DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON, DC 20310-0600

Reply To Attention Of:
ARMY BASE RELIGNMENT AND CLOSURE PROGRAM

JUN 13 2011

Mr. John Burchette
NPL / BRAC / Federal Facilities Branch
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Draft Final Long-Term Monitoring Report, Ordnance Demolition Area Operable Unit, September 2010 Sampling Event

Dear Mr. Burchette:

Please find enclosed one original and two copies of the *Draft Final Long-Term Monitoring Report, Ordnance Demolition Area Operable Unit, Patuxent Research Refuge-North Tract, Anne Arundel County, Maryland, September 2010 Sampling Event* for EPA review and comment.

If you have any questions, please feel free to contact me at (703) 545-2474 or Steve Cardon at (301) 677-9178.

Sincerely,

Markus Craig

Markus A. Craig
Program Manager, Office of the Assistant Chief of Staff for Installation Management; Base Realignment and Closure Division

Enclosure: Draft Final Long-Term Monitoring Report, Ordnance Demolition Area Operable Unit, September 2010 Sampling - 1 original and 2 copies

DISTRIBUTION:

Elisabeth Green (Maryland Department of the Environment) -- 1 copy
Andrea Graham (US Army Corps of Engineers) -- 1 copy
Brad Knudsen – (US Fish and Wildlife Service) -- 1 copy
Steve Cardon (Fort Meade BRAC Environmental Office) -- 2 copies

Printed on Recycled Paper

Draft Final

2010 Long-Term Monitoring Report
Ordnance Demolition Area
Patuxent Research Refuge – North Tract
Anne Arundel County, MD

Legacy Base Realignment and Closure Program

September 2010 Sampling Event

June 2011

Contract Number: W912DR-09-D-0017
Delivery Order: 0020

Prepared for:

US Army Corps of Engineers ®
Baltimore District

10 South Howard Street
Baltimore, MD 21201

Prepared by:

URS

URS Group, Inc.
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
Project no. 15302066

TABLE OF CONTENTS

LIST OF ACRONYMS ..... **v**

EXECUTIVE SUMMARY **ES-1**

1.0 INTRODUCTION **1-1**

1.1 PURPOSE 1-4

1.2 SAMPLING PROGRAM 1-4

2.0 BACKGROUND **2-1**

2.1 SITE HISTORY 2-1

2.2 ENVIRONMENTAL SETTING 2-4

2.2.1 Climate 2-4

2.2.2 Topography 2-5

2.2.3 Surface Water Hydrology 2-5

2.2.4 Geology 2-5

2.2.5 Hydrogeology 2-6

2.2.5.1 Regional Hydrogeology. 2-6

2.2.5.2 Local Hydrogeology. 2-8

2.2.6 Groundwater and Surface Water Use 2-9

3.0 FIELD ACTIVITIES **3-1**

3.1 GROUNDWATER SAMPLING AND CHEMICAL ANALYSES 3-1

3.2 CHEMICAL ANALYSIS 3-8

3.3 CHEMICAL DATA VALIDATION/REVIEW 3-9

3.4 DATA MANAGEMENT 3-9

3.5 INVESTIGATION-DERIVED WASTE 3-9

4.0 RESULTS **4-1**

4.1 WELL INSPECTION 4-1

4.2 HYDROLOGICAL RESULTS 4-2

4.3 CHEMICAL RESULTS 4-2

4.3.1 Detections 4-4

4.3.2 PRG Exceedances 4-4

TABLE OF CONTENTS (cont'd)

4.4 CHEMICAL EVALUATION 4-4
4.4.1 MNA Parameter Evaluation 4-4
4.4.2 Current Groundwater Quality 4-7
4.4.3 Groundwater Quality Trends 4-8
4.4.4 IDW Characterization and Disposal 4-14

5.0 CONCLUSIONS AND RECOMMENDATIONS 5-1
5.1 CONCLUSIONS 5-1
5.2 RECOMMENDATIONS 5-2

6.0 REFERENCES 6-1

Appendix A: Field Procedures and Calibration Requirements
Appendix B: Field Notes
Appendix C: Well Inspection Logs
Appendix D: Well Purge and Sampling Forms
Appendix E: Groundwater Laboratory Analytical Results (CD Only)
Appendix F: Data Validation Report (CD Only)
Appendix G: Scatter Plots and Lowess Curves
Appendix H: Regulatory Acceptance Letters and Response to Comments

LIST OF FIGURES

No.		Page
Figure 2-1:	Vicinity Map, Patuxent Research Refuge – North Tract	2-2
Figure 2-2:	Site Map, Ordinance Demolition Area, Patuxent Research Refuge – North Tract	2-3
Figure 2-3:	Stratigraphy of the Southern Patuxent Research Refuge – North Tract	2-7
Figure 3-1:	Locations of Monitoring Wells, Ordinance Demolition Area, Patuxent Research Refuge – North Tract	3-2
Figure 3-2:	Geological Cross Section A–A, Patuxent Research Refuge – North Tract	3-3
Figure 4-1:	Groundwater Elevation Contour Map – September 2010, Ordinance Demolition Area, Patuxent Research Refuge – North Tract	4-3
Figure 4-2:	Detections Above PRGs	4-5

LIST OF TABLES

No. Page

Table 1-1: Target Analytes for the ODA 1-3

Table 1-2: Additional MNA Parameters for the ODA 1-3

Table 1-3: Summary of Well Locations 1-5

Table 3-1: Monitoring Well Construction Details 3-4

Table 3-2: Sample Analyses/Analytical Method 3-4

Table 3-3: Sample Containers, Preservation Methods, and Hold Times 3-5

Table 3-4: Final Monitoring Parameters 3-7

Table 4-1: Well Inspection Results 4-1

Table 4-2: ODA Groundwater Elevations, September 20, 2010 4-2

Table 4-3: ODA 2010 Groundwater Chemical Results 4-6

Table 4-4: ODA Historical Chemical Results 4-9

Table 4-5: Summary Statistics and Trend Analyses 4-12

Table 5-1: Proposed 2011 Sampling Analysis Plan for ODA 5-4

LIST OF ACRONYMS

2A46-DNT	2-amino-4,6-dinitrotoluene
4A26-DNT	4-amino-2,6-dinitrotoluene
bgs	Below ground surface
BRAC	Base Realignment and Closure
BWI	Baltimore-Washington International Airport
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	Cis1,2-dichloroethene
dh/dl	Hydraulic difference between two well locations (i.e., hydraulic gradient)
DO	Dissolved oxygen
DoD	Department of Defense
DOI	Department of Interior
EPA	U.S. Environmental Protection Agency
FGGM	Fort George G. Meade
ID	Identification
FWS	U.S. Fish and Wildlife Service
HHRA	Human health risk assessment
K	Hydraulic conductivity
LTM	Long-term monitoring
LTMP	Long-Term Monitoring Plan
LUC	Land use control
MCL	Maximum contaminant level
MD	Maryland
MDE	Maryland Department of the Environment
MDL	Method Detection Limit
MEC	Munitions and explosives of concern
MNA	Monitored natural attenuation
MSD	Matrix Spike Duplicate
n	Porosity
NAVD	North American Vertical Datum
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ODA	Ordnance Demolition Area
PCE	Tetrachloroethene
PRG	Preliminary Remediation Goal
PRR	Patuxent Research Refuge
PRR-NT	Patuxent Research Refuge-North Tract
QC	Quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RAO	Remedial Action Objective

LIST OF ACRONYMS (cont'd)

redox	Reduction-oxidation potential
RDX	Royal Demolition Explosives (a.k.a. Cyclotrimethylenetrinitramine)
RI	Remedial Investigation
RL	Reporting Limit
ROD	Record of Decision
TCE	Trichloroethene
TNT	2A46-trinitrotoluene
TOC	Top of Casing
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
UXO	Unexploded ordnance
v	Average linear (i.e., macroscopic) groundwater velocity
VOC	Volatile organic compound

UNITS

°F	Degrees Fahrenheit
ft	Feet
µg/L	Microgram per liter
µs/cm	Microsiemens per centimeter
mV	Millivolt
NTU	Nephelometric turbidity unit
L/min	Liter per minute

EXECUTIVE SUMMARY

This report presents the results of the 2010 annual groundwater sampling under the Long-Term Monitoring Plan (LTMP) (USACE, 2003) for the former Ordnance Demolition Area (ODA) located at the Patuxent Research Refuge-North Tract (PRR-NT), Anne Arundel County, Maryland (MD).

In 2009, the U.S. Environmental Protection Agency (EPA) reviewed the results of the long-term monitoring (LTM) program and the 2009 Revised Draft Proposed Plan for the ODA and determined that it was uncertain whether natural attenuation was occurring at the site. The EPA recommended the following changes to the ODA LTM program:

- Add the daughter products, cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride to the list of volatile organic compounds (VOCs) monitored at the site.
- Add additional suite of monitored natural attenuation (MNA) parameters to the LTM program to more effectively measure natural attenuation processes at the site.

These modifications will be incorporated into the 2003 LTMP (USACE, 2003) which was written based upon the Draft ODA Proposed Plan (dated April 2003). The revised LTMP will specify the sampling frequency and analytical program necessary to assure the remedy is protective of human health and the environment.

The U.S. Army is proposing the following Remedial Action Objectives (RAOs) for the ODA. The RAOs consist of goals to achieve adequate protection of human health and the environment. These objectives can be achieved by preventing exposure (e.g., limiting access) as well as by reducing contaminant levels. The RAOs developed for the ODA are as follows:

(1) To prevent human exposure to groundwater COPCs that exceed remedial goals established at levels that satisfy the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requirements for the protection of human health and the environment;

(2) To clean up the groundwater above the Arundel Clay to numerical PRGs defined as maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) and to meet site-specific, risk-based remedial goals;

(3) To mitigate risks associated with the disturbance of buried munitions and explosives of concern (MEC); and

(4) To prevent groundwater migration of contaminants beyond the current monitoring network.

The U.S. Army believes that the LTM program modifications will better address the groundwater RAOs 1, 2, and 4 for the ODA. The third RAO for the ODA is not addressed in this LTM report.

Table ES-1 lists the ODA target analytes and their PRGs. Table ES-2 present the MNA parameters added to the ODA LTM program. Attainment of the PRGs completes the remedial action, a required component of site closure. During the monitoring phase of the remedial activity, statistical techniques are applied to identify significant concentration trends.

Table ES-1: Target Analytes for the ODA

Analyte	PRG[1]
Select VOCs	
cis-1,2-Dichloroethene (cis-1,2-DCE) [3]	70
Chloroform [2]	2
Tetrachloroethene (PCE) [3]	5
Trichloroethene (TCE) [3]	5
Vinyl Chloride [3]	2
Select Explosives and Explosive Degradation Products	
Cyclotrimethylenetrinitramine (RDX) [2]	20
2A46-trinitrotoluene (TNT) [2]	3.4
2-amino-4,6-dinitrotoluene (2A46-DNT) [2]	0.8
4-amino-2,6-dinitrotoluene (4A26-DNT) [2]	0.8
Metals	
Cadmium (filtered) [3]	5

Note 1: PRG in units of micrograms per liter (µg/L)
Note 2: HHRA-derived values (USACE, 2002a)
Note 3: federal MCLs (dated November 2010)

Table ES-2: Additional MNA Parameters for the ODA

MNA Parameters
Soluble Manganese
Iron[1]
Ferric Iron[1]
Ferrous Iron[1]
Organic Carbon[1]
Alkalinity
Chloride[2]
Nitrate-Nitrite
Sulfate
Sulfite

[1] total and dissolved
[2] total only

Groundwater samples were collected during September 20 through 29, 2010 from eight monitoring wells at the ODA and analyzed for selected explosives (RDX, TNT, 2A46-DNT, and 4A26-DNT),, VOCs (PCE, TCE, chloroform, cis-1,2-DCE, and vinyl chloride), cadmium, and MNA parameter data. All detections of explosives and VOCs were collected from the four wells within the demolition site berm. PCE was the only target analyte with one result above its PRG from well ODAMW-4.Statistical tools (Mann-Kendall tests, scatter plots, and Lowess curves) were used to evaluate the chemical data for concentration trends. A downward trend for PCE was evident at ODAMW-1, but no discernable trends for PCE were identified at the other demolition ground wells. Trace detections of daughter product cis-1,2DCE were reported at wells ODAMW-1, ODAMW-2, and ODAMW-4. No VOCs were detected at side gradient well ODAMW-5, up gradient well ODAMW-7, and down gradient wells ODAMW-10 and ODAMW-11. Therefore, the VOC groundwater contamination remains within the demolition grounds at the ODA.

The trend analysis reports downward trends for RDX at wells ODAMW-1, ODAMW-3, and ODAMW-4. The detected results for RDX at the demolition grounds have remained at or below the PRG of 20 µg/L from 2006 to 2010. Similar to the VOCs, the LTM results for RDX, 2A24-DNT, and 4A26-DNT were all non-detect for side gradient well ODAMW-5, up gradient well ODAMW-7, and down gradient wells ODAMW-10 and ODAMW-11. The LTM results were below the PRG (0.8 µg/L) for 2A24-DNT and 4A26-DNT since 2007 and 2008 LTM events, respectively. The LTM results for TNT were all below the PRG of 3.4 µg/L.

