 11MW211D, and 11MW211S.

8.6.2 Question B – Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Since land use is not anticipated to change, the exposure assumptions and RAOs developed at the time of remedy selection are still valid. Soil contamination was adequately addressed through the 1986 removal action, as established in the "No Further Action" ROD for Site 11 soil (Navy Engineering Field Activity Chesapeake, 2002). The groundwater cleanup levels (MCSs) are still valid, as they were based on USEPA MCLs, which have not changed. Additionally, LUCs prevent exposure to groundwater that may still have concentrations above the MCSs.

8.6.3 Question C – Has any other information come to light that could question the protectiveness of the remedy?

Monitoring well 11MW201S was destroyed during construction of the FDA campus, resulting in a missing data point in the LTM Plan.

8.7 Issues, Recommendations, and Follow-up Actions

Based on the information presented as answers to questions A–C above, the remedy for Site 11 is still functioning as intended. Based on evaluation of the LTM data, the following recommendations are provided for the RA for Site 11 groundwater:

- Groundwater sampling should continue on an annual basis. Groundwater optimization should continue to occur based on the decision rules provided the Site 11 LTM Plan.

It is recommended that LUC inspections of Site 11 be conducted at least once a year, and that documentation of these inspections be included in an annual LUC Inspection Report in accordance with the Site 11 LUC RD (NAVFAC, 2009). A summary of the annual LUC Inspection Reports should be included in the next Five-Year Review.

8.8 Protectiveness Statement

The selected remedy for Site 11 groundwater, consisting of "hot spot" EISB, ICs, and LTM, is protective in the long term of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs.

TABLE 8-3
Historical Constituents Detected in Groundwater at Site 11
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 11**	11MW204D					11MW204S				11MW205D	
Sample ID		11GW204D-0112	11MW204D-0313	11MW204D-0514	11MW204D-1115	11MW204DP-1115	11GW204S-0112	11MW204S-0313	11MW204S-0514	11MW204S-1115	11MW205D-0514	11MW205D-1115
Sample Date		01/16/12	03/07/13	05/06/14	11/11/15	11/11/15	01/18/12	03/08/13	05/06/14	11/11/15	05/06/14	11/11/15
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1-Dichloroethane	--	0.5 U	1 U	0.2 U	NA	NA	0.5 U	1 U	0.2 U	NA	0.2 U	NA
1,1-Dichloroethene	7	0.5 U	1 U	**12**	**5.2**	**6.5**	**16**	1 U	**13**	**6**	**1.2**	**1 J**
1,2-Dichlorobenzene	--	0.5 U	1 U	**0.36 J**	NA	NA	0.5 U	1 U	**0.29 J**	NA	0.2 U	NA
1,2-Dichloropropane	--	0.5 U	1 U	0.2 U	NA	NA	0.5 U	1 U	0.2 U	NA	0.2 U	NA
1,4-Dichlorobenzene	--	0.5 U	1 U	**0.33 J**	NA	NA	0.5 U	1 U	**0.19 J**	NA	0.2 U	NA
2-Butanone	--	2.5 U	12 U	4 U	NA	NA	2.5 U	12 U	4 U	NA	4 U	NA
Acetone	--	2.5 U	12 U	5 U	NA	NA	2.5 U	12 U	5 U	NA	5 U	NA
Benzene	--	0.5 U	1 U	**0.42 J**	NA	NA	0.5 U	1 U	**0.35 J**	NA	0.2 U	NA
Carbon disulfide	--	0.5 U	5 U	0.5 U	NA	NA	0.5 U	5 U	0.5 U	NA	0.5 U	NA
Chlorobenzene	--	**1.1**	1 U	**0.89 J**	NA	NA	0.5 U	1 U	**0.63 J**	NA	0.2 U	NA
Chloroform	80	0.5 U	1 U	0.22 B	**0.14 J**	**0.15 J**	0.5 U	1 U	0.2 B	**0.12 J**	0.2 U	0.2 U
cis-1,2-Dichloroethene	70	0.5 U	1 U	0.2 U	**0.35 J**	**0.33 J**	**4.7**	**6.2**	**1.5**	**1.1**	**1.6**	**1**
Dichlorodifluoromethane (Freon-12)	--	**0.83 J**	1 U	**0.38 J**	NA	NA	0.5 U	1 U	**0.32 J**	NA	0.3 U	NA
Ethylbenzene	--	0.5 U	1 U	0.2 U	NA	NA	0.5 U	1 U	0.2 U	NA	0.2 U	NA
Isopropylbenzene	--	0.5 U	1 U	0.2 U	NA	NA	0.5 U	1 U	0.2 U	NA	0.2 U	NA
Methyl-tert-butyl ether (MTBE)	--	0.5 U	1 U	**0.16 J**	NA	NA	0.5 U	1 U	**0.17 J**	NA	0.2 U	NA
Tetrachloroethene	5	**1.8 J**	**1.7 J**	**1.3**	**1.1**	**1.1**	**5.7**	**7.2**	**4.1**	**2.7**	0.2 U	0.2 U
Toluene	--	0.5 U	1 U	0.2 U	NA	NA	0.5 U	1 U	0.2 U	NA	0.2 U	NA
trans-1,2-Dichloroethene	--	0.5 U	1 U	0.2 U	NA	NA	0.5 U	1 U	0.2 U	NA	0.2 U	NA
Trichloroethene	5	**1.4**	1 U	**0.62 J**	**0.56 J**	**0.54 J**	**1.8**	**1.7 J**	**0.91 J**	**0.66 J**	**0.1 J**	**0.12 J**
Trichlorofluoromethane (Freon-11)	--	**5.6**	**2.4**	**3.2**	NA	NA	**4.3**	**3**	**2.7**	NA	0.3 U	NA
Vinyl chloride	2	0.5 U	1 U	**0.19 J**	**0.33 J**	**0.37 J**	**4.6**	1 U	**0.44 J**	**0.92 J**	**0.13 J**	**0.22 J**
Xylene, total	--	NA	2 U	0.2 U	NA	NA	NA	2 U	0.2 U	NA	0.2 U	NA
Explosives (UG/L)												
Perchlorate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Iron, Dissolved	--	**254**	NA	NA	NA	NA	**3,210**	NA	NA	NA	NA	NA
Manganese, Dissolved	--	**433**	NA	NA	NA	NA	**2,980**	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	**11**	NA	NA	NA	NA	**13**	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	**2.56 J**	NA	NA	NA	NA	2.5 U	NA	NA	NA	NA	NA
Chloride (mg/l)	--	**96**	NA	NA	NA	NA	**100**	NA	NA	NA	NA	NA
Methane (mg/l)	--	5.00E-04 U	NA	NA	NA	NA	**0.48**	NA	NA	NA	NA	NA
Nitrate/Nitrite (mg/l)	--	**5.2**	NA	NA	NA	NA	**3.1**	NA	NA	NA	NA	NA
Nitrite (mg/l)	--	**0.462**	NA	NA	NA	NA	0.075 U	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**5.6**	NA	NA	NA	NA	**3.4**	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	**1.12**	NA	NA	NA	NA	**0.64 J**	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	**1.4**	NA	NA	NA	NA	**1.3**	NA	NA	NA	NA	NA

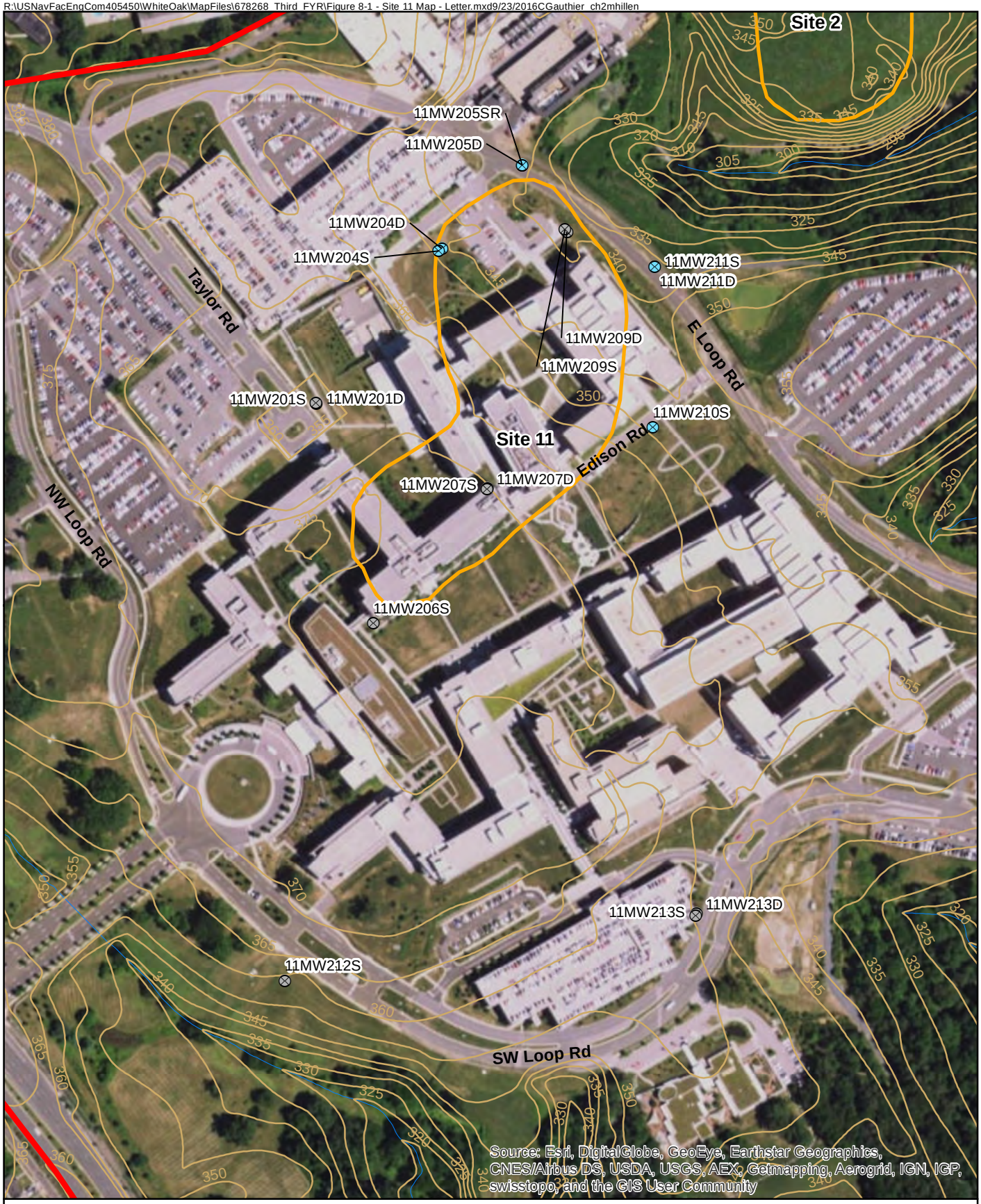
Notes:
Shading indicates exceedance of Site 11 PRGs
Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
UG/L - Micrograms per liter

TABLE 8-3
Historical Constituents Detected in Groundwater at Site 11
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 11**	11MW205SR			11MW211D			11MW211S	
Sample ID		11MW205SR-0514	11MW205SRP-0514	11MW205S-1115	11MW211D-0514	11MW211D-1115	11MW211DP-1115	11MW211S-0514	11MW211S-1115
Sample Date		05/06/14	05/06/14	11/11/15	05/06/14	11/11/15	11/11/15	05/06/14	11/11/15
Chemical Name									
Volatile Organic Compounds (UG/L)									
1,1-Dichloroethane	--	**0.66 J**	**0.61 J**	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	7	**76**	**71**	**7.7**	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	--	0.2 U	0.2 U	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	--	**2**	**2**	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	--	**0.14 J**	**0.13 J**	NA	NA	NA	NA	NA	NA
2-Butanone	--	**5.3 J**	**4.2 J**	NA	NA	NA	NA	NA	NA
Acetone	--	**23**	**23**	NA	NA	NA	NA	NA	NA
Benzene	--	**0.34 J**	**0.35 J**	NA	NA	NA	NA	NA	NA
Carbon disulfide	--	**0.54 J**	**0.66 J**	NA	NA	NA	NA	NA	NA
Chlorobenzene	--	**0.2 J**	**0.2 J**	NA	NA	NA	NA	NA	NA
Chloroform	80	**1.5**	**1.5**	0.2 U	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	70	**0.17 J**	**0.16 J**	**0.11 J**	NA	NA	NA	NA	NA
Dichlorodifluoromethane (Freon-12)	--	0.3 U	0.3 U	NA	NA	NA	NA	NA	NA
Ethylbenzene	--	**0.67 J**	**0.67 J**	NA	NA	NA	NA	NA	NA
Isopropylbenzene	--	**0.26 J**	**0.26 J**	NA	NA	NA	NA	NA	NA
Methyl-tert-butyl ether (MTBE)	--	**0.3 J**	**0.29 J**	NA	NA	NA	NA	NA	NA
Tetrachloroethene	5	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA	NA
Toluene	--	**0.69 J**	**0.66 J**	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	--	**0.2 J**	**0.14 J**	NA	NA	NA	NA	NA	NA
Trichloroethene	5	**0.11 J**	**0.12 J**	0.2 U	NA	NA	NA	NA	NA
Trichlorofluoromethane (Freon-11)	--	0.3 U	0.3 U	NA	NA	NA	NA	NA	NA
Vinyl chloride	2	**9.7**	**8.4**	**4.5**	NA	NA	NA	NA	NA
Xylene, total	--	**1.5 J**	**1.5 J**	NA	NA	NA	NA	NA	NA
Explosives (UG/L)									
Perchlorate	--	NA	NA	NA	0.1 U	0.1 U	0.1 U	**0.639**	**0.255 J**
Dissolved Metals (UG/L)									
Iron, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry									
Alkalinity (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Methane (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Sulfide (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Shading indicates exceedance of Site 11 PRGs
Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
UG/L - Micrograms per liter

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 8-1 - Site 11 Map - Letter.mxd9/23/2016CGauthier_ch2mhillen



Legend

- Monitoring Well
- 2015 Long Term Monitoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Water Bodies
- Site Boundary

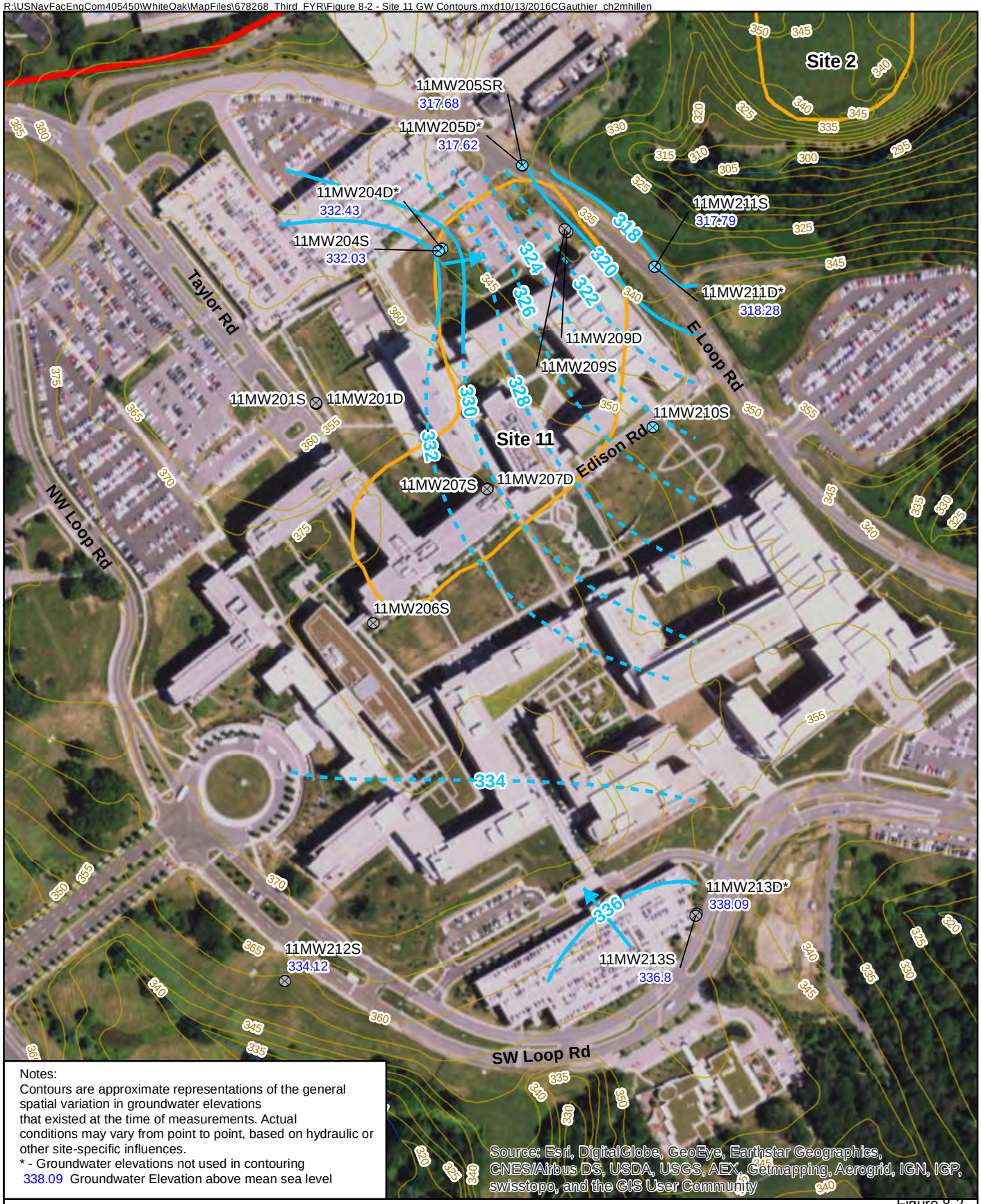
N

0 150 300 Feet

Figure 8-1
Site 11 Map
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 8-2 - Site 11 GW Contours.mxd10/13/2016CGauthier_ch2mhillen



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
338.09 Groundwater Elevation above mean sea level

Legend

- Monitoring Well
- 2015 Long Term Monitoring Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Site Boundary
- Water Bodies
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

N

0 150 300
Feet

Figure 8-2
Site 11 Potentiometric Surface Map and LTM Locations - November 9, 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

SECTION 9

Site 49 – Trichloroethene Groundwater Plume in the 400 Area

9.1 Site Chronology

A chronology of major events for Site 49 is provided in **Table 9-1.**

Table 9-1. 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, 2008)
2002-2003	An RI was conducted for Site 49 that included soil, groundwater, and surface water sampling (CH2M, 2004b)
2004	An FS was conducted for Site 49 to identify and evaluate groundwater remedial alternatives (CH2M, 2004c)
November 16, 2004	ROD issued for Site 49 (NAVFAC, 2004e)
December 2005	Baseline groundwater sampling conducted by CH2M prior to the sodium permanganate injection (CH2M, 2017a)
July-August, 2007	Under the supervision of Shaw, Summit Site Services, Inc. installed 15 injection wells (Shaw, 2008)
August 2007	Sodium permanganate was injected into 15 injection wells (Shaw, 2008)
October 2007	CH2M performed 1-month post-in situ chemical oxidation (ISCO) injection sampling event
December 2007	CH2M performed 3-month post-ISCO injection sampling event
March-April, 2008	CH2M performed 6-month post-ISCO injection sampling event
September 2008	CH2M performed 1-year post-ISCO injection sampling event
August 2009	CH2M performed 2-year post-ISCO injection sampling event
December 2010	CH2M performed 3-year post-ISCO injection sampling event
July 2012	CH2M performed annual LTM sampling event
September 2013	CH2M performed annual LTM sampling event
October 2014	CH2M performed annual LTM sampling event
November 2015	CH2M performed annual LTM sampling event

Site chronology from the Site 49 ROD (NAVFAC, 2004e) and the Final White Oak Basewide Long-Term Monitoring Report 2015 (CH2M, 2017a)

9.2 Background

9.2.1 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 9-1**). 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, 2004b). During this investigation, TCE was detected in groundwater samples collected along the bedding of the WSSC sewer that runs along Paint Branch at a point adjacent to the Building 427 (Site 49) and follow-up sampling identified that the TCE was originating 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 and is slated for demolition.

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 (CH2M, 2006). 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 the 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, 2006).

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, 2006). In 2002, the former leaching well was excavated and removed as part of a housekeeping measure and presumptive remedy (NAVFAC, 2004e).

An FS was prepared in 2004 (CH2M, 2004c) 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 LUCs 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 are provided in **Table 9-2**. The groundwater PRGs were updated in 2010 based on the May 2009 toxicity values for some COCs, and the updated values are also presented in **Table 9-2** (CH2M, 2010).

Table 9-2. PRGs for COCs for Site 49 Groundwater PRG Attainment Area

COC	Groundwater PRGs for Site 49 Attainment Area – 2004 ROD (µg/L)	Basis	Updated Groundwater PRG[a,b] (µg/L)
TCE	5	MCL	5
Cis-1,2-DCE	70	MCL	70

Table 9-2. PRGs for COCs for Site 49 Groundwater PRG Attainment Area

COC	Groundwater PRGs for Site 49 Attainment Area – 2004 ROD (µg/L)	Basis	Updated Groundwater PRG[a,b] (µg/L)
Vinyl Chloride	2	MCL	2
Iron (dissolved)	4,700	RB	11,000

Notes:

MCL – PRG is the maximum contaminant level drinking water standard

RB – PRG is a risk-based standard developed for constituents with concentrations contributing appreciably to the calculated risks and hazards from exposure to groundwater within Site 49.

[a] As per *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2010)

[b] 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).

9.2.2 Physical Characteristics

As summarized in the Site 49 RI Report (CH2M, 2004b), 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 five 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, 2008).

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 decreases 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, 2008).

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 assumed that the hydraulic conductivity of the saprolite and rock 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 x 10^{-4} feet per minute. The hydraulic conductivity of the bedrock units was estimated to be in the range of 2.3 x 10^{-6} and 2.8 x 10^{-6} feet per minute (CH2M, 2004b).

9.2.3 Land and Resource Uses

Currently, 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 well outside the area impacted by Site 49, 1.2 miles from the site.

During the Site 49 RI, no COPCs were retained for surface water; therefore, exposure to surface water is not a concern under current land uses (CH2M, 2004b).

9.2.4 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, 2004b).

The primary contaminants detected in groundwater are TCE and its breakdown products, cis-1,2-dichloroethylene (cis-1,2-DCE) and VC. Maximum concentrations for each these contaminants, as well as iron[6], as listed in the Final LTM Plan for Site 49 groundwater are as follows (CH2M, 2006):

- TCE – 4,400 µg/L
- cis-1,2-DCE – 1,100 µg/L
- VC – 5.7 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 are similar throughout the length of the plume. 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. This suggested that the source is in the vicinity of the former leaching well, that the plume is fairly well established, and that there is little attenuation of contamination in the groundwater until it is intercepted by Paint Branch. The northern side of the TCE plume extends 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. It is postulated that this is due to the complex vertical gradients and groundwater flow patterns near Paint Branch.

6 Iron was the only metal retained as a COC during the RI risk assessment (CH2M HILL, 2004).

9.2.5 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, 2004b). Soil was not evaluated in the 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, 2000a). 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, 2004e). 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).

9.2.5.1 Human Health Risk Assessment

Based on the HHRA included in the Site 49 RI (CH2M, 2004b), there were no constituents retained as COPCs for Paint Branch surface water, and therefore, no unacceptable risks are associated with this medium. The HHRA included in the Site 49 RI evaluated exposure to groundwater for future construction workers and residents.

As detailed in the Site 49 ROD (NAVFAC, 2004e), based on the BHHRA conducted as part of the Site 49 RI, twelve COPCs were identified for the Site 49 groundwater. The COCs are a subset of the COPCs comprising those chemicals requiring RA. The groundwater COCs identified in the Site 49 ROD (NAVFAC, 2004e) included TCE, Cis-1,2-DCE, VC, and Iron (dissolved).

9.2.5.2 Ecological Risk Assessment

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. Ecological risks from the surface water and sediment in the section of Paint Branch potentially affected by Site 49 were evaluated in a separate Basewide ERA (Tetra Tech, 2001a). The surface water data collected during the Site 49 RI were consistent with prior data collected at this same location and used in the Basewide ERA. No CVOCs or other site-related contaminants, with the exception of iron, were detected in the surface water, and iron as well as all of the non-site-related compounds detected in the surface water (other metals) were below either the White Oak-specific ecological screening criteria established for Paint Branch in the Basewide ERA (CH2M, 2004b).

9.3 Remedial Actions

9.3.1 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 metals in groundwater at Site 49.

9.3.2 Response Actions

9.3.2.1 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 (ISCO) with Pneumatic Fracturing," comprised the following components:

- Installation 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
- Installation of injection wells and pneumatic fracturing
- Injection of oxidizing reagent
- Groundwater monitoring of baseline and post-injection conditions
- Preparation of a remediation completion report and 5 year reviews
- Long-term monitoring of the plume until PRGs are met
- Implementation of ICs until PRGs are met

9.3.3 Status of Implementation

9.3.3.1 In Situ Chemical Oxidation

Fifteen injection wells were installed and developed at Site 49 in during 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 injections wells were developed, borehole evaluations using a caliper and optical televiewer were conducted to help determine the locations of fractures and indicated that the majority of fractures observed are small and partially open (Shaw, 2008).

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

9.3.3.2 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 Final 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

since 2008 in order to assess the effectiveness of the RA, and includes assessing the effectiveness of the ISCO injection and the achievement of 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 November 2015, nine monitoring wells were sampled for select VOCs and dissolved iron. The analytical results are provided in **Table 9-3** and 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 samples from all eight monitoring wells analyzed for VOCs. TCE concentrations ranged from 9.9 µg/L (49GW207S) to 620 µg/L (49GW207D); all concentrations exceeded the PRG (5 µg/L).
- Cis-1,2-DCE was detected in groundwater samples collected from all eight monitoring wells analyzed for VOCs. Cis-1,2-DCE concentrations ranged from 15 µg/L (49GW208S) to 880 µg/L (49GW200). Five of the eight detections (49GW200, 49GW206D, 49GW206M, 49GW207D, and 49GW208D) exceeded the PRG (70 µg/L).
- VC was detected in groundwater samples collected from six of the eight monitoring wells analyzed for VOCs. VC concentrations ranged from 1.1 µg/L (49GW208D) to 150 µg/L (49GW207S). Concentrations in four locations (49GW200, 49GW206D, 49GW206M, and 49GW207S) exceeded the PRG (2 µg/L).

Dissolved Iron Results

Dissolved iron was analyzed and detected in groundwater samples from three monitoring wells (49GW203, 49GW206M, and 49GW207S) at concentrations of 16,300 µg/L, 17,200 µg/L, and 29,600 µg/L, respectively. The three detections exceeded the PRG (11,000 µg/L).

9.3.3.3 Operation and Maintenance

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

9.3.3.4 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 restricted (as shown in Figure 2-7 of the Site 49 ROD [NAVFAC, 2004e]) 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 unrestricted use. The LUC RD for On-site 49 Groundwater was made final in 2017 (CH2M, 2017d).

9.4 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 9-4 and 9-5**).

Table 9-4. Protectiveness Determination/Statement from the 2012 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 9-5. Status of Recommendations from the 2012 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.	The injection of additional sodium permanganate solution has not occurred since the last Five-Year Review Report (Tetra Tech, 2012)	As per the recent Site 49 LTM Report (CH2M, 2017a), the injection of either additional permanganate or a substrate that enhances anaerobic biodegradation of TCE should be considered to decrease the overall VOC concentrations in groundwater at Site 49.	NA
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 the annual LTM for CVOCs at Site 49 following the second injection of sodium permanganate and a performance monitoring event.	A second injection has not been completed; LTM is ongoing	LTM sampling is being conducted on an annual basis, and groundwater conditions are re-evaluated following each event.	July 2012 September 2013 October 2014 November 2015

9.5 Five-Year Review Process

9.5.1 Document Review

Table 9-6 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 section is given in the References section.

Table 9-6. Summary of the Site 49 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	1999
Final Report for Investigation of WSSC Sewer Lines Through the Former NSWC White Oak Facility	CH2M	1999
Final RI Report for Site 49	CH2M	2004

Table 9-6. Summary of the Site 49 Documents Reviewed in the Preparation of this Section of the Five-Year Review

Document	Author	Year
Final FS for Site 49	CH2M	2004
ROD for Site 49	NAVFAC	2004
Memorandum Re: Perchlorate Remediation Goal	NAVFAC	2006
Former NSWC-White Oak First Five-Year Review	JM Waller Associates	2007
Memorandum Re: White Oak Site 49 Sodium Permanganate Injection	Shaw	2008
Final Long-Term Monitoring Plan for Site 49 Groundwater	CH2M	2006
Former NSWC-White Oak Second Five-Year Review	Tetra Tech	2012
Final Basewide Long-Term Monitoring Report – 2015, Former NSWC-White Oak	CH2M	2017
Final Land Use Control Remedial Design for On-site 49 Groundwater	CH2M	2017

9.5.2 Data Review and Evaluation

LTM is being conducted for groundwater at Site 49 to evaluate the effectiveness of the RA and the natural attenuation of COCs in groundwater. The Site 49 historical LTM groundwater analytical data collected from 2008 (baseline) through November 2015 are provided in **Table 9-3**, and trend graphs presenting VOC COC results for select monitoring wells at Site 49 are provided in **Appendix C-7**.

The concentration of one or more of the VOCs exceeded the PRGs in the eight monitoring wells sampled during the November 2015 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, possibly because of potential VOC mass in untreated groundwater beneath Building 427 migrating to the east. The permanganate oxidant likely 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 oxidation reduction potential readings, TCE decreases, and fluctuating cis-1-2 DCE and VC concentrations. Increasing cis-1,2-DCE and VC and moderately low oxidation-reduction potential 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 the three monitoring wells sampled during the November 2015 sampling event.

9.6 Technical Assessment

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

9.6.1 Question A - Is the Remedy Functioning as Designed?

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

9.6.1.1 Remedial Action Performance

The concentration of one or more of the VOCs exceeded the PRGs in the eight monitoring wells sampled during the November 2015 sampling event (**Figure 9-2)**. The VOC concentrations, although decreasing following the ISCO application, have generally stabilized with the exception of monitoring wells screened in the deeper portion of the aquifer (**Figure 9-3**). The permanganate oxidant likely 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.

9.6.1.2 Implementation of Institutional Controls and Other Measures

ICs at Site 49 include onsite LUCs to prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA) from within the restricted are 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. The need for an LUC RD documenting the offsite ICs is currently undergoing regulatory evaluation.

9.6.1.3 Opportunities for Optimization

After the last Five-Year review, CH2M recommended and implemented several changes to the LTM program for Site 49. These changes are summarized in **Table 9-7**.

Table 9-7. Site 49 Groundwater Optimization

Sampling Event	Groundwater Optimization
September 2013	Based on Decision Rule 2A: • Eliminate monitoring 49GW209 Based on Decision Rule 2B: • Eliminate VOC analysis for 49GW203
October 2014	• The ferrous iron and dissolved oxygen test kits should be eliminated from the field analytical program. Based on Decision Rule 2B: • Eliminate dissolved iron analysis for monitoring well 49GW208S

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

Since land use is not anticipated to change, 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 per *Technical Memorandum, Revisions to Preliminary Remediation Goals Sites 4/46, 7, 9, 5/13, and 49, Former NSWC-White Oak, Silver Spring, Maryland* (CH2M, 2010) and presented in **Table 9-2**. 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 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 changes to the cleanup levels 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.

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

Monitoring wells 49GW201S, 49GW201D, and 49GW201DD were washed out and subsequently abandoned in June 2015, resulting in missing data points in the LTM Plan.

9.7 Issues, Recommendations, and Follow-up Actions

Based on the information presented as answers to questions A–C above, the remedies for Site 49 are still functioning as intended. Based on evaluation of the LTM data, the following recommendations are provided for the RA for Site 49 groundwater:

- An additional injection should be considered. Because of the nature of the contamination at Site 49 (present in fractured bedrock), it is unlikely that additional injections would reduce concentrations to PRGs; however, the treatment may increase the possibility that PRGs would eventually be met with natural attenuation in an overall shorter timeframe.
- Groundwater sampling should continue on an annual basis. Groundwater optimization should continue to occur based on the decision rules provided the Site 49 LTM Plan.

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. If LTM data from any of these locations are necessary to evaluate the remedy, the well(s) should be replaced.

Additionally, it is recommended that the need for an Off-Site 49 LUC RD should be evaluated and prepared if necessary.

9.8 Protectiveness Statement

The selected remedy for Site 49, consisting of ISCO, LUCs, and groundwater LTM, is protective in the short term of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through the enforcement of LUCs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: (1) finalize the LUC RD for Site 49 and (2) evaluate and prepare a LUC RD for Off-Site 49 if necessary.