Dissolved cadmium was last reported above the PRG of 5 µg/L in 2007 at ODAMW-3. The trend analysis reports a downward trend for cadmium concentrations at the demolition ground wells ODAMW-1, ODAMW-2, ODAMW-4, and downgradient well ODAMW-10. The LTM program has reported trace detections of cadmium in all the ODA wells; the detections of cadmium are more likely attributed to background rather than site-related contamination, but this cannot be substantiated without stakeholder-approved background screening criteria.

The 2010 well inspection revealed that all of the site wells are in serviceable condition, but various deficiencies were noted ranging from rusty casings to broken fittings that compromise security. The protective casings of most of the LTMP wells have faded paint and the exterior well identification (ID) was difficult to read. Extensive, fine root systems obstructed ODAMW-1 and ODAMW-2, but were removed prior to sampling. The concrete pads at ODAMW-1 and ODAMW-3 are broken and should be considered for replacement.

Because PCE remains in the groundwater at concentrations greater than its PRG it is appropriate to continue the annual monitoring at the site. VOCs, explosives, and cadmium are still detected primarily within the demolition grounds. More MNA data are needed to discern whether natural attenuation is occurring at the ODA and address EPA's concerns regarding this issue.

The Army plans to make the following recommendations to the stakeholders to revise the LTM program in accordance with the 2010 groundwater sample results and the feedback that the Army received from the stakeholders regarding the ODA Revised Draft Proposed Plan (USACE, 2009):

- Continue groundwater monitoring under the 2003 LTMP, but update the LTMP using the feedback from stakeholders from the previous Final 2009 LTM Report (USACE, 2010) and the Revised Draft Proposed Plan (USACE, 2009).
- Continue sampling LTM wells for MNA parameters and VOC daughter products, as well as select Resource Conservation and Recovery Act (RCRA) metals and select explosives constituents in all future LTM events.
- Sample all existing on-site shallow well locations for select explosives (RDX, TNT, 2A46-DNT, and 4A26-DNT), a select RCRA metal (cadmium), and select VOCs (PCE,

TCE, Chloroform, cis-1,2-DCE, and vinyl chloride) as a supplemental effort to the LTM program (i.e., one-time event during the next planned LTM round) to 1) provide better understanding of current site conditions 2) identify potential background wells, 3) identify LTM program data gaps, and 3) revise the LTMP.

- Discuss the background data gap issue with stakeholders to better determine whether metal concentrations at the ODA are attributed to background rather than site-related contamination. The supplemental sampling effort (see bullet above) will provide data for this discussion.
- Install one shallow and one deep monitoring well (screened above the clay) proximate to where the seep and intermittent drainage intersect. These wells will 1) re-confirm that contamination has not migrated to the Middle Patapsco Confining Clay, and 2) assess potential shallow eastward contaminant migration toward the unnamed intermittent drainage.
- Collect an up gradient and down gradient surface water sample from the seep and from the unnamed intermittent drainage adjacent to ODAMW-4 (four total samples) to determine whether ODA groundwater contaminants are migrating off site.

Page Intentionally Left Blank

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) contracted URS Group, Inc. (URS) under contract W912DR-09-D-D017, Delivery Order 0020, to perform the 2010 annual groundwater monitoring as provided in the Long-Term Monitoring Plan (LTMP) for the Ordnance Demolition Area (ODA), Patuxent Research Refuge-North Tract (PRR-NT), Anne Arundel County, Maryland (MD) (USACE, 2003). The LTMP is being implemented under the purview of the U.S. Army (Army), the U.S. Environmental Protection Agency (EPA) Region III, and the Maryland Department of the Environment (MDE).

The ODA is located on the Fort George G. Meade (FGGM) Legacy Base Realignment and Closure (BRAC) property that was transferred in 1991 to the Department of Interior (DOI) and the U.S. Fish and Wildlife Service (FWS). This property, including the ODA, is administered by FWS as the Patuxent Research Refuge-North Tract (PRR-NT): a National Wildlife Refuge. However, the Army retained responsibility for environmental issues associated with the ODA site that predate the transfer to FWS.

The Revised Draft Proposed Plan for the ODA site dated December 2009 describes the groundwater contamination at the site and presents the proposed remedy of "monitored natural attenuation (MNA) and land use controls (LUCs)." A Record of Decision (ROD) has not yet been written for the ODA. In response to the EPA's feedback on the Revised Draft Proposed Plan, the Army is proposing the following Remedial Action Objectives (RAOs) for the ODA. The RAOs consist of goals to achieve adequate protection of human health and the environment. These objectives can be achieved by preventing exposure (e.g., limiting access) as well as by reducing contaminant levels. The RAOs developed for the ODA are as follows:

(1) To prevent human exposure to groundwater COPCs that exceed remedial goals established at levels that satisfy the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requirements for the protection of human health and the environment;

(2) To clean up the groundwater above the Arundel Clay to numerical PRGs defined as maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) and to meet site-specific, risk-based remedial goals;

(3) To mitigate risks associated with the disturbance of buried munitions and explosives of concern (MEC); and

(4) To prevent groundwater migration of contaminants beyond the current monitoring network.

Because hazardous substances remain on-site above levels that allow for unlimited use and exposure, the ODA is reviewed every 5 years after initiating the remedial action to ensure that the remedy continues to be protective of human health and the environment. As a result of the 2009 5-year review cycle, the EPA recommended that the daughter products, cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride, for tetrachloroethene (PCE) and trichloroethene (TCE) be added to the list of volatile organic compounds (VOCs) monitored at the site. Also, the EPA recommended that an additional suite of MNA parameters be added to the 2010 sampling event to more effectively measure natural attenuation processes at the site.

Based upon EPA's recommendations, the Army modified the long-term monitoring (LTM) program to incorporate the VOC daughter products and additional MNA parameters into the 2010 LTM sampling event. These modifications will also be incorporated into the 2003 LTMP (USACE, 2003) which was based upon the April 2003 Draft ODA Proposed Plan. The revised LTMP will specify the sampling frequency and analytical program necessary to assure the remedy is protective of human health and the environment. The Fort Meade Environmental Partnership believes that these modifications will better address the first two RAOs for the ODA.

The Partnership has established PRGs for certain constituents that were found to drive elevated risk or hazard. The PRGs for the analytes at the ODA are listed in Table 1-1. Table 1-2 lists the additional MNA parameters added to the LTMP in 2010 to more effectively measure the natural attenuation processes at the ODA. The Army is preparing a separate Proposed Plan and ROD to address potential UXO exposure for the 7,600-acre PRR-NT parcel, which includes the ODA site. These documents will address the third RAO and define the remedial actions and LUCs necessary to protect human health and the environment from UXO exposure at the site. Therefore, the third RAO for the ODA is not addressed in this LTM report.

This LTM report presents the results of the 2010 annual groundwater sampling conducted September 20 through 29, 2010.

Table 1-1: Target Analytes for the ODA

Analyte	PRG[1]
Select VOCs	
cis-1,2-Dichloroethene (cis-1,2-DCE) [3]	70
Chloroform [2]	2
Tetrachloroethene (PCE) [3]	5
Trichloroethene (TCE) [3]	5
Vinyl Chloride [3]	2
Select Explosives and Explosive Degradation Products	
Cyclotrimethylenetrinitramine (RDX) [2]	20
2A46-trinitrotoluene (TNT) [2]	3.4
2-amino-4,6-dinitrotoluene (2A46-DNT) [2]	0.8
4-amino-2,6-dinitrotoluene (4A26-DNT) [2]	0.8
Select Metals	
Cadmium (filtered) [3]	5

Note 1: PRG in units of micrograms per liter (µg/L)
Note 2: HHRA-derived values (USACE, 2002a)
Note 3: federal MCLs (dated November 2010)

Table 1-2: Additional MNA Parameters for the ODA

MNA Parameters
Soluble Manganese
Iron[1]
Ferric Iron[1]
Ferrous Iron[1]
Organic Carbon[1]
Soil Organic Carbon
Alkalinity
Chloride[2]
Nitrate-Nitrite
Sulfate
Sulfite

[1] total and dissolved
[2] total only

1.1 PURPOSE

The purpose of the annual LTM is to meet the all RAOs, except the third, for the ODA. To do this, the LTM report documents the plume configuration (if applicable), measures the contaminant concentrations, determines if degradation is occurring, and derives the rate at which degradation is/is not occurring. The LTM program assesses the progress of the MNA remedy in reducing constituent concentrations to the PRGs.

The current detections are evaluated to assess changes in concentrations over time, and to determine if the PRGs for each contaminant has been achieved. The PRGs in Table 1 are comparison criteria used to screen the chemical results. The PRGs for PCE, TCE, vinyl chloride, cis1,2-DCE, and cadmium are federal MCLs. The PRGs for chloroform, cyclotrimethylenetrinitramine (RDX), 2A46-trinitrotoluene (TNT), 2-amino-4,6-dinitrotoluene (2A46-DNT), and 4-amino-2,6-dinitrotoluene (4A26-DNT) were developed in conjunction with the 2002 RI report and human health risk assessment (HHRA) (USACE, 2002a). The LTM program will continue until compliance with the PRGs has been established.

1.2 SAMPLING PROGRAM

The Fort Meade Environmental Partnership has specified that the revised LTM program involves eight existing monitoring wells. Samples from each well were analyzed for the constituents identified in Table 1-1, which include five VOCs, four explosive and explosive degradation compounds, and cadmium (filtered). The data was used for contamination trend and analysis. In addition to the historical analysis, the samples were also analyzed for the suite of MNA parameters listed in Table 1-2 and include nitrate/nitrite, ferric/ferrous iron, sulfate/sulfite, alkalinity, chloride, and total organic carbon, soil total organic carbon, and soluble manganese. Since 2010 is the initial sampling for these parameters, a trend analysis cannot be performed. The following parameters were measured in the field during the sampling program: dissolved oxygen (DO), reduction-oxidation potential (redox), pH, temperature, conductivity, and turbidity. To achieve dissolved results, metals and MNA parameter samples were filtered through an environmental 0.45 micron filter to remove possible residual turbidity from the aquifer prior to analysis.

During the 2010 sampling event, each well was inspected to assure the integrity and security of the sampling points and the representativeness of the sample. Deficiencies are reported within this annual LTM report.

Table 1-3 identifies the eight monitoring wells relative to their positions at the ODA. Because the previous investigations found PRG exceedances only in the water table aquifer, the LTM program includes only wells screened at the water table. Three deeper wells near the ODA are screened in an interval below a Patapsco confining layer (Middle Patapsco Clay), and are therefore not included in the LTM program.

Table 1-3: Summary of Well Locations

Well Location	Well Identification
On Demolition Ground Site	ODAMW-1 ODAMW-2 ODAMW-3 ODAMW-4
Up gradient	ODAMW-7
Down gradient	ODAMW-10 ODAMW-11
Side gradient	ODAMW-5

Page Intentionally Left Blank

2.0 BACKGROUND

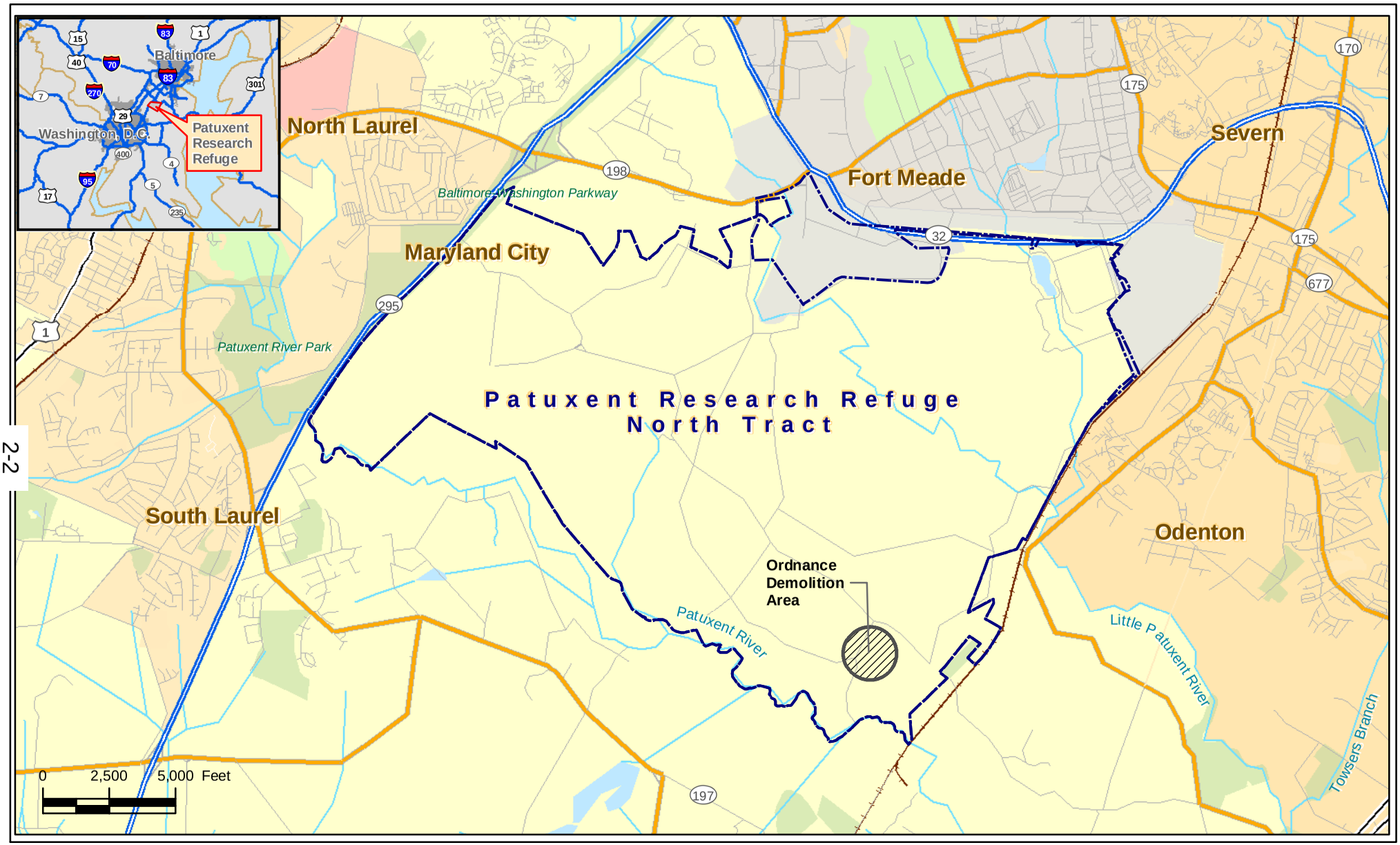
2.1 SITE HISTORY

The Patuxent Research Refuge (PRR) is located in Anne Arundel County, MD, approximately halfway between Washington, DC, and Baltimore, MD. The PRR is bounded on the north by Highways 32 and 198, on the west by the Baltimore-Washington Parkway, on the south by the Patuxent River, and on the east by the active firing ranges, the Amtrak railroad right-of-way, and private property. In 1917, Congress authorized the acquisition of the property for the Army, and approximately 4,000 acres of farmland became Camp Meade in honor of Major General George G. Meade. The property was originally used as a training cantonment for World War I troops. In January 1941, training areas were added within the installation, expanding the post to 13,596 acres. During the 1940s, the facility underwent widespread growth to accommodate several regiments that moved their base of operations to FGGM, including the Second Army and the Eleventh Cavalry (USACE, 2003).

The southern portion of FGGM was previously used for various training activities and firing ranges. As a result of this history, the potential exists for unexploded ordnance (UXO) to be present. Therefore, all subsurface investigations on the property require screening for MEC to be implemented by Explosive Ordnance Disposal trained personnel.

In 1988, the Defense Authorization Amendments and BRAC mandated the closure and realignment of portions of FGGM. In 1991, the Army transferred 7,600 acres to the DOI and the FWS, expanding the contiguous Patuxent Wildlife Research Center. The transferred acreage is now known as the PRR-NT. A second land transfer of approximately 500 acres to the PRR-NT took place in January 1993. The regional map in Figure 2-1 shows the location of the PRR-NT and the ODA.

The ODA covers approximately 2.5 acres in the southern portion of the PRR-NT property, in an otherwise undeveloped wooded area along Wildlife Loop Road (Figure 2-2). Beyond the cleared site the area is heavily forested and locally contains palustrine wetlands to the east and south. A Baltimore Gas and Electric Company power line right-of-way and the



CLIENT	U.S. Army Corps of Engineers, Baltimore District			
DATA SOURCE	ESRI Street Maps 9.2; ODA Long-Term Monitoring 2010 Sampling Event			
REVISION NO	0	GIS:	RP	08/25/09
SCALE	1:60,000	CHECKED:	FM	07/29/08
G:\Projects\Fort_Meade\ODA\Projects\ODAinsetandFigure2-1_2009.mxd		PROJ MGR	FM	-

TITLE

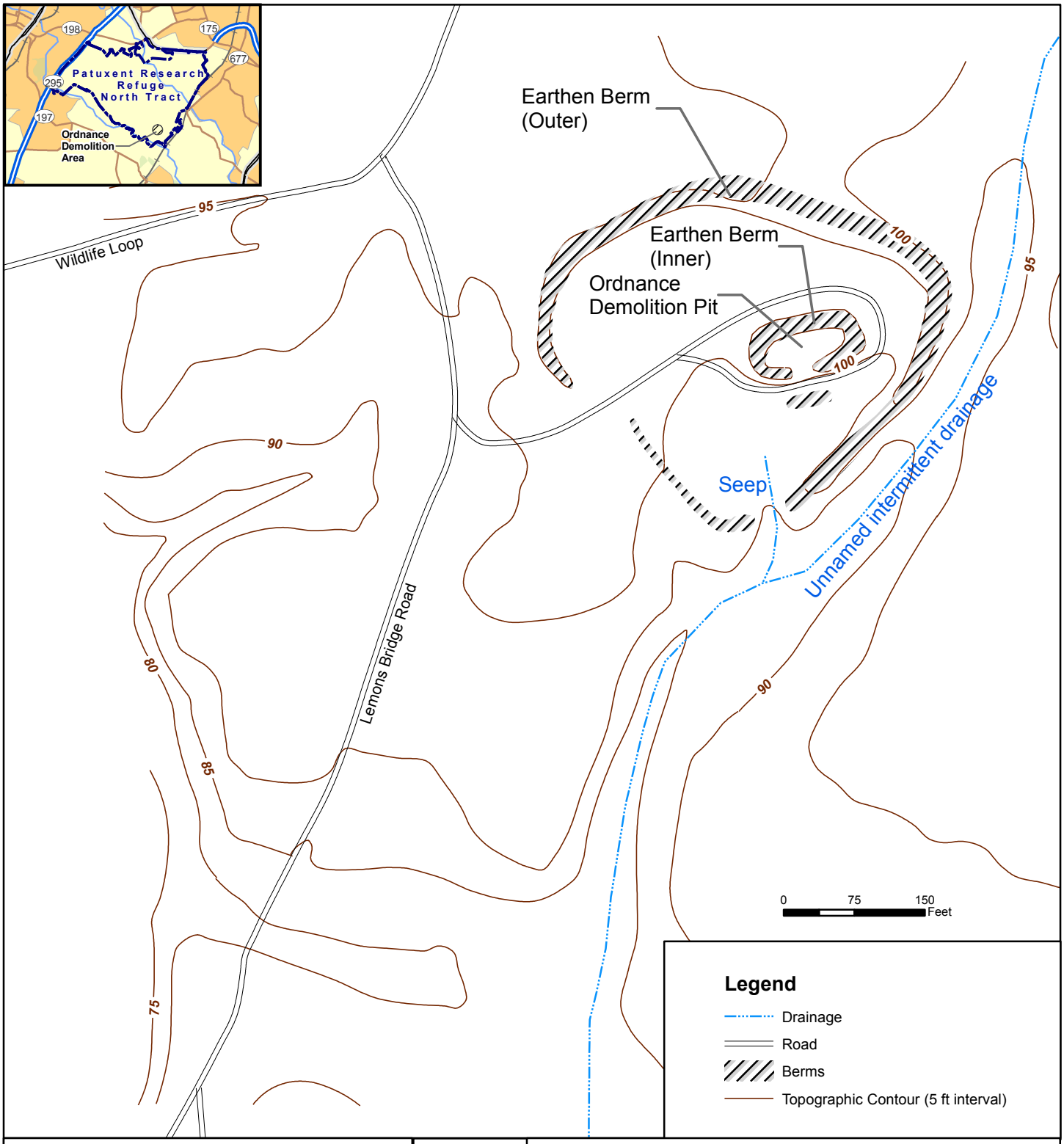
Vicinity Map
Patuxent Research Refuge - North Tract

URS

200 Orchard Ridge Drive
Gaithersburg, MD 20878

PROJ NO 15302389.30000

FIGURE **2-1**



CLIENT	U.S. Army Corps of Engineers, Baltimore District			
PROJ	ODA Long-Term Monitoring 2010 Sampling Event			
SOURCE	Base data: USACE, 2002b.			
REVISION NO	0	GIS:	RP	08/25/09
SCALE	1:1,800	CHECKED:	FM	07/29/08
G:\Projects\Fort_Meade\ODA\Projects\ODAFigure2-2_portrait2009.mxd		PROJ MGR	FM	-

N

TITLE

Site Map
Ordnance Demolition Area,
Patuxent Research Refuge - North Tract

URS

200 Orchard Ridge Drive
Gaithersburg, MD 20878

PROJ NO 15302389.30000

FIGURE **2-2**

Patuxent River are located approximately 700 feet (ft) and 2,000 ft, respectively, to the southwest of the ODA.

The functional portion of the former ODA is bounded by inner and outer earthen berms erected as safety features to reduce the hazard from ejected debris. The inner berm surrounds the ordnance demolition pit, a feature approximately 40 by 80 ft that is predominantly filled with sand. The inner berm rises approximately 8 ft and is constructed of rubble and earthen material. The outer berm is a similarly constructed protective earthwork. The area between the inner and outer berms varies in width from about 50 to 200 ft and is typified by flat grass cover.

The ODA was used for the demolition of known and potential UXO removed from FGGM and the PRR-NT parcel. No documentation exists for earlier activities at the ODA, but given the long history of training, it is possible that the site was used for demilitarization of obsolete and out-of-date rounds. Ordnance demolition occurred within the demolition pit. The explosive limit on ordnance was 5 pounds of explosives, including the amount of donor explosives necessary to detonate the rounds (USACE, 2002a). The ODA is currently inactive.

2.2 ENVIRONMENTAL SETTING

2.2.1 Climate

The climate at the PRR-NT is temperate, influenced by the Chesapeake Bay and the Atlantic Ocean to the east and the Appalachian Mountains to the west. The winter weather in the area is influenced primarily by cold, dry, continental-polar winds from the west and northwest, and less frequent maritime-tropical winds from the south and southwest that bring warm, often humid air to the region. During the summer, the dominance of these two air masses is reversed and warm, humid weather dominates.

Local weather data are compiled by the National Weather Service Forecast Office for the Baltimore-Washington International Airport (BWI) weather station found at the following URL address: http://www.weather.gov/climate/index.php?wfo=lwx. The 2009 annual precipitation was approximately 55.57 inches. The normal distribution of monthly rainfall at BWI is essentially even throughout the year, varying between 3.0 and 3.98 inches. However, the BWI precipitation data revealed a cumulative rainfall in September 2010 of 6.02 inches. The annual mean daily temperature for the FGGM area is 61 degrees Fahrenheit (°F), with a daily annual

maximum of 72°F and a minimum of 45°F. Annual temperature extremes vary from -6°F to 101°F (USACE, 2003).

2.2.2 Topography

The PRR-NT lies within the Coastal Plain physiographic province, which is characterized by broad, low-rolling uplands and low-gradient streams. The area includes the Patuxent River system and numerous tributary streams; fluvial processes have shaped a complex system of small ridges and ponds where the river repeatedly changed course, leaving cutoff meander and ox-bow lake features. The portion of the PRR-NT near the ODA has a shallow slope toward the southwest.

2.2.3 Surface Water Hydrology

The PRR-NT is located within the 932-square-mile Patuxent River watershed, one of the primary drainage systems in Anne Arundel County (USACE, 2003). Several bodies of surface water are present within the PRR-NT, including the Patuxent and Little Patuxent Rivers, Midway and Franklin Branches, Burba Lake, and Lake Allen (formerly known as Soldier Lake). The Patuxent River receives drainage from numerous intermittent streams that emerge from the PRR-NT, including an intermittent stream that drains the former ODA.

Drainage routes through the PRR-NT are generally broad, low-relief features with shallow gradients. Marshy areas and wetlands occur along portions of the major drainages. Much of the PRR-NT is nearly at river level and is prone to flooding.

Surface drainage at the ODA is controlled by an intermittent stream along the east side of the outer berm. Near the ODA this stream is in a confined channel approximately 2 ft wide. South of the ODA, this drainage becomes a perennial stream and ultimately discharges to the Patuxent River. During wet seasons, a seep flows from inside the ODA berm to discharge into the surface water system.