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW200									49GW202D	
Sample ID		049GW200-1205	049GW200-0408	049GW200-0908	049GW200-0809	049GW200-1210	049GW200-0712	049GW200-0913	049GW200-1014	049GW200-1115	049GW202D-1205	049GW202D-0408
Sample Date		12/15/05	03/31/08	09/18/08	08/10/09	12/17/10	07/20/12	09/11/13	10/16/14	11/10/15	12/13/05	04/02/08
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	10 UL	NA	10 U	2 U
1,1-Dichloroethane	--	10 U	**1.1 J**	5 U	**0.84 J**	**0.81 J**	**0.77 J**	**1.1 J**	10 UL	NA	10 U	2 U
1,1-Dichloroethene	--	**6 J**	**4.4**	**4.5 J**	**2.9 J**	**4.4**	**3.3**	**4.5**	10 UL	NA	10 U	2 U
1,2,4-Trichlorobenzene	--	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	10 UL	NA	10 UJ	2 U
Acetone	--	10 U	2 U	80 R	5 R	2.5 U	12 U	12 U	120 UL	NA	10 U	2 U
Benzene	--	10 U	2 U	5 U	5 U	**0.71 J**	1 U	1 U	10 UL	NA	10 U	2 U
Chloroform	--	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	10 UL	NA	10 U	2 U
cis-1,2-Dichloroethene	70	**550**	**850**	**1,300**	**970**	**1,200**	**870**	**970**	**1,000 L**	**880**	**2 J**	**1.5 J**
m- and p-Xylene	--	NA	NA	NA	NA	NA	2 U	2 U	NA	NA	NA	NA
Toluene	--	10 U	2 U	5 U	5 U	**2.5**	1 U	1 U	10 UL	NA	10 U	2 U
trans-1,2-Dichloroethene	--	**41**	**24**	**26**	**29**	**27**	**29**	**29**	**31 L**	NA	10 U	2 U
Trichloroethene	5	**1,700**	**390**	**2.8 J**	**5.7**	**24**	**32**	**420**	**140 L**	**390**	**17**	**12**
Vinyl chloride	2	**4**	2 U	**1.4**	**1.7**	**2.9**	**52**	**5.4**	**27 L**	**8.9**	2 U	2 U
Xylene, total	--	10 U	2 U	5 U	5 U	1.5 U	NA	2 U	20 UL	NA	10 U	2 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	**1,150**	NA	NA	NA	NA	NA	NA	NA	NA	27.4 B
Antimony	--	NA	1.8 U	NA	NA	NA	NA	NA	NA	NA	NA	1.8 U
Arsenic	--	NA	2.8 U	NA	NA	NA	NA	NA	NA	NA	NA	2.8 U
Barium	--	NA	**288**	NA	NA	NA	NA	NA	NA	NA	NA	**69.4 J**
Beryllium	--	NA	**0.055 J**	NA	NA	NA	NA	NA	NA	NA	NA	0.04 U
Cadmium	--	NA	0.16 U	NA	NA	NA	NA	NA	NA	NA	NA	0.16 U
Calcium	--	NA	**77,100**	NA	NA	NA	NA	NA	NA	NA	NA	**15,300**
Chromium	--	**26.6 J**	**101**	**135**	NA	NA	NA	NA	NA	NA	3.2 B	**4.7 J**
Cobalt	--	NA	**32.1 J**	NA	NA	NA	NA	NA	NA	NA	NA	0.32 B
Copper	--	NA	**15.9 J**	NA	NA	NA	NA	NA	NA	NA	NA	5.8 B
Iron	11,000	**7,130 J**	**3,640**	**4,110**	**5,600**	NA	NA	NA	NA	NA	422 B	**222**
Lead	--	NA	**2.6 J**	NA	NA	NA	NA	NA	NA	NA	NA	**1.7 J**
Magnesium	--	NA	**23,800**	NA	NA	NA	NA	NA	NA	NA	NA	**8,200**
Manganese	--	**407**	**421**	**822**	NA	NA	NA	NA	NA	NA	**151**	**74.5**
Nickel	--	NA	**73.3**	NA	NA	NA	NA	NA	NA	NA	NA	**13.2 J**
Potassium	--	**7,230**	**7,760**	NA	NA	NA	NA	NA	NA	NA	**5,930**	**5,120**
Selenium	--	NA	**4.2 J**	NA	NA	NA	NA	NA	NA	NA	NA	3.6 UL
Silver	--	NA	6.7 B	NA	NA	NA	NA	NA	NA	NA	NA	0.57 U
Sodium	--	NA	**37,300**	**32,000**	**34,300**	NA	NA	NA	NA	NA	NA	**20,400**
Thallium	--	NA	2.1 U	NA	NA	NA	NA	NA	NA	NA	NA	2.1 U
Vanadium	--	NA	**2.2 J**	NA	NA	NA	NA	NA	NA	NA	NA	0.43 U
Zinc	--	NA	**85.5 J**	NA	NA	NA	NA	NA	NA	NA	NA	**52.5 J**
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	6.2 U	NA	NA	NA	NA	NA	NA	NA	NA	8.9 B
Antimony, Dissolved	--	NA	1.8 U	NA	NA	NA	NA	NA	NA	NA	NA	1.8 U
Arsenic, Dissolved	--	NA	2.8 U	NA	NA	NA	NA	NA	NA	NA	NA	2.8 U
Barium, Dissolved	--	NA	**252**	NA	NA	NA	NA	NA	NA	NA	NA	**67.9 J**
Beryllium, Dissolved	--	NA	0.04 U	NA	NA	NA	NA	NA	NA	NA	NA	0.04 U
Cadmium, Dissolved	--	NA	0.16 U	NA	NA	NA	NA	NA	NA	NA	NA	0.16 U

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Station ID	CLEAN WO PRGs Site 49	49GW200									49GW202D	
Sample ID		049GW200-1205	049GW200-0408	049GW200-0908	049GW200-0809	049GW200-1210	049GW200-0712	049GW200-0913	049GW200-1014	049GW200-1115	049GW202D-1205	049GW202D-0408
Sample Date		12/15/05	03/31/08	09/18/08	08/10/09	12/17/10	07/20/12	09/11/13	10/16/14	11/10/15	12/13/05	04/02/08
Chemical Name												
Calcium, Dissolved	--	NA	**74,500**	NA	NA	NA	NA	NA	NA	NA	NA	**15,400**
Chromium, Dissolved	--	2.2 B	**0.62 J**	**5 J**	NA	NA	NA	NA	NA	NA	0.65 B	**2 J**
Cobalt, Dissolved	--	NA	**20.6 J**	NA	NA	NA	NA	NA	NA	NA	NA	0.39 B
Copper, Dissolved	--	NA	3.2 B	NA	NA	NA	NA	NA	NA	NA	NA	9.2 B
Iron, Dissolved	11,000	**427 J**	**870**	**753**	**2,060**	**1,570**	NA	NA	NA	NA	39.4 B	**87.3 J**
Lead, Dissolved	--	NA	**1.7 J**	NA	NA	NA	NA	NA	NA	NA	NA	1.4 U
Magnesium, Dissolved	--	NA	**22,800**	NA	NA	NA	NA	NA	NA	NA	NA	**8,210**
Manganese, Dissolved	--	**216 J**	**358**	**819**	NA	NA	NA	NA	NA	NA	**75.3 J**	**53.9**
Nickel, Dissolved	--	NA	**35.1 J**	NA	NA	NA	NA	NA	NA	NA	NA	**12.3 J**
Potassium, Dissolved	--	**6,150**	**7,590**	NA	NA	NA	NA	NA	NA	NA	**6,360**	**5,130**
Selenium, Dissolved	--	NA	3.6 UL	NA	NA	NA	NA	NA	NA	NA	NA	3.6 UL
Silver, Dissolved	--	NA	0.84 B	NA	NA	NA	NA	NA	NA	NA	NA	0.57 U
Sodium, Dissolved	--	NA	**37,300**	**32,300**	**33,600**	NA	NA	NA	NA	NA	NA	**20,300**
Thallium, Dissolved	--	NA	2.1 U	NA	NA	NA	NA	NA	NA	NA	NA	2.1 U
Zinc, Dissolved	--	NA	**67.3 J**	NA	NA	NA	NA	NA	NA	NA	NA	**53.7 J**
Wet Chemistry												
Alkalinity (mg/l)	--	**150**	**190 L**	**160**	**200**	NA	NA	NA	NA	NA	**42**	**40 L**
Chemical oxygen demand (mg/l)	--	20 U	**21**	20 U	20 U	NA	NA	NA	NA	NA	20 U	20 U
Chloride (mg/l)	--	**54 J**	**140**	**130**	**150**	NA	NA	NA	NA	NA	**45 J**	**52**
Nitrate (mg/l)	--	0.025 U	NA	NA	NA	NA	NA	NA	NA	NA	**0.38 J**	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.8**
Sulfate (mg/l)	--	**120 J**	NA	NA	NA	NA	NA	NA	NA	NA	**17 J**	NA
Total organic carbon (TOC) (mg/l)	--	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA	10 U	10 U

Notes:

Shading indicates exceedance of Site 49 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Station ID	CLEAN WO PRGs Site 49	49GW202D						49GW203				
Sample ID		049GW202D-0908	049GW202D-0809	049GW202D-0111	049GW202D-0712	049GW202D-0913	049GW202D-1014	049GW203-1205	049GW203-0408	049GW203-0908	049GW203-0809	049GW203P-0809
Sample Date		09/18/08	08/11/09	01/05/11	07/18/12	09/11/13	10/16/14	12/13/05	04/01/08	09/19/08	08/13/09	08/13/09
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	5 U	5 U	**0.23 J**	1 U	1 U	1 U	10 U	2 U	5 U	5 U	5 U
1,1-Dichloroethane	--	5 U	5 U	0.5 U	1 U	1 U	1 U	10 U	2 U	5 U	5 U	5 U
1,1-Dichloroethene	--	5 U	5 U	0.5 U	1 U	1 U	1 U	10 U	2 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	--	5 U	5 U	0.5 U	1 U	1 U	1 U	10 UJ	2 U	5 U	5 U	5 U
Acetone	--	5 R	5 R	2.5 U	12 U	12 U	12 U	10 U	2 U	5 R	5 R	5 R
Benzene	--	5 U	5 U	0.5 U	1 U	1 U	1 U	10 U	2 U	5 U	5 U	5 U
Chloroform	--	5 U	5 U	**0.66 J**	1 U	1 U	0.82 B	10 U	2 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	70	**1.1 J**	**0.87 J**	**1.1**	**1.2 J**	**1.2 J**	**1.6 J**	**19**	**18**	5 U	5 U	5 U
m- and p-Xylene	--	NA	NA	NA	2 U	2 U	NA	NA	NA	NA	NA	NA
Toluene	--	5 U	5 U	2.3 B	1 U	1 U	1 U	10 U	2 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	--	5 U	5 U	0.5 U	1 U	1 U	1 U	10 U	2 U	5 U	5 U	5 U
Trichloroethene	5	**6.9**	**9.6**	**49**	**46**	**41**	**56**	**120**	**110**	**2.4 J**	**2 J**	**1.8 J**
Vinyl chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	1 U
Xylene, total	--	5 U	5 U	1.5 U	NA	2 U	2 U	10 U	2 U	5 U	5 U	5 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	NA	NA	NA	NA	32.9 B	NA	NA	NA
Antimony	--	NA	NA	NA	NA	NA	NA	NA	1.8 U	NA	NA	NA
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	2.8 U	NA	NA	NA
Barium	--	NA	NA	NA	NA	NA	NA	NA	**158 J**	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	NA	NA	NA	**0.084 J**	NA	NA	NA
Cadmium	--	NA	NA	NA	NA	NA	NA	NA	0.16 U	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	NA	**29,700**	NA	NA	NA
Chromium	--	**5.3 J**	NA	NA	NA	NA	NA	0.37 B	**2.2 J**	1.1 U	NA	NA
Cobalt	--	NA	NA	NA	NA	NA	NA	NA	**5.6 J**	NA	NA	NA
Copper	--	NA	NA	NA	NA	NA	NA	NA	3.5 B	NA	NA	NA
Iron	11,000	**319**	**1,610**	NA	NA	NA	NA	**11,900 J**	**12,400**	**19,400**	**9,630**	**10,300**
Lead	--	NA	NA	NA	NA	NA	NA	NA	1.4 U	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA	NA	NA	**14,000**	NA	NA	NA
Manganese	--	**68.6**	NA	NA	NA	NA	NA	**3,230**	**3,540**	**3,220**	NA	NA
Nickel	--	NA	NA	NA	NA	NA	NA	NA	**21.4 J**	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA	NA	**8,980**	**6,130**	NA	NA	NA
Selenium	--	NA	NA	NA	NA	NA	NA	NA	3.6 UL	NA	NA	NA
Silver	--	NA	NA	NA	NA	NA	NA	NA	0.57 U	NA	NA	NA
Sodium	--	**19,700**	**20,200**	NA	NA	NA	NA	NA	**45,900**	**45,100**	**44,200**	**44,100**
Thallium	--	NA	NA	NA	NA	NA	NA	NA	2.1 U	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA	NA	NA	0.43 U	NA	NA	NA
Zinc	--	NA	NA	NA	NA	NA	NA	NA	**26.2 L**	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	6.2 U	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	1.8 U	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	2.8 U	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**151 J**	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**0.054 J**	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	0.16 U	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Station ID	CLEAN WO PRGs Site 49	49GW202D						49GW203				
Sample ID		049GW202D-0908	049GW202D-0809	049GW202D-0111	049GW202D-0712	049GW202D-0913	049GW202D-1014	049GW203-1205	049GW203-0408	049GW203-0908	049GW203-0809	049GW203P-0809
Sample Date		09/18/08	08/11/09	01/05/11	07/18/12	09/11/13	10/16/14	12/13/05	04/01/08	09/19/08	08/13/09	08/13/09
Chemical Name												
Calcium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**30,400**	NA	NA	NA
Chromium, Dissolved	--	**1.1 J**	NA	NA	NA	NA	NA	0.2 U	0.15 U	1.1 U	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**5.4 J**	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	0.65 B	NA	NA	NA
Iron, Dissolved	11,000	61 U	**92.2 J**	**237**	NA	NA	NA	**11,600 J**	**11,100**	**13,800**	**6,020**	**5,880**
Lead, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	1.4 U	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**14,300**	NA	NA	NA
Manganese, Dissolved	--	**17.6 J**	NA	NA	NA	NA	NA	**3,290 J**	**3,580**	**3,370**	NA	NA
Nickel, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**20.5 J**	NA	NA	NA
Potassium, Dissolved	--	NA	NA	NA	NA	NA	NA	**8,550**	**6,120**	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	3.6 UL	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	0.57 U	NA	NA	NA
Sodium, Dissolved	--	**20,200**	**20,100**	NA	NA	NA	NA	NA	**45,900**	**46,600**	**43,200**	**44,600**
Thallium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	2.1 U	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	**23.2 J**	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	**39**	**34**	NA	NA	NA	NA	**78**	**65 L**	**72**	**58**	**60**
Chemical oxygen demand (mg/l)	--	20 U	20 U	NA	NA	NA	NA	20 U	20 U	20 U	20 U	**4.3 J**
Chloride (mg/l)	--	**52**	**52**	NA	NA	NA	NA	**110 J**	**130**	**130**	**120**	**120**
Nitrate (mg/l)	--	NA	NA	NA	NA	NA	NA	**0.094 J**	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	**6.2**	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	NA	NA	NA	NA	**9.3 J**	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	10 U	10 U	NA	NA	NA	NA	10 U	10 U	10 U	10 U	10 U

Notes:

Shading indicates exceedance of Site 49 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Station ID	CLEAN WO PRGs Site 49	49GW203					49GW206D					
Sample ID		49GW203-1210	49GW203-0712	49GW203-0913	49GW203-1014	49GW203-1115	049GW206D-1205	049GW206D-0908	049GW206D-0809	49GW206D-1210	49GW206D-0712	49GW206D-0913
Sample Date		12/17/10	07/23/12	09/09/13	10/16/14	11/12/15	12/15/05	09/17/08	08/12/09	12/17/10	07/18/12	09/11/13
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	0.5 U	1 U	1 U	NA	NA	10 U	5 U	5 U	0.5 U	1 U	1 U
1,1-Dichloroethane	--	0.5 U	1 U	1 U	NA	NA	10 U	5 U	**0.6 J**	**0.81 J**	**0.7 J**	1 U
1,1-Dichloroethene	--	0.5 U	1 U	1 U	NA	NA	10 U	5 U	5 U	0.5 U	1 U	1 U
1,2,4-Trichlorobenzene	--	0.5 U	1 U	1 U	NA	NA	10 U	5 U	5 U	0.5 U	1 U	1 U
Acetone	--	2.5 U	12 U	12 U	NA	NA	10 U	5 R	5 R	2.5 U	12 U	12 U
Benzene	--	0.5 U	1 U	1 U	NA	NA	10 U	5 U	5 U	**0.41 J**	1 U	1 U
Chloroform	--	0.5 U	1 U	1 U	NA	NA	**11**	**1.6 J**	**1.1 J**	0.99 B	1 U	1 U
cis-1,2-Dichloroethene	70	**0.62 J**	**1.2 J**	1 U	NA	NA	**85**	**44**	**1.4 J**	**4.1**	**3.5**	**14**
m- and p-Xylene	--	NA	2 U	**1.6 J**	NA	NA	NA	NA	NA	NA	2 U	2 U
Toluene	--	2.5 B	1 U	1 U	NA	NA	10 U	5 U	5 U	3 B	1 U	1 U
trans-1,2-Dichloroethene	--	0.5 U	1 U	1 U	NA	NA	**2 J**	**8.3**	**10**	**13**	**13**	**5.4**
Trichloroethene	5	1.6 B	**2.9**	**1.2 J**	NA	NA	**46**	**6.7**	**1.1 J**	3.2 B	**1.1 J**	**0.99 J**
Vinyl chloride	2	1 U	1 U	1 U	NA	NA	2 U	**12**	**1.4**	**4.5**	**2.9**	**9.8**
Xylene, total	--	1.5 U	NA	**1.6 J**	NA	NA	10 U	5 U	5 U	1.5 U	NA	2 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	NA	NA	NA	11.5 B	**8 J**	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA	439 B	**899**	**1,860**	NA	NA	NA
Lead	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA	**35**	**331**	NA	NA	NA	NA
Nickel	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA	**9,020**	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	**88,500**	**71,900**	NA	NA	NA
Thallium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW203					49GW206D					
Sample ID		49GW203-1210	49GW203-0712	49GW203-0913	49GW203-1014	49GW203-1115	049GW206D-1205	049GW206D-0908	049GW206D-0809	49GW206D-1210	49GW206D-0712	49GW206D-0913
Sample Date		12/17/10	07/23/12	09/09/13	10/16/14	11/12/15	12/15/05	09/17/08	08/12/09	12/17/10	07/18/12	09/11/13
Chemical Name												
Calcium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	NA	NA	NA	NA	6.4 B	**2.1 J**	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**6,830**	**15,000**	**15,000**	**13,700**	**16,300**	**260 J**	**409**	**612**	**1,990**	NA	NA
Lead, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA	**33.3 J**	**357**	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	NA	NA	NA	NA	**8,970**	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	**87,200**	**75,900**	NA	NA	NA
Thallium, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	NA	NA	NA	NA	**190**	NA	**250**	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	NA	**46**	NA	**12 J**	NA	NA	NA
Chloride (mg/l)	--	NA	NA	NA	NA	NA	**47 J**	NA	**62**	NA	NA	NA
Nitrate (mg/l)	--	NA	NA	NA	NA	NA	0.025 U	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	NA	NA	NA	**370 J**	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	NA	NA	NA	**19**	NA	10 U	NA	NA	NA

Notes:

Shading indicates exceedance of Site 49 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW206D		49GW206M								
Sample ID		49GW206D-1014	49GW206D-1115	049GW206M-1205	049GW206M-0408	049GW206M-0908	049GW206M-0809	49GW206M-1210	49GW206M-0712	49GW206MP-0712	49GW206M-0913	49GW206M-1014
Sample Date		10/16/14	11/10/15	12/15/05	04/01/08	09/17/08	08/12/09	12/15/10	07/20/12	07/20/12	09/11/13	10/16/14
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	1 U	NA	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	--	1 U	NA	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	--	1 U	NA	10 U	**1.2 J**	5 U	5 U	**0.56 J**	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	--	1 U	NA	10 U	2 U	**1.2 J**	5 U	0.5 U	1 U	1 U	1 U	1 U
Acetone	--	12 U	NA	10 U	2 U	10 R	5 R	2.5 U	12 U	12 U	12 U	12 UJ
Benzene	--	1 U	NA	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	1 U	1 U
Chloroform	--	1 U	NA	10 U	2 U	5 U	5 U	0.5 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	70	**2.1**	**290**	**210**	**190**	**230**	**170**	**180**	**200**	**190**	**140**	**170 L**
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U	NA
Toluene	--	1 U	NA	10 U	2 U	5 U	5 U	0.39 B	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	--	**8.9**	NA	**2 J**	**1.2 J**	**1.4 J**	**1.3 J**	**2**	1 U	1 U	1 U	1 U
Trichloroethene	5	**0.9 J**	**22**	**210**	**210**	**200**	**150**	**190**	**150**	**130**	**140**	**180**
Vinyl chloride	2	1 U	**29**	**81**	**11**	**18**	**15**	**8.1**	**6.6**	**6.1**	**3.9**	**6.6**
Xylene, total	--	2 U	NA	10 U	2 U	5 U	5 U	1.5 U	NA	NA	2 U	2 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	**234**	NA	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	NA	1.8 U	NA	NA	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	NA	2.8 U	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	**166 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	0.04 U	NA	NA	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	NA	0.16 U	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	**32,600**	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	7.8 B	**49.5**	**26.1**	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	**6 J**	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	6 B	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	**18,700 J**	**11,600**	**21,800**	**28,800**	NA	NA	NA	NA	NA
Lead	--	NA	NA	NA	**2.5 J**	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	**17,700**	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	**1,310**	**1,730**	**2,070**	NA	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	**75.3**	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	**7,470**	**7,950**	NA	NA	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	3.6 UL	NA	NA	NA	NA	NA	NA	NA
Silver	--	NA	NA	NA	0.57 U	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	**13,400**	**14,000**	**14,700**	NA	NA	NA	NA	NA
Thallium	--	NA	NA	NA	2.1 U	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	0.43 U	NA	NA	NA	NA	NA	NA	NA
Zinc	--	NA	NA	NA	**52.7 J**	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	NA	7.5 B	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	1.8 U	NA	NA	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	2.8 U	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	**162 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	0.04 U	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	0.16 U	NA	NA	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 49**	49GW206D		49GW206M								
Sample ID		49GW206D-1014	49GW206D-1115	049GW206M-1205	049GW206M-0408	049GW206M-0908	049GW206M-0809	49GW206M-1210	49GW206M-0712	49GW206MP-0712	49GW206M-0913	49GW206M-1014
Sample Date		10/16/14	11/10/15	12/15/05	04/01/08	09/17/08	08/12/09	12/15/10	07/20/12	07/20/12	09/11/13	10/16/14
Chemical Name												
Calcium, Dissolved	--	NA	NA	NA	**33,000**	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	NA	3 B	**3.5 J**	1.1 U	NA	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	**5.5 J**	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	0.71 B	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	NA	NA	**16,100 J**	**11,400**	**20,900**	**25,500**	**18,600**	**19,400**	**19,400**	**17,100**	**17,300 J**
Lead, Dissolved	--	NA	NA	NA	1.4 U	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	**18,300**	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	NA	**1,470 J**	**1,720**	**2,110**	NA	NA	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	NA	**62**	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	NA	**6,930**	**8,110**	NA	NA	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	3.6 UL	NA	NA	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	0.57 U	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	**13,400**	**14,100**	**14,200**	NA	NA	NA	NA	NA
Thallium, Dissolved	--	NA	NA	NA	2.1 U	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	**47.2 J**	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	NA	**79**	**60 L**	**84**	**64**	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	20 U	20 U	20 U	**7.4 J**	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	**53 J**	**56**	**57**	**56**	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	NA	NA	0.025 U	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	**6**	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	**37 J**	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA

Notes:

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B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 49**	49GW206M		49GW206S								
Sample ID		49GW206M-1115	49GW206MP-1115	049GW206S-1205	049GW206S-0408	049GW206S-0908	049GW206S-0809	049GW206SP-0809	49GW206S-1210	49GW206S-0712	49GW206S-0913	49GW206S-1014
Sample Date		11/10/15	11/10/15	12/16/05	04/01/08	09/17/08	08/11/09	08/11/09	12/15/10	07/20/12	09/11/13	10/16/14
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	NA	NA	10 U	2 U	5 U	5 U	5 U	0.5 U	1 U	1 U	1 U
1,1-Dichloroethane	--	NA	NA	10 U	2 U	5 U	5 U	5 U	0.5 U	1 U	1 U	1 U
1,1-Dichloroethene	--	NA	NA	10 U	2 U	5 U	5 U	5 U	**0.39 J**	1 U	1 U	1 U
1,2,4-Trichlorobenzene	--	NA	NA	10 U	2 U	5 U	5 U	5 U	0.5 U	1 U	1 U	1 U
Acetone	--	NA	NA	10 U	2 U	10 R	5 R	5 R	2.5 U	12 U	12 U	12 U
Benzene	--	NA	NA	10 U	2 U	5 U	5 U	5 U	0.5 U	1 U	1 U	1 U
Chloroform	--	NA	NA	**4 J**	**3.8**	**3.8 J**	**2.4 J**	**2.3 J**	1.7 B	2.4 B	**5.3**	**2.5**
cis-1,2-Dichloroethene	70	**190**	**190**	**87**	**67**	**61**	**36**	**36**	**64**	**41**	**34**	**33**
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	NA
Toluene	--	NA	NA	10 U	2 U	5 U	5 U	5 U	0.34 B	1 U	1 U	1 U
trans-1,2-Dichloroethene	--	NA	NA	10 U	2 U	5 U	5 U	5 U	**1.1**	**0.79 J**	1 U	1 U
Trichloroethene	5	**140**	**150**	**180**	**250**	**290**	**180**	**170**	**200**	**140**	**150**	**130**
Vinyl chloride	2	**5.7**	**6**	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene, total	--	NA	NA	10 U	2 U	5 U	5 U	5 U	1.5 U	NA	2 U	2 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	**369**	NA	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	NA	1.8 U	NA	NA	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	NA	2.8 U	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	**63.9 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	**0.16 J**	NA	NA	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	NA	**0.17 J**	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	**9,790**	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	4.3 B	**41.9**	**15.7 J**	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	**3 J**	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	10.2 B	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	**2,740 J**	**2,200**	**2,710**	**4,630 J**	**1,670 J**	NA	NA	NA	NA
Lead	--	NA	NA	NA	**1.7 J**	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	**5,360**	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	**275**	**329**	**341**	NA	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	**59.6**	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	3,040 B	**3,780 J**	NA	NA	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	3.6 UL	NA	NA	NA	NA	NA	NA	NA
Silver	--	NA	NA	NA	0.57 U	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	**16,600**	**16,600**	**18,400**	**18,400**	NA	NA	NA	NA
Thallium	--	NA	NA	NA	2.1 U	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	**0.87 J**	NA	NA	NA	NA	NA	NA	NA
Zinc	--	NA	NA	NA	**65.2 J**	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	NA	14.9 B	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	1.8 U	NA	NA	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	2.8 U	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	**58.1 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	**0.086 J**	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	0.16 U	NA	NA	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW206M		49GW206S								
Sample ID		49GW206M-1115	49GW206MP-1115	049GW206S-1205	049GW206S-0408	049GW206S-0908	049GW206S-0809	049GW206SP-0809	49GW206S-1210	49GW206S-0712	49GW206S-0913	49GW206S-1014
Sample Date		11/10/15	11/10/15	12/16/05	04/01/08	09/17/08	08/11/09	08/11/09	12/15/10	07/20/12	09/11/13	10/16/14
Chemical Name												
Calcium, Dissolved	--	NA	NA	NA	**10,300**	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	NA	0.84 B	**4.3 J**	**2.2 J**	NA	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	**2.4 J**	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	5.9 B	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**16,900**	**17,200**	**2,000 J**	**280**	**198 J**	**200**	**192 J**	**393**	NA	NA	NA
Lead, Dissolved	--	NA	NA	NA	1.4 U	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	**5,270**	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	NA	**254 J**	**236**	**287**	NA	NA	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	NA	**45.2**	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	NA	**2,970**	**3,670 J**	NA	NA	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	3.6 UL	NA	NA	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	0.57 U	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	**16,300**	**16,600**	**18,300**	**18,200**	NA	NA	NA	NA
Thallium, Dissolved	--	NA	NA	NA	2.1 U	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	**68 J**	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	NA	**27**	20 UL	20 U	**29**	**22**	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	20 U	20 U	21 U	20 U	20 U	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	**71 J**	**38**	**39**	**38**	**40**	NA	NA	NA	NA
Nitrate (mg/l)	--	NA	NA	**0.54 J**	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	**5.6**	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	**12 J**	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA

Notes:

Shading indicates exceedance of Site 49 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW206S	49GW207D									
Sample ID		49GW206S-1115	049GW207D-1205	049GW207D-1207	049GW207DP-1207	049GW207D-0408	049GW207D-0908	049GW207D-0809	49GW207D-1210	49GW207D-0712	49GW207D-0913	49GW207D-1014
Sample Date		11/10/15	12/16/05	12/18/07	12/18/07	04/01/08	09/16/08	08/10/09	12/16/10	07/19/12	09/12/13	10/15/14
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	NA	10 U	2 U	2 U	2 U	5 U	5 U	0.5 U	1 U	1 U	5 UJ
1,1-Dichloroethane	--	NA	10 U	2 U	2 U	2 U	5 U	**0.88 J**	0.5 U	1 U	**0.83 J**	5 U
1,1-Dichloroethene	--	NA	10 U	2 U	2 U	2 U	5 U	**3.2 J**	**0.76 J**	**2.4**	**4**	5 U
1,2,4-Trichlorobenzene	--	NA	10 U	2 U	2 U	2 U	5 U	5 U	0.5 U	1 U	1 U	5 U
Acetone	--	NA	10 U	**17**	2 U	**36**	54 B	5 R	**5.6**	**9 J**	12 U	62 U
Benzene	--	NA	10 U	2 U	2 U	2 U	5 U	**0.77 J**	**1.7**	**0.75 J**	**1 J**	5 U
Chloroform	--	NA	**1 J**	**1 J**	2 U	2 U	5 U	5 U	**0.49 J**	1 U	1 U	5 U
cis-1,2-Dichloroethene	70	**30**	**130**	**2**	**1 J**	**60**	**3.2 J**	**490**	**200**	**690**	**520**	**740**
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	NA
Toluene	--	NA	10 U	2 U	2 U	2 U	5 U	5 U	**0.28 J**	1 U	1 U	5 U
trans-1,2-Dichloroethene	--	NA	10 U	2 U	2 U	2 U	5 U	**20**	**1.9**	**1.3 J**	1 U	**37**
Trichloroethene	5	**93**	**520**	**6**	**4**	**2.3**	**36**	**1,100**	**7.7**	**400**	**980**	**820**
Vinyl chloride	2	0.2 U	2 U	2 U	2 U	2 U	1 U	**3.6**	**0.44 J**	1 U	1 U	5 U
Xylene, total	--	NA	10 U	2 U	2 U	2 U	5 U	5 U	1.5 U	NA	2 U	10 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	**322**	**553**	**288**	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	**11.9 J**	**13.3 J**	1.8 U	NA	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	10 U	10 U	2.8 U	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	**37.3 J**	**40 J**	**7.2 J**	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	5 U	5 U	**0.043 J**	NA	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	5 U	5 U	0.16 U	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	**48,300**	**49,400**	**53,900**	NA	NA	NA	NA	NA	NA
Chromium	--	NA	4.7 B	**188**	**206**	**182**	**415**	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	1.5 B	**2.3 J**	0.37 B	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	**26.6**	**26.1**	**11.6 J**	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	**651 J**	**1,710**	**3,050**	**917**	**874**	348 B	NA	NA	NA	NA
Lead	--	NA	NA	**2.8 L**	**4.9 J**	**7.9**	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	**14,600**	**14,800**	**19,700**	NA	NA	NA	NA	NA	NA
Manganese	--	NA	**171**	**20,600**	**33,300**	**61,500**	**124,000**	NA	NA	NA	NA	NA
Nickel	--	NA	NA	**76**	**87.4**	**39.2 J**	NA	NA	NA	NA	NA	NA
Potassium	--	NA	**3,900**	**6,590**	**6,810**	**7,020**	NA	NA	NA	NA	NA	NA
Selenium	--	NA	NA	17.3 B	17.6 B	**48.3 J**	NA	NA	NA	NA	NA	NA
Silver	--	NA	NA	10 U	10 U	**9.7 J**	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	**92,500**	**93,600**	**107,000**	**152,000**	**57,400**	NA	NA	NA	NA
Thallium	--	NA	NA	**72.2**	**99.6**	2.1 U	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	50 U	50 U	0.43 U	NA	NA	NA	NA	NA	NA
Zinc	--	NA	NA	**75.2**	**72.4**	**33.7 J**	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	**46.5 J**	**46.2 J**	**41.7 J**	NA	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	7.6 B	**9.4 J**	1.8 U	NA	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	10 U	10 U	2.8 U	NA	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	**5.3 J**	**5.3 J**	0.98 B	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	5 U	5 U	0.04 U	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	5 U	5 U	0.16 U	NA	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 49**	49GW206S	49GW207D									
Sample ID		49GW206S-1115	049GW207D-1205	049GW207D-1207	049GW207DP-1207	049GW207D-0408	049GW207D-0908	049GW207D-0809	49GW207D-1210	49GW207D-0712	49GW207D-0913	49GW207D-1014
Sample Date		11/10/15	12/16/05	12/18/07	12/18/07	04/01/08	09/16/08	08/10/09	12/16/10	07/19/12	09/12/13	10/15/14
Chemical Name												
Calcium, Dissolved	--	NA	NA	**49,200**	**48,800**	**54,000**	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	1 B	**118**	**118**	**143**	**383**	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	50 U	0.33 B	0.12 U	NA	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	25 U	25 U	0.51 U	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	NA	53.9 B	**116**	**139**	23.3 B	**75.1 J**	200 U	**589**	NA	NA	NA
Lead, Dissolved	--	NA	NA	**1.9 L**	**2.3 L**	**7.2**	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	**14,400**	**14,400**	**19,600**	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	**187 J**	**20,500**	**21,200**	**63,300**	**119,000**	NA	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	**26.7 J**	**26.2 J**	**15.4 J**	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	**3,670**	**6,890**	**6,750**	**7,290**	NA	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	11.9 B	18.4 B	**47.4**	NA	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	10 U	10 U	**9.2 J**	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	**94,300**	**91,400**	**107,000**	**155,000**	**56,500**	NA	NA	NA	NA
Thallium, Dissolved	--	NA	NA	**73.2**	**73.9**	2.1 U	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	**10.1 J**	**11.8 J**	14.4 B	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	**43**	**210**	NA	2,000 UL	**340**	**200**	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	20 U	20 U	NA	20 U	20 U	20 U	NA	NA	NA	NA
Chloride (mg/l)	--	NA	**73 J**	**75**	NA	**72**	**73**	**63**	NA	NA	NA	NA
Nitrate (mg/l)	--	NA	**0.54 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	**7.1**	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	**13 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	10 U	5 U	NA	10 U	10 U	10 U	NA	NA	NA	NA

Notes:

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NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Station ID	CLEAN WO PRGs Site 49	49GW207D	49GW207S									
Sample ID		49GW207D-1115	049GW207S-1205	049GW207S-1207	049GW207S-0408	049GW207S-0908	049GW207S-0809	49GW207S-1210	49GW207SP-1210	49GW207S-0712	49GW207S-0913	49GW207SP-0913
Sample Date		11/10/15	12/16/05	12/18/07	03/31/08	09/16/08	08/11/09	12/16/10	12/16/10	07/19/12	09/10/13	09/10/13
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	NA	10 U	2 U	2 U	5 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U
1,1-Dichloroethane	--	NA	10 U	2 U	2 U	5 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U
1,1-Dichloroethene	--	NA	10 U	2 U	**1.8 J**	**1.4 J**	**1 J**	0.5 U	0.5 U	1 U	**2.3**	**2.1**
1,2,4-Trichlorobenzene	--	NA	10 U	2 U	2 U	5 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U
Acetone	--	NA	10 U	2 U	2 U	25 R	5 R	2.5 U	2.5 U	12 U	12 U	12 U
Benzene	--	NA	10 U	2 U	2 U	5 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U
Chloroform	--	NA	**1 J**	2 U	2 U	5 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	70	**820**	**140**	**480**	**420**	**610**	**290**	**150**	**150**	**80**	**330**	**330**
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	NA	2 U	2 U	2 U
Toluene	--	NA	10 U	2 U	2 U	5 U	5 U	0.5 U	0.5 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	--	NA	10 U	2 U	**1 J**	**1.3 J**	**2.3 J**	**2.8**	**2.8**	1 U	**1.7 J**	**1.7 J**
Trichloroethene	5	**620**	**650**	**9**	**1.9 J**	**8.1**	**240**	**1.2**	**1.1**	**190**	**30**	**30**
Vinyl chloride	2	**2**	2 U	2 U	2 U	**1.7**	**45**	**89**	**83**	**4.9**	**110**	**120**
Xylene, total	--	NA	10 U	2 U	2 U	5 U	5 U	1.5 U	1.5 U	NA	2 U	2 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	**64.9 J**	**120 J**	NA	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	2 B	1.8 U	NA	NA	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	**2.8 J**	2.8 U	NA	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	**64.3 J**	**69.2 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	5 U	0.04 U	NA	NA	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	0.12 B	**0.26 J**	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	**16,600**	**17,400**	NA	NA	NA	NA	NA	NA	NA
Chromium	--	NA	15.3 B	**2.5 J**	**8.7 J**	**60.3**	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	0.75 B	**1.8 J**	NA	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	**6.1 J**	3 B	NA	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	**51,100 J**	**42,700**	**46,000**	**57,400**	**23,000**	NA	NA	NA	NA	NA
Lead	--	NA	NA	**1.5 L**	1.4 U	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	**8,800**	**9,390**	NA	NA	NA	NA	NA	NA	NA
Manganese	--	NA	**821**	**508**	**550**	**741**	NA	NA	NA	NA	NA	NA
Nickel	--	NA	NA	**3.8 J**	**8.4 J**	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	**8,390**	**4,810 J**	**4,650 J**	NA	NA	NA	NA	NA	NA	NA
Selenium	--	NA	NA	35 U	3.6 UL	NA	NA	NA	NA	NA	NA	NA
Silver	--	NA	NA	8.7 B	0.94 B	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	**34,700**	**34,400**	**36,000**	**32,200**	NA	NA	NA	NA	NA
Thallium	--	NA	NA	25 UL	2.5 B	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	1.1 B	0.43 U	NA	NA	NA	NA	NA	NA	NA
Zinc	--	NA	NA	**12.2 J**	**26.5 J**	NA	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	200 U	6.2 U	NA	NA	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	1.6 B	1.8 U	NA	NA	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	**2.8 J**	2.8 U	NA	NA	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	**59.9 J**	**64.1 J**	NA	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	5 U	0.04 U	NA	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	0.22 B	**0.44 J**	NA	NA	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW207D	49GW207S									
Sample ID		49GW207D-1115	049GW207S-1205	049GW207S-1207	049GW207S-0408	049GW207S-0908	049GW207S-0809	49GW207S-1210	49GW207SP-1210	49GW207S-0712	49GW207S-0913	49GW207SP-0913
Sample Date		11/10/15	12/16/05	12/18/07	03/31/08	09/16/08	08/11/09	12/16/10	12/16/10	07/19/12	09/10/13	09/10/13
Chemical Name												
Calcium, Dissolved	--	NA	NA	**15,800**	**17,000**	NA	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	0.54 B	10 U	0.15 U	1.1 U	NA	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	0.46 B	0.82 B	NA	NA	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	**5.5 J**	0.52 B	NA	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	NA	**27,500 J**	**38,000**	**42,100**	**39,200**	**17,800**	8.1 B	13.7 B	**11,600**	**28,100**	**28,700**
Lead, Dissolved	--	NA	NA	**0.68 L**	1.4 U	NA	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	**8,160**	**9,050**	NA	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	**500 J**	**464**	**521**	**697**	NA	NA	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	**1.3 J**	**2.4 J**	NA	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	**5,590**	**4,670 J**	**4,680 J**	NA	NA	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	4 B	**5.3 L**	NA	NA	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	8 B	0.57 U	NA	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	**33,400**	**34,600**	**35,500**	**32,600**	NA	NA	NA	NA	NA
Thallium, Dissolved	--	NA	NA	25 UL	2.1 U	NA	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	**13.2 J**	**19.1 J**	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	**48**	**40**	**78 L**	**57**	**48**	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	20 U	20 U	21 U	**23**	20 U	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	**63 J**	**77**	**80**	**81**	**69**	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	NA	**0.26 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	**8 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	10 U	5 U	10 U	10 U	10 U	NA	NA	NA	NA	NA

Notes:

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TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
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Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW207S		49GW208D								
Sample ID		49GW207S-1014	49GW207S-1115	049GW208D-1205	049GW208D-1207	049GW208D-0408	049GW208D-0908	049GW208DP-0908	049GW208D-0809	049GW208DP-0809	49GW208D-1210	49GW208D-0712
Sample Date		10/15/14	11/10/15	12/14/05	12/19/07	04/01/08	09/17/08	09/17/08	08/11/09	08/11/09	12/17/10	07/19/12
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	2 UJ	NA	10 UJ	2 U	2 U	5 U	5 U	5 U	NA	0.5 U	1 U
1,1-Dichloroethane	--	2 U	NA	**2 J**	2 U	2 U	**1.5 J**	**1.5 J**	5 U	NA	**0.94 J**	**0.73 J**
1,1-Dichloroethene	--	2 U	NA	**9 J**	**2**	**3.3**	**5.8**	**6**	**0.58 J**	NA	**4.4**	**3.2**
1,2,4-Trichlorobenzene	--	2 U	NA	10 UJ	2 U	2 U	5 U	5 U	5 U	NA	0.5 U	1 U
Acetone	--	25 U	NA	10 UJ	2 U	2 U	100 R	100 R	5 R	NA	2.5 U	12 U
Benzene	--	2 U	NA	10 UJ	2 U	**1.6 J**	5 U	5 U	5 U	NA	0.5 U	1 U
Chloroform	--	2 U	NA	10 UJ	2 U	2 U	5 U	5 U	**0.91 J**	NA	2.6 B	3.4 B
cis-1,2-Dichloroethene	70	**130**	**23**	**450**	**350**	**320**	**490**	**460**	**60**	NA	**440 L**	**330**
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 U
Toluene	--	2 U	NA	10 UJ	2 U	2 U	5 U	5 U	5 U	NA	2.6 B	1 U
trans-1,2-Dichloroethene	--	**1.6 J**	NA	**30 J**	**4**	**5.8**	**34**	**33**	**2.7 J**	NA	**27**	**23**
Trichloroethene	5	**16**	**9.9**	**3,100**	**830**	**920**	**2,500**	**2,300**	**270**	NA	**1,200 L**	**1,200**
Vinyl chloride	2	**120**	**150**	**6 J**	**1 J**	2 U	**3.1**	**3.4**	1 U	NA	**2.2**	**1.9 J**
Xylene, total	--	4 U	NA	10 UJ	2 U	2 U	5 U	5 U	5 U	NA	1.5 U	NA
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	**0.4 J**	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	**82.2 J**	**223**	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	NA	60 U	1.8 U	NA	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	NA	10 U	2.8 U	NA	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	**45.6 J**	**76.6 J**	NA	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	5 U	0.04 U	NA	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	NA	5 U	0.16 U	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	**49,000**	**50,300**	NA	NA	NA	NA	NA	NA
Chromium	--	NA	NA	10.1 B	**6.5 J**	**60.1**	**11.3 J**	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	50 U	0.43 B	NA	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	25 U	5.2 B	NA	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	**2,810 J**	**106**	**612**	**215**	NA	197 B	NA	NA	NA
Lead	--	NA	NA	NA	10 UL	**1.8 J**	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	**20,700**	**21,300**	NA	NA	NA	NA	NA	NA
Manganese	--	NA	NA	**681**	**539**	**2,670**	**1,780**	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	**30.6 J**	**76.5**	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	**4,350**	**8,250**	**7,500**	NA	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	10.7 B	3.6 UL	NA	NA	NA	NA	NA	NA
Silver	--	NA	NA	NA	10 U	0.57 U	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	**56,300**	**45,200**	**62,500**	NA	**50,800**	NA	NA	NA
Thallium	--	NA	NA	NA	25 UL	2.1 U	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	0.79 B	**0.57 J**	NA	NA	NA	NA	NA	NA
Zinc	--	NA	NA	NA	**16.4 J**	**56.1 J**	NA	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	NA	9.4 B	6.2 U	NA	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	1 B	1.8 U	NA	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	10 U	2.8 U	NA	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	**45.6 J**	**67.1 J**	NA	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	5 U	0.04 U	NA	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	5 U	0.16 U	NA	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW207S		49GW208D								
Sample ID		49GW207S-1014	49GW207S-1115	049GW208D-1205	049GW208D-1207	049GW208D-0408	049GW208D-0908	049GW208DP-0908	049GW208D-0809	049GW208DP-0809	49GW208D-1210	49GW208D-0712
Sample Date		10/15/14	11/10/15	12/14/05	12/19/07	04/01/08	09/17/08	09/17/08	08/11/09	08/11/09	12/17/10	07/19/12
Chemical Name												
Calcium, Dissolved	--	NA	NA	NA	**49,900**	**49,900**	NA	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	NA	1.2 B	**2.9 J**	**0.91 J**	1.1 U	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	50 U	0.12 U	NA	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	25 U	2.9 B	NA	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	**15,900**	**29,600**	**999 J**	100 U	20.5 B	61 U	NA	200 U	NA	80 U	NA
Lead, Dissolved	--	NA	NA	NA	10 UL	1.4 U	NA	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	**20,900**	**20,900**	NA	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	NA	**584 J**	**492**	**2,530**	**1,800**	NA	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	NA	**28.5 J**	**65.6**	NA	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	NA	**4,010**	**8,100**	**7,560**	NA	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	9.1 B	3.6 UL	NA	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	10 U	0.57 U	NA	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	**55,400**	**45,100**	**65,200**	NA	**49,300**	NA	NA	NA
Thallium, Dissolved	--	NA	NA	NA	25 UL	2.1 U	NA	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	**16.1 J**	**60 J**	NA	NA	NA	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	NA	**78**	**130**	**120 L**	**110**	NA	**70**	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	20 U	20 U	20 U	20 U	NA	21 U	NA	NA	NA
Chloride (mg/l)	--	NA	NA	**77 J**	**130**	**130**	**160**	NA	**110**	NA	NA	NA
Nitrate (mg/l)	--	NA	NA	**0.16 J**	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	**6.4**	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	**56 J**	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	10 U	5 U	10 U	10 U	NA	10 U	NA	NA	NA

Notes:

Shading indicates exceedance of Site 49 PRGs

Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs Site 49	49GW208D				49GW208S						
Sample ID		49GW208DP-0712	49GW208D-0913	49GW208D-1014	49GW208D-1115	049GW208S-1205	049GW208SP-1205	049GW208S-1207	049GW208S-0408	049GW208S-0908	049GW208S-0809	49GW208S-1210
Sample Date		07/19/12	09/10/13	10/15/14	11/10/15	12/14/05	12/14/05	12/18/07	03/31/08	09/17/08	08/11/09	12/16/10
Chemical Name												
Volatile Organic Compounds (UG/L)												
1,1,1-Trichloroethane	--	1 U	1 U	1 UJ	NA	10 U	10 U	2 U	2 U	5 U	5 U	0.5 U
1,1-Dichloroethane	--	**0.75 J**	1 U	1 U	NA	10 U	10 U	2 U	2 U	5 U	5 U	0.5 U
1,1-Dichloroethene	--	**3.4**	**2.5**	1 U	NA	10 U	10 U	2 U	2 U	5 U	5 U	0.5 U
1,2,4-Trichlorobenzene	--	1 U	1 U	1 U	NA	10 UJ	10 UJ	2 U	2 U	5 U	5 U	0.5 U
Acetone	--	12 U	12 U	12 U	NA	10 U	10 U	2 U	2 U	5 R	5 R	2.5 U
Benzene	--	1 U	1 U	1 U	NA	10 U	10 U	2 U	2 U	5 U	5 U	0.5 U
Chloroform	--	3.3 B	7.1 B	**4.3 K**	NA	**8 J**	**7 J**	2 U	2 U	5 U	**0.54 J**	**1.1**
cis-1,2-Dichloroethene	70	**320**	**160**	**150 K**	**240**	**120**	**120**	**74**	**63**	**65**	**29**	**26**
m- and p-Xylene	--	2 U	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	--	1 U	1 U	1 U	NA	10 U	10 U	2 U	2 U	5 U	5 U	**0.27 J**
trans-1,2-Dichloroethene	--	**21**	**9.5**	**12 K**	NA	10 U	10 U	2 U	2 U	5 U	5 U	**0.76 J**
Trichloroethene	5	**1,200**	**700**	**360**	**540**	**270**	**290**	**110**	**140**	**130**	**48**	**34**
Vinyl chloride	2	**1.8 J**	1 U	1 U	**1.1**	2 U	2 U	2 U	2 U	1 U	1 U	1 U
Xylene, total	--	NA	2 U	2 U	NA	10 U	10 U	2 U	2 U	5 U	5 U	1.5 U
Semivolatile Organic Compounds (UG/L)												
1,4-Dioxane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (UG/L)												
Aluminum	--	NA	NA	NA	NA	NA	NA	**944**	**1,310**	NA	NA	NA
Antimony	--	NA	NA	NA	NA	NA	NA	5.5 B	1.8 U	NA	NA	NA
Arsenic	--	NA	NA	NA	NA	NA	NA	10 U	2.8 U	NA	NA	NA
Barium	--	NA	NA	NA	NA	NA	NA	**116 J**	**130 J**	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	NA	NA	5 U	**0.13 J**	NA	NA	NA
Cadmium	--	NA	NA	NA	NA	NA	NA	5 U	0.16 U	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	**50,800**	**64,100**	NA	NA	NA
Chromium	--	NA	NA	NA	NA	**55.1 J**	**37.6 J**	**104**	**272**	**9.8 J**	NA	NA
Cobalt	--	NA	NA	NA	NA	NA	NA	**13.9 J**	**11.5 J**	NA	NA	NA
Copper	--	NA	NA	NA	NA	NA	NA	**13.5 J**	**21.9 J**	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	**10,300 J**	**8,780 J**	**13,200**	**13,600**	**2,040**	**53,800**	NA
Lead	--	NA	NA	NA	NA	NA	NA	**1.9 L**	**3.3**	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA	NA	**24,700**	**32,800**	NA	NA	NA
Manganese	--	NA	NA	NA	NA	**1,080**	**1,040**	**812**	**1,030**	**1,140**	NA	NA
Nickel	--	NA	NA	NA	NA	NA	NA	**154**	**267**	NA	NA	NA
Potassium	--	NA	NA	NA	NA	**10,700**	**10,600**	**8,180**	**8,820**	NA	NA	NA
Selenium	--	NA	NA	NA	NA	NA	NA	10.2 B	3.6 UL	NA	NA	NA
Silver	--	NA	NA	NA	NA	NA	NA	10 U	0.57 U	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	**41,500**	**46,700**	**50,700**	**60,500**	NA
Thallium	--	NA	NA	NA	NA	NA	NA	25 UL	2.1 U	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA	NA	2.3 B	**2.2 J**	NA	NA	NA
Zinc	--	NA	NA	NA	NA	NA	NA	**36.9 J**	**69.5 J**	NA	NA	NA
Dissolved Metals (UG/L)												
Aluminum, Dissolved	--	NA	NA	NA	NA	NA	NA	10.9 B	6.6 B	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	NA	NA	NA	60 U	1.8 U	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	NA	NA	NA	10 U	2.8 U	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	NA	NA	NA	**105 J**	**112 J**	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	NA	NA	NA	5 U	0.04 U	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	NA	NA	NA	5 U	0.16 U	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 49**	49GW208D				49GW208S						
Sample ID		49GW208DP-0712	49GW208D-0913	49GW208D-1014	49GW208D-1115	049GW208S-1205	049GW208SP-1205	049GW208S-1207	049GW208S-0408	049GW208S-0908	049GW208S-0809	49GW208S-1210
Sample Date		07/19/12	09/10/13	10/15/14	11/10/15	12/14/05	12/14/05	12/18/07	03/31/08	09/17/08	08/11/09	12/16/10
Chemical Name												
Calcium, Dissolved	--	NA	NA	NA	NA	NA	NA	**49,300**	**61,600**	NA	NA	NA
Chromium, Dissolved	--	NA	NA	NA	NA	2.4 B	2.4 B	**2 J**	**6.6 J**	**1.9 J**	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	NA	NA	NA	**12.4 J**	**8.1 J**	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	NA	NA	NA	25 U	6.5 B	NA	NA	NA
Iron, Dissolved	11,000	NA	NA	NA	NA	67 B	68.8 B	**271**	**556**	61 U	**26,000**	**136**
Lead, Dissolved	--	NA	NA	NA	NA	NA	NA	10 UL	**1.4 J**	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	NA	NA	NA	**24,300**	**31,100**	NA	NA	NA
Manganese, Dissolved	--	NA	NA	NA	NA	**949 J**	**925 J**	**794**	**949**	**1,160**	NA	NA
Nickel, Dissolved	--	NA	NA	NA	NA	NA	NA	**115**	**133**	NA	NA	NA
Potassium, Dissolved	--	NA	NA	NA	NA	**8,740**	**8,620**	**7,980**	**8,390**	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	NA	NA	NA	11.4 B	3.6 UL	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	NA	NA	NA	10 U	0.57 U	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	NA	NA	**41,500**	**45,000**	**50,300**	**60,600**	NA
Thallium, Dissolved	--	NA	NA	NA	NA	NA	NA	**2.4 L**	2.1 U	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	NA	NA	NA	**34.5 J**	**57.7 J**	NA	NA	NA
Wet Chemistry												
Alkalinity (mg/l)	--	NA	NA	NA	NA	**52**	**50**	**46**	**53 L**	**38**	**60**	NA
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	20 U	20 U	20 U	20 U	20 U	20 U	NA
Chloride (mg/l)	--	NA	NA	NA	NA	**170 J**	**170 J**	**180**	**240**	**210**	**260**	NA
Nitrate (mg/l)	--	NA	NA	NA	NA	**1.1 J**	**1.1 J**	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	NA	NA	**9.5 J**	**12 J**	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	NA	NA	10 U	10 U	5 U	10 U	10 U	10 U	NA

Notes:

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L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
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UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 49**	49GW208S				
Sample ID		49GW208S-0712	49GW208S-0913	49GW208S-1014	49GW208SP-1014	49GW208S-1115
Sample Date		07/19/12	09/10/13	10/15/14	10/15/14	11/10/15
Chemical Name						
Volatile Organic Compounds (UG/L)						
1,1,1-Trichloroethane	--	1 U	1 U	1 UJ	1 UL	NA
1,1-Dichloroethane	--	1 U	1 U	1 U	1 UL	NA
1,1-Dichloroethene	--	1 U	1 U	1 U	1 UL	NA
1,2,4-Trichlorobenzene	--	1 U	1 U	1 U	1 UL	NA
Acetone	--	12 U	12 U	12 U	12 UL	NA
Benzene	--	1 U	1 U	1 U	1 UL	NA
Chloroform	--	4.1 B	7.2 B	**2.2**	**2.2 L**	NA
cis-1,2-Dichloroethene	70	**37**	**20**	**16**	**15 L**	**15**
m- and p-Xylene	--	2 U	2 U	NA	NA	NA
Toluene	--	1 U	1 U	1 U	1 UL	NA
trans-1,2-Dichloroethene	--	1 U	1 U	1 U	1 UL	NA
Trichloroethene	5	**66**	**32**	**19**	**21 L**	**16**
Vinyl chloride	2	1 U	1 U	1 U	1 UL	0.2 U
Xylene, total	--	NA	2 U	2 U	2 UL	NA
Semivolatile Organic Compounds (UG/L)						
1,4-Dioxane	--	NA	NA	NA	NA	NA
Total Metals (UG/L)						
Aluminum	--	NA	NA	NA	NA	NA
Antimony	--	NA	NA	NA	NA	NA
Arsenic	--	NA	NA	NA	NA	NA
Barium	--	NA	NA	NA	NA	NA
Beryllium	--	NA	NA	NA	NA	NA
Cadmium	--	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA
Chromium	--	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	NA	NA
Copper	--	NA	NA	NA	NA	NA
Iron	11,000	NA	NA	NA	NA	NA
Lead	--	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA
Nickel	--	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA
Selenium	--	NA	NA	NA	NA	NA
Silver	--	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA
Thallium	--	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA
Zinc	--	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)						
Aluminum, Dissolved	--	NA	NA	NA	NA	NA
Antimony, Dissolved	--	NA	NA	NA	NA	NA
Arsenic, Dissolved	--	NA	NA	NA	NA	NA
Barium, Dissolved	--	NA	NA	NA	NA	NA
Beryllium, Dissolved	--	NA	NA	NA	NA	NA
Cadmium, Dissolved	--	NA	NA	NA	NA	NA

TABLE 9-3
Historical Constituents Detected in Groundwater at Site 49
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs Site 49**	49GW208S				
Sample ID		49GW208S-0712	49GW208S-0913	49GW208S-1014	49GW208SP-1014	49GW208S-1115
Sample Date		07/19/12	09/10/13	10/15/14	10/15/14	11/10/15
Chemical Name						
Calcium, Dissolved	--	NA	NA	NA	NA	NA
Chromium, Dissolved	--	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	NA	NA	NA	NA	NA
Copper, Dissolved	--	NA	NA	NA	NA	NA
Iron, Dissolved	11,000	208 B	**9,180**	**8,050**	**8,180**	NA
Lead, Dissolved	--	NA	NA	NA	NA	NA
Magnesium, Dissolved	--	NA	NA	NA	NA	NA
Manganese, Dissolved	--	NA	NA	NA	NA	NA
Nickel, Dissolved	--	NA	NA	NA	NA	NA
Potassium, Dissolved	--	NA	NA	NA	NA	NA
Selenium, Dissolved	--	NA	NA	NA	NA	NA
Silver, Dissolved	--	NA	NA	NA	NA	NA
Sodium, Dissolved	--	NA	NA	NA	NA	NA
Thallium, Dissolved	--	NA	NA	NA	NA	NA
Zinc, Dissolved	--	NA	NA	NA	NA	NA
Wet Chemistry						
Alkalinity (mg/l)	--	NA	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	NA	NA	NA	NA	NA
Chloride (mg/l)	--	NA	NA	NA	NA	NA
Nitrate (mg/l)	--	NA	NA	NA	NA	NA
pH (ph)	--	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	NA	NA	NA	NA	NA

Notes:

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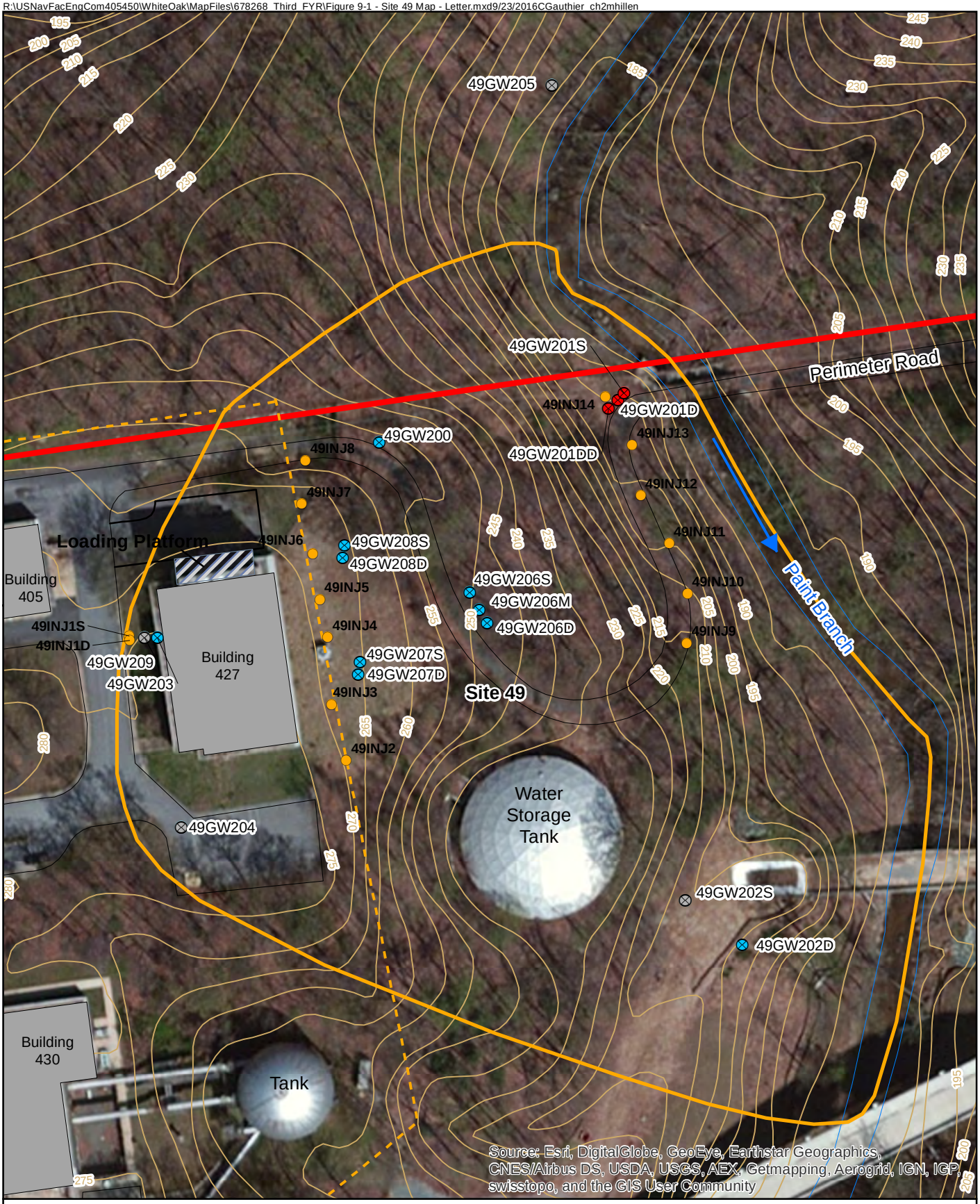
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/L - Milligrams per liter
PH - pH units
UG/L - Micrograms per liter

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 9-1 - Site 49 Map - Letter.mxd9/23/2016CGauthier_ch2mhillen



Legend

- Abandoned Monitoring Well
- 2015 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Fence
- Site Boundary
- Buildings and Other Structures
- Direction of Stream Flow

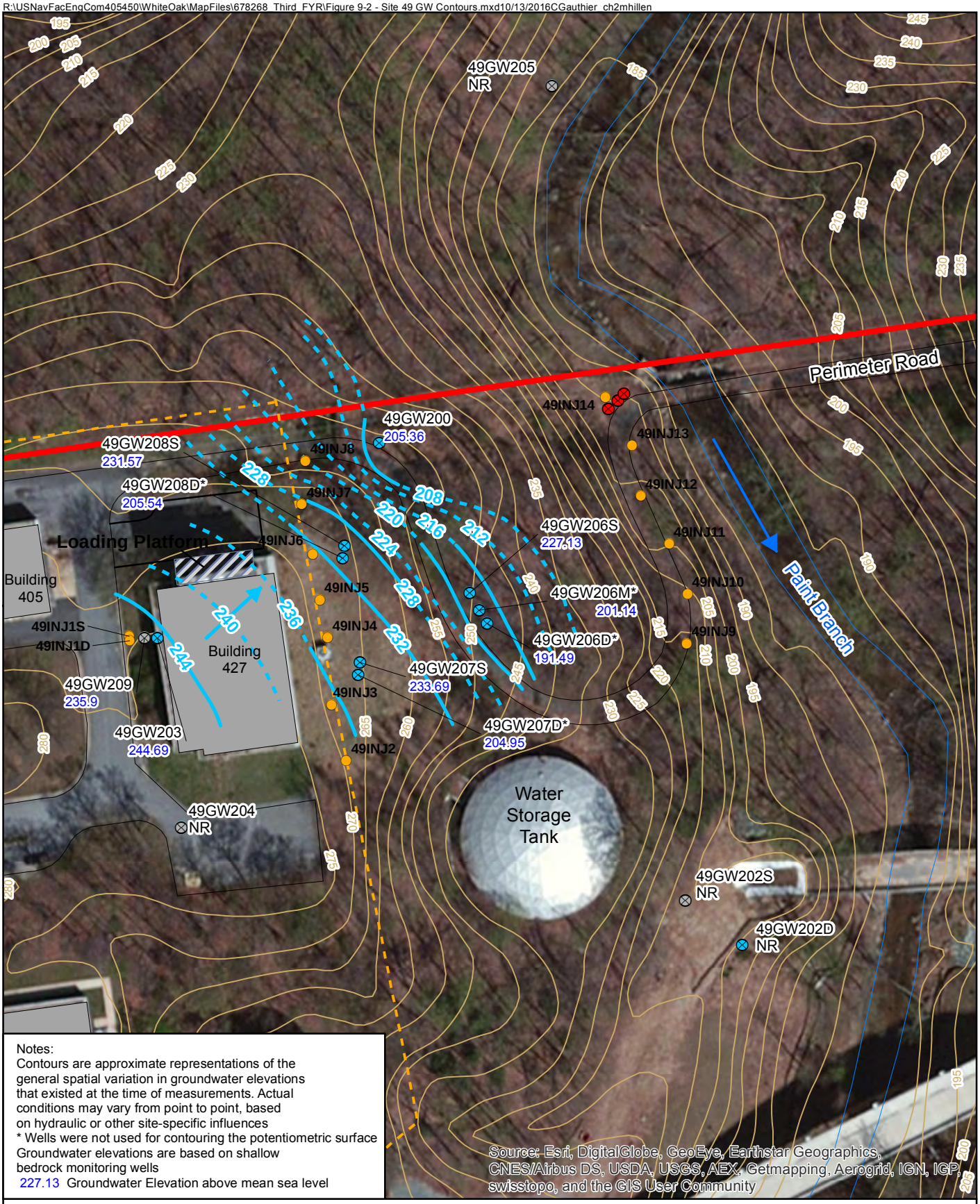
N

0 50 100 Feet

Figure 9-1
Site 49 Map
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 9-2 - Site 49 GW Contours.mxd10/13/2016CGauthier_ch2mhillen



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
* Wells were not used for contouring the potentiometric surface
Groundwater elevations are based on shallow bedrock monitoring wells
227.13 Groundwater Elevation above mean sea level

Legend

- Abandoned Monitoring Well
- 2015 Long Term Monitoring Well
- Monitoring Well
- Injection Well
- Topographic Contours (ft msl)
- Former NSWC - White Oak Facility Boundary
- Fence
- Buildings and Other Structures
- Direction of Stream Flow
- Groundwater Contour
- Groundwater Contour (inferred)
- Groundwater Flow Direction

N

0 50 100 Feet

Figure 9-2
Site 49 Potentiometric Surface Map and LTM Locations – November 10, 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 9-3 - Site 49 Exceedances.mxd10/13/2016CGauthier_ch2mhillen

Station ID	49GW200
Sample ID	49GW200-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	**880**
Trichloroethene	**390**
Vinyl chloride	**8.9**
Dissolved Metals (UG/L)	
Iron, Dissolved	NA

Station ID	49GW208S
Sample ID	49GW208S-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	15
Trichloroethene	**16**
Vinyl chloride	0.2 U
Dissolved Metals (UG/L)	
Iron, Dissolved	NA

Station ID	49GW208D
Sample ID	49GW208D-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	**240**
Trichloroethene	**540**
Vinyl chloride	1.1
Dissolved Metals (UG/L)	
Iron, Dissolved	NA

Station ID	49GW203
Sample ID	49GW203-1115
Sample Date	11/12/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	NA
Trichloroethene	NA
Vinyl chloride	NA
Dissolved Metals (UG/L)	
Iron, Dissolved	**16,300**

Station ID	49GW207S
Sample ID	49GW207S-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	23
Trichloroethene	**9.9**
Vinyl chloride	**150**
Dissolved Metals (UG/L)	
Iron, Dissolved	**29,600**

Station ID	49GW207D
Sample ID	49GW207D-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	**820**
Trichloroethene	**620**
Vinyl chloride	2
Dissolved Metals (UG/L)	
Iron, Dissolved	NA

Station ID	49GW206S
Sample ID	49GW206S-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	30
Trichloroethene	**93**
Vinyl chloride	0.2 U
Dissolved Metals (UG/L)	
Iron, Dissolved	NA

Station ID	49GW206M*
Sample ID	49GW206MP-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	**190**
Trichloroethene	**150**
Vinyl chloride	**6**
Dissolved Metals (UG/L)	
Iron, Dissolved	**17,200**

Station ID	49GW206D
Sample ID	49GW206D-1115
Sample Date	11/10/15
Chemical Name	
Volatile Organic Compounds (UG/L)	
cis-1,2-Dichloroethene	**290**
Trichloroethene	**22**
Vinyl chloride	**29**
Dissolved Metals (UG/L)	
Iron, Dissolved	NA

	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

Legend

- Abandoned Monitoring Well
- Monitoring Well
- 2015 Long Term Monitoring Well
- Injection Well
- Direction of Stream Flow
- Fence
- Former NSWC - White Oak Facility Boundary
- Topographic Contours (ft msl)
- Site Boundary
- Buildings and Other Structures

Notes:

Shading indicates detections

Bold text indicates exceedance of the PRGs

NA - Not analyzed

U - The material was analyzed for, but not detected

UG/L - Micrograms per liter

* - Field duplicate collected at this location; the greater result is shown

N

0 50 100 200 Feet

1 inch = 100 feet

Figure 9-3
Site 49 Groundwater Exceedance Map - November 2015
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

ch2m

SECTION 10

SWMU 87 – Building 611 Solid Waste Storage Area

10.1 Site Chronology

A chronology of major events for SWMU 87 is provided in **Table 10-1**.

Table 10-1. 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.
1995	EA Engineering Science and Technology conducted a Phase I Environmental Baseline Study that included SWMU 87.
1997	Tetra Tech conducted investigation to characterize background soil, sediment, groundwater, and surface water.
1999	Tetra Tech collects surface and subsurface soil samples and installed three temporary monitoring wells downgradient of SWMU 87.
2002	Tetra Tech installed three temporary monitoring wells during a supplemental investigation.
June 2003	Tetra Tech conducted an additional investigation that includes the collection of surface and subsurface soil samples.
April 2005	Tetra Tech conducted a CMS for SWMU 87 that included the evaluation of remedial alternatives for SWMU 87 groundwater.
October 11, 2005	ROD for SWMU 87 finalized.
April 2007	Baseline groundwater sampling conducted before the EVO injection.
June 2007	Injection wells installed, injections of EVO into the groundwater.
July 2007	Tetra Tech performed 1-month post-injection sampling event.
October 2007	Tetra Tech performed 3-month post-injection sampling event.
January 2008	Tetra Tech performed 6-month post-injection sampling event.
April 2008	Tetra Tech performed 9-month post-injection sampling event.
August 2008	Tetra Tech performed 1-year post-injection sampling event.
October 2009	Tetra Tech performed 2-month post-injection sampling event.
October 2011	Tetra Tech performed 3-year post-injection sampling event.
January 2013	CH2M performed 4-year post-injection sampling event.
May 2014	CH2M performed 5-year post-injection sampling event.
August 2015	CH2M performed 6-year post-injection sampling event.

10.2 Background

10.2.1 Description and History

SWMU 87 is located west and north of the former Building 611 in the south-central portion of the facility (**Figure 1-2**). The unit is located within 50 feet of Paint Branch and was reportedly used to store wood, metal waste and other debris. As documented in the SWMU 87 SWMU 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 conducted by a contractor for the USEPA 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 (Tetra Tech, 2004b)[7]. 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, 2005a). 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.

As summarized in the CMS (Tetra Tech, 2005a), the RFI for SWMU 87 was completed based on the results of the Site Screening Report (Tetra Tech, 2004b). In general, surface and subsurface soil samples were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, TCL pesticides and PCBs, and Target Analyte List metals. 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. 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 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 included the collection of surface and subsurface soil samples. Two potential source areas were identified; the catch basin at the northern end of the building and the area off the edge of the former compressed air tanks slab on the eastern side of the building. The second objective of this investigation was to delineate the extent of the VOC plume to the northeast of the building. Three surface and six subsurface soil samples were collected and analyzed for VOCs. Three groundwater samples were collected from temporary wells and analyzed for VOCs. Additional temporary monitoring wells, 87-WP-101, 87-WP-102, and 87-WP-103 were installed 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 87WPlO1, 102, and 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 10-2**).

The HIs across all exposure pathways for construction workers, maintenance workers, full-time employees, adolescent trespassers, and day care children were less than unity, indicating that no adverse health effects were anticipated for these receptors under the defined exposure conditions. The HI for the child (HI:4) and adult residents (HI:1) equals or exceeds one under the most conservative exposure scenario. Exposures through the

7 It is assumed that this screening was conducted in 2004; however, this could not be verified since the site screening report was not located in the Administrative Record.

ingestion of groundwater were the major contributors to the HI for residents. Trichloroethene 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 day care 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.

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 requirements for groundwater LTM are specified in the SWMU 87 ROD. The MCSs developed for groundwater and presented in the ROD are provided in **Table 10-2**.

Table 10-2. MCSs for COCs for SWMU 87 Groundwater included in SWMU 87 ROD - 2005

COC for SWMU 87 Groundwater	MCSs (µg/L)	Basis
PCE	5	MCL
TCE	5	MCL
cis-1,2-DCE	70	MCL

10.2.2 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 10-1**). Groundwater generally flows to the south-southwest (**Figure 10-2**).

As summarized in the CMS (Tetra Tech, 2005a), 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.

10.2.3 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 US government. 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 at this time 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.

10.2.4 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, limited VOC concentrations have been detected in the bedrock aquifer. The most commonly detected compound was PCE, which was detected at concentrations ranging from 9 to 120 µg/L. TCE and cis-1,2-DCE were also detected in the SWMU 87 groundwater

Contaminants are migrating west toward Paint Branch. However, VOCs have not been detected in surface water or sediments in Paint Branch (Tetra Tech, 2004b). Additionally, all chemicals identified in SWMU 87 soil were either below screening values or at levels that were not statistically different from background.

10.2.5 Site Risks

The summary of site risks is based on the information presented in the SWMU 87 ROD (NAVFAC, 2005b) and the previous Five Year Review Report (Tetra Tech, 2012). 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).

10.2.5.1 Human Health Risk Assessment

The HHRA evaluated noncarcinogenic hazards and carcinogenic hazards associated with exposure to surface soil and subsurface soil by current and future industrial workers, maintenance/utility workers, construction workers, recreational users, trespassers, daycare-center child, 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 future site use. The HHRA was conducted using surface and subsurface soil collected during the various site investigations. Based on a comparison of the soil data to the USEPA Region 3 RBCs for residential soil current at the time of the HHRA and background concentrations, iron, manganese, and nickel were identified as COPCs for evaluation in the HHRA. The calculated noncarcinogenic hazards for all receptors except the child resident are within acceptable USEPA hazard levels and the calculated carcinogenic risks for all potential receptors were within USEPA target levels. 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 concentrations of the constituents detected in soil were also compared to the USEPA Region 3 soil-to-groundwater SSLs based on a dilution and attenuation factor of 1 to evaluated the potential for migration of contaminants from soil to groundwater. The concentrations of manganese in both surface soil and subsurface soil exceeded the soil-to-groundwater SSL and background levels, and the concentrations of 1,2-dibromo-3-chloropropane, chloroform, PCE, and TCE in subsurface soil exceeded the soil-to-groundwater SSLs.

The HHRA evaluated site-specific noncarcinogenic hazards and carcinogenic hazards associated with exposure to groundwater by current and future industrial workers, future 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 future site use. Based on a comparison of the groundwater data to the USEPA Region 3 RBCs current at the time of the HHRA and background concentrations, cis-1,2-DCE, PCE, and TCE were identified as groundwater COPCs for evaluation in the HHRA. Calculated noncarcinogenic hazards to future child residents and carcinogenic risks to future child and adult residents exceeded USEPA acceptable levels.

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

10.2.5.2 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 ecological risk assessment 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, significant 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. No site-related chemicals were detected in the surface water or sediment in Paint Branch and therefore, risks to ecological receptors were not evaluated for these media relative to SWMU 87.

As stated in the SWMU 87 ROD, the BHHRA determined that the SWMU 87 soil does not present an unacceptable risk for exposure to soil (that is, the HI was below unity [one] for all receptors). The site also does not pose an unacceptable ecological risk (NAVFAC, 2005b).

10.3 Remedial Actions

10.3.1 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.

10.3.2 Response Actions

10.3.2.1 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 above risk-based screening criteria (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: In-Situ Bioremediation, Institutional Controls 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[8]
- 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.

10.3.3 Status of Implementation

10.3.3.1 In Situ Bioremediation

In-situ bioremediation injection activities concluded in 2007, with baseline monitoring beginning in April 2007. Post injection monitoring continued every three 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, 2012).

10.3.3.2 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 2014 and 2015 LTM sampling, only 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 August 2015, selected monitoring wells were 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 provided in **Table 10-3** and are summarized below.

PCE Results

PCE was detected in the groundwater at one monitoring well (87WP212) at a concentration of 10 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 10 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 wells 87WP201 and 87WP212 at concentrations of 3 µg/L and 9.1 µg/L, respectively. The detected concentration of TCE from monitoring well 87WP212 exceeded the MCS (5 µg/L). TCE concentrations in samples from monitoring well 87WP212 have remained above the MCS since the baseline sampling event, ranging from 9.1 to 34 µg/L, with the exception of October 2011, when the TCE concentration was detected at 4.8 µg/L. TCE concentrations in samples from monitoring well 87WP201 were not

[8] 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.

detected during the baseline sampling conducted in 2007; however, detected concentrations have ranged from 2.8 to 11 µg/L since 2009. The TCE concentration in monitoring well 87WP201 (3 µg/L) during the most recent sampling event was below the MCS (5 µg/L).

Cis-1,2-DCE Results

Cis-1,2-DCE was detected in samples from monitoring wells 87WP201 and 87WP212 at concentrations of 11 µg/L to 8 µg/L, respectively. Neither of these detections exceeded the MCS (70 µg/L). Cis-1,2-DCE has consistently been detected at similar concentrations over the last several years in samples from both of these wells.

10.3.3.3 Operation and Maintenance

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

10.3.3.4 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 LUC RD for SWMU 87 is currently in draft form and should be finalized.

10.4 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 10-4 and 10-5**).

Table 10-4. Protectiveness Determination/Statement from the 2012 Five-Year Review – SWMU 87

Protectiveness Determination	Protectiveness Statement
Protective	Based on the activities implemented to date, the selected remedy is protective 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.

Table 10-5. Status of Recommendations from the 2012 Five-Year Review – SWMU 87

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to address the areas of highest concentrations of remaining VOCs	Groundwater monitoring should be continued at 15-month intervals to evaluate the MNA of the groundwater contaminations.	Ongoing	LTM is being conducted on a 15-month basis and groundwater conditions are re-evaluated following each event.	January 2013 May 2014 August 2015

Table 10-5. Status of Recommendations from the 2012 Five-Year Review – SWMU 87

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date(s)
Need to implement ICs	The LUC RD should be finalized to formalize the procedures needed to limit exposure to site contaminants.	Ongoing	The LUC RD is currently in draft form and should be finalized.	NA
Need to assess whether oxidant/ catalyst solution continues to destroy dissolved and adsorbed VOCs at SWMU 87 and whether additional treatment at SWMU 87 may be warranted.	The sampling of the upgradient monitoring wells 87WP212, 87WP213, and 87WP211 is recommended to determine if the observed contamination is localized.	Ongoing	LTM sampling is being conducted on a 15-month basis, and groundwater conditions are re-evaluated following each event.	January 2013 May 2014 August 2015

10.5 Five-Year Review Process

10.5.1 Document Review

Table 10-6 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 section is given in the References section.