2.2.4 Geology

The PRR-NT is located on the Cretaceous sediments of the Coastal Plain physiographic province. The Coastal Plain is underlain by a wedge of unconsolidated alluvial sediments that dip and thicken eastward toward the Atlantic Ocean. The crystalline rocks of the Piedmont

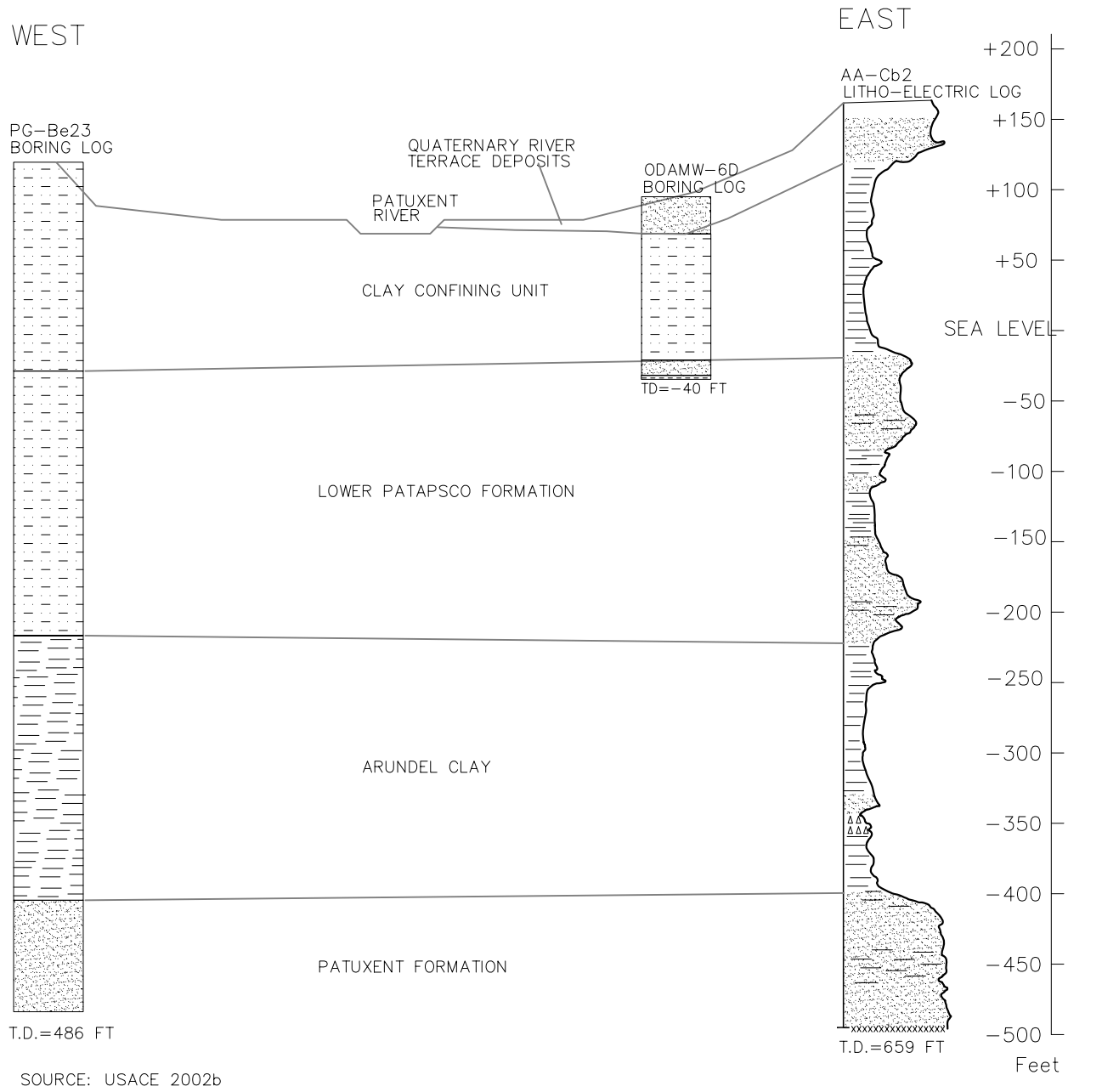
physiographic province (the easternmost portion of the Appalachian Plateau) lie beneath the sediments at the PRR-NT, but they are exposed near the Anne Arundel County line to the west. The demarcation between the Piedmont and Coastal Plain physiographic provinces is termed the "Fall Line" after the falls and rapids found where streams cross this boundary.

The unconsolidated sands, clays, and silts of the Coastal Plain were deposited during the Cretaceous and the Quaternary geologic periods. Unconsolidated deposits present at the PRR-NT are from the lower Cretaceous age Potomac Group; these sediments consist of, from youngest to oldest, the Patapsco Formation, Arundel Clay, and Patuxent Formation, and have a total thickness of at least 600 ft at the PRR. The formations result from fluvial and lacustrine deposition and consist of interbedded sand, silt, and clay layers. The Patuxent Formation is exposed at the surface west of the PRR, the Arundel Clay crops out over the western portion of the PRR, and the Patapsco Formation crops out over the central and eastern portions of the PRR. Quaternary alluvium and river terrace deposits locally overlay the Potomac Group near the Patuxent and Little Patuxent Rivers (USACE, 2003).

The ODA is situated on Quaternary alluvium, which is the local water table aquifer. The underlying Lower Patapsco sands and clays have been penetrated by three well borings near the ODA. Wells do not extend as deep as the Arundel Clay and the Patuxent aquifer. A cross section showing the general stratigraphy of the southern portion of the PRR-NT is shown in Figure 2-3.

2.2.5 Hydrogeology

2.2.5.1 Regional Hydrogeology. Groundwater resources in the Potomac Group sediments include three aquifers: the Upper Patapsco, the Lower Patapsco, and the Patuxent (USACE, 2005b). The Arundel Formation and the middle confining layer of the Patapsco Formation act as confining layers separating the aquifers. The aquifers are confined on a regional scale, but they act as unconfined aquifers within the respective outcrop areas. The regional groundwater flow is to the southeast, generally following the eastward structural dip. However, groundwater flow in the water table aquifer often mirrors the topography and can deviate significantly from the surface configuration. Some seasonal fluctuations locally influence flow direction, but the general flow is controlled by the Patuxent River, the Little Patuxent River, and the perennial streams that serve as "constant head" hydraulic boundaries.



CLIENT: U.S. Army Corps of Engineers, Baltimore District	LOCATION: U.S. Army Corps of Engineers, Baltimore District
DATE: 01/08/07	FILE: G:\FtMeade\Projects\demolition_area 2-3inset.mxd
DESIGN: AER CHECKED: FM SENIOR: SM	URS 200 Orchard Ridge Drive Gaithersburg, MD 20878

Figure 2-3

Stratigraphy of the Southern Patuxent Research Refuge-North Tract

P:\Gaithersburg\U000000572 USACE\15291965 ODA - Ft. Meade\Long-Term Monitoring\LTM Reports\FIGURES - ACAD\FIGURE 2-3(01-07).dwg, Layout1, 2/1/2007 9:30:25 AM, sokhons, Adobe PDF.pc3, 1:1

2.2.5.2 Local Hydrogeology. Quaternary river terrace sands are present in this area and are the water table aquifer at the ODA. The terrace deposits cover the Lower Patapsco sediments, which crop out on much of the PRR, and which underlie the terrace deposits at the ODA. Earlier investigations that supported the remedial action for the water table aquifer also demonstrated that the Lower Patapsco aquifer is hydraulically isolated from the water table aquifer. Three hydrostratigraphic units of the Cretaceous Potomac Formation are present at the ODA:

- The uppermost hydrostratigraphic unit consists of the locally preserved Quaternary alluvial and terrace deposits, which is the water table aquifer. This unit is composed of surficial sandy soils and reddish and reddish-yellow, well sorted, medium-grained, quartz sands. The Quaternary terrace deposits are of similar lithology and difficult to distinguish in boring cuttings from the underlying Patapsco. Groundwater is encountered at depths between the ground surface (at the seep) and about 10 ft below ground surface (bgs). The thickness of this unit ranges up to 40 ft at the ODA.
- The Lower Patapsco sand is a confined aquifer in this area and consists of approximately 190 to 230 ft of yellowish-orange to brown sand and lesser amounts of sandy gravel. This unit crops out a short distance west of the PRR where it is in recharge as the water table aquifer. Because previous investigations demonstrated this aquifer is isolated from the water table aquifer, the ODA LTMP did not provide for monitoring this interval (USACE, 2003).
- The Patuxent Formation is the lowest Cretaceous unit represented in the vicinity of the FGGM and the PRR. This confined aquifer is a water supply for nearby municipal systems, including FGGM, and for facilities on the PRR-NT. Production comes from screens as deep as 800 ft bgs.

Two clay intervals separate the Potomac Group aquifers:

- The middle portion of the Patapsco Formation in this area consists of low-permeability silty and sandy clays and sand-silt-clay mixtures, with local zones of silts and sand. This interval, which is approximately 70 ft thick at the ODA, acts as a confining unit. The three deep monitoring wells at the ODA are screened in sand intervals within the middle Patapsco.

- The Arundel Clay is a regional confining unit. Although the Arundel Clay was not encountered in the drilling at the ODA, it is estimated that the top of the Arundel Clay should be encountered at approximately 300 ft bgs in this area. Facility deep well logs indicate that the Arundel Clay consists of stiff, reddish-brown clays with a thickness of 200 to 250 ft.

Slug tests were performed in 1996 on five shallow wells at the ODA (USACE, 1998a). The calculated hydraulic conductivities (K) of the sand matrix of the (unconfined) water table aquifer are in the 1 to 7 ft per day range, and the geometric means calculated between the rising and falling head tests are approximately 3 ft per day. This is consistent with published conductivities for unconsolidated sands or silty sands (Freeze and Cherry, 1979). A previously estimated hydraulic gradient (dh/dl) of the water table across the ODA, calculated from the head difference between wells ODAMW-3 and ODAMW-1, was approximately 0.008 ft to the southwest toward the Patuxent River. Assuming an average conductivity of 3 ft per day and a porosity (n) of 0.3, the average linear groundwater velocity (v) using the equation

$$v = K \times (dh/dl)/n$$

was estimated to be approximately 0.08 ft per day, or approximately 30 ft per year.

The direction of groundwater flow in the shallow aquifer follows topography and is generally to the south-southwest. Based on the results of previous studies, shallow groundwater is assumed to discharge to the Patuxent River.

2.2.6 Groundwater and Surface Water Use

FGGM obtains water from two sources: (1) surface water from the Little Patuxent River and (2) six deep facility production wells (PW-1 to PW-6) The Maryland regulations (Code of Maryland Regulations 26.08.02) designate the Little Patuxent River south of the Old Forge Bridge as a Use I waterway—suitable for human water contact recreation, fishing, and the protection and propagation of aquatic life. The Little Patuxent River north (upstream) of the Old Forge Bridge is designated as Use I-P, which is additionally suitable for use as a public water supply. The Water Treatment Plant surface water intake is located north of Route 198. The Patuxent River within the PRR, which ultimately receives drainage from the ODA, is also designated as a Use I-P waterway.

The six FGGM production wells are screened between 500 and 800 ft bgs in the Patuxent Formation. Production wells PW-1 and PW-2 are located on the FGGM cantonment area north of Route 32. Wells PW-3 to PW-6, located near Range Road, are on the extreme eastern side of the PRR-NT. These deep wells are not near the ODA and are screened well below the thick Arundel Clay regional confining layer.

At this time the PRR-NT produces water from three wells completed in the Patuxent aquifer with screen depths of greater than 230 ft below the surface (Russ Dyrland, Personal Communication). Water is supplied from wells at the athletic fields near the entrance at Maryland Route 198, at the Visitor Contact Center, and at the Environmental Education Center. No groundwater is extracted near the ODA. Records exist of three additional Patuxent wells that once served isolated facilities on the property, but these wells are not in service and are in unknown condition at this time.

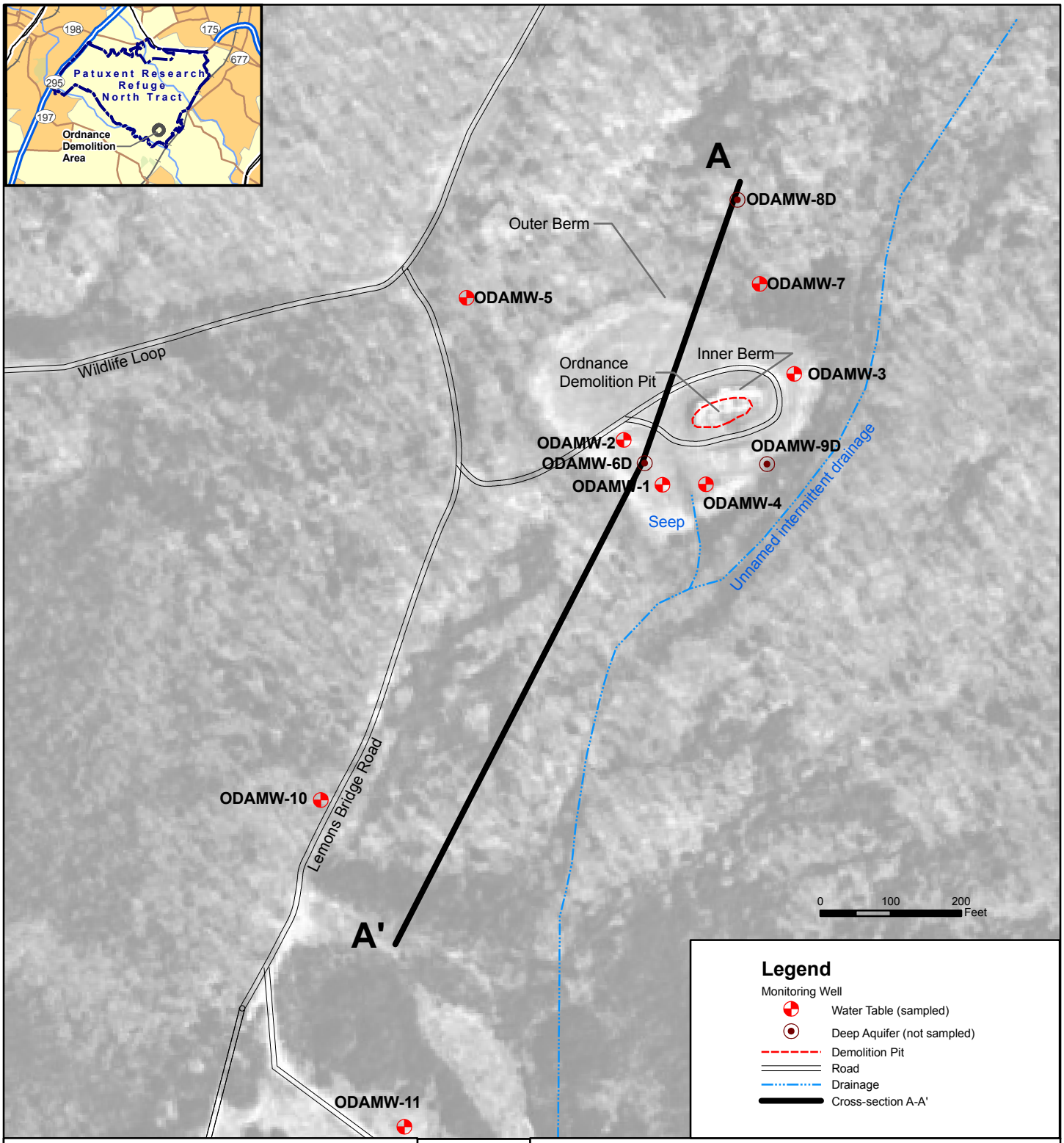
Surface water on the PRR-NT is dedicated to wildlife management, including wetlands habitats and ponds supporting migratory waterfowl. This resource is important for sportsman's activities during hunting season.

3.0 FIELD ACTIVITIES

3.1 GROUNDWATER SAMPLING AND CHEMICAL ANALYSES

Eight monitoring wells were sampled for the 2010 LTM event. The field procedures and instrument calibration procedures are described in Appendix A and the field notes are provided in Appendix B. Figure 3-1 illustrates the location of the eight water table wells that were sampled, and the three deeper wells that were not included in the LTMP. Figure 3-2 is a geological cross section through the ODA that illustrates the relative positions of the well screens to the water table. The locations of and sampling rationale for the eight wells sampled in 2010 are described below. Construction details of these wells are listed in Table 3-1.

- ODAMW-1: This shallow well is located southwest of the demolition pit and is between the inner and outer berms.
- ODAMW-2: This shallow well is located just south of the road to the demolition pit and is between the inner and outer berms.
- ODAMW-3: This shallow well is just east of the demolition pit and is between the inner and outer berms.
- ODAMW-4: This shallow well is located just east of ODAMW-1 and north of the seep. It is also immediately down gradient of the demolition pit between the inner and outer berms.
- ODAMW-5 and -7: The ODAMW-5 is a side gradient well and the ODAMW-7 is an up gradient well from the ODA. These wells provide background water quality information from locations unlikely to be affected by the site activity.
- ODAMW-10 and -11: These wells are located south-southwest and are hydraulically down gradient of the demolition pit along the main axis of the plume.



CLIENT	U.S. Army Corps of Engineers, Baltimore District			
PROJ	ODA Long-Term Monitoring 2010 Sampling Event			
SOURCE	Location data: USACE, 2002b; DOQ, TerraServer, na.			
REVISION NO	0	GIS:	RP	08/25/09
SCALE	1:2,400	CHECKED:	FM	08/27/08
G:\Projects\Fort_Meade\ODA\Projects\ODAFigure3-1_portrait2009.mxd		PROJ MGR	FM	-

TITLE

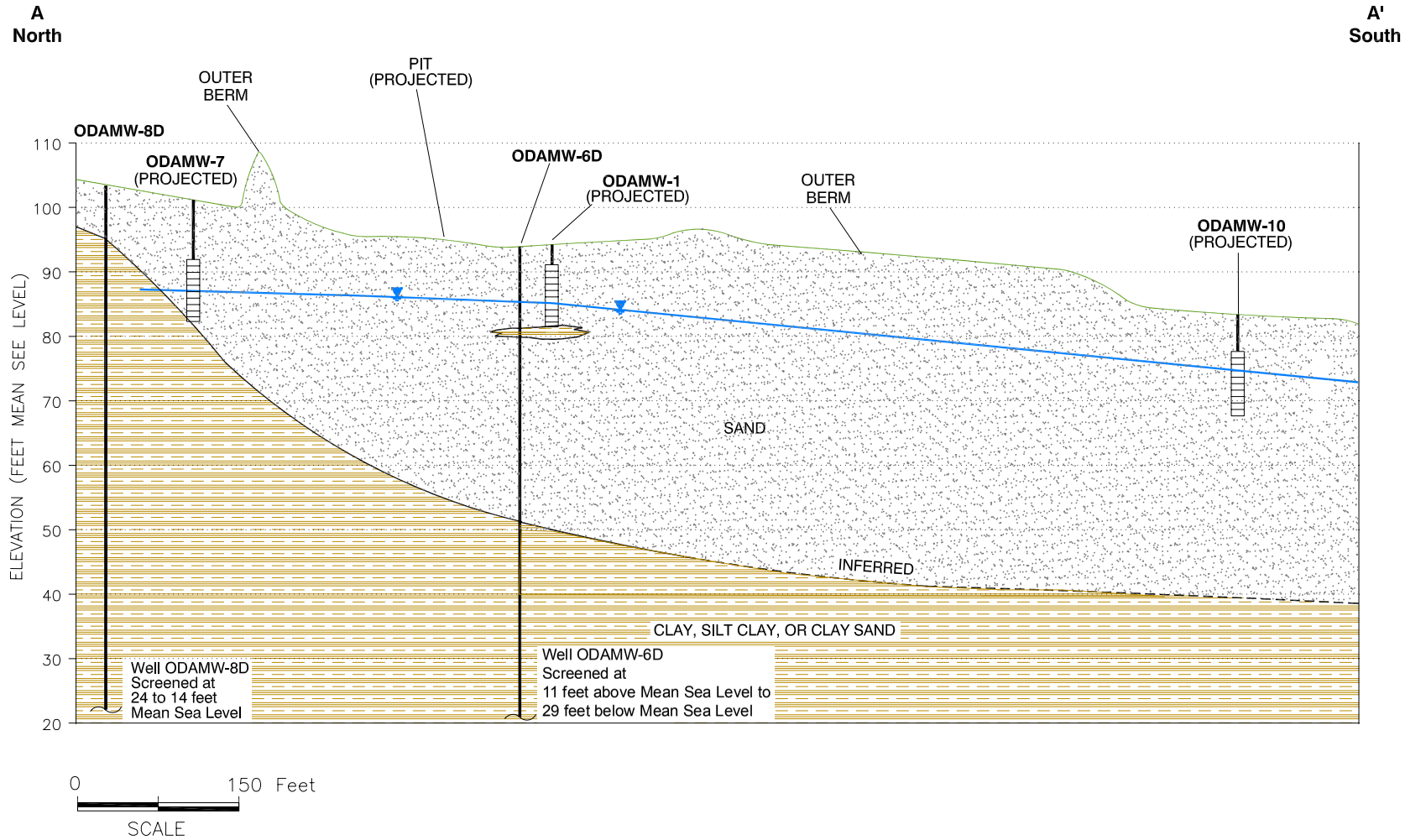
Locations of Monitoring Wells
Ordnance Demolition Area,
Patuxent Research Refuge - North Tract

URS

200 Orchard Ridge Drive
Gaithersburg, MD 20878

PROJ NO 15302389.30000

FIGURE 3-1



LEGEND:

ODAMW-6D WELL NAME

WELL SCREEN

GROUNDWATER SURFACE

(Projected) Relative position of the well screens to the water table at the Site.

CLIENT: U.S. Army Corps of Engineers, Baltimore District	LOCATION: U.S. Army Corps of Engineers, Baltimore District
DATE: 10/08/07	FILE: G:\FtMeade\Projects\demolition_area 2-3inset.mxd
DESIGN: AER	URS 200 Orchard Ridge Drive Gaithersberg, MD 20878
CHECKED: FM	
SENIOR: SM	

Figure 3-2

Geologic Cross Section A-A' Patuxent Research Refuge-North Tract

Table 3-1: Monitoring Well Construction Details

Well No.	Well Depth (ft bgs)s	Approx Screen Interval (ft bgs)	Borehole Diameter (inches)	Surface Protective Casing/Well and Screen Diameter (inches)	Top of Filter Pack (ft bgs)	Top of Casing Elevation (ft NAVD* 1988)
ODAMW-1	13.5	3.5-13.5	13	6/4	3	95.40
ODAMW-2	14	4-14	13	6/4	3	97.45
ODAMW-3	15	5-15	13	6/4	3.5	98.36
ODAMW-4	12	2-12	12	6/4	1.5	94.72
ODAMW-5	12	2-12	12	6/4	1.5	98.76
ODAMW-7	19.5	9.5-19.5	12	6/4	6	102.82
ODAMW-10	15	5-15	12	6/4	2.8	86.70
ODAMW-11	15	5-15	12	6/4	2.8	77.81

* NAVD = North American Vertical Datum; ft = feet; bgs = below ground surface

The parameters specified in the LTMP and the EPA analytical methods for the groundwater samples and the quality control (QC) are listed in Table 3-2. The metals samples were filtered in the field at the time of collection.

Table 3-2: Sample Analyses/Analytical Method

Well No./QC	Select VOCs (3,7) /8260B	Select Explosives (2,8)/8330	Cd & Mn(3,9) /6020A	Nitrate/Nitrite(3,6) /353.2	Ferric/ferrous Iron (5,6) / 3500 FE D	Iron (5,10) /6010B	Sulfate(6) /300	Sulfite(6) /377.1	Alkalinity(6) /2320B	Total Chloride(6) /300	Total Organic Carbon(6) /5310C	Dissolved Organic(3,6) / Carbon 5310C
ODAMW-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-2 Dup (4)	✓	✓	✓									
ODAMW-3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Well No./QC	Select VOCs[1,7] /8260B	Select Explosives[2,8]/8330	Cd & Mn[3,9] /6020A	Nitrate/Nitrite[3,6] /353.2	Ferric/ferrous Iron[5,6] / 3500 FE D	Iron[5,10] /6010B	Sulfate[6] /300	Sulfite[6] /377.1	Alkalinity[6] /2320B	Total Chloride[6] /300	Total Organic Carbon[6] /5310C	Dissolved Organic[3,6] / Carbon 5310C
Equipment Rise	✓	✓	✓									
Trip Blanks	✓											

(1) PCE, TCE, Chloroform, cis-1,2-DCE, and vinyl chloride
(2) RDX, TNT, 2A46-DNT, 4A26-DNT
(3) Filtered Sample
(4) Duplicate Sample labeled "ODAMW-12"
(5) Two samples taken, one filtered, one not filtered
(6) Preparation Method as listed for the Analytical Method
(7) Preparation Method SW-846 5030B
(8) Preparation Method SW-846 3535
(9) Preparation Method SW-846 3005A
(10) Preparation Method SW-846 3010A

The sample container specification, preservation, and hold times for the analyte are provided in Table 3-3.

Table 3-3: Sample Containers, Preservation Methods, and Hold Times

Parameter	Container Type	Preservation	Container Quantity	Hold Time
VOCs	40-mL glass bottles with Teflon-lined septum cap	HCl to pH <2 Cool, 4 ± 2°C	3	14 days
Explosives	1-liter amber glass bottles with Teflon-lined caps	--	2	7 days
Cd & Mn	500-ml plastic bottle	HNO_3 to pH <2 Cool, 4 ± 2°C	1	6 months
Nitrate/Nitrite	250-ml plastic bottle	H_2SO_4 to PH<2 Cool, 4 ± 2°C	1	28 days
Ferric/ferrous Iron (Filtered)	250-ml plastic bottle	HCl to pH <2 Cool, 4 ± 2°C	1	24 Hours
Ferric/ferrous Iron	250-ml plastic bottle	HCl to pH <2 Cool, 4 ± 2°C	1	24 Hours
Iron (Filtered)	250-ml plastic bottle	HNO_3 to pH <2 Cool, 4 ± 2°C	1	6 months
Iron	250-ml plastic bottle	HCl to pH <2 Cool, 4 ± 2°C	1	6 months
Sulfate, Alkalinity, and Total Chloride	500-ml plastic bottle	--	1	28 days

Parameter	Container Type	Preservation	Container Quantity	Hold Time
Sulfite	--	--	Use Hatch Kit	Immediate
Total Organic Carbon	40-mL glass bottles with Teflon-lined septum cap	H_2SO_4 to PH<2 Cool, 4 ± 2°C	2	28 days
Dissolved Organic Carbon	40-mL glass bottles with Teflon-lined septum cap	H_2SO_4 to PH<2 Cool, 4 ± 2°C	2	28 days

Three monitoring wells at the site (ODAMW-6D, ODAMW-8D, and ODAMW-9D) examined deeper parts of the aquifer during the ODA RIs. These wells are screened at depths of greater than 80 ft bgs, in a Lower Patapsco confined aquifer that is isolated from the water table aquifer by Patapsco clay layers. The RIs determined that site-related contaminants are not detected in deeper groundwater therefore these deep wells were not incorporated into the LTMP.