Table 10-6. 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	1999
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	2012
Final Basewide Long-Term Monitoring Report – 2015, Former NSWC-White Oak	CH2M	2017

10.5.2 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. The SWMU 87 historical LTM groundwater analytical data collected from 2007 (baseline) through August 2015 are provided in **Table 10-3**, and trend graphs presenting VOC COC results for select monitoring wells at SWMU 87 are provided in **Appendix C-8**.

The results of the August 2015 sampling event 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, appears to have been unaffected by the injection and continues to exhibit low, but greater-than-MCS, levels of TCE and PCE. This well is in the upland portion of the SWMU 87. Monitoring well 87WP201, located in the lower portion of the SWMU, has one round of sampling with all COC concentrations below the MCS.

10.6 Technical Assessment

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

10.6.1 Question A – Is the Remedy Functioning as Designed?

The SWMU 87 remedy of bioremediation with 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.

10.6.1.1 Implementation of Institutional Controls and Other Measures

ICs at SWMU 87 include LUCs to prohibit withdrawal of groundwater for any purpose (except for monitoring conducted pursuant to CERCLA or RCRA) from within the restricted are 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 should be finalized.

10.6.1.2 Opportunities for Optimization

After the last Five-Year review, CH2M recommended and implemented several changes to the LTM program for SWMU 87. These changes are summarized in **Table 10-7**.

Table 10-7. SWMU 87 Groundwater Optimization

Sampling Event	Groundwater Optimization
January 2013	• Discontinue sampling at monitoring wells 87WP101, 87WP103, 87WP203, 87WP204, 87WP206, 87WP213, and 87WP214. • Perform LTM at a 15-month intervals.
November 2015	• Sampling for chemical oxygen demand should be discontinued because results are not being used in decision-making.

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

The exposure assumptions and cleanup levels (which are MCLs) are still valid. Toxicity for some of the detected analytes have changed, but these revisions do not change the results of the HHRA or the COCs. Toxicity data for some of the COCs have changed, but this is not relevant since the cleanup levels are based on MCLs.

10.6.3 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.

10.7 Issues, Recommendations, and Follow-up Actions

The results of the August 2015 sampling event 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, appears to have been unaffected by the injection and continues to exhibit low, but greater-than-MCS, levels of TCE and PCE. This well is in the upland portion of the SWMU 87. Monitoring well 87WP201, located in the lower portion of the SWMU, has one round of sampling with all COC concentrations below the MCS.

Based on the conclusions, the following recommendations are provided for the RA for SWMU 87 groundwater:

- Groundwater sampling should continue at 15-month intervals. Groundwater optimization should continue to occur based on the decision rules provided the SWMU 87 LTM Plan.

It is also recommended that the LUC RD for SWMU 87 be finalized.

10.8 Protectiveness Statement

The selected remedy for SWMU 87, consisting of EISB with ICs and LTM, is protective in the short term of human health and the environment. Exposure pathways that could result in and unacceptable risk are being controlled through the enforcement of LUCs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: Finalize the LUC RD for SWMU 87.

TABLE 10-3
Historical Constituents Detected in Groundwater at SWMU 87
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	CLEAN WO PRGs SWMU 87																	
Sample ID		87WP201-BL01	87WP201-4WK	87WP201QTR01	87WP201-QTR2	87WP201-QTR2-D	87WP201-QTR3	87WP201-QTR4	87WP201-1009	87WP201-1011	87WP201-0113	87WP201-0514	87WP201P-0514	87WP201-0815	87WP212-BL01	87WP212-QTR2	87WP212-QTR3	87WP212-1009
Sample Date		04/25/07	07/11/07	10/07/07	01/08/08	01/08/08	04/08/08	08/20/08	10/08/09	10/19/11	01/14/13	05/05/14	05/05/14	08/04/15	04/24/07	01/08/08	04/09/08	10/06/09
Chemical Name																		
Volatile Organic Compounds (UG/L)																		
1,2-Dichloroethene (total)	--	NA	NA	NA	NA	NA	NA	NA	**19**	NA	NA	NA	NA	NA	NA	NA	NA	**9.8**
2-Butanone	--	10 U	10 U	1,000 U	**13 J**	**22 J**	**9.3 J**	**4.4 J**	0.5 R	2.5 R	12 U	4 U	4 U	NA	10 U	10 UJ	10 U	0.5 R
Acetone	--	10 UJ	12 B	1,000 UJ	**38 J**	**64 J**	**13 J**	**15 J**	1.4 B	2.5 UJ	12 U	5 U	5 U	NA	10 U	10 UJ	10 UJ	1.2 U
Chloroform	--	1 U	1 U	100 U	1 U	1 U	1 U	1 U	0.1 U	0.5 UJ	1 U	0.2 U	0.2 U	NA	1 U	1 U	1 U	0.1 U
cis-1,2-Dichloroethene	70	1 U	1 U	**38 J**	**51**	**59**	**41**	**26**	**19**	**3.4 J**	**4.8**	**7.7**	**8**	**11**	**8.8**	**9.3**	**9.6**	**9.7**
m- and p-Xylene	--	NA	NA	NA	NA	NA	NA	NA	0.2 U	1 UJ	2 U	NA	NA	NA	NA	NA	NA	0.2 U
Methyl acetate	--	1 U	**52**	100 U	1 U	1 U	1 U	1 U	0.1 U	0.5 UJ	1 U	0.5 U	0.5 U	NA	1 U	1 U	1 U	0.1 U
Methylene chloride	--	1 U	1 U	**52 J**	1 U	1 U	1 U	1 U	0.1 U	0.5 UJ	5 U	1 U	1 U	NA	1 U	1 U	1 U	0.1 U
o-Xylene	--	NA	NA	NA	NA	NA	NA	NA	0.1 U	0.5 UJ	1 U	NA	NA	NA	NA	NA	NA	0.1 U
Tetrachloroethene	5	**42**	**12**	**280 J**	1 U	1 U	1 U	1 U	0.11 U	0.5 UJ	1 U	0.2 U	0.2 U	0.2 U	**12**	**25**	**25**	**19**
Toluene	--	1 U	1 U	100 U	1 U	1 U	1 U	**1.2**	**0.12 J**	0.5 UJ	1 U	**0.1 J**	0.2 U	NA	1 U	1 U	1 U	0.1 U
trans-1,2-Dichloroethene	--	1 U	1 U	100 U	1 U	1 U	1 U	1 U	**0.31 J**	0.5 UJ	**2.1**	**0.63 J**	**0.64 J**	NA	1 U	1 U	1 U	0.1 U
Trichloroethene	5	1 U	1 U	100 U	1 U	1 U	1 U	1 U	**2.8**	**7 J**	**6.4**	**11**	**11**	**3**	**33**	**32**	**34**	**22**
Vinyl chloride	--	1 U	1 U	100 U	**1.2**	**1.2**	**1.4 J**	**2.7**	**2.8**	**2.2 J**	**1.3 J**	**1.7**	**1.6**	NA	1 U	1 U	1 U	0.1 U
Xylene, total	--	1 U	1 U	100 U	1 U	1 U	1 U	1 U	0.1 U	NA	2 U	0.2 U	0.2 U	NA	1 U	1 U	1 U	0.1 U
Semivolatile Organic Compounds (UG/L)																		
No Detections																		
Dioxin/Furans (NG/L)																		
No Detections																		
Total Metals (UG/L)																		
Iron	--	NA	NA	NA	**140,000**	**160,000**	**70,000 J**	**66,000**	NA	NA	NA	NA	NA	NA	NA	**5,300**	NA	NA
Manganese	--	NA	NA	NA	**24,000**	**27,000**	**13,000**	**9,820**	NA	NA	NA	NA	NA	NA	NA	**650**	NA	NA
Dissolved Metals (UG/L)																		
Iron, Dissolved	--	**54 K**	**79,000 J**	**110,000 K**	NA	NA	NA	NA	**33,000**	**19,400**	**20,500**	**12,800**	NA	**13,800**	**5,200 L**	NA	NA	**3,370**
Manganese, Dissolved	--	**160**	**34,000**	**27,000**	NA	NA	NA	NA	**4,980**	**4,240**	**4,750**	**2,850**	NA	**2,600**	**640**	NA	NA	**439**
Wet Chemistry																		
Alkalinity (mg/l)	--	**26**	**290**	**320 J**	**360 L**	**340 L**	**200**	**210**	**115**	**96**	**90**	**66.9**	NA	**76.3**	**72**	**70 L**	NA	**297**
Carbon dioxide (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	**173**	**83**	NA	**74**	NA	NA	NA	NA
Chemical oxygen demand (mg/l)	--	10 U	**272**	**50,000**	**280**	**280**	**110**	**41.6 L**	**25**	**7.41 J**	**45**	**5.84 J**	NA	**24.6**	10 U	10 U	NA	**9.1**
Chloride (mg/l)	--	**13**	**19**	**8.7 L**	**15 L**	**15 L**	**16**	**18.2**	**13**	**12 K**	**9.7**	**9.5**	NA	**10.2**	**7.5**	**10 L**	NA	**13**
Ethane (mg/l)	--	0.01 U	0.01 U	0.01 U	**7.60E-05**	**9.70E-05**	**7.10E-05**	1.00E-03 U	0.002 U	5.00E-04 U	0.00196 U	**3.40E-04 J**	NA	**4.50E-04 J**	0.01 U	**8.60E-05**	NA	0.002 U
Ethene (mg/l)	--	0.01 U	0.01 U	0.01 U	**2.50E-04**	**3.10E-04**	**3.20E-04**	1.00E-03 U	0.002 U	5.00E-04 U	**0.00192 J**	**9.50E-04 J**	NA	**0.0015 J**	0.01 U	**8.30E-04**	NA	0.002 U
Methane (mg/l)	--	0.01 U	0.01 U	**5.5**	**15**	**18**	**23**	**12**	**0.97**	**0.53**	**2.77 D**	**3.1**	NA	**1.5**	0.01 U	**0.0017**	NA	5.00E-04 B
Nitrate (mg/l)	--	2 UL	2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.25 U	0.05 U	0.05 U	0.21 U	**0.0541 J**	NA	0.05 U	2 U	0.5 U	NA	0.05 U
Nitrate/Nitrite (mg/l)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**12**	1 U	1 U	1 UL	1 UL	1 U	0.5 UJ	**11**	**8.9 L**	**5.5**	**7.88**	NA	**6.63**	**13**	**11 L**	NA	**16**
Sulfide (mg/l)	--	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2 U	1 U	0.5 U	**0.6 J**	**0.0547 J**	NA	**0.0453 J**	0.2 U	0.2 U	NA	1 U
Total organic carbon (TOC) (mg/l)	--	1 U	**82**	**8,900**	**110**	**110**	**41**	**4 L**	**1.5**	1.7 B	**1.5**	**1.35**	NA	**0.679 J**	**2.7**	1 U	NA	**1.3**

Notes:
Exceeds all criteria
Bold indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
D - Compound identified in an analysis at a secondary dilution factor
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
MG/L - Milligrams per liter
NG/L - Nanograms per liter
UG/L - Micrograms per liter

TABLE 10-3
Historical Constituents Detected in Groundwater at SWMU 87
Third Five-Year Review Report
Former NSWC-White Oak

Station ID	**CLEAN WO PRGs SWMU 87**					
Sample ID		87WP212-1011	87WP212-0113	87WP212-0514	87WP212-0815	87WP212P-0815
Sample Date		10/18/11	01/14/13	05/05/14	08/04/15	08/04/15
Chemical Name						
Volatile Organic Compounds (UG/L)						
1,2-Dichloroethene (total)	--	NA	NA	NA	NA	NA
2-Butanone	--	2.5 UL	12 U	4 U	NA	NA
Acetone	--	2.5 UL	12 U	5 U	NA	NA
Chloroform	--	0.5 UL	1 U	0.2 U	NA	NA
cis-1,2-Dichloroethene	70	**6.6 J**	**8.6**	**8.9**	**7.6**	**8**
m- and p-Xylene	--	1 UL	2 U	NA	NA	NA
Methyl acetate	--	0.5 UL	1 U	0.5 U	NA	NA
Methylene chloride	--	**13 J**	5 U	1 U	NA	NA
o-Xylene	--	0.5 UL	1 U	NA	NA	NA
Tetrachloroethene	5	**1 L**	**15**	**13**	**8 J**	**10 J**
Toluene	--	0.5 UL	1 U	0.2 U	NA	NA
trans-1,2-Dichloroethene	--	0.5 UL	1 U	0.2 U	NA	NA
Trichloroethene	5	**4.8 L**	**15**	**14**	**7.8**	**9.1**
Vinyl chloride	--	0.5 UL	1 U	0.2 U	NA	NA
Xylene, total	--	NA	2 U	0.2 U	NA	NA
Semivolatile Organic Compounds (UG/L)						
No Detections						
Dioxin/Furans (NG/L)						
No Detections						
Total Metals (UG/L)						
Iron	--	NA	NA	NA	NA	NA
Manganese	--	NA	NA	NA	NA	NA
Dissolved Metals (UG/L)						
Iron, Dissolved	--	**5,600**	**6,790**	**4,960**	**3,670**	NA
Manganese, Dissolved	--	**744**	**880**	**553**	**477**	NA
Wet Chemistry						
Alkalinity (mg/l)	--	**69**	**71**	**67.7**	**66.2**	NA
Carbon dioxide (mg/l)	--	NA	**93.6**	**48**	**36**	NA
Chemical oxygen demand (mg/l)	--	2.5 U	**7.3 J**	**3.78 J**	**16.5**	NA
Chloride (mg/l)	--	**11**	**10**	**12.5**	**14.6**	NA
Ethane (mg/l)	--	5.00E-04 U	**0.00122 J**	6.40E-04 U	6.40E-04 U	NA
Ethene (mg/l)	--	5.00E-04 U	**0.00238 J**	**6.70E-04 J**	6.00E-04 U	NA
Methane (mg/l)	--	5.00E-04 U	**0.00387**	**0.0011 J**	**7.20E-04 J**	NA
Nitrate (mg/l)	--	0.05 U	0.21 U	**0.055 J**	**0.0454 J**	NA
Nitrate/Nitrite (mg/l)	--	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	**19 L**	**31**	**16.4**	**13.5**	NA
Sulfide (mg/l)	--	0.5 U	1 U	0.02 U	0.02 U	NA
Total organic carbon (TOC) (mg/l)	--	**2.1**	**2.3**	**1.36**	**0.761 J**	NA

Notes:

Exceeds all criteria

Bold indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

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

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

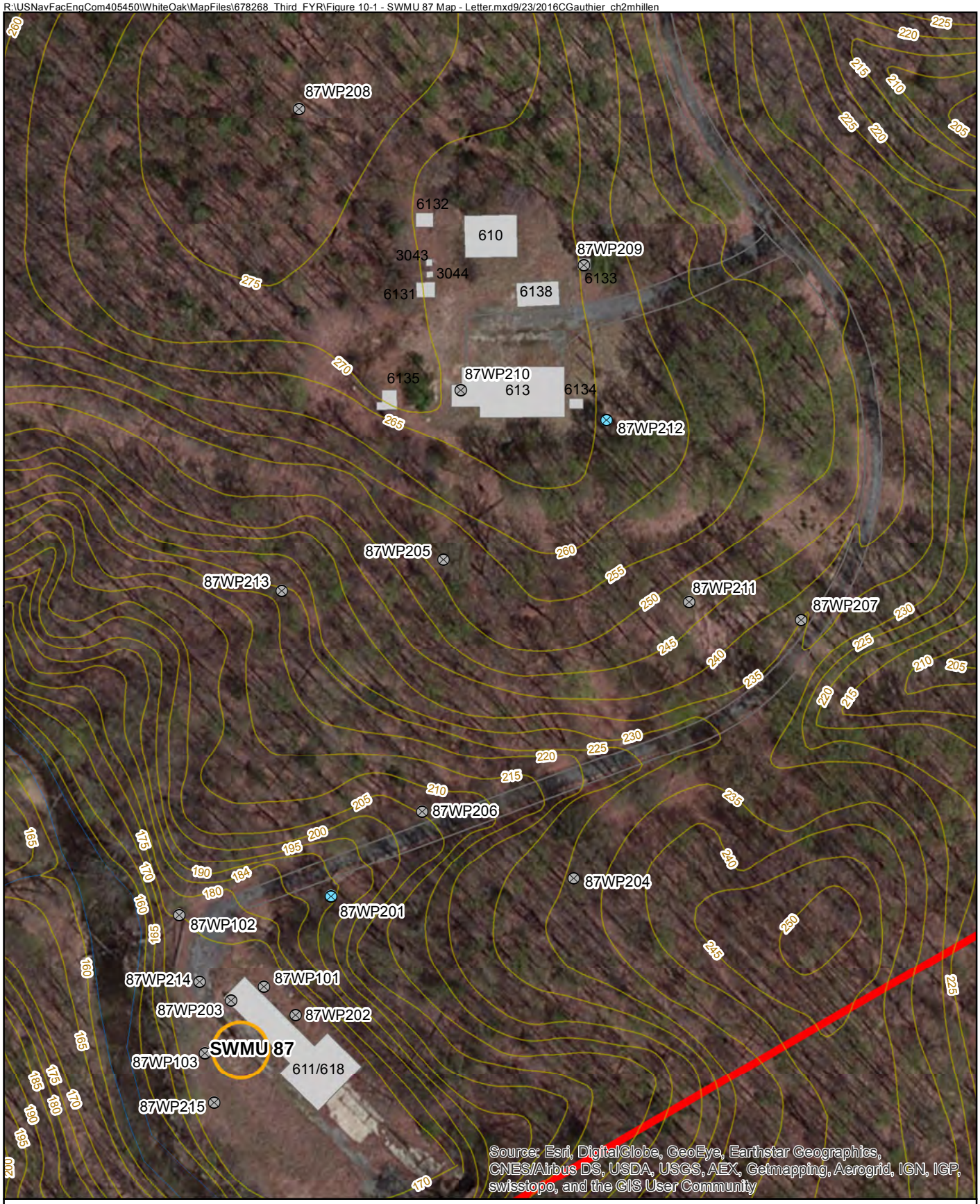
U - The material was analyzed for, but not detected

MG/L - Milligrams per liter

NG/L - Nanograms per liter

UG/L - Micrograms per liter

R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 10-1 - SWMU 87 Map - Letter.mxd9/23/2016CGauthier_ch2mhillen



Legend

- 2015 Long Term Monitoring Well
- Monitoring Well
- Topographic Contours (ft msl)
- Former NSWC – White Oak Facility Boundary
- Water Bodies
- Roads
- Site Boundary
- Abandoned Building and Other Structures

N

0 60 120 Feet

Figure 10-1
SWMU 87 Map
Third Five-Year Review Report
Former NSWC-White Oak
Silver Spring, Maryland

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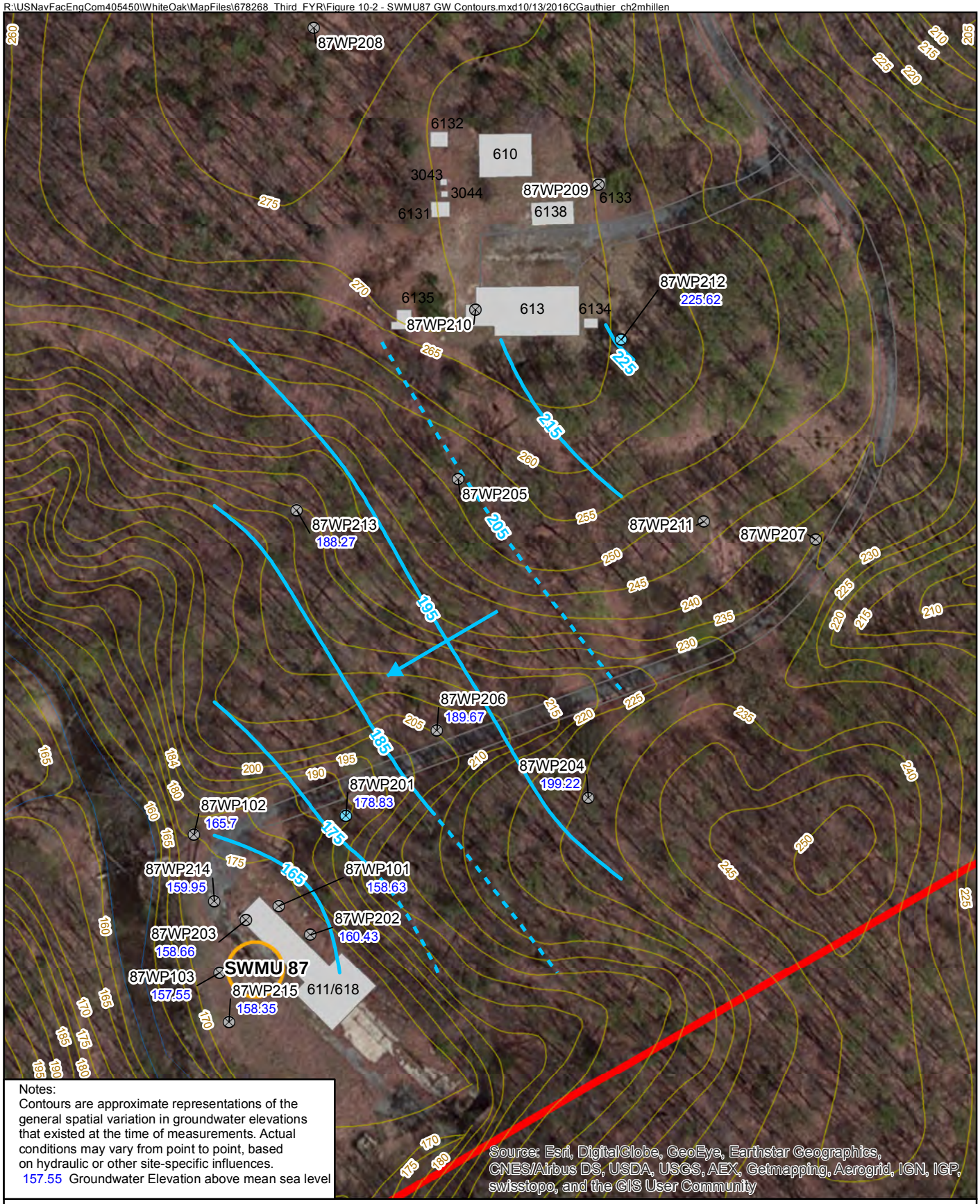
R:\USNavFacEngCom405450\WhiteOak\MapFiles\678268_Third_FYR\Figure 10-2 - SWMU87 GW Contours.mxd10/13/2016CGauthier_ch2mhillen



SECTION 11

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 12

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Appendix A
Public Notice

Public Meeting and Five-Year Review of Environmental Cleanup Actions

Federal Research Center at White Oak
(Former Naval Surface Warfare Center – White Oak)
Silver Spring, Maryland

Public Meeting

The former Naval Surface Warfare Center – White Oak (presently known as the Federal Research Center at White Oak) will host its next Restoration Advisory Board (RAB) meeting:

Where: **White Oak Library**
11701 New Hampshire Avenue, Silver Spring, Maryland

When: **Wednesday, April 20, 2016, 6:00 p.m.**

The RAB is a Navy/community advisory group that meets to discuss environmental restoration activities at the former Naval Surface Warfare Center – White Oak. **The public is welcome to attend RAB meetings to learn more about the environmental restoration program.**

Five-Year Review of Environmental Cleanup Actions

In addition, the Department of the Navy, with concurrence from the Maryland Department of the Environmental (MDE), is beginning a Five-Year Review of eight ongoing remedial (environmental cleanup) actions at the installation.

The purpose of a Five-Year Review is to ensure that cleanup actions are continuing to protect human health and the environment. A site is included in the Five-Year Review if contaminants remain above levels that would allow for unlimited use and unrestricted exposure and if there is a signed 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.

This is the third Five-Year Review for White Oak. The Navy will submit draft findings of the Five-Year Review to MDE in September 2016. The final report will be made available to the public by April 2017.

Community members who have questions, comments, or information about the effectiveness of the remedies that would help the review team are encouraged to contact:

Ms. Armalia Berry-Washington
NAVFAC Washington
(202) 685-3273
armalia.berry-washin@navy.mil

For More Information

The Administrative Record for technical reports and other information about the environmental cleanup program, including all documents that will be used as the basis for this review, is available to the public at the following website: ***http://www.bracpmo.navy.mil/brac_bases/northeast/former_warfare_center_white_oak/documents.html.*** Public computer access, as well as a copy of the Five-Year Review document, can be obtained at: **White Oak Library, 11701 New Hampshire Avenue, Silver Spring, Maryland.**

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

Appendix B-1
Third 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:** 6/30/16
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

Remedy Includes: (Check all that apply)

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

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/CH2M
Emily Curbo/CH2M
Laura Lampshire/CH2M
Anne Laurie Wong/GSA

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 Gates at OU2 landfill are locked; gate providing access to OU2 monitoring wells is 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 - 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 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)

☑ 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: 6/30/16**
Location and Region: NSWC White Oak – Region 3	**EPA ID: MD0170023444**
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

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 / CH2M
Emily Curbo / CH2M
Laura Lampshire / CH2M
Anne Laurie Wong / GSA

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 Shaw building broken into Nov. 2015 - 2 generators stolen

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 _____

_____

_____

_____

_____

_____

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 ☑ 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 5/13	**Date of inspection:** 6/30/16
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

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 / CH2M
Emily Curbo / CH2M
Laura Lampshire / CH2M
Anne Laurie Wong / GSA

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 Site 13 offsite access road – downhill portion washed-out
_____

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

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 ☑ 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 7	**Date of inspection: 6/30/16**
Location and Region: NSWC White Oak – Region 3	**EPA ID: MD0170023444**
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

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/CH2M
Emily Curbo/CH2M
Laura Lampshire/CH2M
Anne Laurie Wong/GSA

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 Site 7 exceptionally overgrown.

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 ☑ Good condition
☑ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks overgrown vegetation observed at Site 7 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.

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 9	**Date of inspection:** 6/30/16
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

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/CH2M
Emily Curbo/CH2M
Laura Lampshire/CH2M
Anne Laurie Wong/GSA

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 Site 9 in generally good condition, but vegetation is overgrown

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 ☑ 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, the COC concentrations (with the exception of RDX) are below the PRGs.

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 11	**Date of inspection:** 6/30/16
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

Remedy Includes: (Check all that apply)

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

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 / CH2M
Emily Curbo / CH2M
Laura Lampshire / CH2M
Anne Laurie Wong / BSA

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 _____

_____

_____

_____

_____

_____

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 ☑ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks Monitoring well 11MW210S was destroyed during construction of the FDA campus.

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

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:** 6/30/16
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

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 / CH2M
Emily Curbo / CH2M
Laura Lampshire / CH2M
Anne Laurie Wong / GSA

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 Access road to monitoring wells is steep, blocked by a fallen tree, and exhibits wash-out damage.

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

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 ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks Downgradient monitoring wells 49GW201S, 49GW201D and 49201DD were washed out and subsequently abandoned in June 2015.

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, the VOC concentrations, although decreasing following the ISCO application, have generally stabilized with the exception of several monitoring wells where concentrations continue to fluctuate and increase (49GW207D, 49GW206D, and 49GW208D)

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: SWMU 87	**Date of inspection:** 6/30/16
Location and Region: NSWC White Oak – Region 3	**EPA ID:** MD0170023444
Agency, office, or company leading the five-year review: NAVFAC Washington	**Weather/temperature:** 82°F, mostly sunny

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 / CH2M
Emily Curbo / CH2M
Laura Lampshire / CH2M
Anne Laurie Wong / USA

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 road partially blocked by fallen tree limbs
_____

B. Other Site Conditions

Remarks Wells appear to be in good condition, but somewhat overgrown vegetation. Access road to site partially obstructed.

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 ☑ 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, the COC concentrations have decreased with the exception of groundwater at 87WP212 (which appears to have been unaffected by the injection.)

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 – June 30, 2016

Site Inspection Photo Log
June 30, 2016
NWSC White Oak, Silver Spring, MD

Site 4 Photos



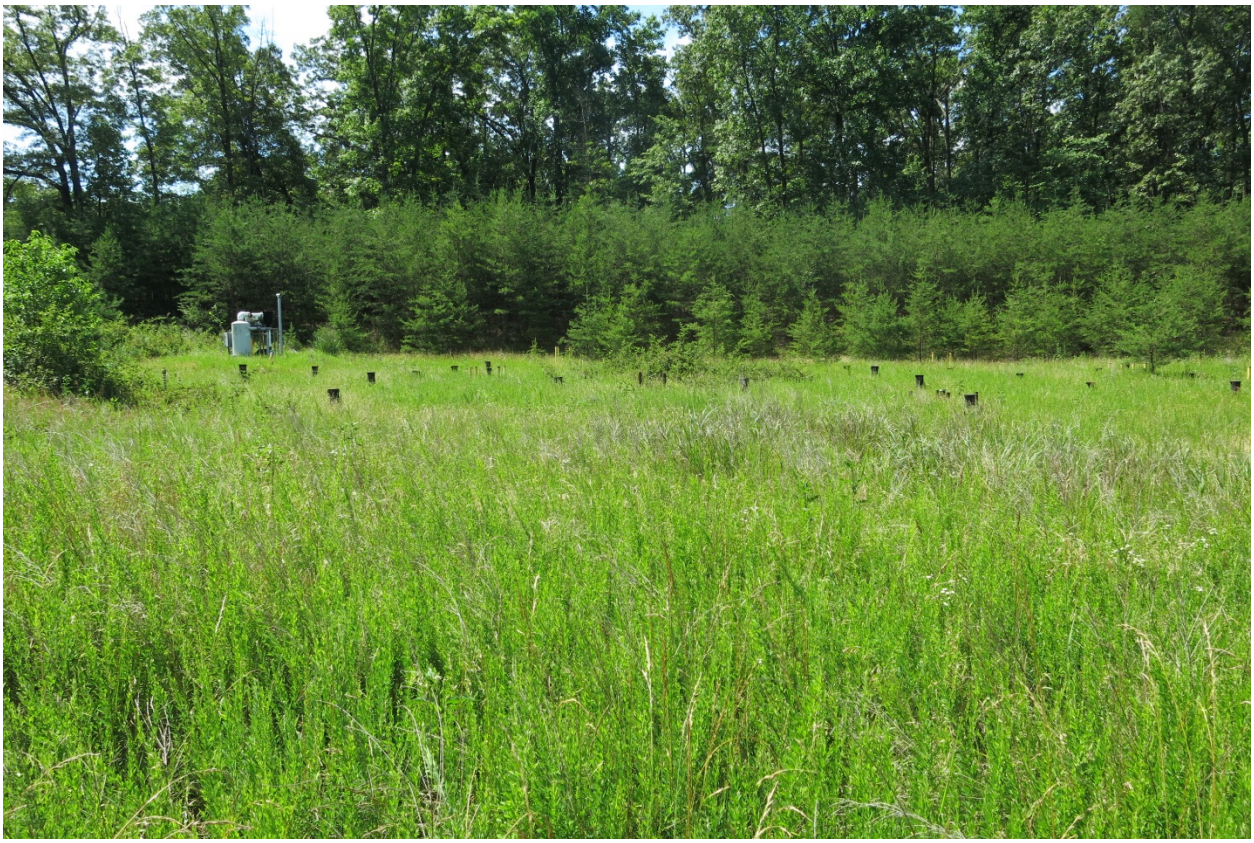
Looking west to monitoring well 04GW09



Looking north from Dahlgren Road to the 200 Series Injection Wells



Looking southwest to the Source Area



Looking south to the Source Area



Looking south - Close-up of Source Area and former Soil Vapor Extraction System

Site 5/13 Photos



Looking south from the access road to monitoring well 13GW300



Looking northwest to monitoring well 13GW202



Looking north to monitoring well 13GW303



Looking northeast to monitoring well 05GW01

Site 7 Photo



Looking northwest to monitoring well 07GW102

Site 9 Photos



Looking northwest to monitoring well 09GW215



Looking southeast to monitoring wells 09GW208 and 09GW209



Looking southeast to monitoring well 09GW205 (to the left in the photo) and monitoring wells 09GW210 and 09GW207 (to the right in the photo)

Site 11 Photos



Looking north to monitoring wells 204S and 204D



Looking northeast to monitoring wells 204S and 204D



Looking northwest to monitoring wells 211S and 211D



Looking northeast to location of former monitoring well 11MW210S (well destroyed during construction of building)

Site 49 Photos



Looking southeast to monitoring wells 49GW206S, 49GW206M, and 49GW206D



Looking northwest to abandoned monitoring well 49GW201DD



Looking north-northwest at collapsed bridge on perimeter road that formerly crossed Paint Branch



Looking north-northwest at collapsed bridge along Perimeter Road that formerly crossed Paint Branch



Looking northwest to abandoned monitoring well 49GW201DD



Looking east-northeast at collapsed bridge along Perimeter Road



Looking south up the Site 49 access road, with injection wells 49INJ12 and 49INJ11 on the east side of the road



Looking north (from the access road) at the former bridge along Perimeter Road



Looking northeast (from the access road) across Paint Branch stream – close-up of the collapsed bridge along Perimeter Road

SWMU 87 Photos



Looking southwest along SWMU 87 access road at monitoring well 87WP201



Looking southwest along SWMU 87 access road at monitoring well 87WP201



Looking east toward monitoring wells 87WP203 and 87WP101



Looking south toward monitoring wells 86WP103 and 87WP215

OU2 Photos



Looking east-southeast through fence at OU2 from the back of the power plant parking lot



Looking east-southeast through fence at OU2 from the back of the power plant parking lot