Because of the former ordnance activity at the site, all access paths to wells were swept by a certified UXO technician to mark avoidances. All personnel and vehicular movement was restricted to the cleared areas near the wells. Based upon the results of previous sampling events, all personnel worked with personal protection equipment at Level D with foot, hand, and eye protection.

Groundwater sampling was conducted September 20 through 29, 2010 using the low-flow sampling method (see Appendix A). Each well was first inspected for integrity and security, and deficiencies were recorded. As the well cap was opened, the head space was tested with a photoionization detector for the presence of VOCs. A water level meter was used to gauge the water level and measure the total depth of each well. The volume of the water in each well and the saturated annulus was calculated using the conversion of 0.65 gallons per foot of column in the 4-inch diameter wells, and an assumed 30 percent porosity for the sand in the annulus. Between wells the water level meter was rinsed in deionized water, scrubbed in a non-phosphate detergent solution, and rinsed in deionized water. Purging and sampling were accomplished using 12-volt submersible pumps and disposable polyethylene tubing. According to the procedures presented in section 3.0 of the LTMP, the submersible pump was decontaminated prior to each use. The pump was placed in the well with the inlet screen at the deeper of the midpoint of the well screen or the midpoint of the water column. In cases where non-dedicated sampling equipment was used (e.g., rental bladder pumps), the equipment was transported to the

decontamination pad and decontaminated according to procedures outlined in Appendix A, Section A.3.

Low-flow purging was used at all the ODA wells with the pump delivering approximately 0.18 to 0.53 liter per minute (L/min) while maintaining a drawdown of less than one ft (approximately 0.3 ft in most cases) from the static level. Water level was monitored at ten-minute intervals during the purge.

During the purge the physical parameters of pH, conductivity, temperature, dissolved oxygen, redox, and turbidity were measured using an in-line flow cell and recorded at approximately ten-minute intervals. Purging continued until parameters had stabilized which is defined as three successive readings 10 minutes apart in which the pH changes by less than 0.1 pH unit; temperature changes less than 1°F or less; and conductivity and turbidity change by less than 10 percent. Table 3-4 presents the final monitoring parameters for the ODA wells. The purge records in Appendix D list the full suite of monitoring parameters. Purge water was containerized for future disposal (see Section 3.5).

Table 3-4: Final Monitoring Parameters

Well ID	pH	Temperature °C	Conductivity (µmohs/cm)	DO (ppm)	REDOX (mV)	Turbidity (NTU)	Drawdown (ft)	Date
ODAMW-1	4.47	19.58	0.089	5.75	341	7.6	0.06	09/22/2010
ODAMW-2	4.39	18.97	0.066	6.76	109	68.3	0.06	09/28/2010
ODAMW-3	5.86	21.15	0.112	<0.2	55	29.7	1.08	09/22/2010
ODAMW-4	2.24	19.45	0.1	5.23	418	21	0.29	09/22/2010
ODAMW-5	5.35	19.41	0.047	0.1	117	83.3	1.26	09/28/2010
ODAMW-7	4.36	16.07	0.06	7.78	362	3.8	0.28	09/23/2010
ODAMW-10	4.47	16.36	0.054	<0.2	325	1.3	0.28	09/21/2010
ODAMW-11	4.36	21.14	0.045	1.34	258	90.1	0.17	09/23/2010

Notes:
DO = dissolved oxygen
°F =degrees Celsius
mV = millivolt
ft = feet
µmohs/cm = micro mohs per centimeter
NTU = nephelometric turbidity unit
ppm = parts per million

Minimum volume is when at least one equivalent well volume of water has been evacuated from the well (if practicable) before a sample is collected and the before-mentioned water quality parameters have stabilized. This minimum purge volume requirement is stated in the 2003 ODA LTMP (USACE, 2003). URS further defines practicality as a minimum of 1 hour of purge time. Turbidity failed to meet the ten percent criterion at ODAMW-1 and ODAMW-3.

This parameter frequently failed to meet the stabilization criterion in past sampling rounds. Although the ODA wells were carefully developed after installation and had been purged in previous sampling events, the river terrace sediments continue to release fine particles, even with the low-flow protocol. Because the metals samples were filtered prior to analysis, residual turbidity is expected not to influence the metals results. It is not known if the residual turbidity influences the concentrations of the organic compounds. Temperature did not meet the specified criteria at ODAMW-2, ODAMW-3, ODAMW-5, and ODAMW-11. The pH level did not meet the specified criteria at ODAMW-3. These anomalies were due to persistent minor temperature and pH fluctuations.

Samples were collected in laboratory-supplied and appropriately pre-preserved bottles. All bottles were labeled with the sample identification (ID), sample date and time, analysis, preservative, and sampler. The samples that required filtering were passed through a 0.45-micron in-line filter prior to filling the pre-preserved bottle. QC samples include one field duplicate sample and daily trip blanks that traveled with the VOC samples. Samples were collected for the laboratory matrix spike and matrix spike duplicate (MS/MSD) analyses at the same wells as the field duplicates. All samples were placed in sealed, ice-filled coolers for shipment.

The nomenclature for the sample ID uses the monitoring well designation, for example "ODAMW-4." For the QC samples, the codes appended to the sample IDs are FD for field duplicate, MS for matrix spike, and MSD for matrix spike duplicate. The equipment rinse was collected with sample ODAMW-2 as well as the duplicate, labeled ODAMW-12. One equipment blank was collected from the decontaminated submersible pump per the requirement of one blank per 20 environmental samples. The daily trip blanks accompany the VOC samples and were designated Test Blank.

3.2 CHEMICAL ANALYSIS

The samples were shipped under Chain of Custody (COC) protocol to three Test America Labs to meet the specified hold time associated with each parameter. The Test America Lab locations are Nashville, Tennessee, Pittsburgh, Pennsylvania, and St. Louis, Missouri. COC forms and the waybills are included in Appendix E. The laboratory sample results summary sheets and definitions for field and laboratory QC samples are provided in Appendix E.

3.3 CHEMICAL DATA VALIDATION/REVIEW

URS performed a Level III validation of the chemical data to evaluate and assess the quality of the sample data and the data usability for its intended purpose. In addition to assessing the results of the various analytical QC, the validation identifies potential errors in the results, such as transcription errors, laboratory methods out of control, cross-contamination of samples, etc. All the results were reported as useable, with some flags noted. The Validation Report is provided in Appendix F.

3.4 DATA MANAGEMENT

Field data generated under this project were recorded in a bound field log book (see Appendix B) and on well inspection logs and purge and sampling forms provided in Appendices C and D, respectively. Chemical data were supplied by the laboratory in hardcopy and electronic formats as laboratory reports; the electronic copy is provided in Appendix E.

3.5 INVESTIGATION-DERIVED WASTE

Purge water was collected and stored in 55-gallon drums that will be collected and disposed of by Potomac Environmental, Inc. The water will not be sampled; it is considered investigation-derived waste (IDW) water with trace explosives (i.e., non-hazardous). All disposable sampling material, including tubing and personal protective equipment, was collected in trash bags and will be disposed of as directed by Post personnel.

Page Intentionally Left Blank

4.0 RESULTS

This section presents the results of the 2010 LTM fieldwork activities and analyses conducted as discussed in Section 3.0. The results are from activities that included well inspection, groundwater level measurements, groundwater sampling/chemical analyses, and statistical analyses. Historical chemical results are also provided in tabular form and are analyzed with the 2010 data in the trend analysis section.

4.1 WELL INSPECTION

A visual inspection of the casing of each of the ODA wells was performed by URS during the sampling event. The inspection revealed that all of the site wells are in serviceable condition, but various deficiencies were noted ranging from rusty casings to broken fittings that compromise security. Table 4-1 presents the conditions discovered at the time of inspection. Most well locks are stiff and difficult to open. Paint is faded on many well casings and the exterior well ID is difficult to read. Extensive, fine root systems obstructed ODAMW-1 and ODAMW-2, but were removed prior to sampling. The concrete pads at ODAMW-1 and ODAMW-3 are broken and should be considered for replacement. Table 4-1 presents a summary of the deficiencies discovered during the inspection. The well inspection logs are included in Appendix C.

Table 4-1: Well Inspection Results

Well ID	Concrete Pad	Casing Paint	Well ID Legible	Well Permit Tag Present	Additional Notes
ODAMW-1	Cracked	Faded	No	Yes	Roots in well
ODAMW-2	Intact	Faded	No	Yes	Roots in well
ODAMW-3	Cracked	Faded	No	Yes	--
ODAMW-4	Intact	OK	Yes	Yes	Ant infestation
ODAMW-5	Intact	Faded	Yes	Yes	Rusted casing
ODAMW-6D	Intact	OK	No	Yes	Rusted casing
ODAMW-7	Intact	OK	Yes	Yes	Rusted casing
ODAMW-8D	Intact	OK	Yes	Yes	--
ODAMW-9D	Intact	Faded	Yes	Yes	Rusted casing
ODAMW-10	Gravel pad	OK	Yes	Yes	--
ODAMW-11	Intact	Faded	Yes	No	Rusted casing

4.2 HYDROLOGICAL RESULTS

Table 4-2 presents the static water levels measured on September 20, 2010. These elevations were used to produce the water level contour map presented in Figure 4-1. The groundwater flow at the ODA is to the south toward the Patuxent River.

Table 4-2: ODA Groundwater Elevations, September 20, 2010

Well ID	Top of Casing (TOC) Elevation[1] (ft)	Depth to Water (ft, TOC[2])	Groundwater Elevation[1] (ft)	Depth to Top of Screen (ft, TOC[2])	Height of Water Above Top of Screen (ft)
ODAMW-1	95.40	8.28	87.12	5.38	-2.90
ODAMW-2	97.45	10.73	86.72	5.92	-4.81
ODAMW-3	98.36	9.55	88.81	7.04	-2.51
ODAMW-4	94.72	6.98	87.74	4.28	-2.70
ODAMW-5	98.76	11.87	86.89	4.25	-7.62
ODAMW-7	102.82	15.00	87.82	12.37	-2.63
ODAMW-10	86.70	11.93	74.77	7.27	-4.66
ODAMW-11	77.81	4.61	73.20	7.08	2.47

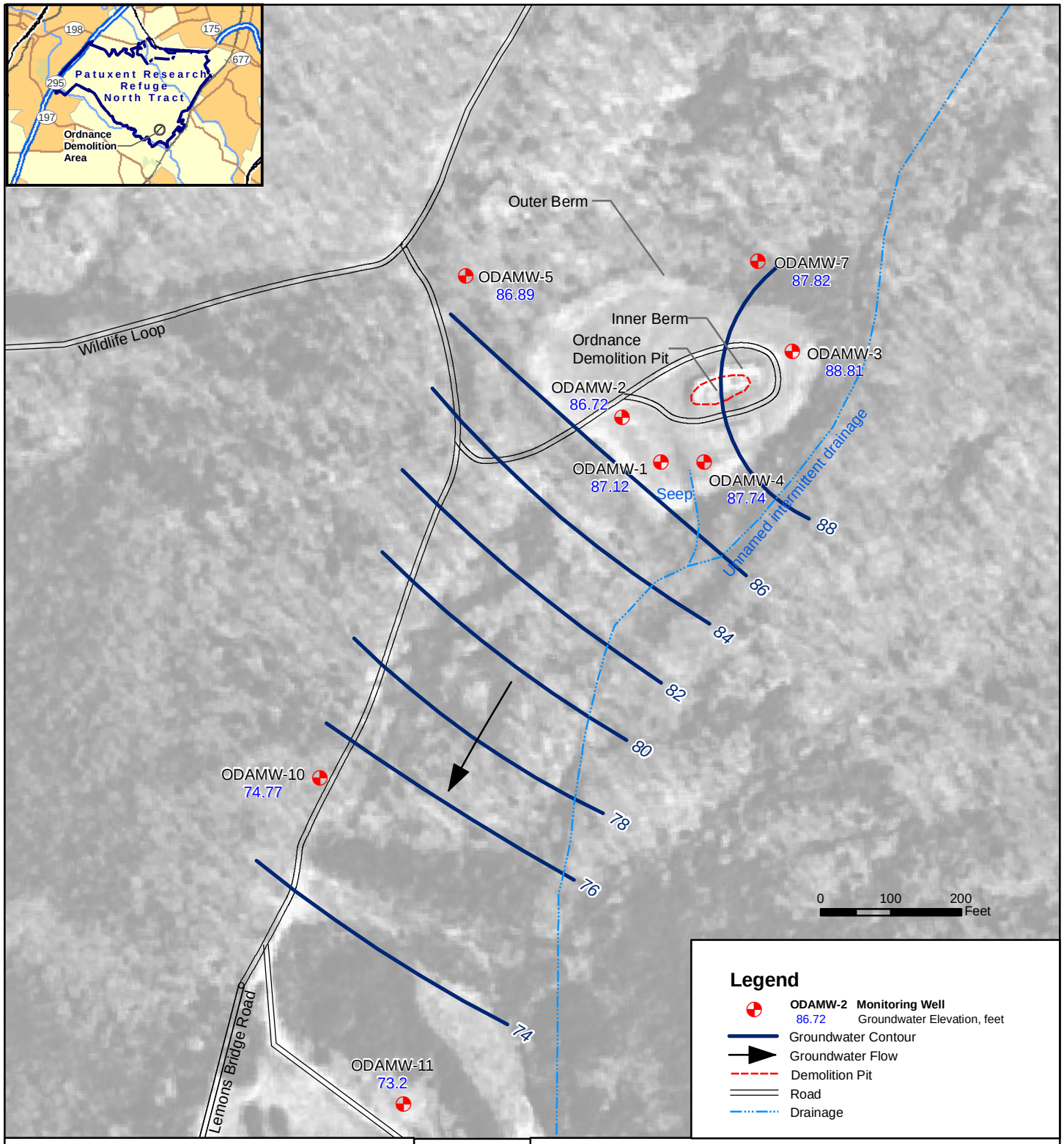
Notes [1]Elevation relative to Mean Sea Level NAVD 1988.
[2]Depth measured below top of casing (TOC)

The horizontal gradient between wells ODAMW-3 and ODAMW-4 is approximately 0.0054 ft per foot. Assuming the porosity of the terrace sediment is 30 percent and hydraulic conductivity is on the order of 3 ft per day, the horizontal groundwater velocity beneath the site is approximately 0.054 ft per day, or 19.5 ft per year to the southwest. This is similar to the velocity reported in Section 2.2.5.2 using historic data.