Looking northeast at OU2 from Bowditch Road



Looking northeast at OU2 from Bowditch Road



Looking northeast at OU2 from Bowditch Road

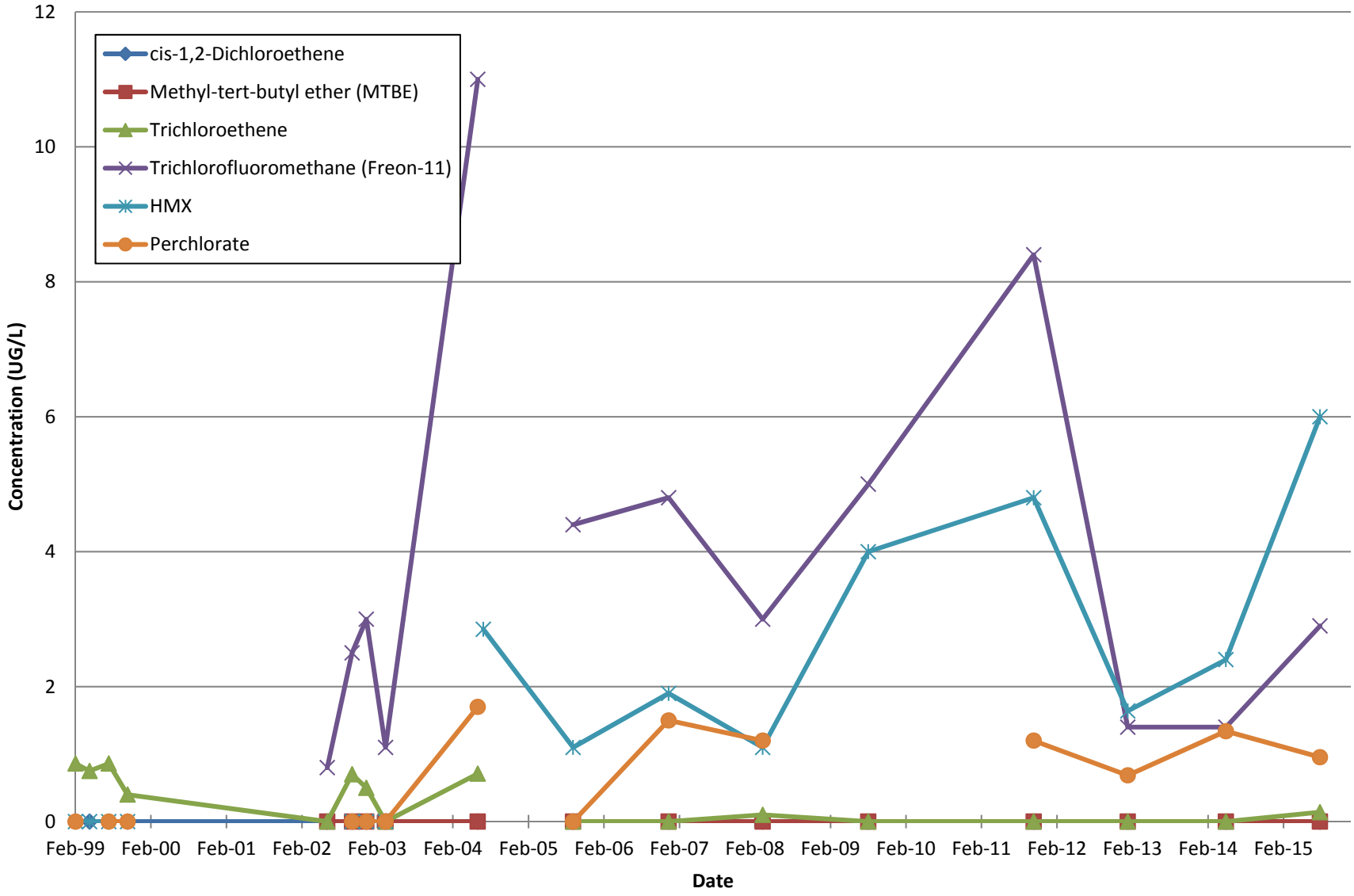


Looking northeast at OU2 from Bowditch Road

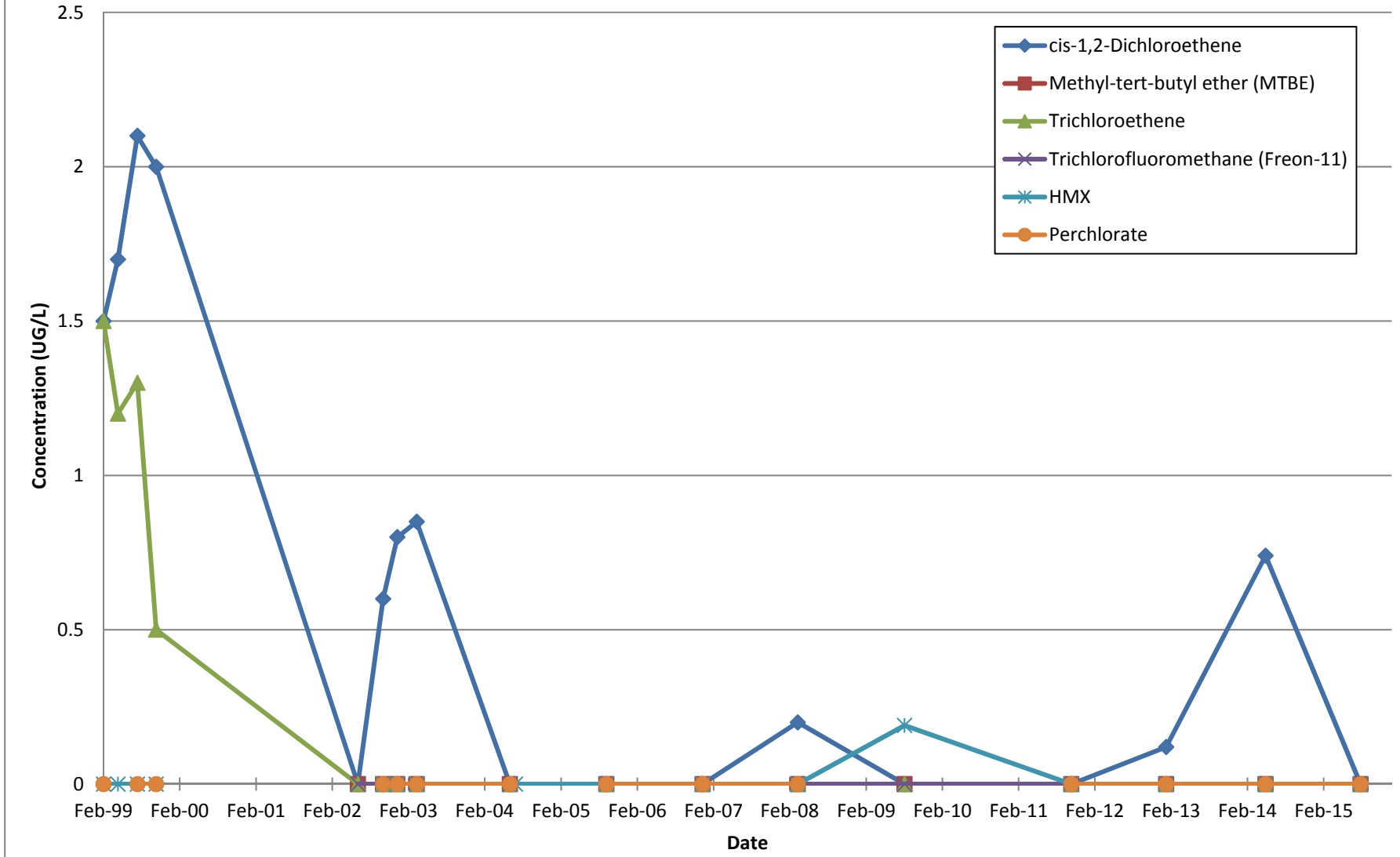
Appendix C
Five-Year Trend Graphs

Appendix C-1
OU2 Groundwater Trend Graphs

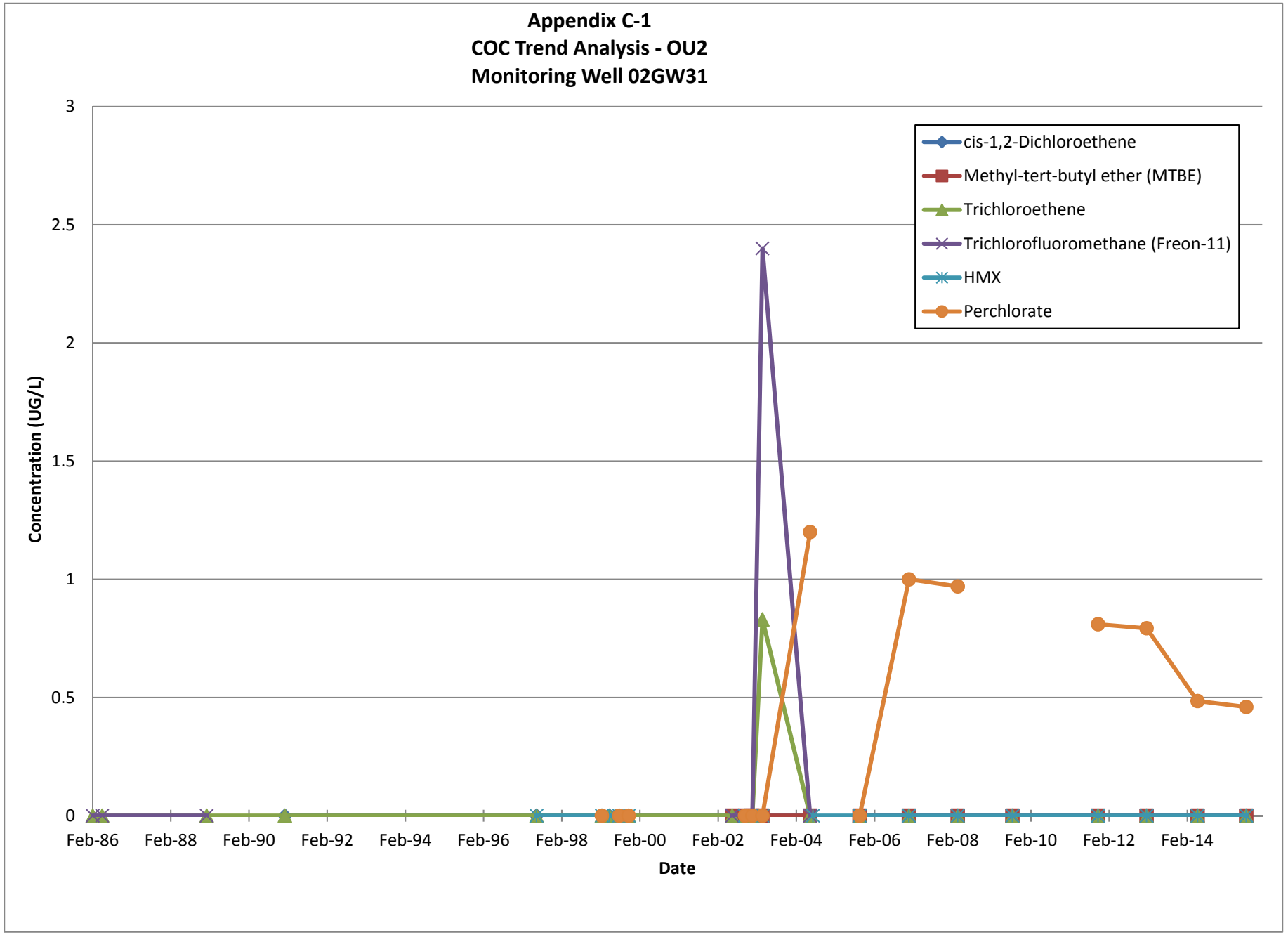
Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW103



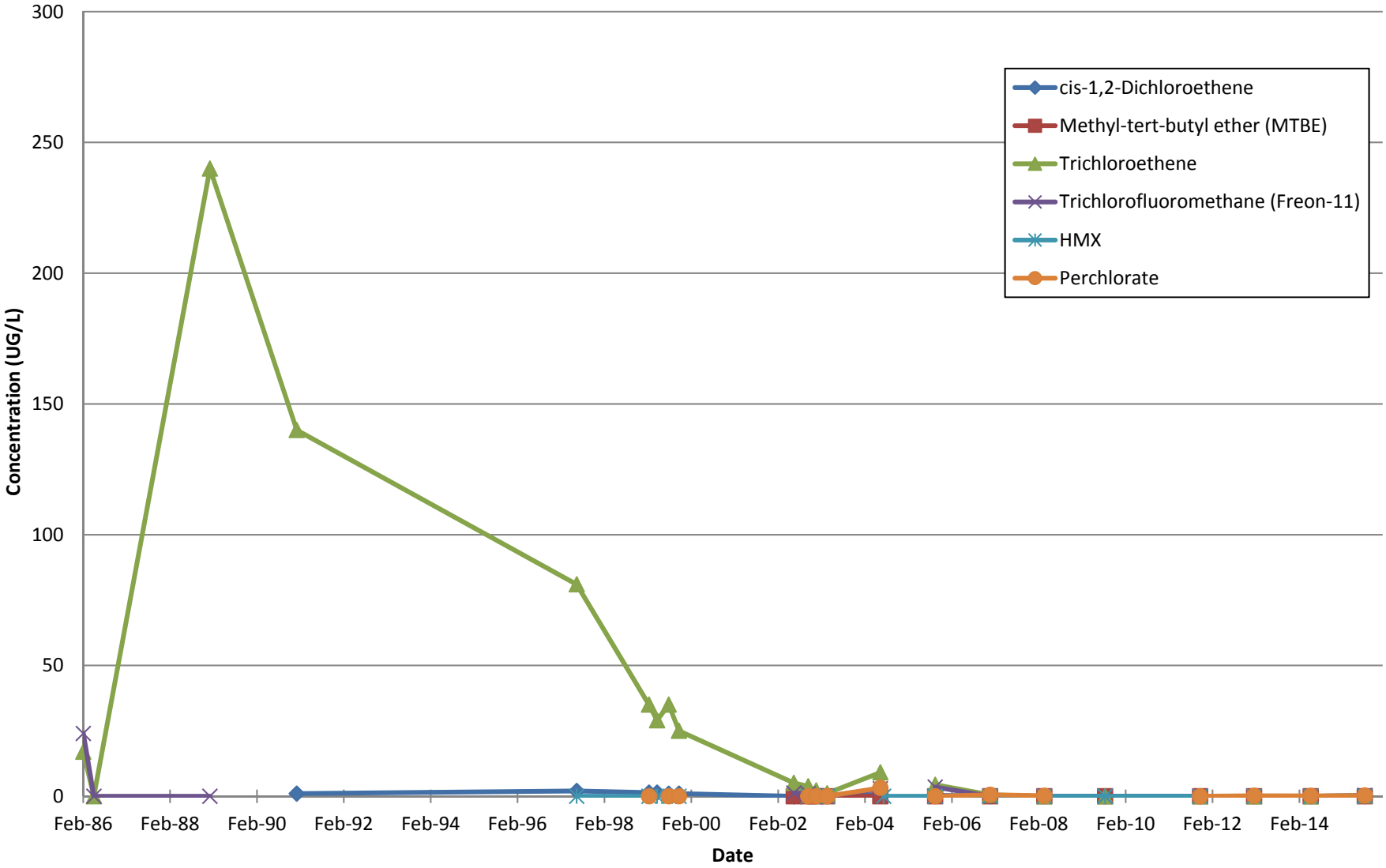
Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW104



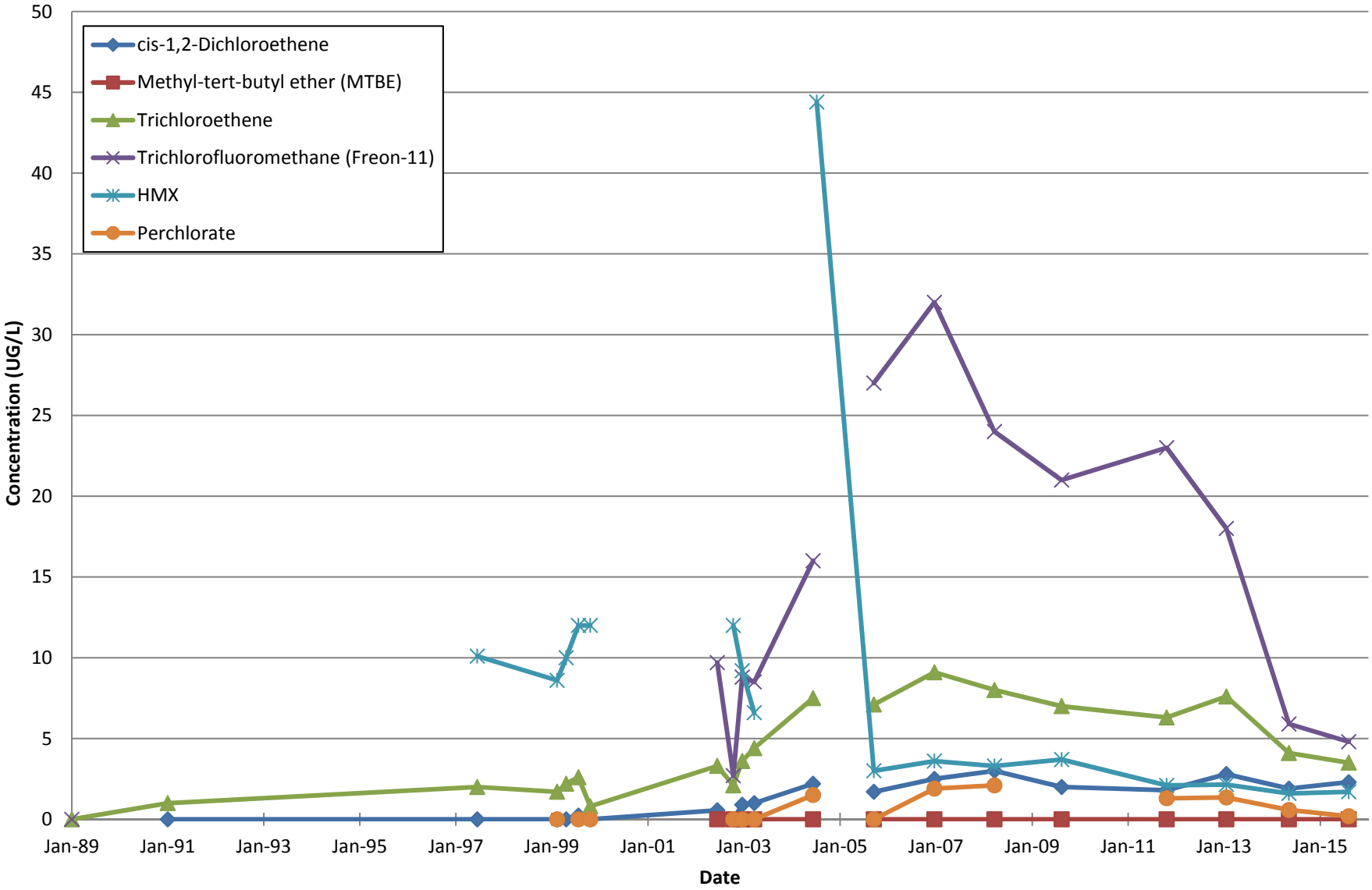
Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW31



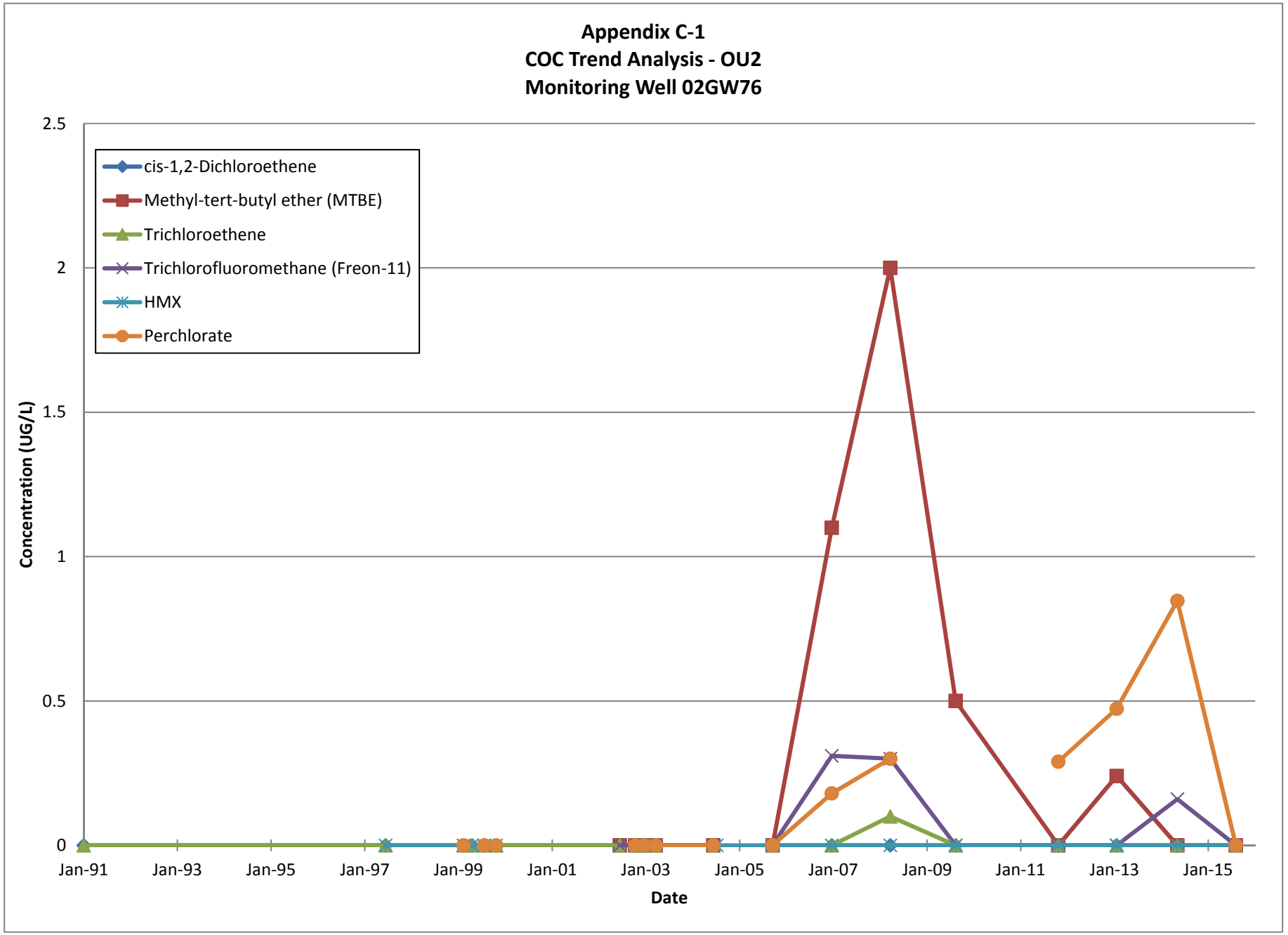
Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW32



Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW45

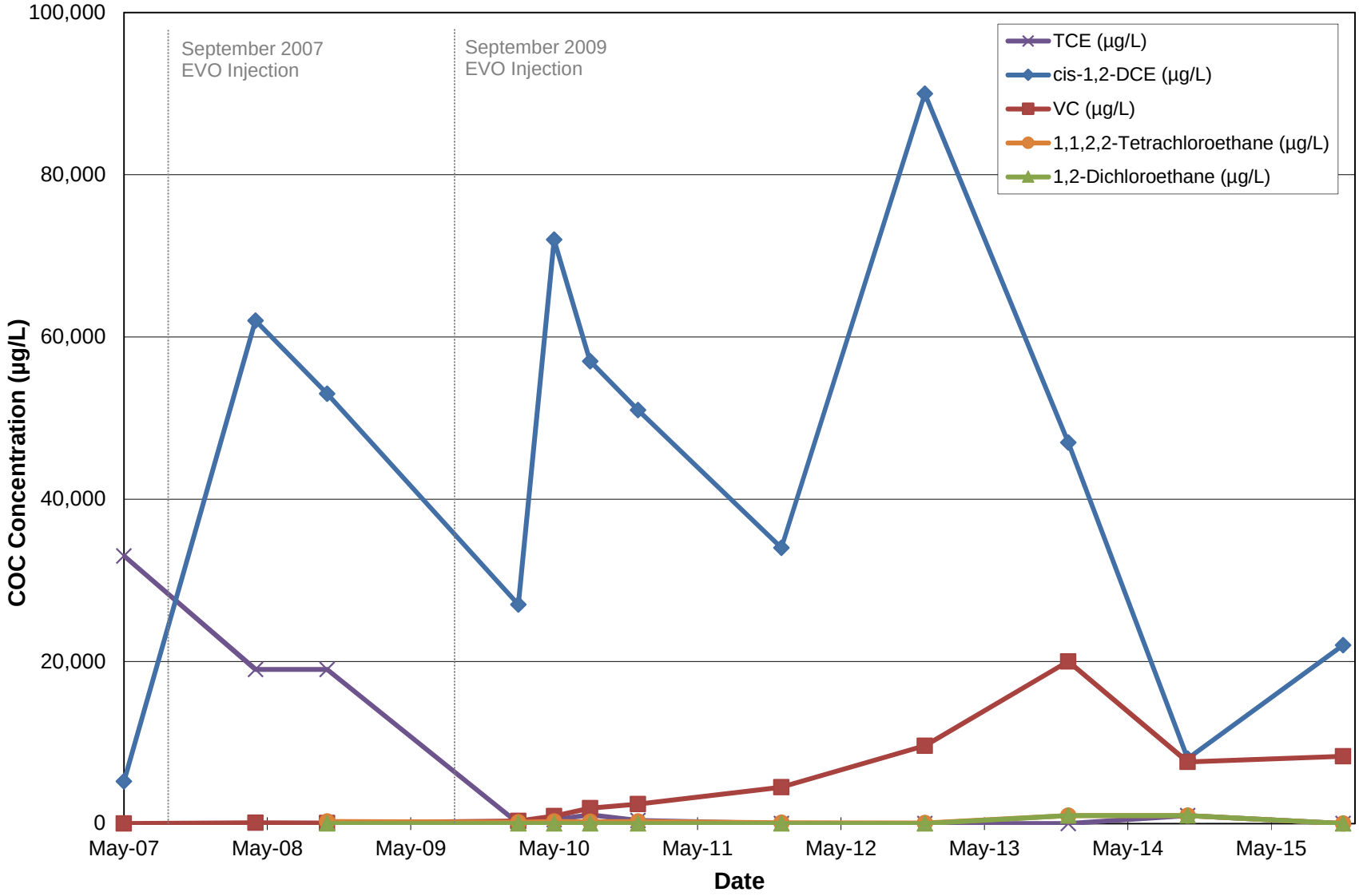


Appendix C-1
COC Trend Analysis - OU2
Monitoring Well 02GW76

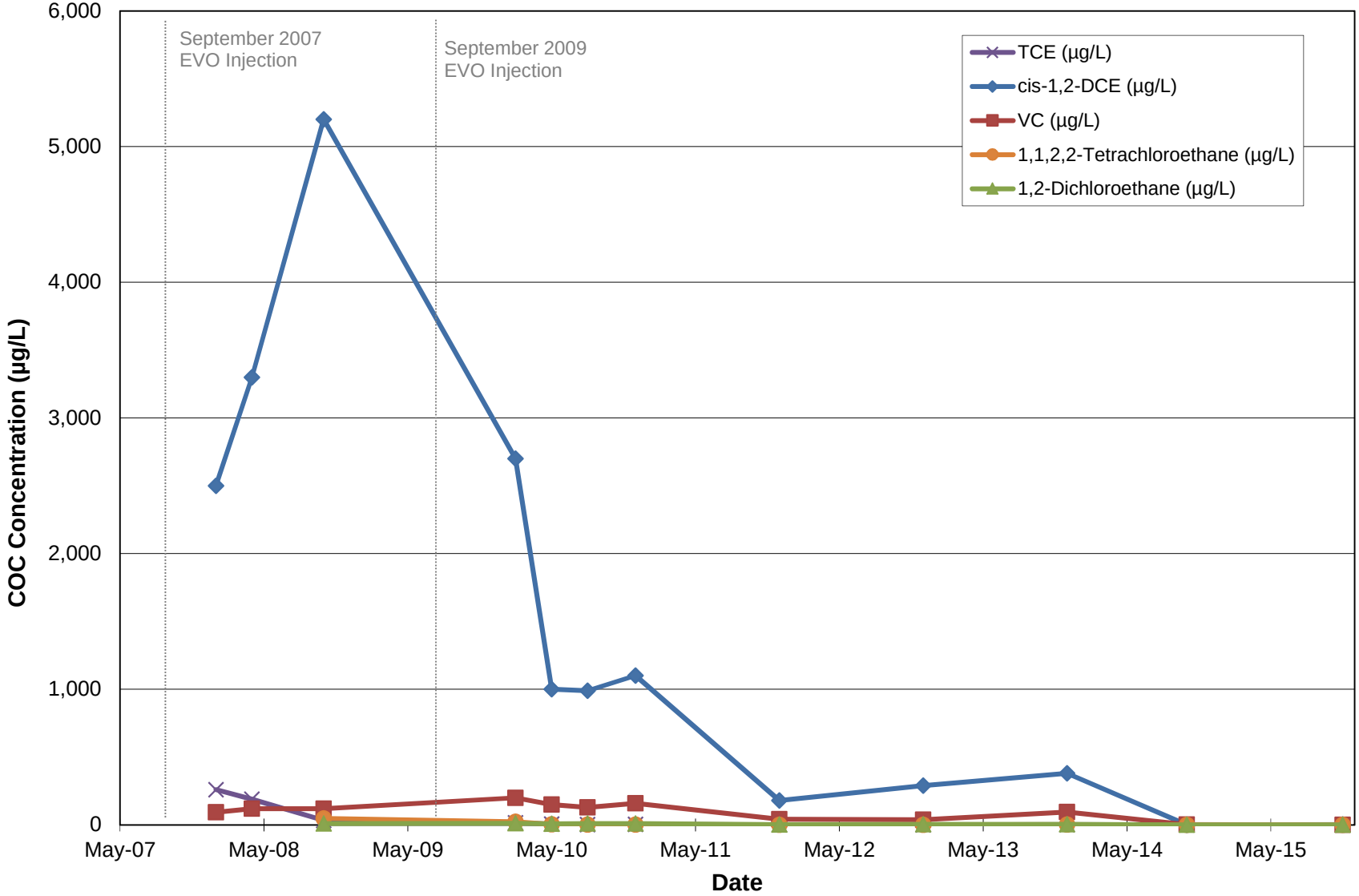


Appendix C-2
Site 4 Groundwater Trend Graphs

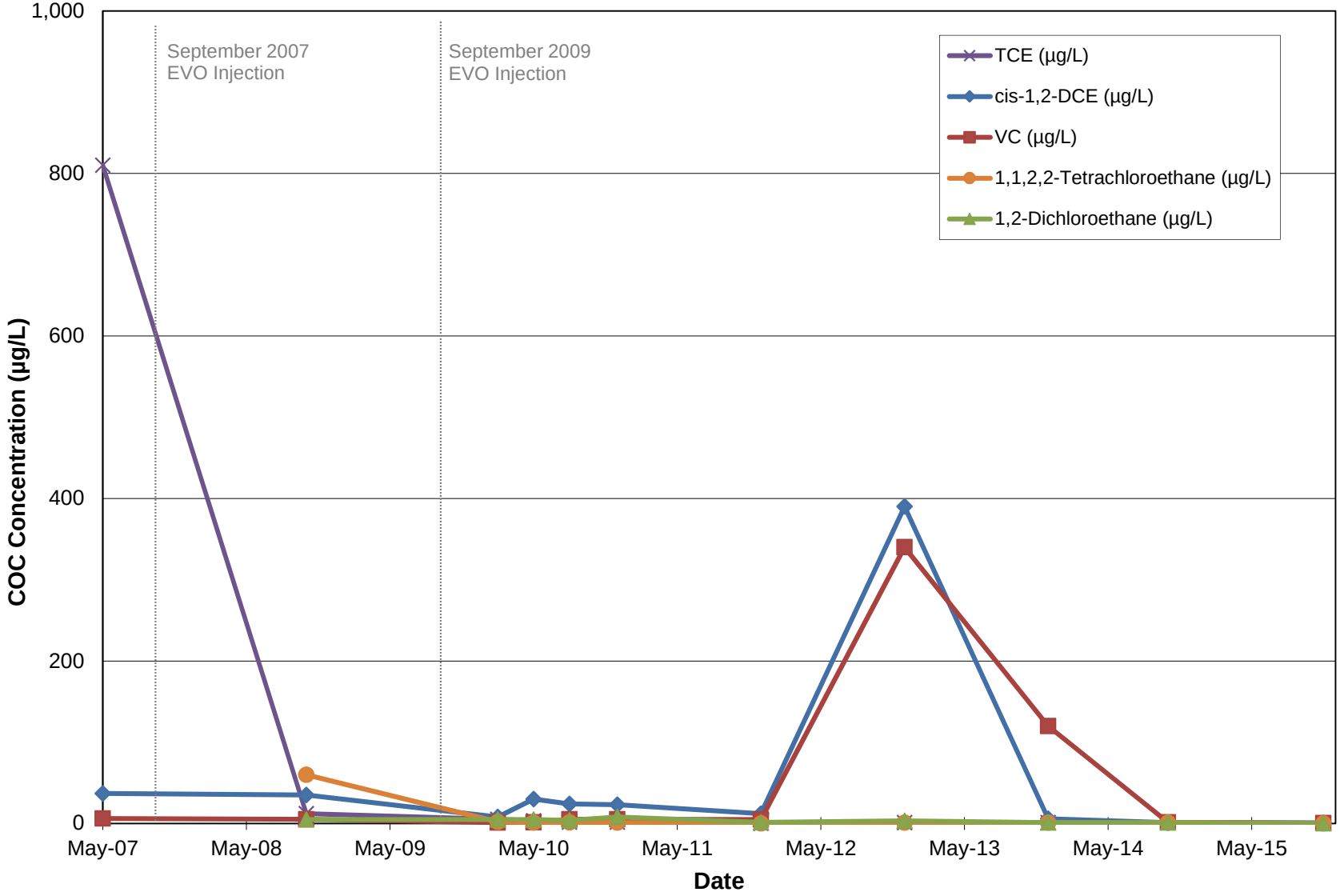
Appendix C-2.1
VOC Trend Analysis - Site 4 Source Area
Monitoring Well 04GW413



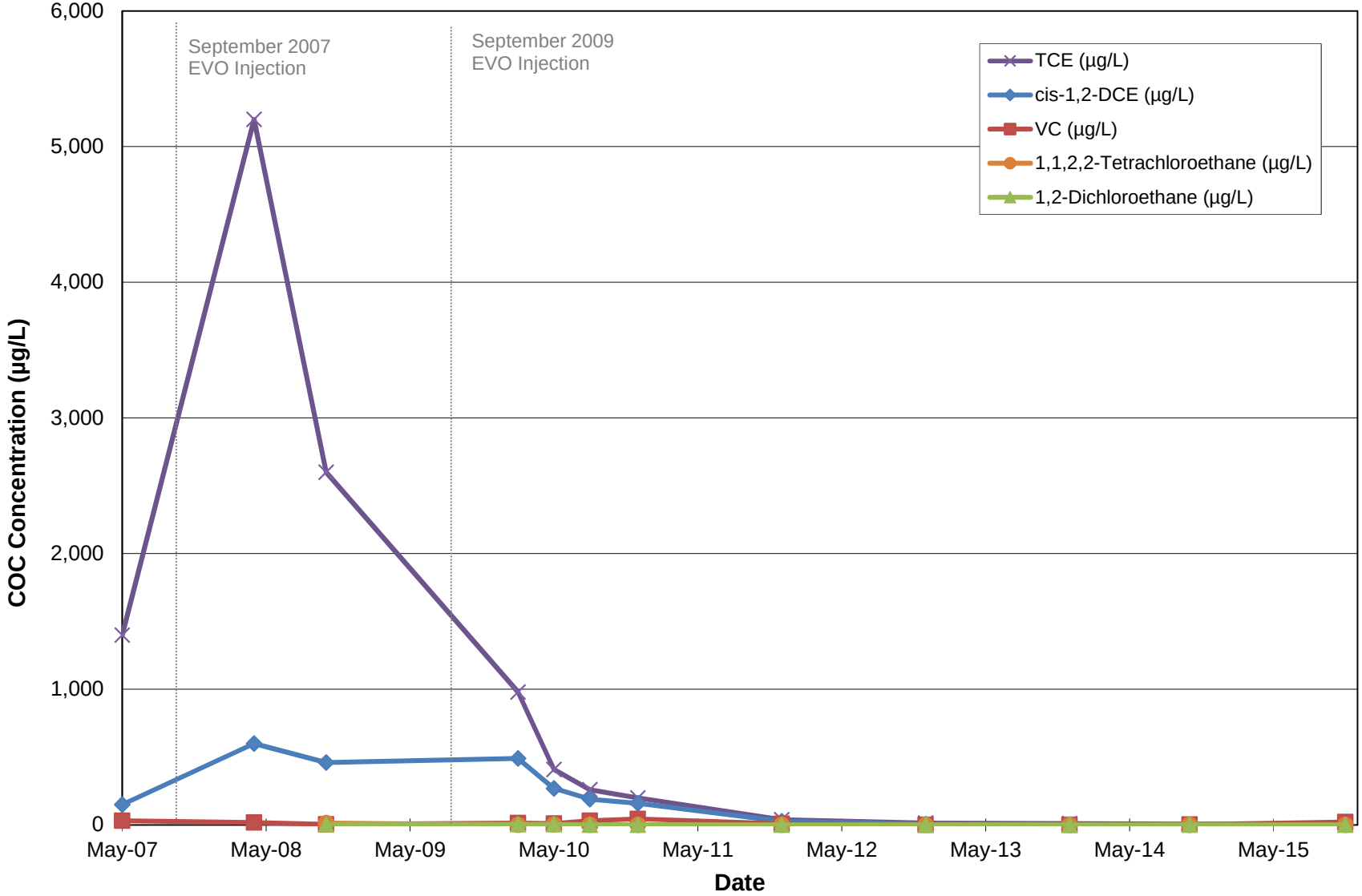
Appendix C-2.1
VOC Trend Analysis - Site 4 Source Area
Monitoring Well 04GW301



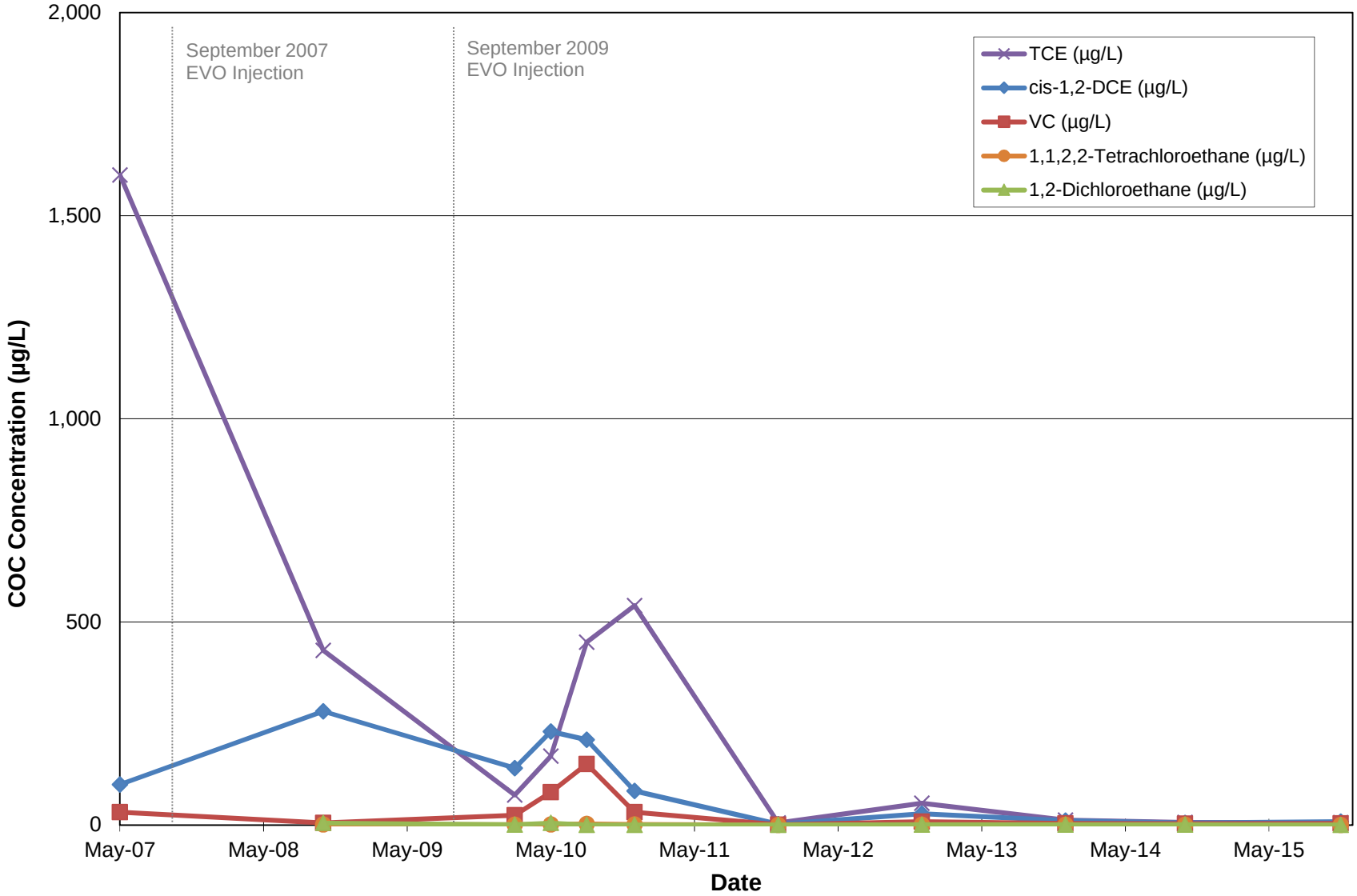
Appendix C-2.1
VOC Trend Analysis - Site 4 Source Area
Monitoring Well 04GW414