The water table elevation relative to the well screen is revealed in the calculation of the height of the water above the top of the screen in Table 4-2. A positive result indicates the entire screen is in the saturated aquifer; a negative result indicates the screen straddles the water table and the vadose zone is exposed to the screen. At the time of the water level measurements, groundwater elevations were below the top of the screen in all wells except ODAMW-11.

4.3 CHEMICAL RESULTS

This section reviews the analytical results for the 2010 monitoring. The detections for the original parameters are compared to the PRGs identified in the 2002 RI Report and human health risk assessment (USACE, 2002a) and reviewed with the historic data to assess the progress toward the long-term goal of attenuation to the PRGs by natural attenuation. In addition, the



CLIENT	U.S. Army Corps of Engineers, Baltimore District			
PROJ	ODA Long-Term Monitoring 2010 Sampling Event			
SOURCE	Location data: USACE, 2002b; DOQ, TerraServer, na.			
REVISION NO	0	GIS:	JK	11/22/10
SCALE	1:2,400	CHECKED:	BK	11/23/10
G:\Projects\Fort_Meade\ODA\Projects\2010 ODAFigure4-1_portrait2010.mxd		PROJ MGR	FM	-

N

TITLE

Groundwater Elevation Contour Map, September 2010
Ordnance Demolition Area,
Patuxent Research Refuge - North Tract

URS

200 Orchard Ridge Drive
Gaithersburg, MD 20878

PROJ NO 15302389.30000

FIGURE **4-1**

preliminary data for the new suite of analytes are presented. Since this is the first year of MNA parameter sampling, a trend analysis cannot be performed.

4.3.1 Detections

The chemical results for the 2010 monitoring are presented in Table 4-3. The PRGs for each analyte and the laboratory's reporting limits (RLs) and method detection limits (MDLs) are included in this table. All concentrations reported greater than the Reporting Limit (RL) are considered detections; trace detections, concentrations reported greater than the MDL and below the RL have the laboratory qualifier "J" to indicate the concentrations are considered to be only approximate. The shaded boxes indicate concentrations that are above PRGs. Figure 4-2 shows the location of results that were above PRGs.

4.3.2 PRG Exceedances

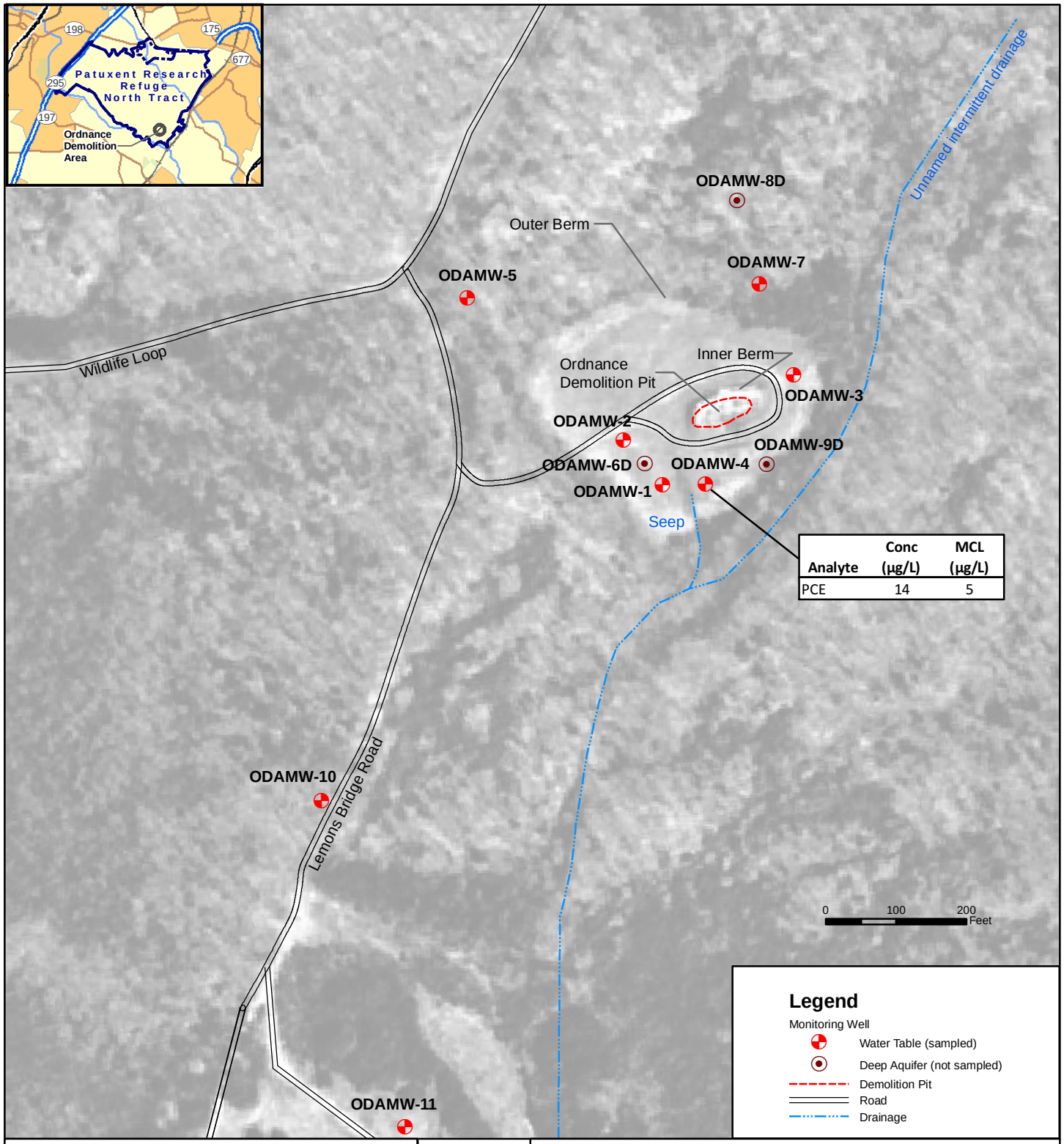
- VOCs: Only one detected result (14 µg/L at OWAMW-4) for PCE was above its PRG. The other VOCs were either non-detect (e.g., chloroform and vinyl chloride) or the detections were below PRGs. No VOCs were detected in side gradient well ODAMW-5 and up gradient well ODAMW-7.
- Explosives and Explosive Degradation Products: None.
- Metals: None.

4.4 CHEMICAL EVALUATION

This section examines the chemical results to evaluate the present site conditions and assess the progress of natural attenuation toward the goals of the PRGs.

4.4.1 MNA Parameter Evaluation

The 2010 sampling event marks the beginning of collecting the additional MNA parameters identified in Table 4-3. The MNA parameter data collected at the ODA will be used to access evidence of the reductive dechlorination of VOCs such as PCE and TCE. However, the likelihood of ODA VOCs inducing any geochemical reactions in the site groundwater is diminished by the extremely low groundwater VOC concentrations. Contaminant biodegradation is largely based upon microbial respiration. In respiration, microbes gain energy from the



CLIENT	U.S. Army Corps of Engineers, Baltimore District			
PROJ	ODA Long-Term Monitoring 2010 Sampling Event			
SOURCE	Location data: USACE, 2002b; DOQ, TerraServer, na.			
REVISION NO	0	GIS:	JK	02/03/11
SCALE	1:2,400	CHECKED:	GW	08/27/08
G:\Projects\Fort_Meade\ODA\Projects\2010 ODAFigure4-2_portrait2010.mxd		PROJ MGR	FM	-

TITLE

Detections Above DRGs
Ordnance Demolition Area,
Patuxent Research Refuge - North Tract

URS

200 Orchard Ridge Drive
Gaithersburg, MD 20878

PROJ NO 15302389.30000

FIGURE **4-2**

Page Intentionally Left Blank

TABLE 4-3

Groundwater Chemical Results for 2010 Sampling Event and Screening Criteria

Well Site Sample Collection Data Screen Interval (feet bgs)	Proposed Plan-specified PRGs	On Demolition Ground Site Wells																Upgradient Wells								Downgradient Wells								Detection Limits	
		ODAMW-1 ODA 9/22/10 3.5-13.5				ODAMW-2 ODA 9/28/10 4-14				ODAMW-3 ODA 9/22/10 5-15				ODAMW-4 ODA 9/22/10 2-12				ODAMW-5 ODA 9/28/10 2-12				ODAMW-7 ODA 9/23/10 9.5-19.5				ODAMW-10 ODA 9/21/10 5-15				ODAMW-11 ODA 9/23/10 5-15				Method Detection Limit	Method Reporting Limit
		Result	LQ	VF	RC	Result	LQ	VF	RC	Result	LQ	VF	RC	Result	LQ	VF	RC	Result	LQ	VF	RC	Result	LQ	VF	RC	Result	LQ	VF	RC	Result	LQ	VF	RC		
Field Parameters																																			
Turbidity (NTU)	--	7.6				68.3				29.7				32				83.3				3.8				1.3				90.1				--	--
pH	--	4.47				4.39				5.86				2.24				5.35				4.36				4.47				4.36				--	--
Temperature (Deg Celsius)	--	19.58				18.97				21.15				19.45				19.41				16.07				16.36				21.14				--	--
Conductivity (µ-mohs/cm)	--	0.089				0.066				0.112				0.1				0.047				0.06				0.054				0.045				--	--
Redox Potential (mV)	--	341				109				55				418				117				362				325				258				--	--
Dissolved Oxygen (ppm)	--	5.75				6.76				0				5.23				0.1				7.78				0				1.34				--	--
Select VOCs																																			
CIS-1,2-DICHLOROETHENE (µg/L)	70	0.33	J			0.98	J			bdl				6.2				bdl				bdl				bdl				bdl				0.24	1
CHLOROFORM (µg/L)	2	bdl				bdl				bdl				bdl				bdl				bdl				bdl				bdl				0.17	1
TETRACHLOROETHENE (µg/L)	5	1.2				4.3				3.2				14				bdl				bdl				bdl				bdl				0.15	1
TRICHLOROETHENE (µg/L)	5	0.15	J			0.4	J			1				1.6				bdl				bdl				bdl				bdl				0.14	1
VINYL CHLORIDE (µg/L)	2	bdl				bdl				bdl				bdl				bdl				bdl				bdl				bdl				0.23	1
Select Explosives																																			
RDX (µg/L)	20	10				10				0.15	J			16				bdl				bdl				bdl				bdl				0.094	0.2
2,4,6-TRINITROTOLUENE (µg/L)	3.4	bdl				bdl				bdl				bdl				bdl				bdl				bdl				bdl				0.080	0.2
4-AMINO-2,6-DINITROTOLUENE (µg/L)	0.8	0.23				0.57				bdl				0.3				bdl				bdl				bdl				bdl				0.123	0.2
2-AMINO-4,6-DINITROTOLUENE (µg/L)	0.8	0.16	J			0.48				bdl				0.14	J			bdl				bdl				bdl				bdl				0.097	0.2
Dissolved Metals																																			
CADMIUM (µg/L)	5	1.3				0.57	B			0.49	B			2				bdl				bdl				0.12	B			bdl				0.11	1
MNA Parameters																																			
IRON-dissolved (mg/L)	--	bdl				0.091				3.88				bdl				0.503				bdl				bdl				2.26	B			0.049	0.05
IRON-total (mg/L)	--	1.18				0.376				6.44				0.252				5.62				bdl				0.247				3.9		K	w	0.049	0.05
MANGANESE-dissolved (µg/L)	--	33				83				200				81.6				227				133				51				97				0.039	0.5
ORGANIC CARBON-dissolved (mg/L)	--	1.7				1.4		B	o	3.7				1.7				6.5				1.8		B	o	2.1				3.8		B	o	0.14	1
ORGANIC CARBON-total (mg/L)	--	1.7		B	o	1.5				3.7		B	o	1.7		B	o	7	J			0.94	B			2		B	o	3.2				0.19	1
FERRIC IRON-dissolved (mg/L)	--	bdl				bdl				bdl				bdl				bdl				bdl				bdl**				bdl					0.15
FERROUS IRON-dissolved (mg/L)	--	0.028	J, HTI	L	h	0.059	J, HTI	L	h	3.84	HTI	L	h	bdl	HTI	UL	h	0.412	HTI	L	h	bdl	HTI	UL	h	bdl	HTI	UL	h	2.31	HTI	L	h	0.02	0.1
FERRIC IRON-total (mg/L)	--	1.18		K	h	0.166		K	h	2.5		K	h	0.252		K	h	4.31		K	h	bdl				0.247**				1.47		K	h	0.049	0.1
FERROUS IRON-total (mg/L)	--	bdl	HTI	UL	h	0.21	HTI	L	h	3.94	HTI	L	h	bdl	HTI	UL	h	1.31	HTI	L	h	bdl	HTI	UL	h	bdl	HTI	UL	h	2.42	HTI	L	h	0.02	0.1
NITRATE-NITRITE (mg/L)	--	0.56				0.73				bdl		UL	o	0.82				bdl		UL	o	bdl		UL	o	bdl		UL	o	bdl		UL	o	0.014	0.1
SULFATE (mg/L)	--	23.6				19.1				13.7				31.9				6.4				11.7				10				8.7				0.21	1
SULFITE (mg/L)	--	<0.64				<0.64				<0.64				<0.64				<0.64				<0.64				<0.64				<0.64				--	--
ALKALINITY (mg/L)	--	bdl				4.3	B,J	B	o	22.3	J			0.83	B,J	B	o	10.6	J			bdl				0.6	B,J	B	o	bdl				0.41	5
CHLORIDE-total (mg/L)	--	1.5				1.3				3.4				2.8				1.1				3.1				2.4				4				0.2	1