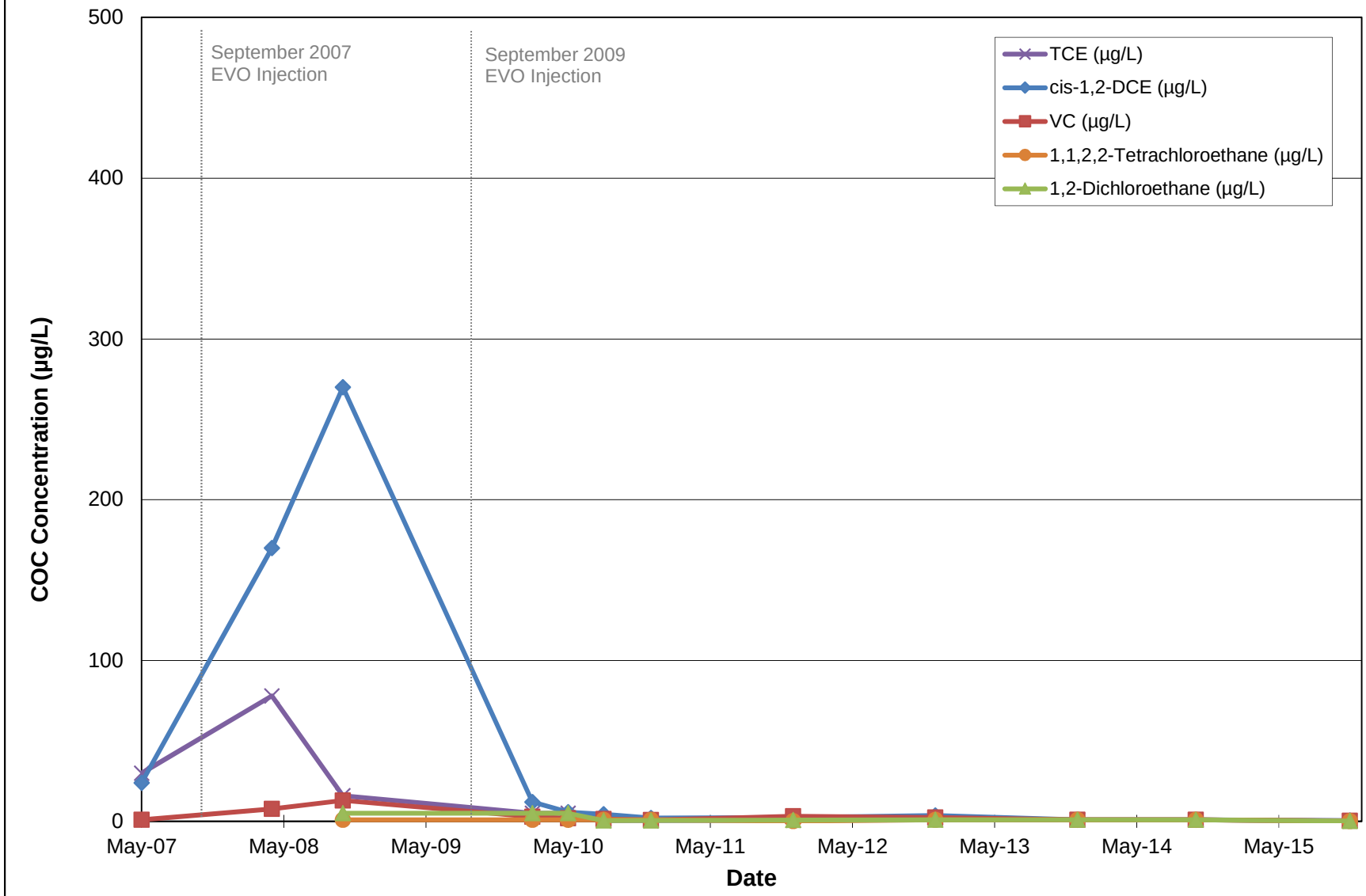
Appendix C-2.1
VOC Trend Analysis - Site 4 Source Area
Monitoring Well 04GW407



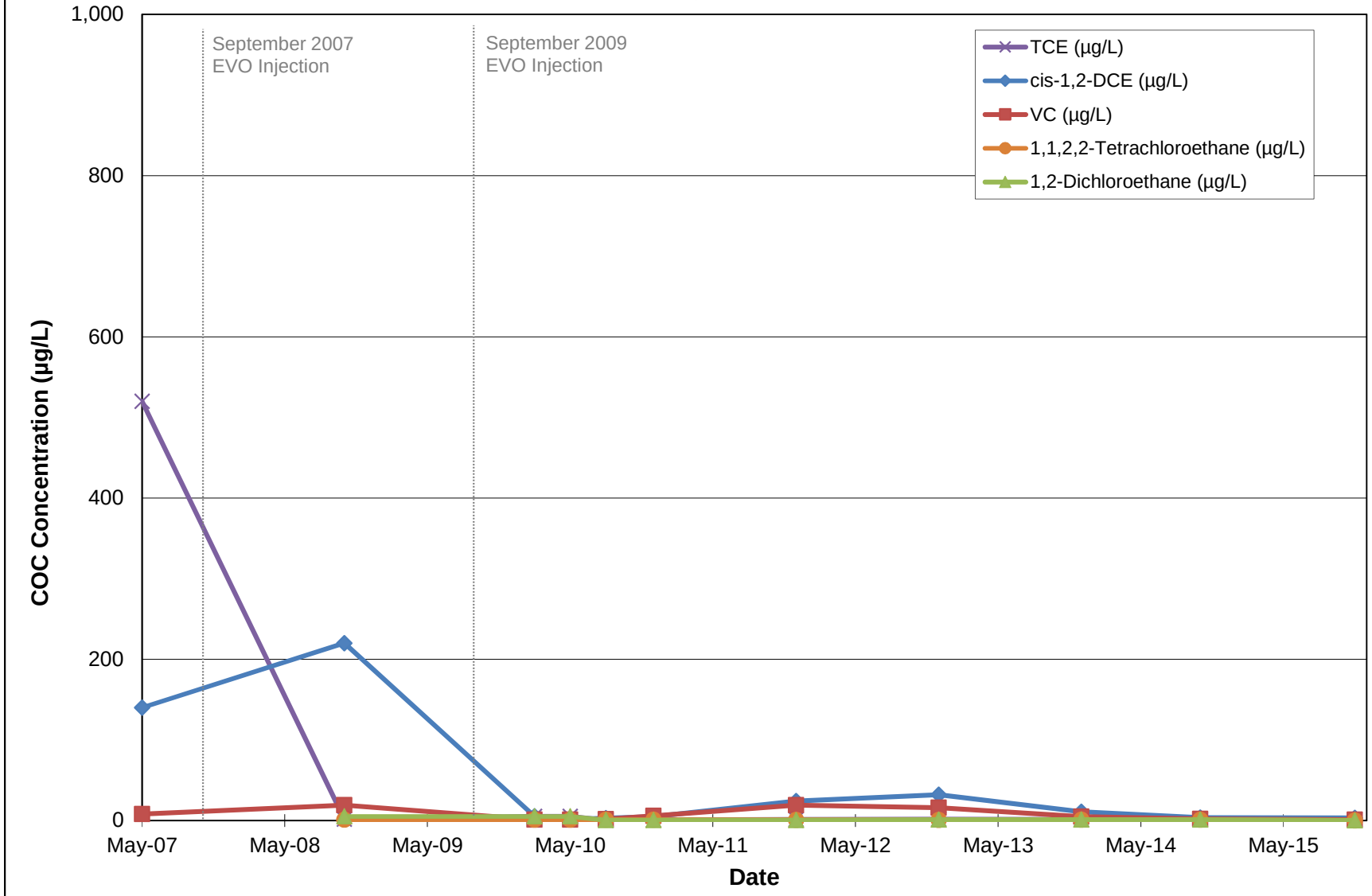
Appendix C-2.1
VOC Trend Analysis - Site 4 100-Series
Monitoring Well 04GW412



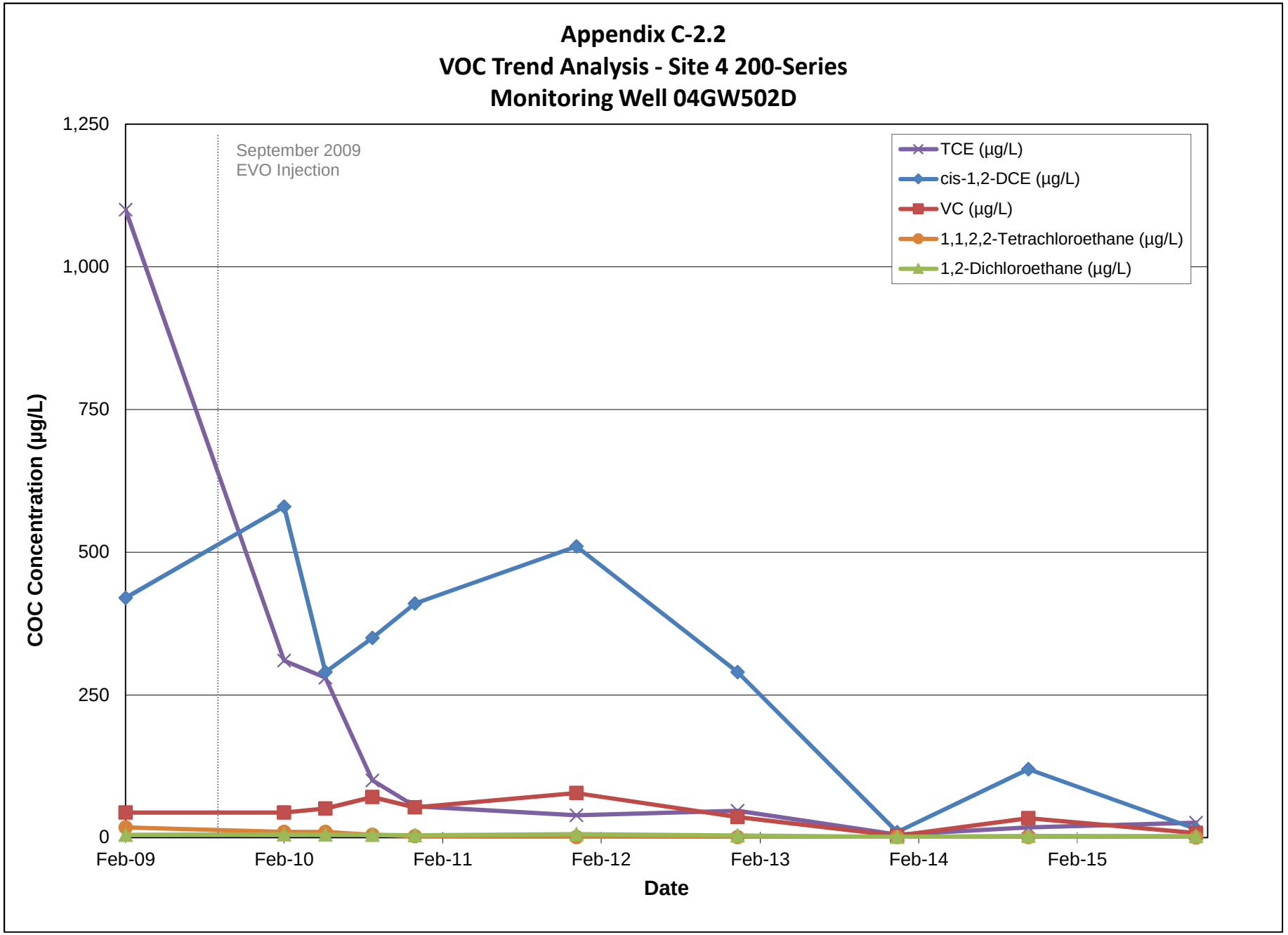
Appendix C-2.1
VOC Trend Analysis - Site 4 100-Series
Monitoring Well 04GW409



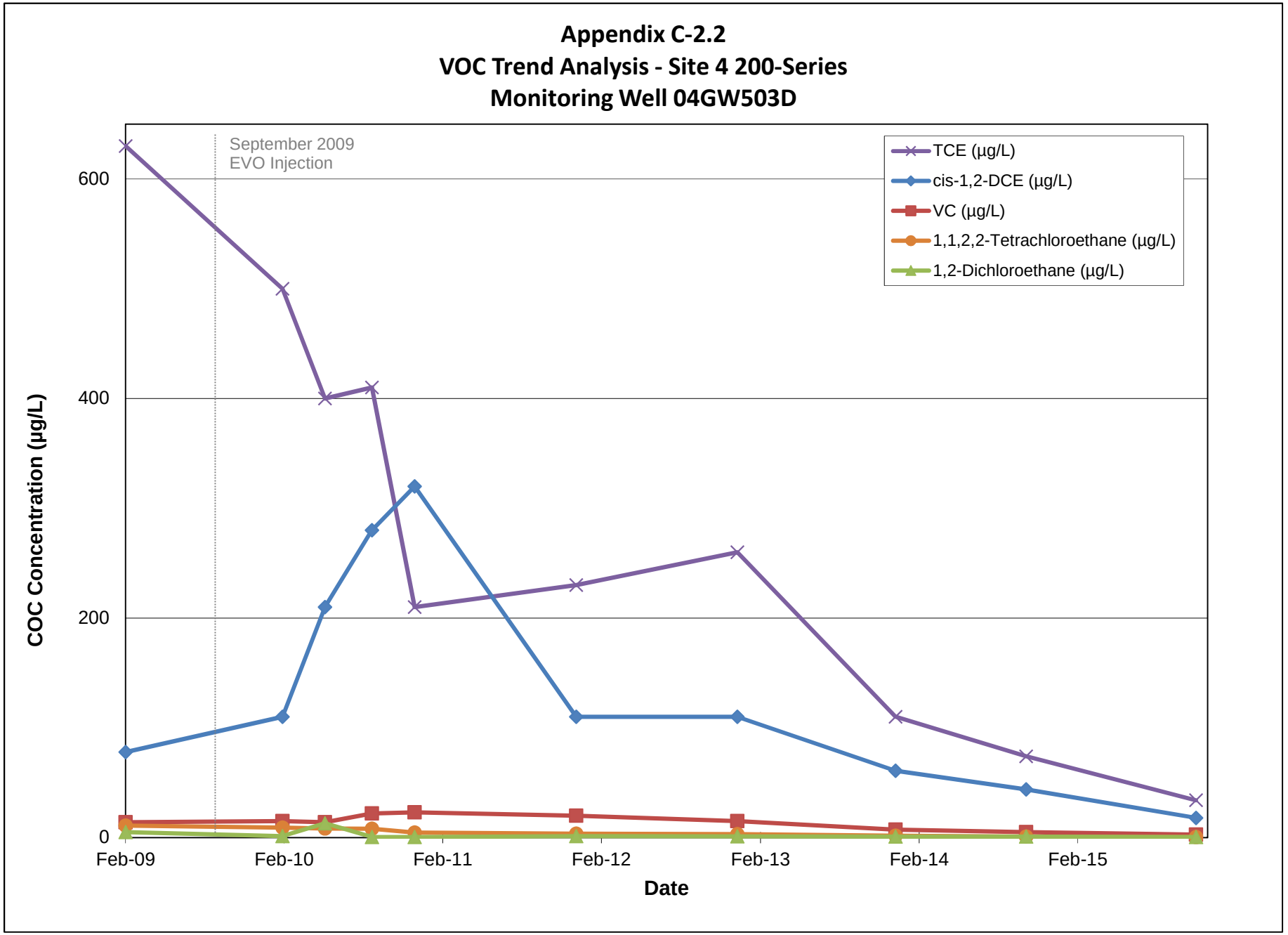
Appendix C-2.1
VOC Trend Analysis - Site 4 100-Series
Monitoring Well 04GW405



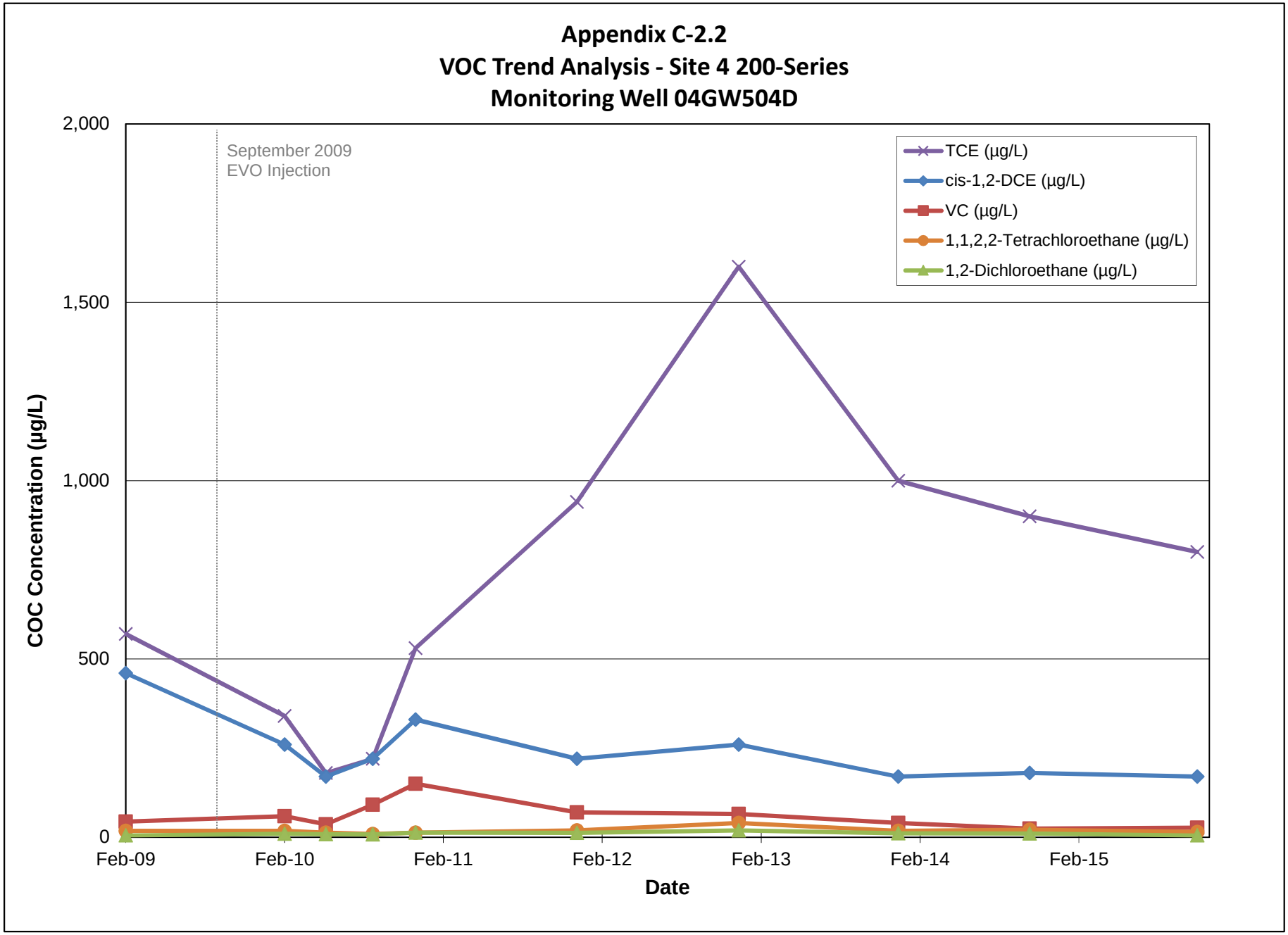
Appendix C-2.2
VOC Trend Analysis - Site 4 200-Series
Monitoring Well 04GW502D



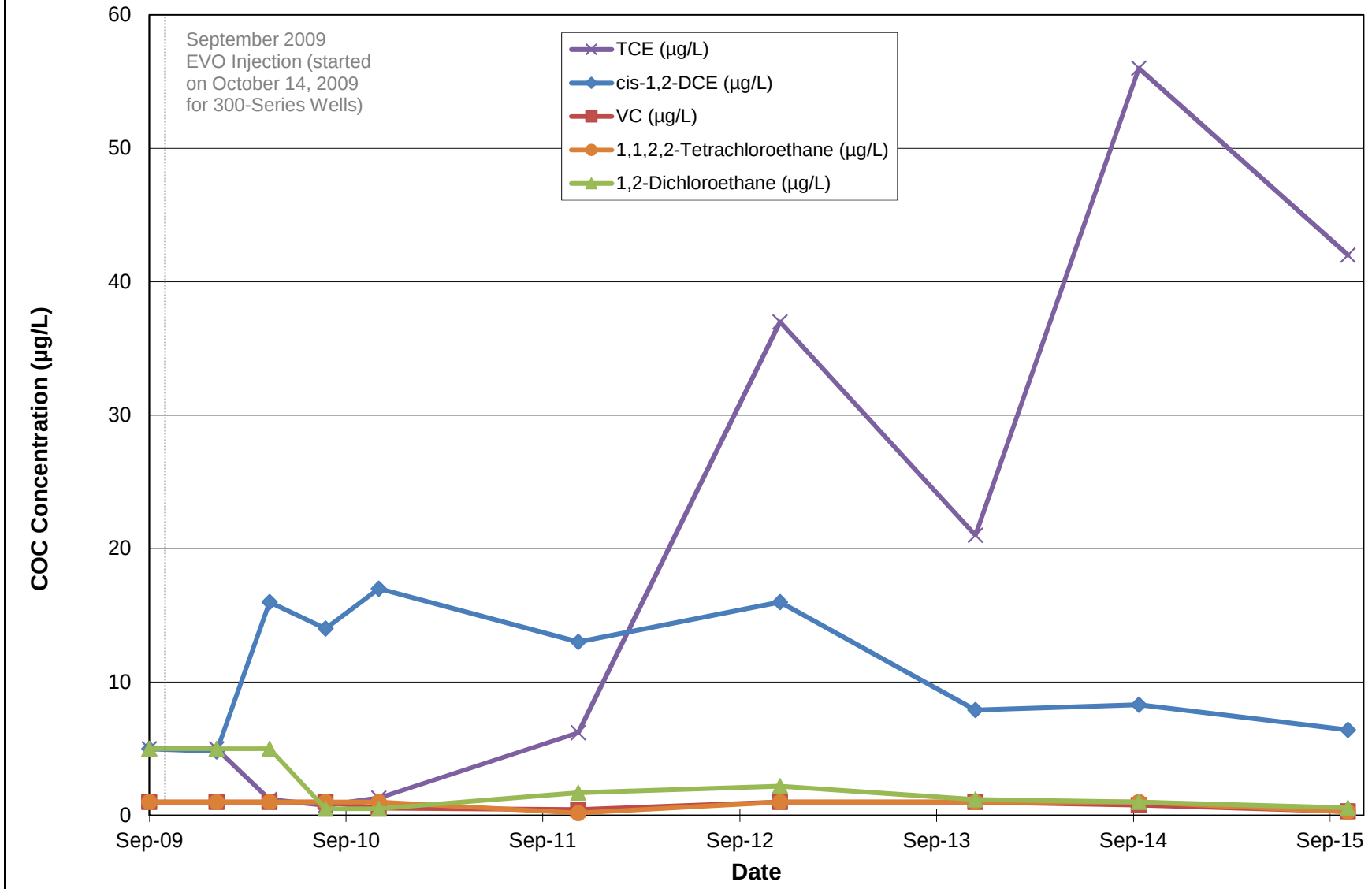
Appendix C-2.2
VOC Trend Analysis - Site 4 200-Series
Monitoring Well 04GW503D



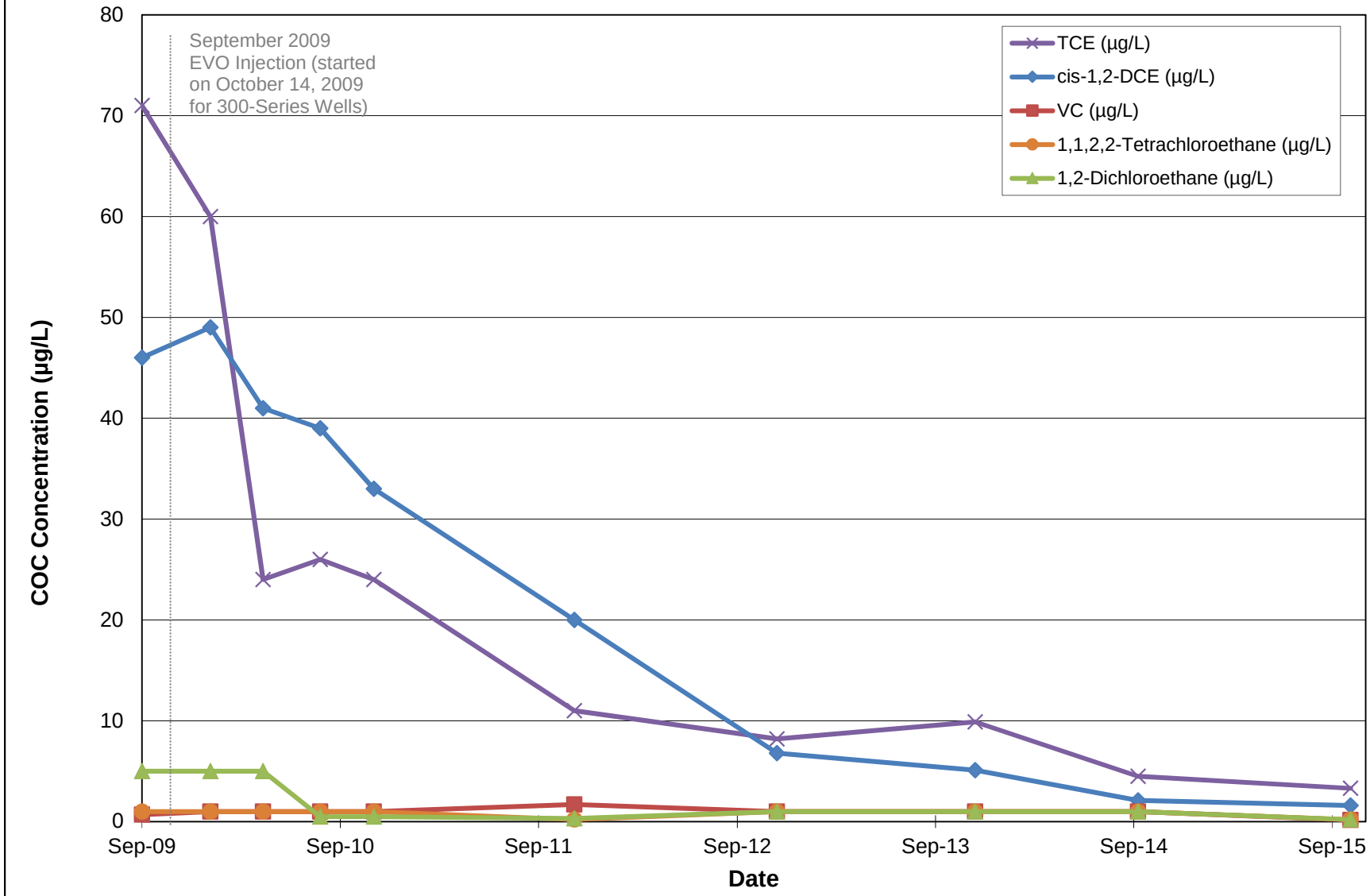
Appendix C-2.2
VOC Trend Analysis - Site 4 200-Series
Monitoring Well 04GW504D



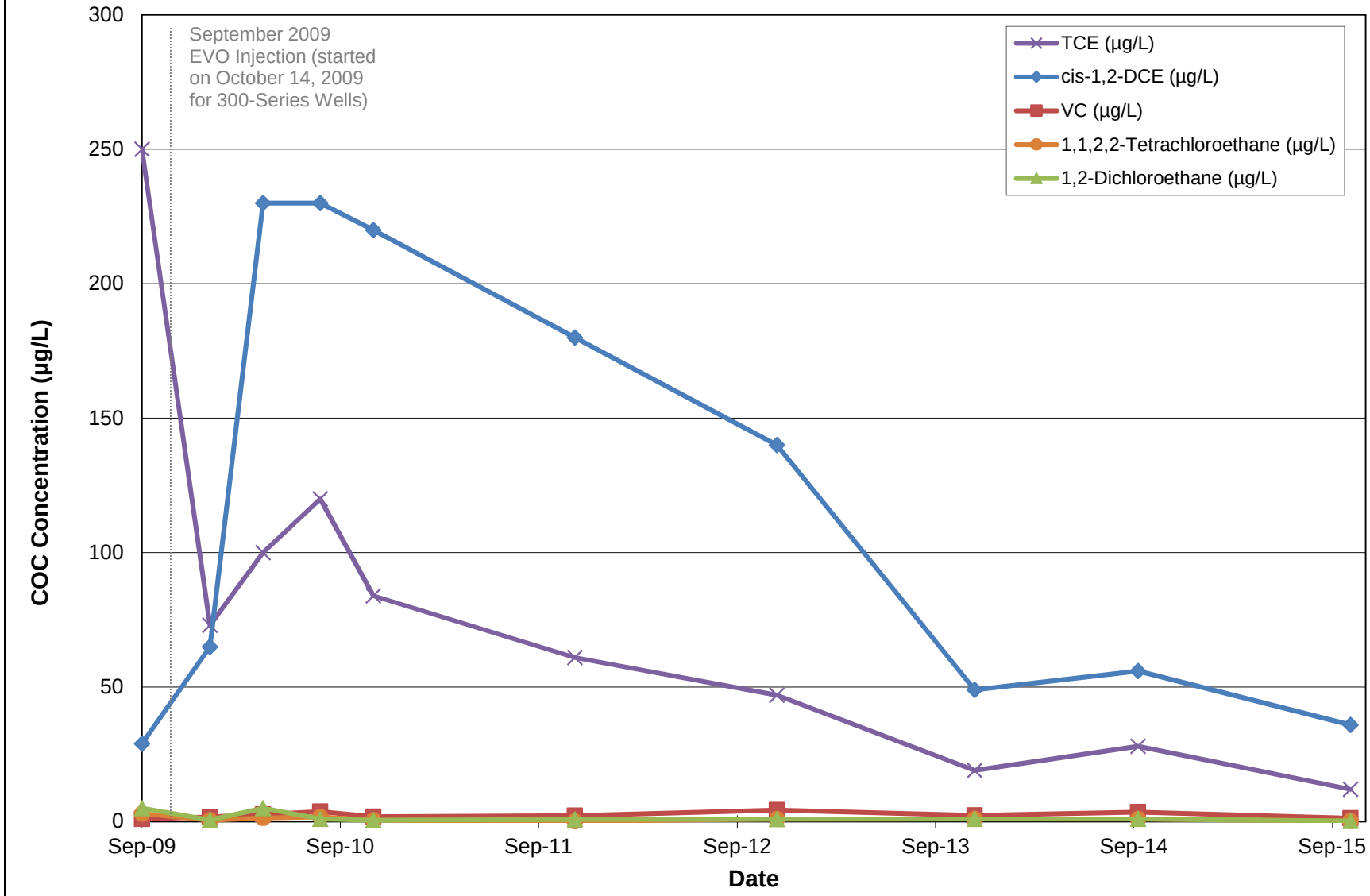
Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW601D



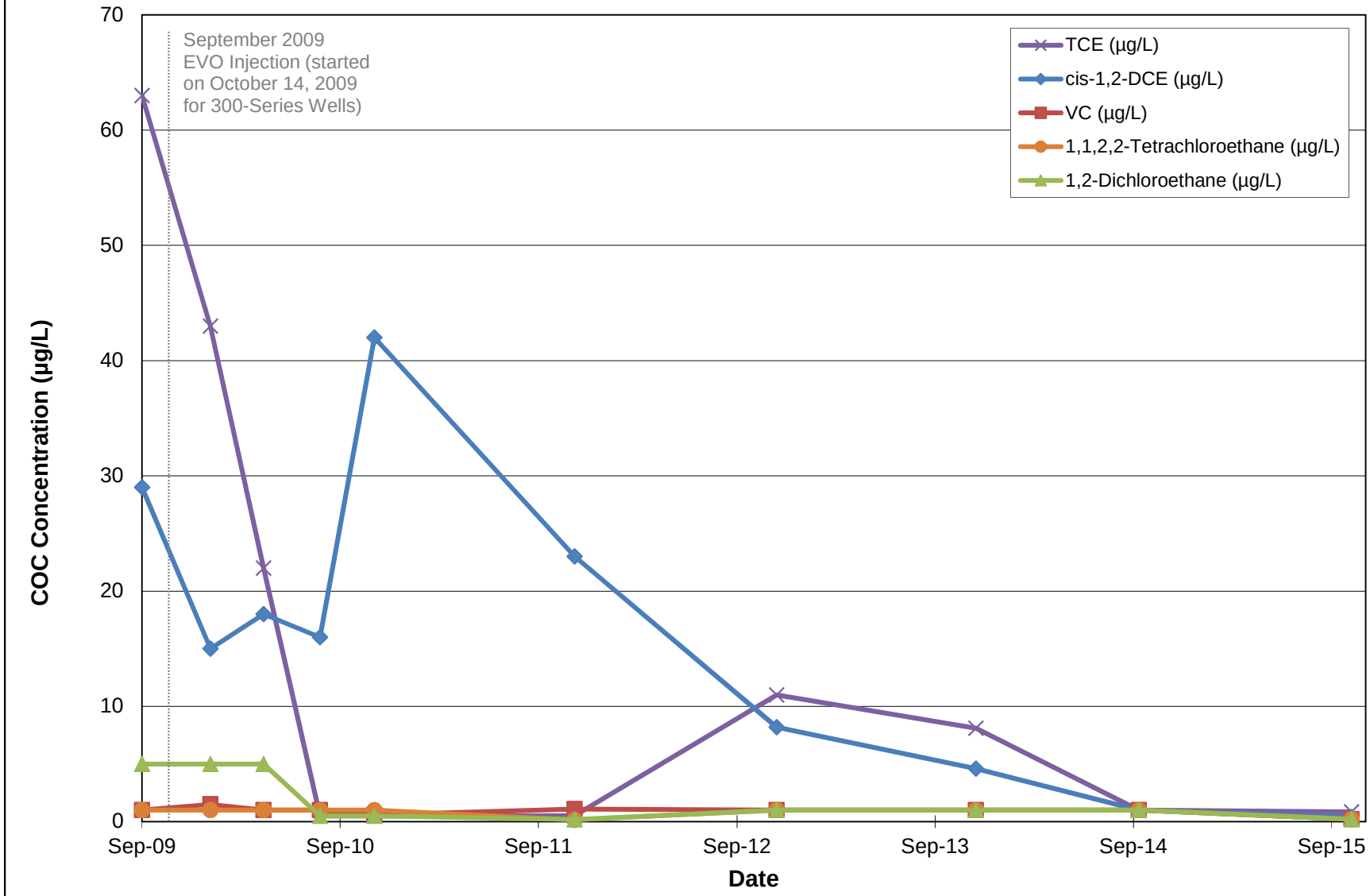
Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW602S



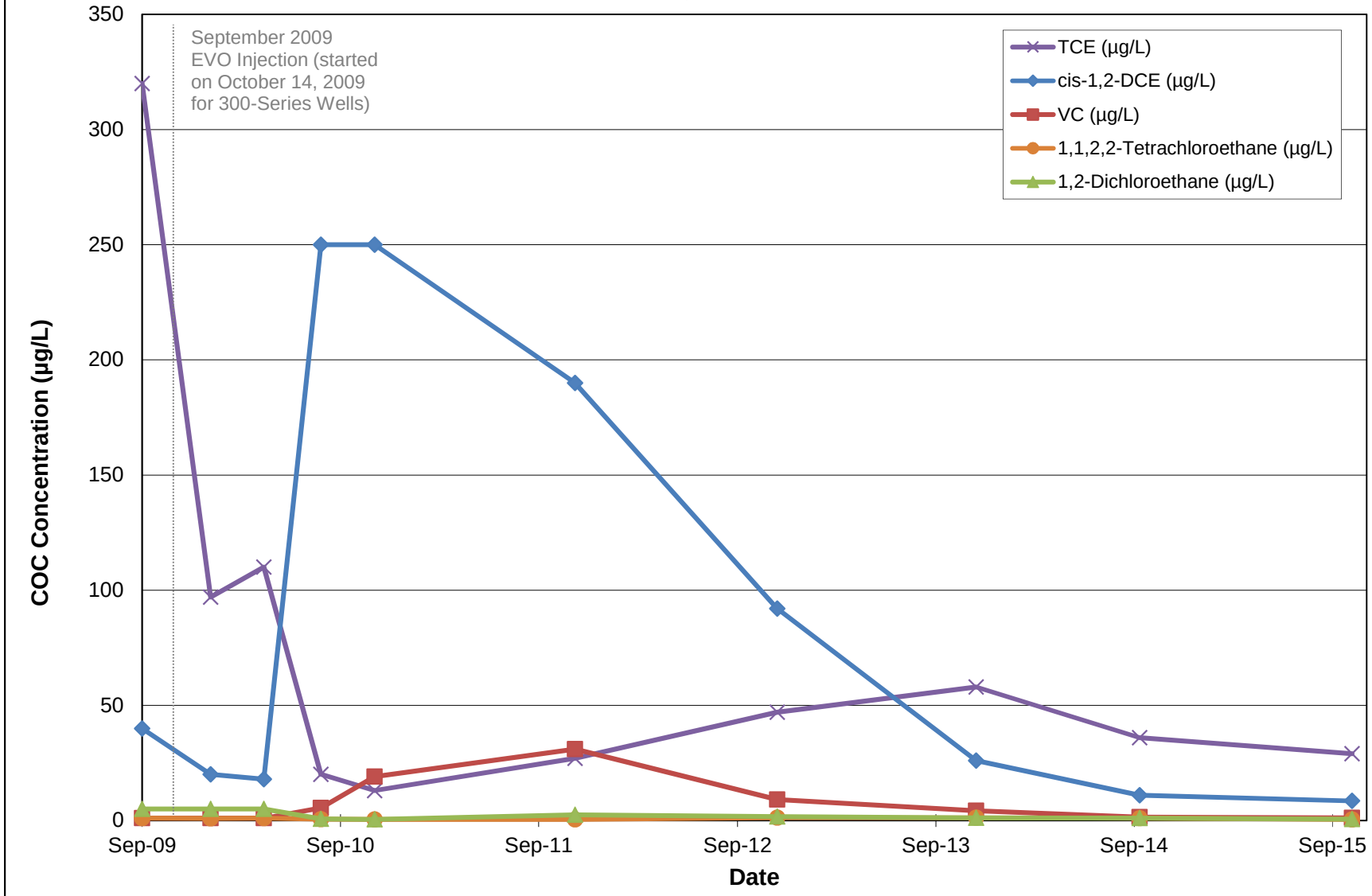
Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW602D



Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW604S

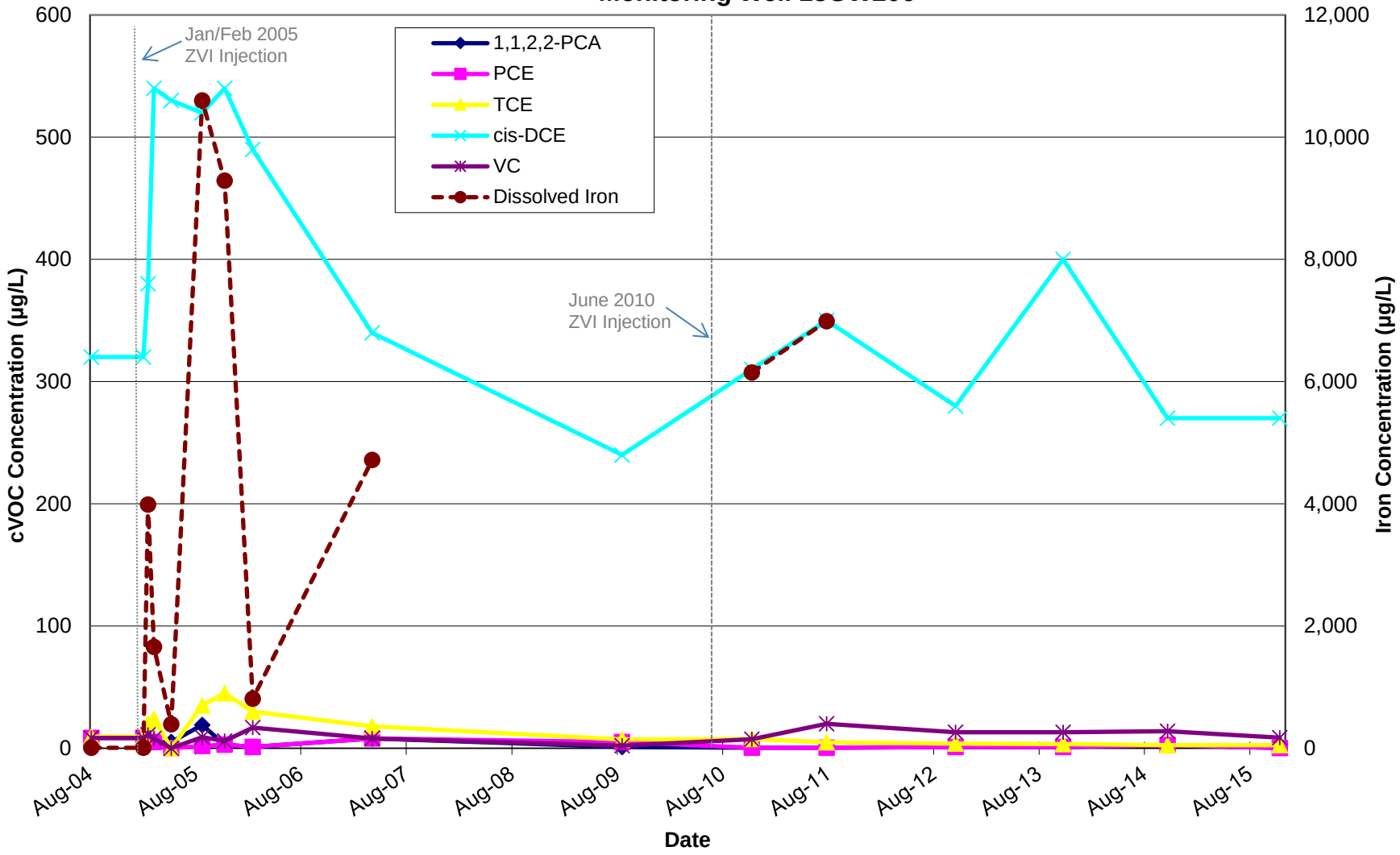


Appendix C-2.3
VOC Trend Analysis - Site 4 300-Series
Monitoring Well 04GW604D

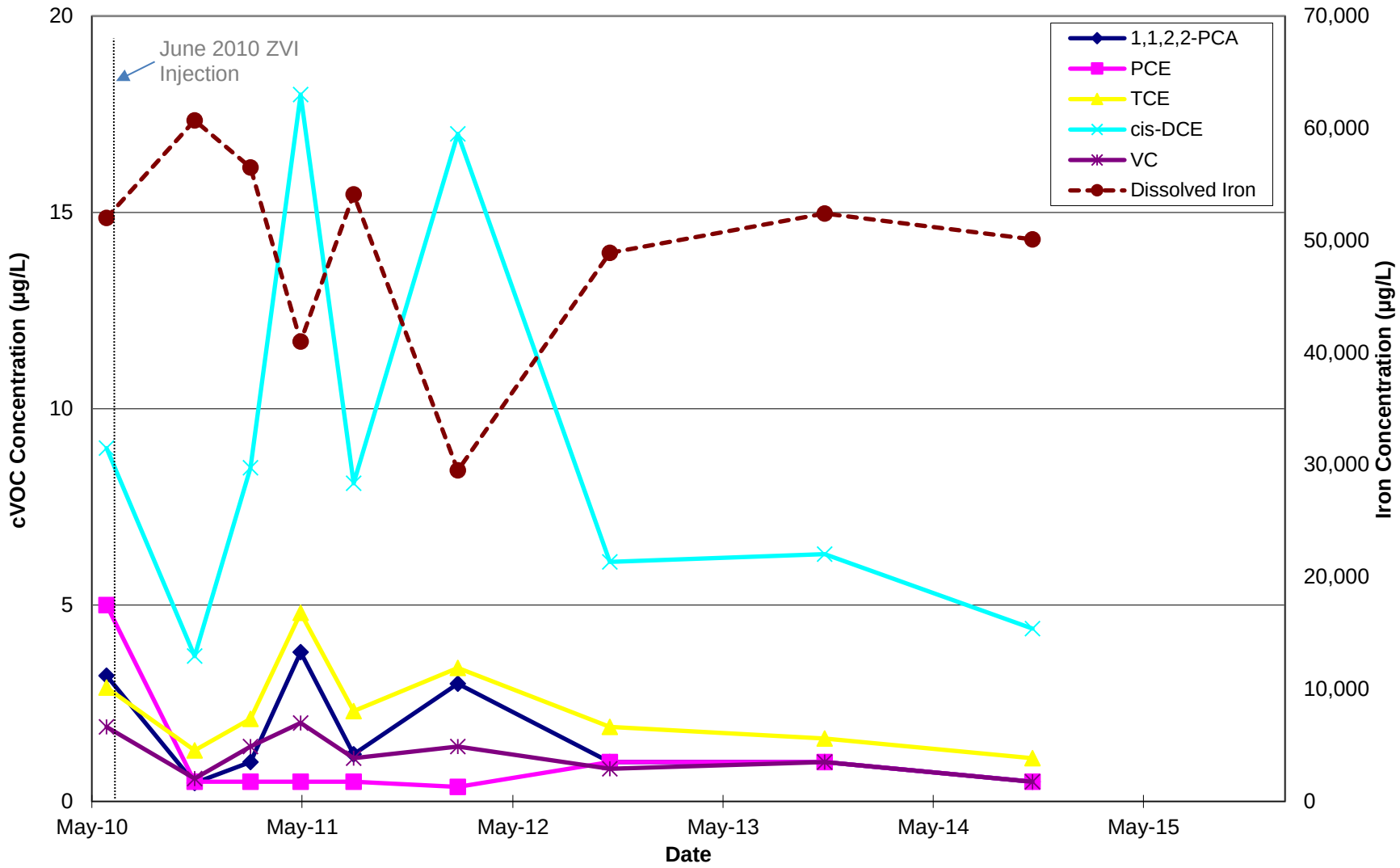


Appendix C-3
Site 5/13 Groundwater Trend Graphs

Appendix C-3.1
COC Trend Analysis - Site 13
Monitoring Well 13GW206

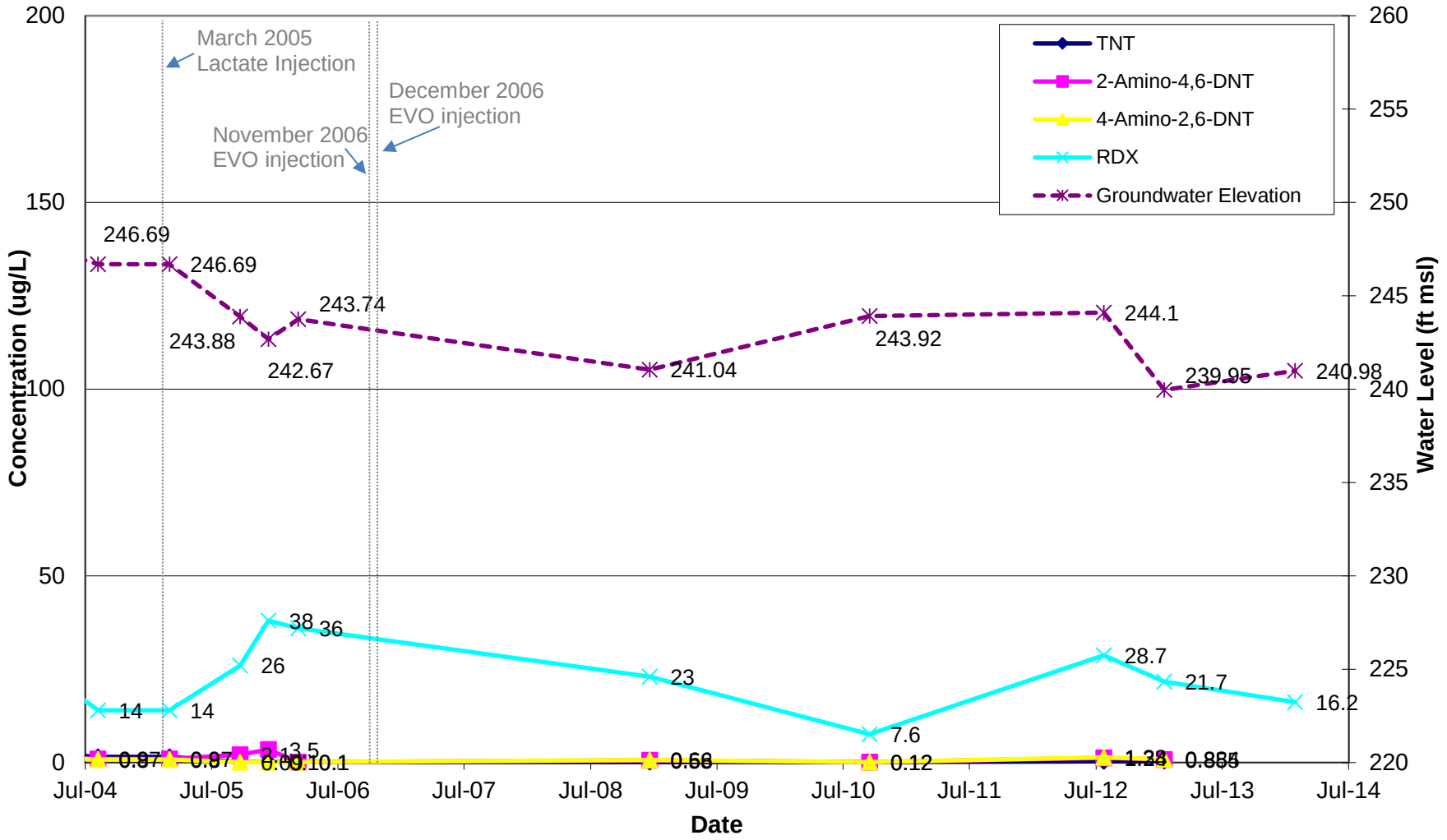


Appendix C-3.2
COC Trend Analysis - Offsite 13
Monitoring Well 13GW302



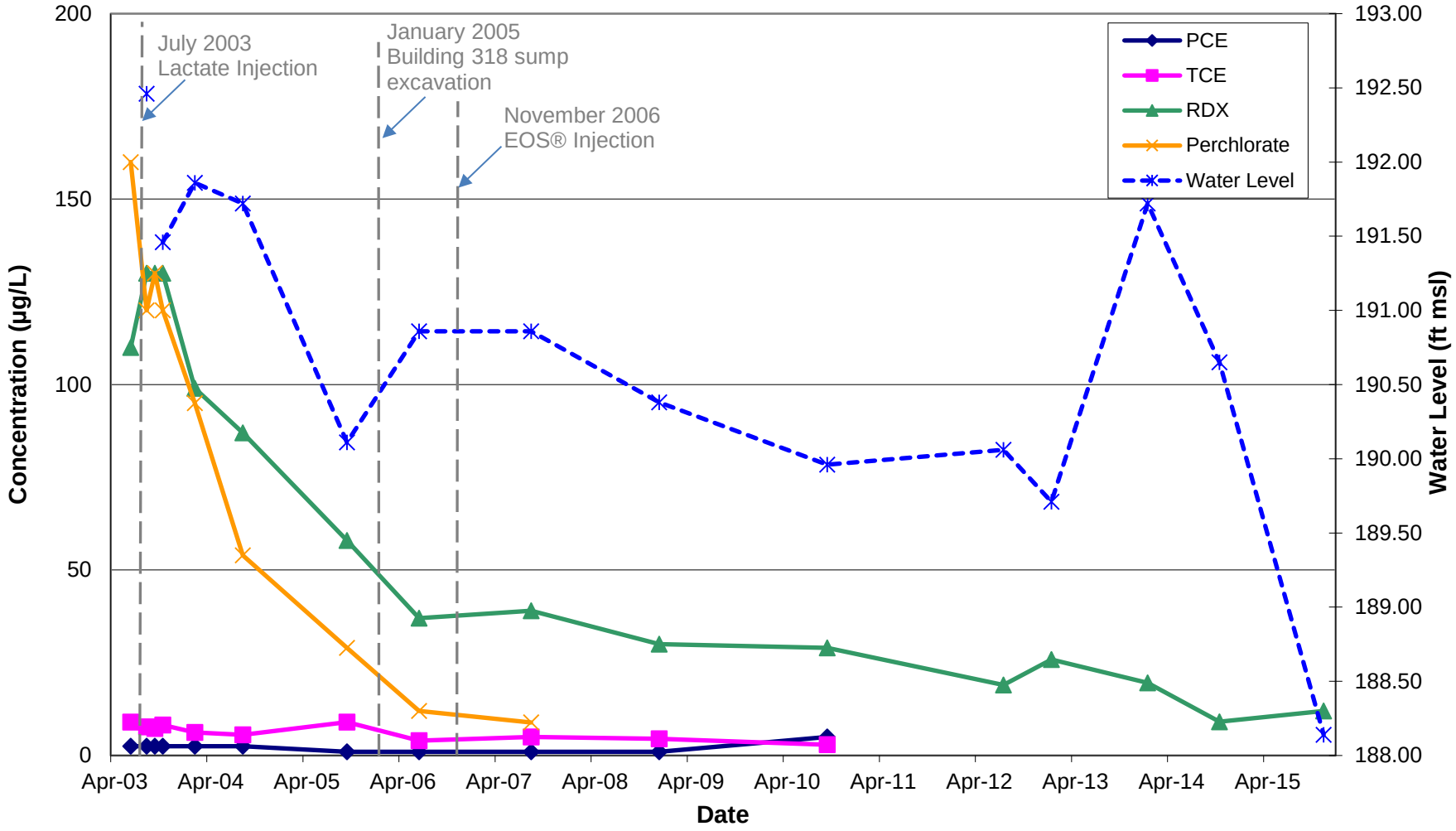
Appendix C-4
Site 7 Groundwater Trend Graph

Appendix C-4
Explosives Trend Analysis - Site 7
Monitoring Well 07GW105



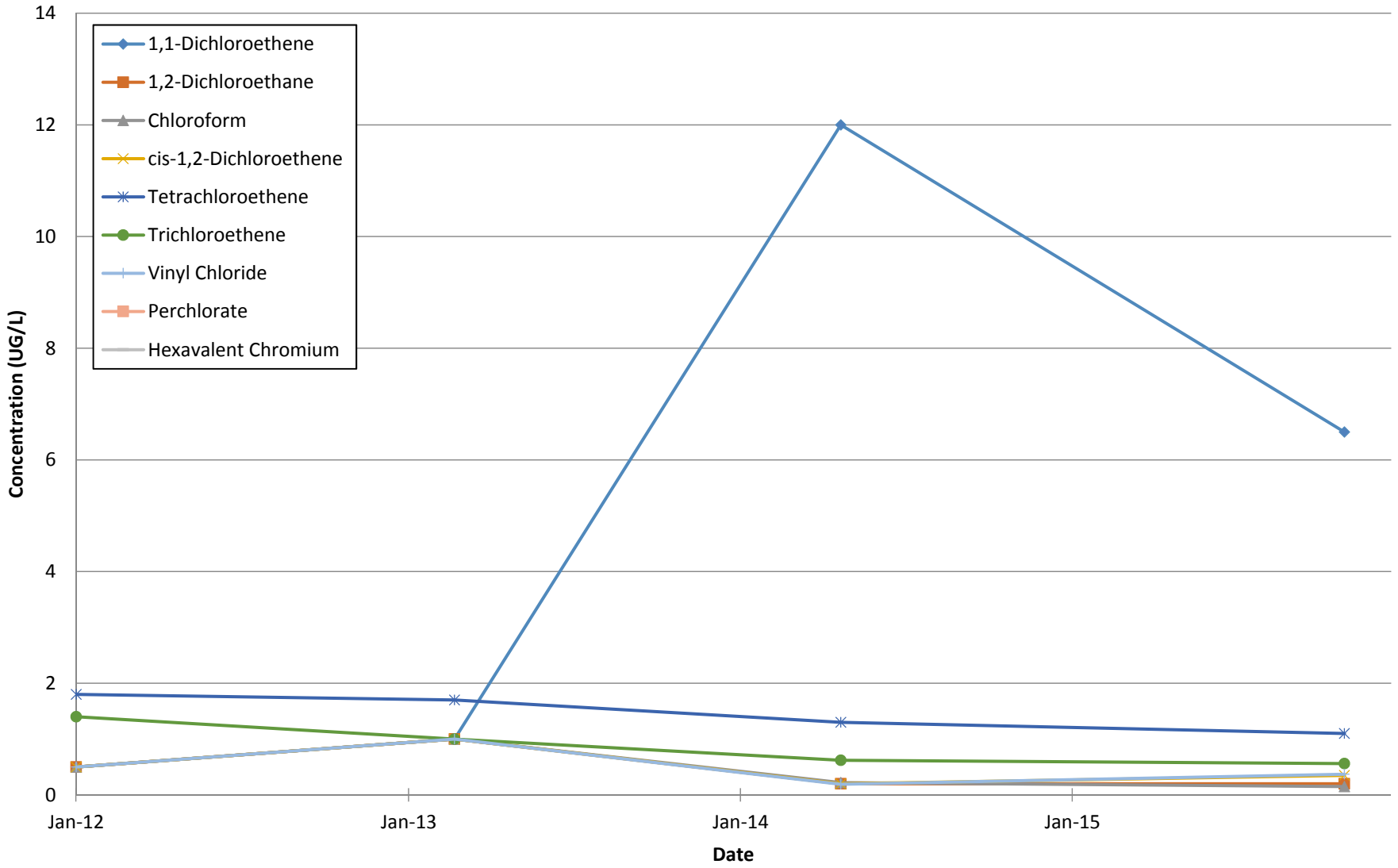
Appendix C-5
Site 9 Groundwater Trend Graphs

Appendix C-5
COC Trend Analysis - Site 9
Monitoring Well 09GW01



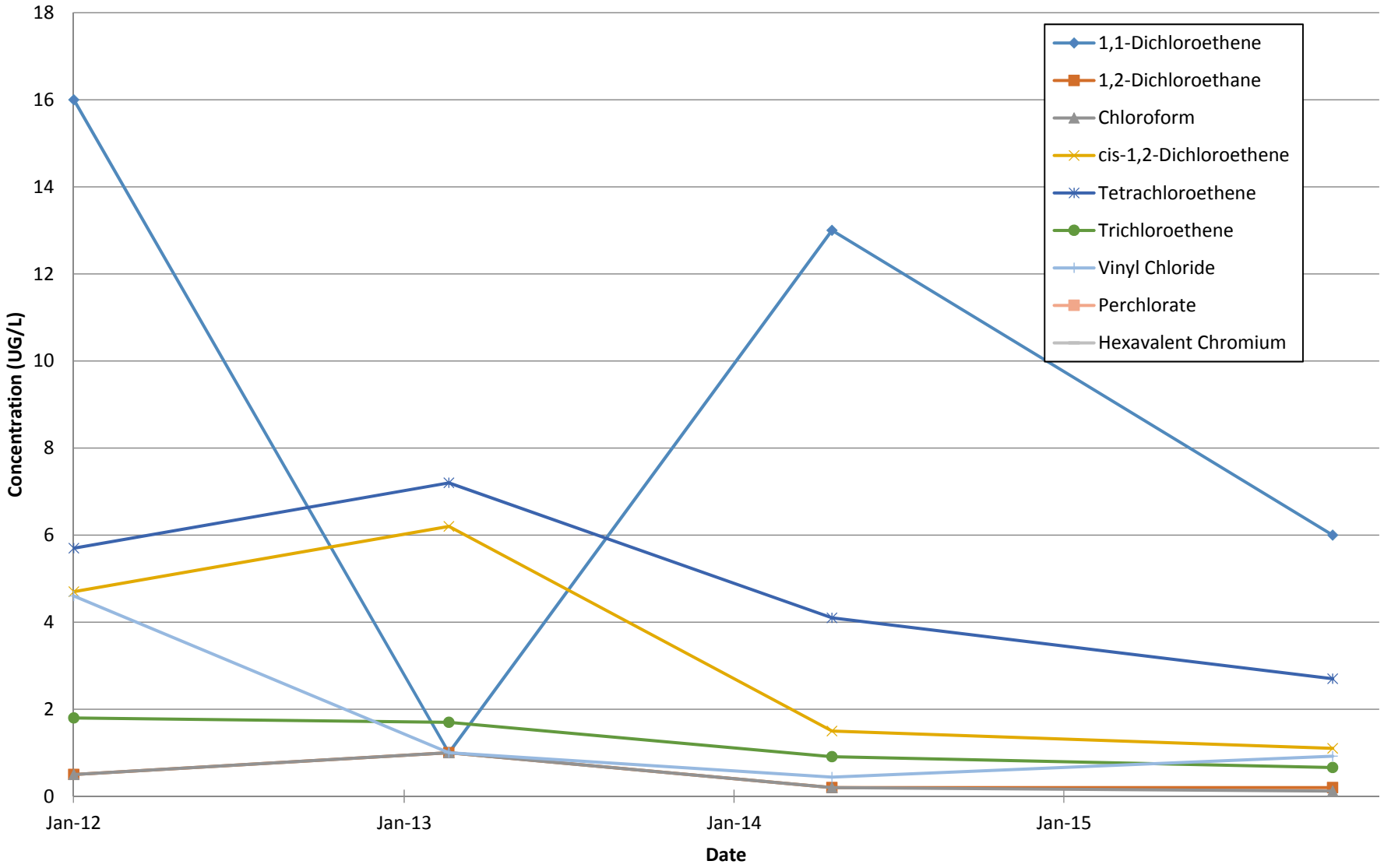
Appendix C-6
Site 11 Groundwater Trend Graphs

Appendix C-6
COC Trend Analysis - Site 11
Monitoring Well 11MW204D



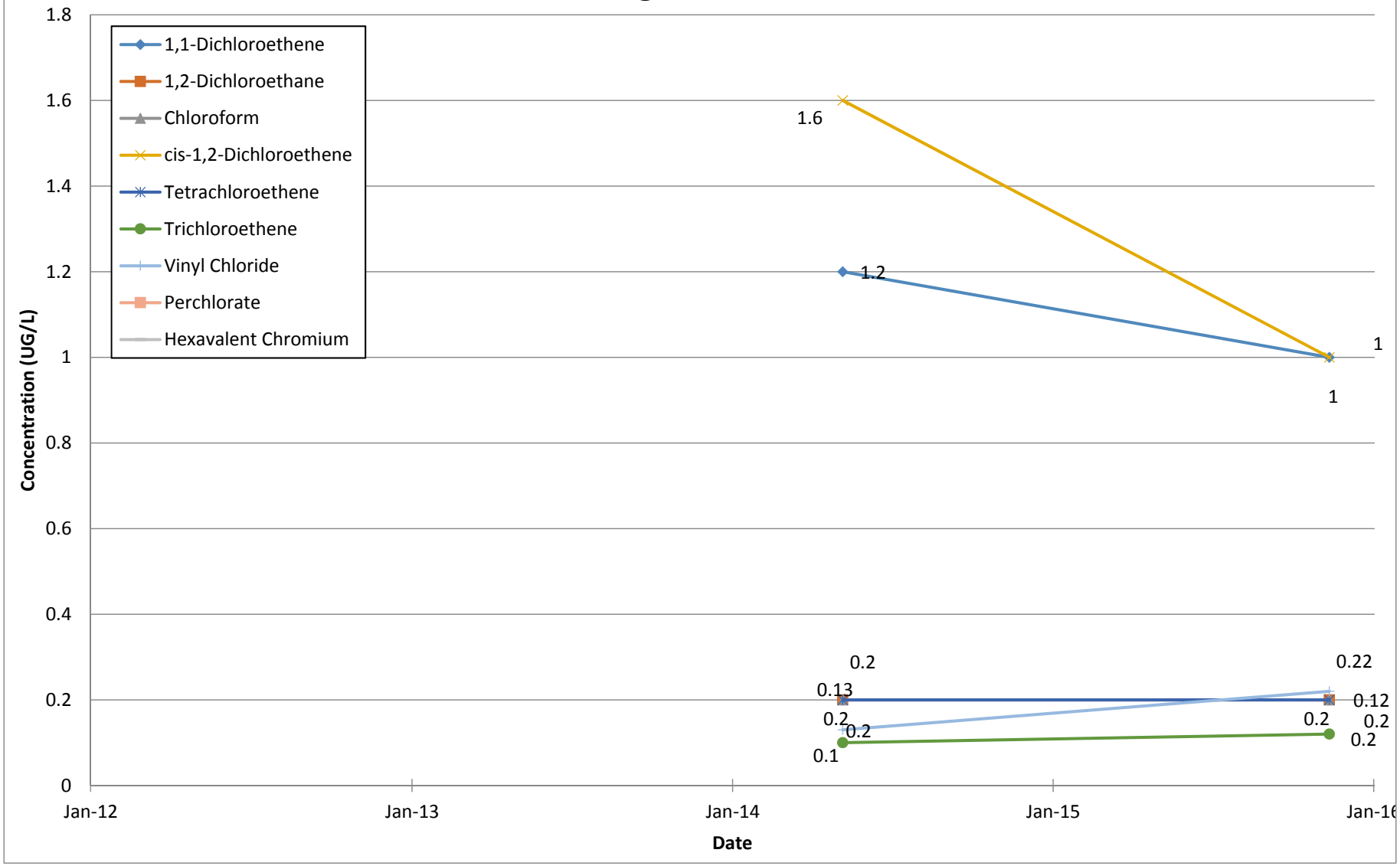
Note: EOS® was injected at Site 11 in November/December 2004

Appendix C-6
COC Trend Analysis - Site 11
Monitoring Well 11MW204S



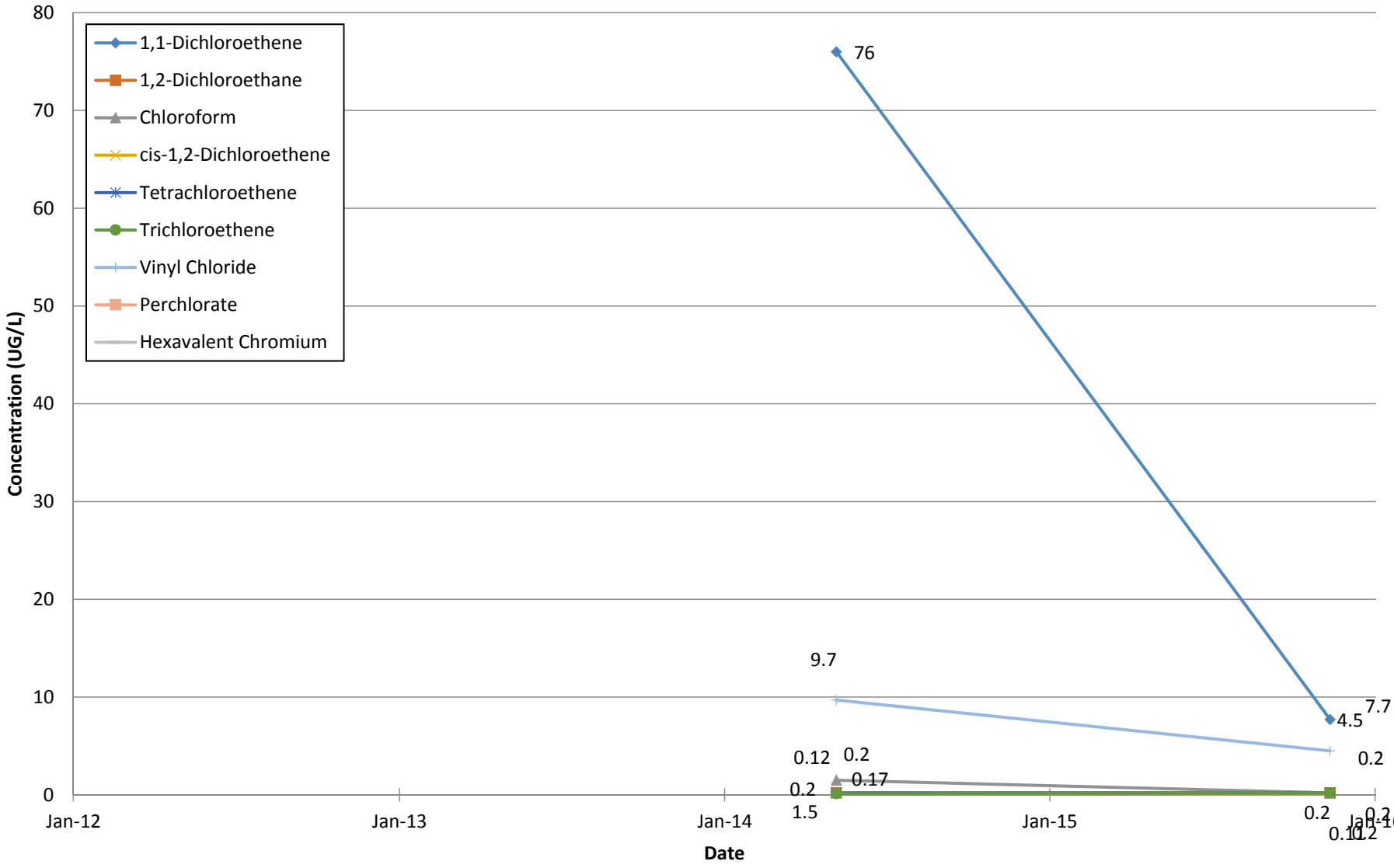
Note: EOS® was injected at Site 11 in November/December 2004

Appendix C-6
COC Trend Analysis - Site 11
Monitoring Well 11MW205D



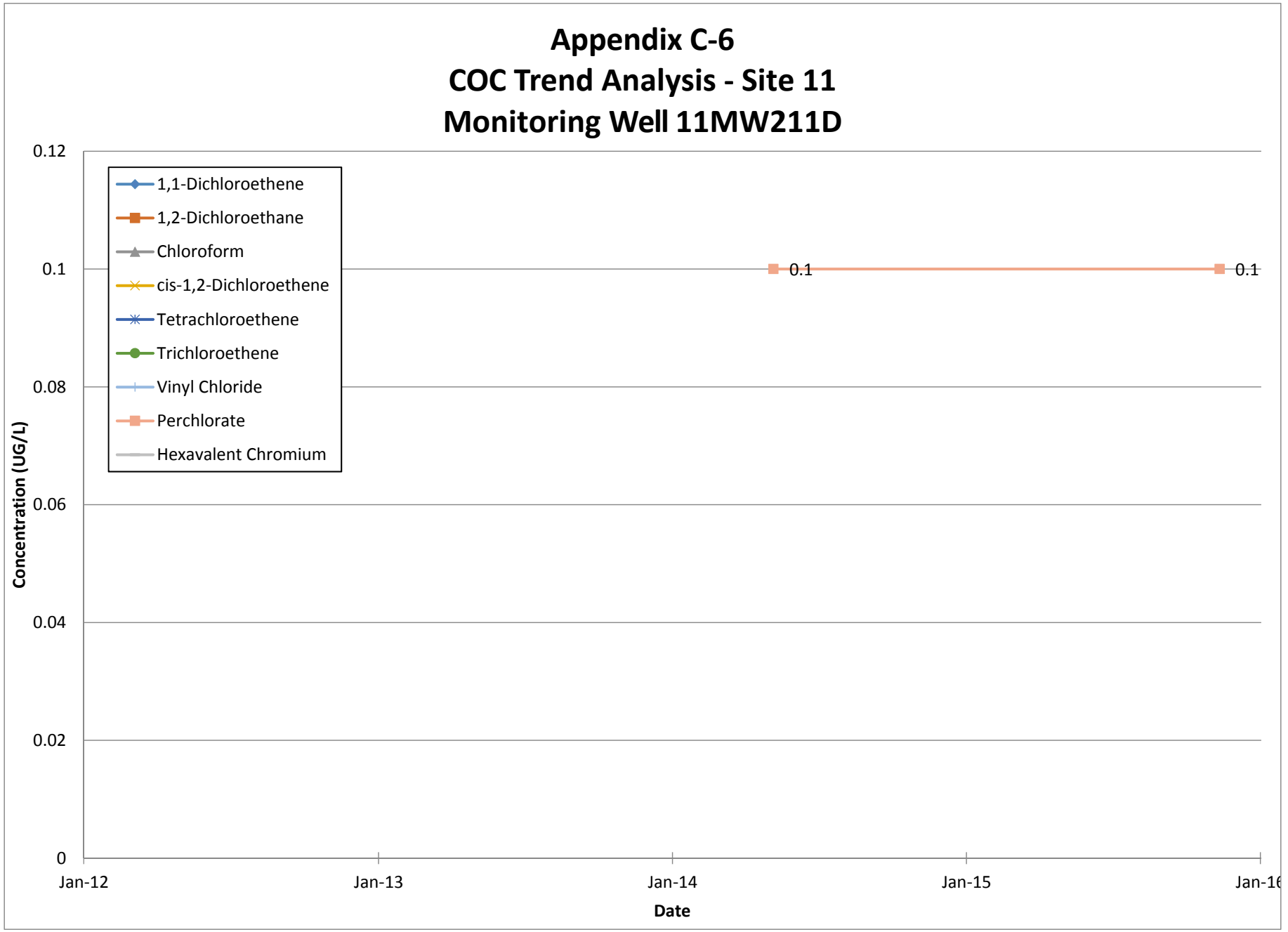
Note: EOS® was injected at Site 11 in November/December 2004

Appendix C-6
COC Trend Analysis - Site 11
Monitoring Well 11MW205SR



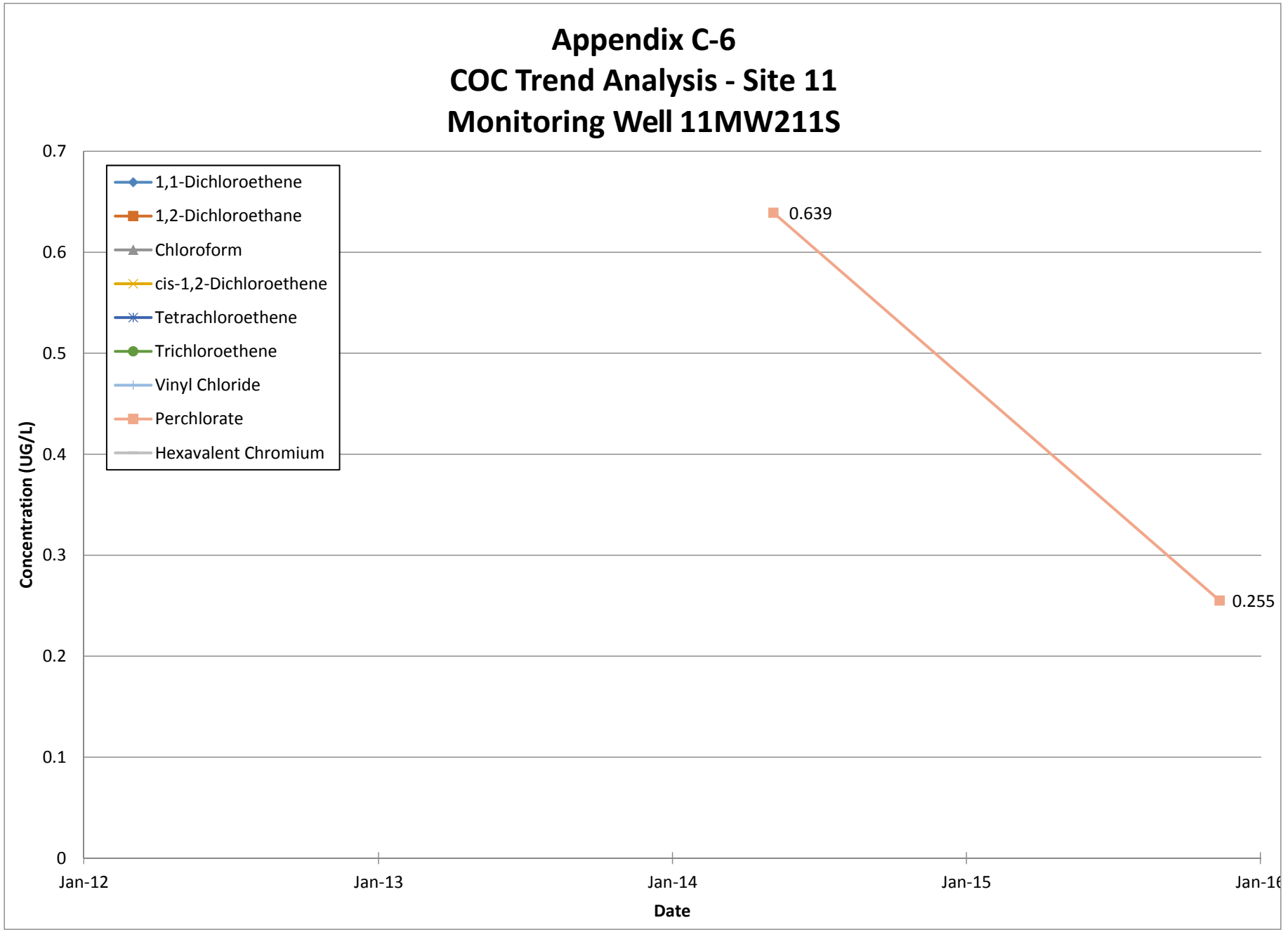
Note: EOS® was injected at Site 11 in November/December 2004

Appendix C-6
COC Trend Analysis - Site 11
Monitoring Well 11MW211D



Note: EOS® was injected at Site 11 in November/December 2004

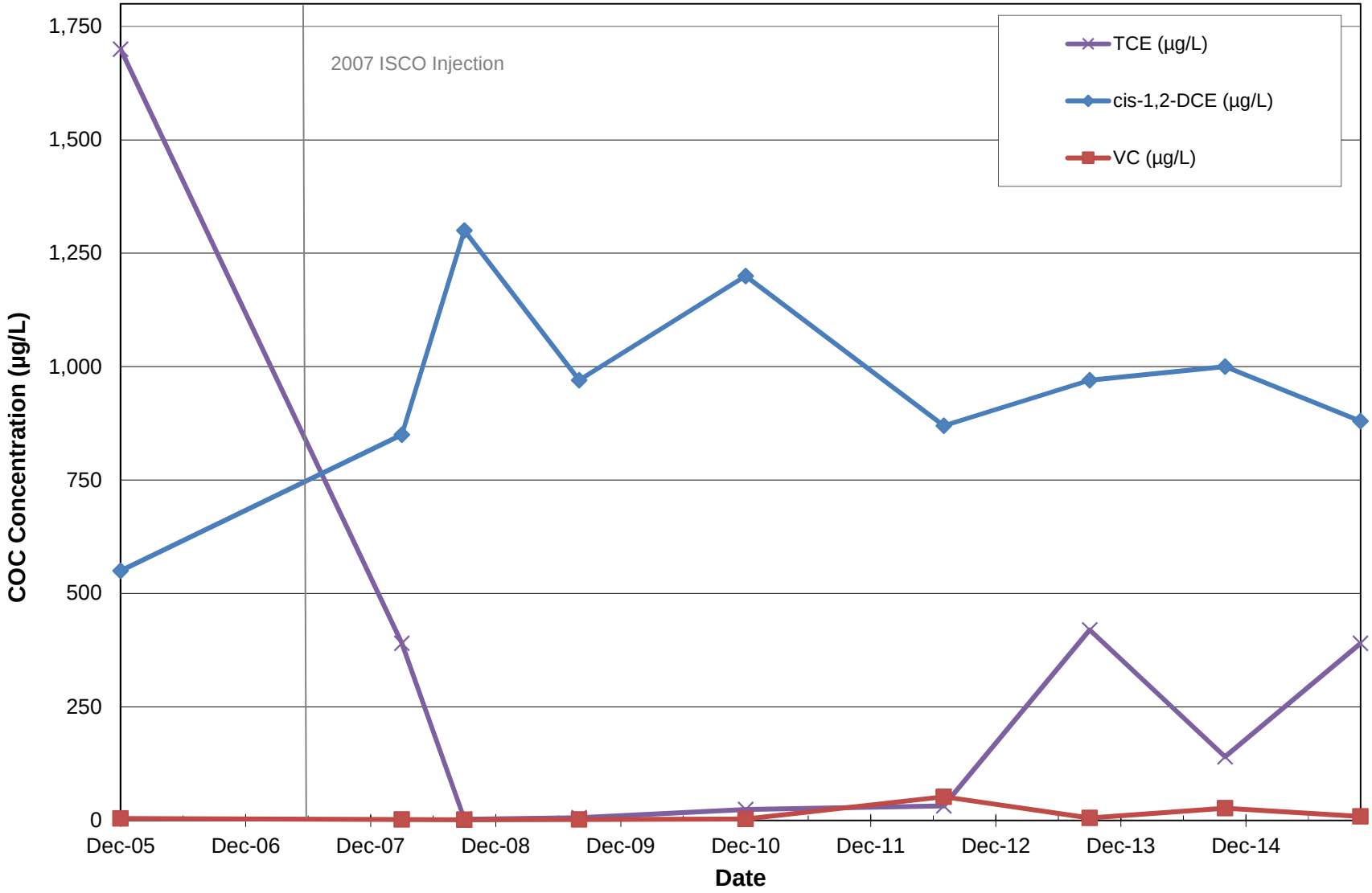
Appendix C-6
COC Trend Analysis - Site 11
Monitoring Well 11MW211S



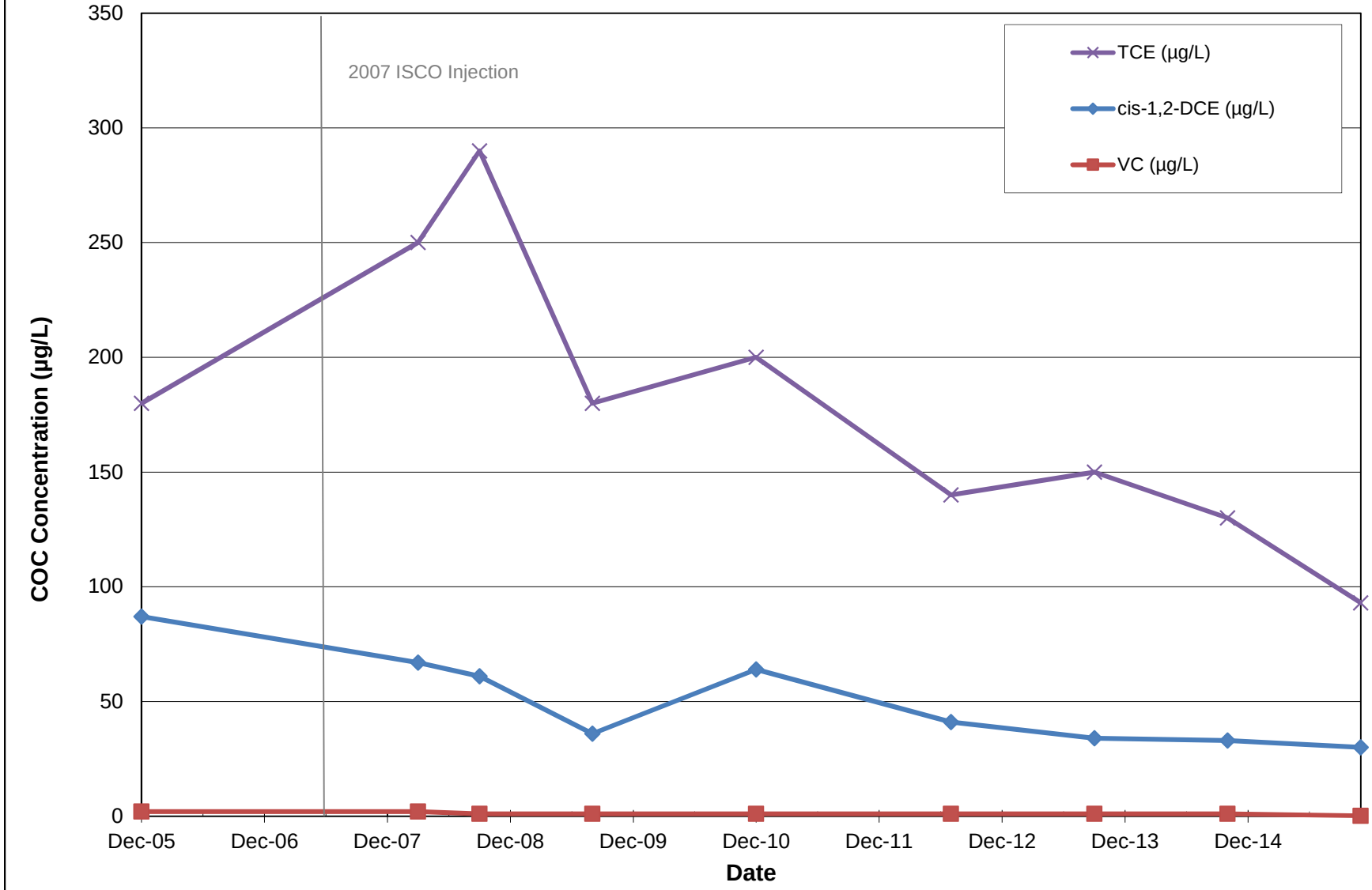
Note: EOS® was injected at Site 11 in November/December 2004

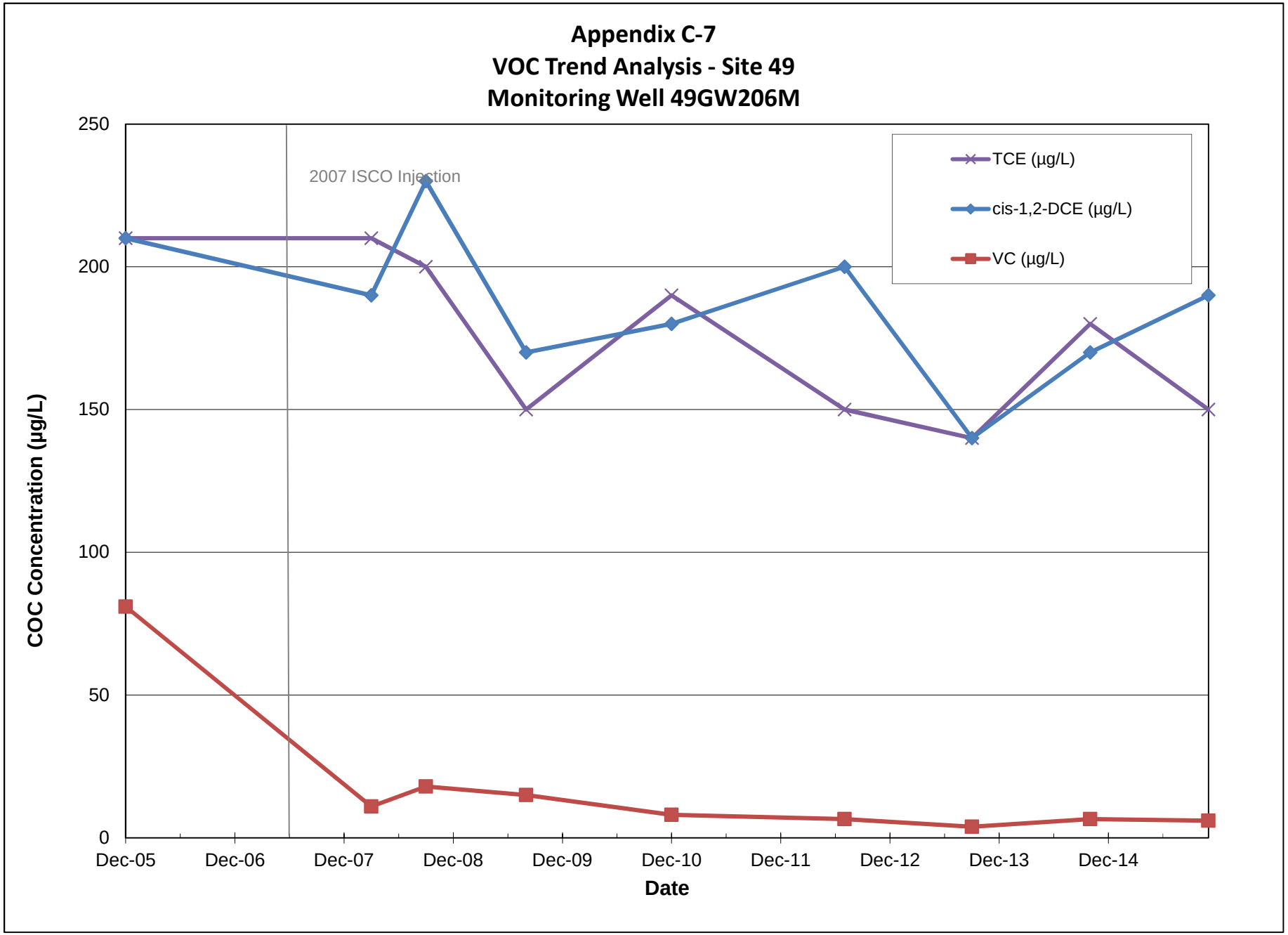
Appendix C-7
Site 49 Groundwater Trend Graphs

Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW200

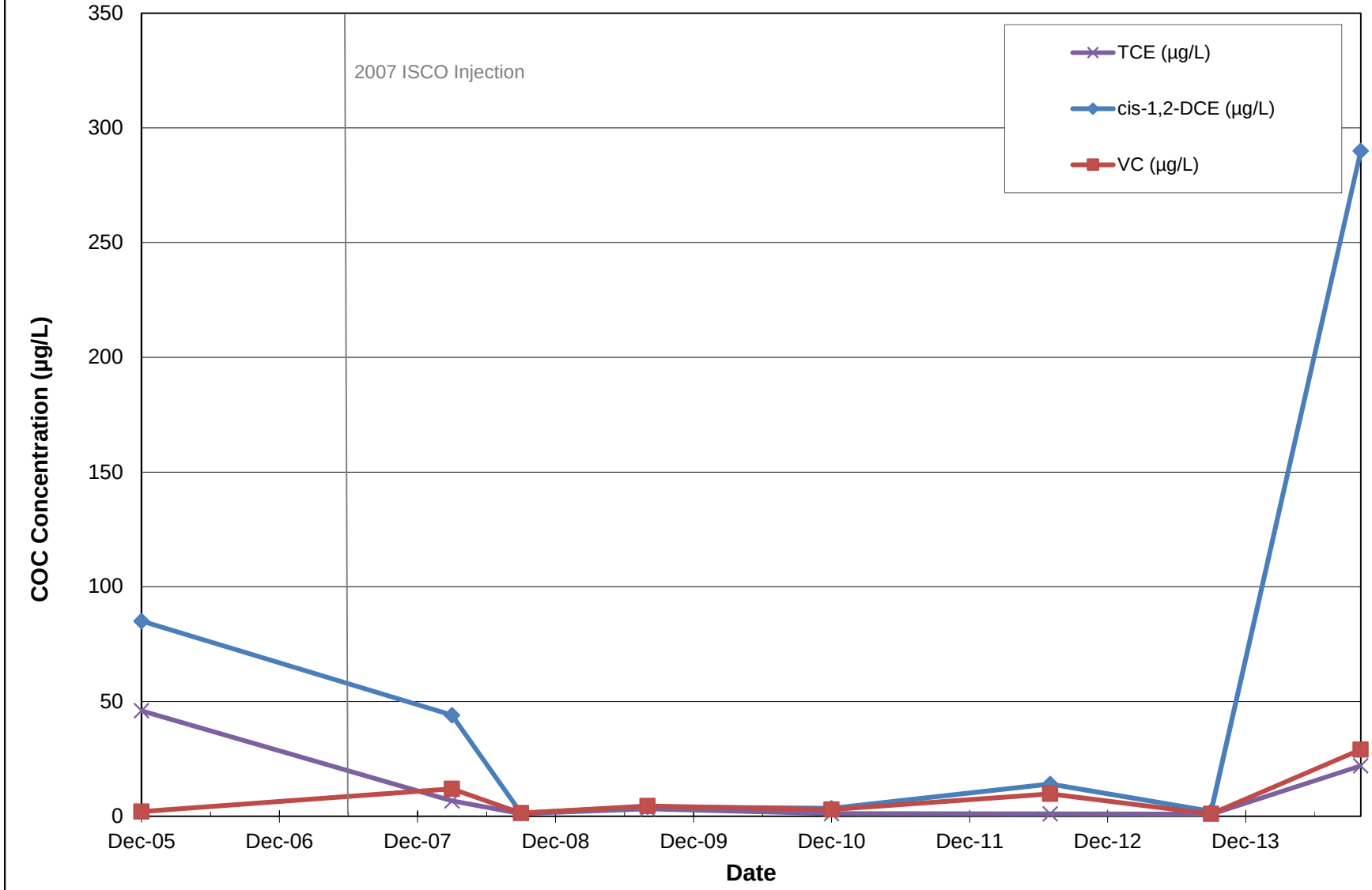


Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW206S

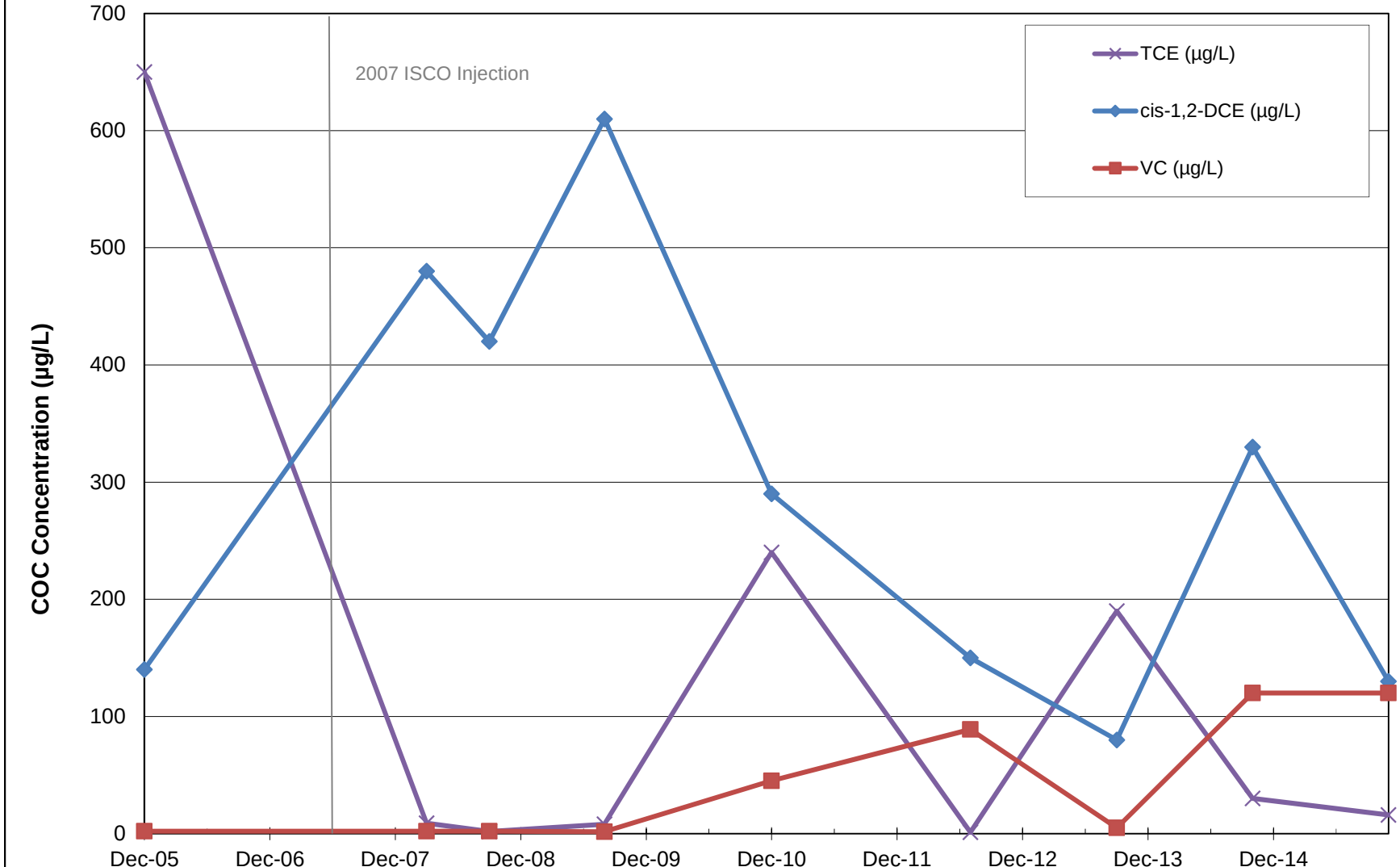


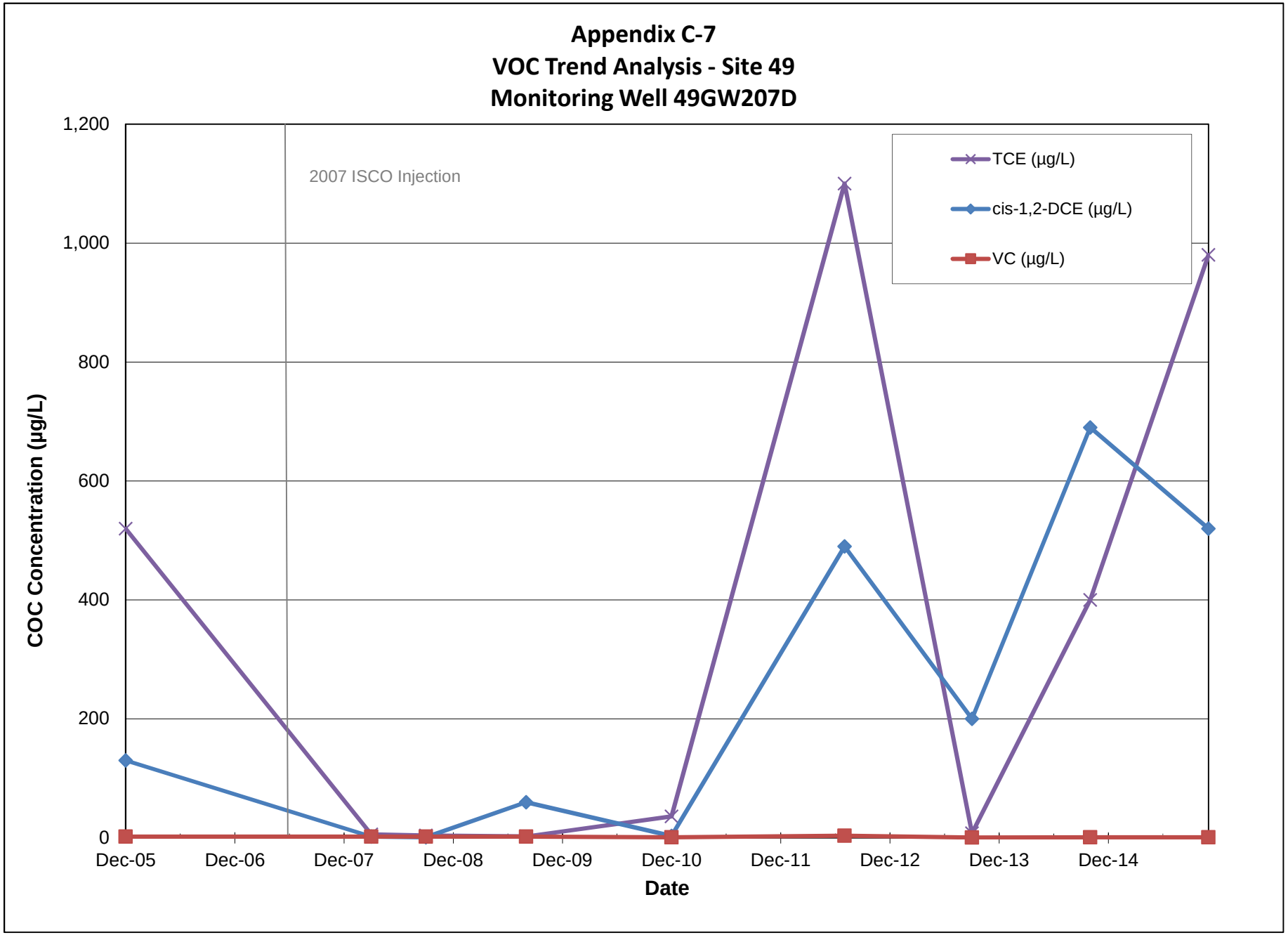

Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW206M
2007 ISCO Injection
TCE (µg/L)
cis-1,2-DCE (µg/L)
VC (µg/L)
COC Concentration (µg/L)
250
200
150
100
50
0
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Date

Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW206D

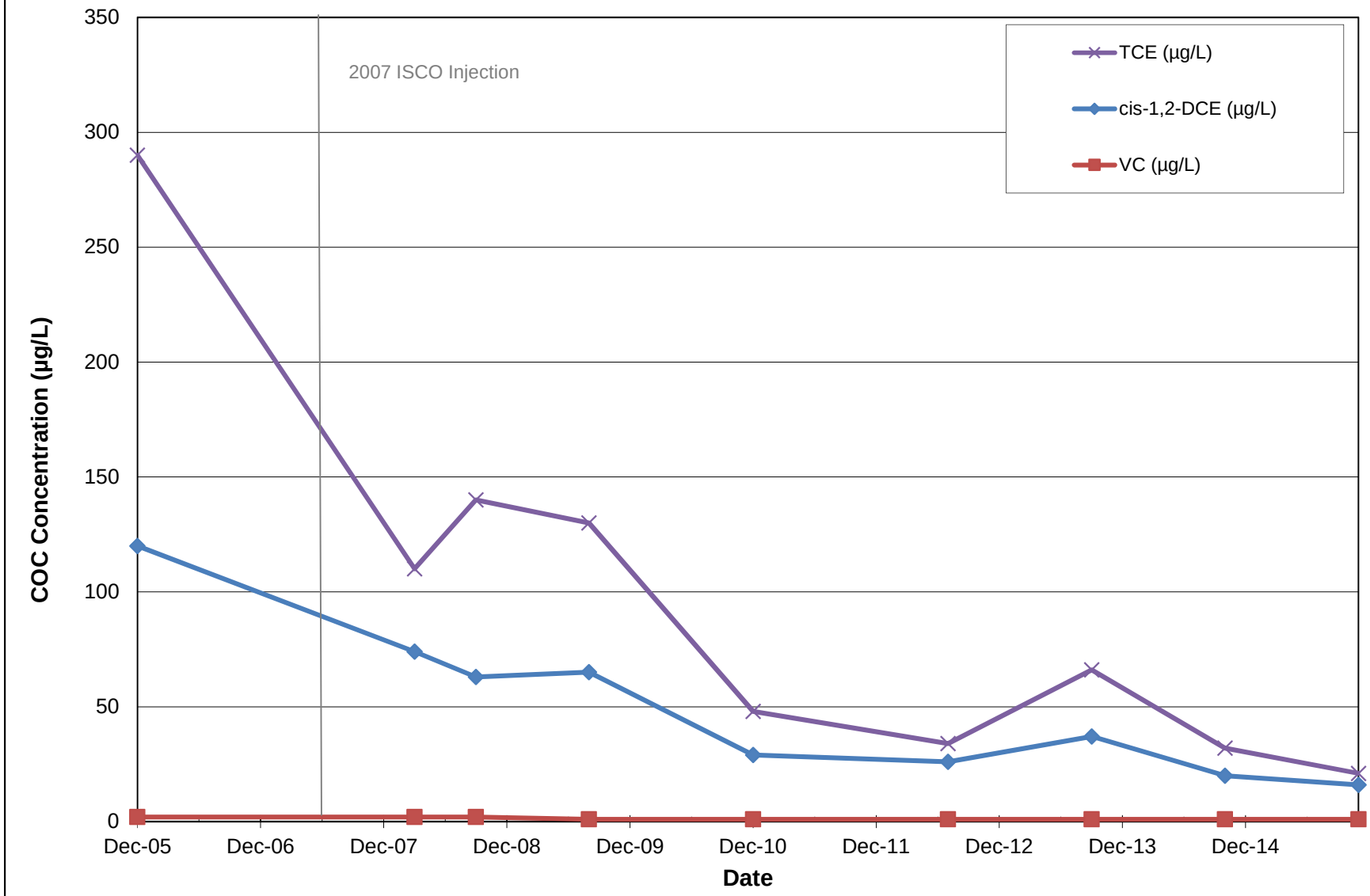


Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW207S

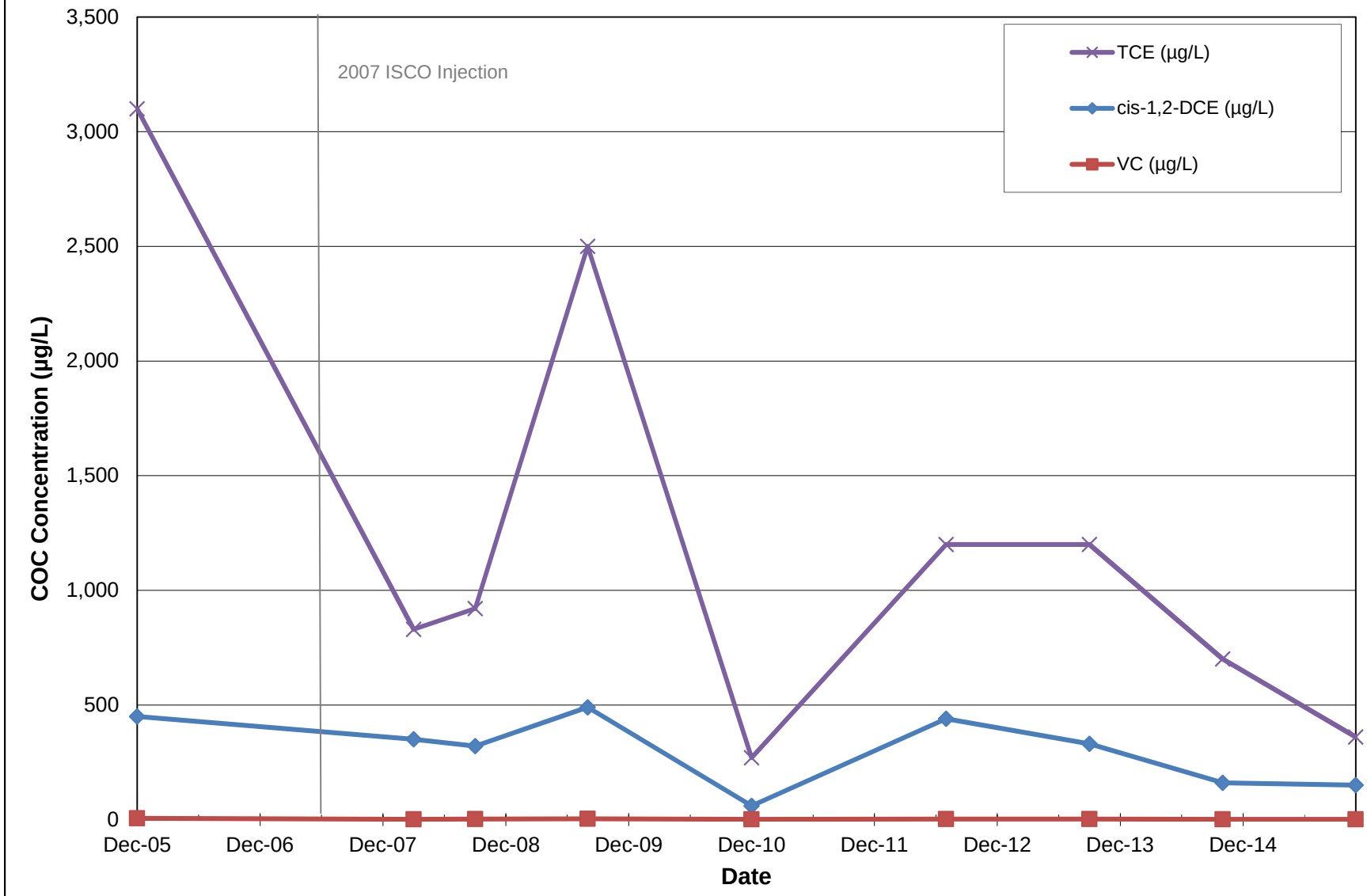



Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW207D
2007 ISCO Injection
TCE (µg/L)
cis-1,2-DCE (µg/L)
VC (µg/L)
COC Concentration (µg/L)
1,200
1,000
800
600
400
200
0
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Date

Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW208S

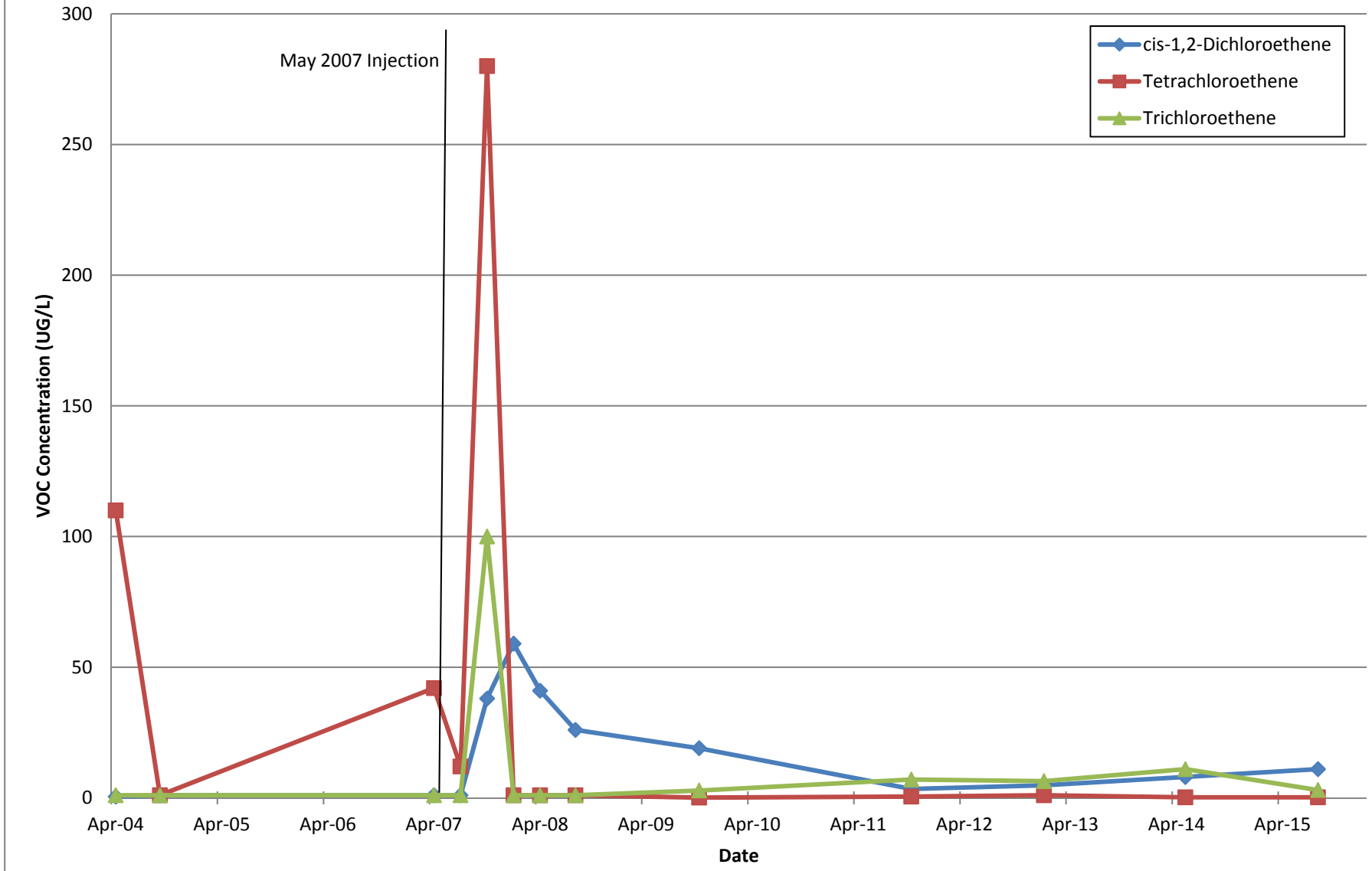


Appendix C-7
VOC Trend Analysis - Site 49
Monitoring Well 49GW208D



Appendix C-8
SWMU 87 Groundwater Trend Graphs

Appendix C-8
COC Trend Analysis - SWMU 87
Monitoring Well 87WP201



Appendix C-8
COC Trend Analysis - SWMU 87
Monitoring Well 87WP212