B-Not detected substantially above the level reported in laboratory or field blanks
bdl - Below the method detection limit and reporting limit.
h- Holding time violation
HTI - The holding time for this test is immediate. The laboratory measurements, therefore, may not be suitable for compliance purposes.
J - Estimated result. Result less than RL.
K- Analyte present. Reported value may be biased high. Actual value is expected to be lower
L- Analyte present. Reported value may be biased low. Actual value is expected to be higher
LQ - Laboratory Qualifier

NS - Not sampled.
o- Calibration blank contamination
PRG - Preliminary Remediation Goal
RC - Reason Code (Validation)
UL- Not detected, quantitation limit is probably higher
VF - Validation Flag
w- CRDL Standard Failure
** = Ferric Iron calculated by consultant (Total minus Ferrous)

Page Intentionally Left Blank

consumption (oxidation) of electron donors coupled to the utilization (reduction) of electron acceptors. Contaminants will either serve as electron donors or electron acceptors. In general, rates of biodegradation follow an order of favorable electron acceptor availability: oxygen (O_2) >manganese (Mn^{4+}) >nitrate (NO_3^-) >ferric iron (Fe^{3+}) > sulfate (SO_4^{2-}) >carbon dioxide (CO_2).

Thus, the indicators of anaerobic degradation include total organic carbon (TOC), DO, ferric/ferrous iron, sulfate/sulfite, nitrate/nitrite, magnesium, methane, alkalinity, chloride, and redox. The indicators do not directly demonstrate that contaminant degradation is occurring, but provide weight of evidence of whether geochemical conditions in the aquifer are conducive to biodegradation.

Theoretically, as the oxygen is depleted during aerobic biotransformation of organic chemicals, an anaerobic environment is created. Under anaerobic conditions, iron (used as an indicator) is reduced from ferric iron (Fe^{3+}), generally insoluble and stable under naturally oxygenated groundwater conditions, to ferrous iron (Fe^{2+}), which is more soluble in reduced groundwater conditions.

At the ODA, the DO levels reported in Table 3-4 are greater than 1 parts per million (ppm) except for wells ODAMW-3 and ODAMW-10; typically, low DO (less than 1 ppm) indicates that the oxygen is being consumed via aerobic biodegradation of the VOCs. The 2010 redox levels for all the wells are positive values, ranging from 55 to 418 mV. Theoretically, aerobic degradative activity occurs at a highly positive redox potential, while anaerobic microbial processes such as methanogenesis (methane levels) and sulfate reduction will occur at strongly negative redox potentials. However, factors other than microbial activity can induce the low redox potential.

In general, high TOC levels indicate a robust anaerobic environment. As noted in Table 4-3, the dissolved TOC levels are low, ranging from 1.4 to 6.5 mg/L which is consistent with the very low VOC concentrations detected at the ODA. The soil TOC result was 31,100 mg/kg.

4.4.2 Current Groundwater Quality

The 2010 results show that only PCE was detected above its PRG; this exceedance was from ODAMW-4, which is located within the berm area of the site. With the exception of one trace concentration of cadmium (0.41 J µg/L) in up gradient well ODAMW-7, all the 2010 LTM

event detections were from wells located inside the formerly active bermed area. In the previous 2009 LTM report (USACE, 2010), PCE was detected above its PRG in wells ODAMW-1 (8.4 µg/L), ODAMW-3 (7.9 µg/L), and ODAMW-4 (7.9 µg/L). The detections in well ODAMW-1 and ODAMW-3 were "J"-flagged, indicating the detection is an estimated value. TCE was also detected in the same well as PCE, but all the results were below the PRG of 5 µg/L. The TCE detections in ODAMW-1 and ODAMW-3 were also "J"-flagged.

For the 2010 LTM event, the detected concentrations for the other VOCs, the explosives, and cadmium remained below the PRGs. TCE was positively detected at ODAMW-4 (1.6 µg/L) and ODAMW-3 (1 µg/L). The remaining 2010 detected results were "J-flagged" indicating that the concentrations were estimated.

4.4.3 Groundwater Quality Trends

One goal of the LTM program is to evaluate the chemical results for possible trends over the span of monitoring, in particular, to determine if degradation is occurring. Table 4-4 presents the historic and current results for the ODA.

The ODA data were evaluated with the Mann-Kendall trend test to search for trends that would be indicative of changing conditions in the groundwater quality. The Mann-Kendall test does not require particular distributional assumptions, and non-detects are permitted. However, the test requires the data set to contain a minimum of four sample results. The Mann-Kendall tests were conducted using Visual Sample Plan (VSP) version 5.0 available at http://vsp.pnl.gov/. The VSP is a software tool developed by Pacific Northwest National Laboratory for the Department of Energy – Office of Health, Safety, and Security.

In generating the data set for the VSP tool, the non-detections were assigned the value of the detection (reporting) limit even though the detection limit varied over the period of record, and the "J" flag results are included as detections. VSP tools were set to "account for non-detects" which addresses variations in the reported detection limit values over time using the Kaplan-Meier Product Limit Estimator (Telephone conversation with Mr. Brent Pulsipher, 17 November 2010). The Mann-Kendall test yields a value that corresponds to a probability level that a trend is the result of random fluctuations, based on the number of observations considered and the desired confidence level. If the probability is low that a trend is based on random fluctuations (e.g., $\leq$5%), then the trend is considered to be statistically significant. Conversely, if

TABLE 4-4
ODA Historical Chemical Results
(concentrations in µg/L)

ODAMW-1

		2002		2003-2004		2005		2006		2007		2008		2009		2010														
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	11-Jul-03	24-Oct-03	10-Feb-04	30-Apr-04	23-Jul-04	25-Jun-05	31-Aug-06	16-Aug-07	30-Jun-08	29-Jun-09	22-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	0.33 J
PCE	5	1	0.2	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	22	14	12	8.9	8.3	3.7	1.4	9.4	6.3	7.5	8.4 M J m	1.2
TCE	5	1	0.2	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	2.4	1.6	1.5	1.5	1.1	0.45 J	< 1	1.1	0.84 J	1.2	1.3 J s	0.15 J
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	0.6	0.2	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	<0.6	<1	<1	<1	<1	<1	<1	0.18 J	<1	<1	<0.2	<0.17
RDX	20	0.4	0.2	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	10	25	31 J h	24	21	25	19.3	19	15	20	12	10
TNT	3.4	0.2	1	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	<0.2	0.26 J	0.24 J h	0.23 J u	0.2 J J u	0.52 J	<1	<1	< 0.7	< 0.7	< 1	--
2A46-DNT	0.8	1	0.2	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	0.25	1.3	1.3 J h	1.1	0.97	0.8	<2.5	0.82 J	0.47 J	0.7 J	0.56 J	0.23
4A26-DNT	0.8	1	0.2	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	<1	1.3	1.4 J h	1.1	0.91	0.76 J	<1.5	1.0 J	0.7 J	0.98	0.56 J	0.16 J
Cadmium	5	--	--	2	0.28	1	0.28	5	0.062	5	0.062	5	0.056	0.53	0.16	1	0.11	--	3.9	4.9	4.6	4.2	4.7 J	2	2.8 J	2.9 J	0.6 J	0.36 J	1.3

ODAMW-2

		2002		2003-2004		2005		2006		2007		2008		2009		2010														
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	11-Jul-03	20-Oct-03	10-Feb-04	30-Apr-04	21-Jul-04	25-Jun-05	31-Aug-06	17-Aug-07	30-Jun-08	29-Jun-09	28-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	0.98 J
PCE	5	1	0.2	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	4.2	<1	0.29 J	1.7	<1	<1	<1	0.56 J	0.91 J	<1	<0.2	4.3
TCE	5	1	0.2	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	0.4 J
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	0.6	0.2	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	<0.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.17
RDX	20	0.4	0.2	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	24	1.5	5.5 J, h	7.5	3.5	3.5	4.4	8.7	10	1.9	1.2 P J g	10
TNT	3.4	0.2	1	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	<0.2	<0.2	<0.2 UJ, h	<0.2	<0.2	<0.2	<1	<1	< 0.7	< 0.7	< 1	--
2A46-DNT	0.8	1	0.2	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	0.82	<0.2	<0.2 UJ, h	0.16 J	<0.2	<0.2	<2.5	<2.5	< 0.7	< 0.8	<0.9	0.57
4A26-DNT	0.8	1	0.2	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	1.1	<0.2	<0.2 UJ, h	0.18 J	<0.2	<0.2	<1.5	<1.5	0.28 J	< 0.7	<1	0.48
Cadmium	5	--	--	2	0.28	1	0.28	5	0.062	5	0.062	5	0.056	0.53	0.16	1	0.11	--	<2	0.87 B	1.0 B B o	0.81 B	0.73 B B o	NS	0.6 J B p	0.62 J	0.2 J	<0.53	0.57

ODAMW-3

		2002		2003-2004		2005		2006		2007		2008		2009		2010														
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	11-Jul-03	22-Oct-03	9-Feb-04	29-Apr-04	22-Jul-04	25-Jun-05	31-Aug-06	16-Aug-07	1-Jul-08	30-Jun-09	22-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	<1
PCE	5	1	0.2	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	30	1.2	28	3.7	1.4	17	11.7	26	60	22	7.9 J s	3.2
TCE	5	1	0.2	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	6.3	<1	7.4	0.38 J	<1	5.4	1.8	7.5	28 J c	5.6	1.3 J s	1
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	0.6	0.2	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	<0.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.17
RDX	20	0.4	0.2	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	2.1	2.2	1.5	1.9	2.2	1.1	2.3	0.87	1.3 J J p	0.6 J	<0.9	0.15 J
TNT	3.4	0.2	1	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	< 0.7	< 0.7	< 1	--
2A46-DNT	0.8	1	0.2	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<2.5	<2.5	< 0.7	< 0.8	<0.9	--
4A26-DNT	0.8	1	0.2	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<1.5	<1.5	< 0.7	< 0.7	<1	--
Cadmium	5	--	--	2	0.28	1	0.28	1	0.062	5	0.062	5	0.056	0.530	0.160	1	0.11	--	<2	2.1	1.7 B	1.2 B	2.2 J	6	2.3 J	5.4	3 J	<0.53	0.49

ODAMW-4

		2002		2003-2004		2005		2006		2007		2008		2009		2010													
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	14-Jul-03	20-Oct-03	10-Feb-04	30-Apr-04	22-Jul-04	25-Jun-05	31-Aug-06	16-Aug-07	30-Jun-08	29-Jun-09	22-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	6.2
PCE	5	1	0.2	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	4.6	35	32	26	19	10	40.8	13	39	7.9	7.9	14
TCE	5	1	0.2	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	0.33	3.9	4.1	2.9	2.2	1.3	4.9	1.7	6.1 J c	1	0.9	1.6
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	0.6	0.2	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	<0.6	<1	<1	<1	<1	<1	<1	0.2 J	<1	<1	<0.2	<0.17
RDX	20	0.4	0.2	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	11	41	43 J, h	37	39	35	34.4	17	20	9.9	15	16
TNT	3.4	0.2	1	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	<0.2	<0.2	0.16 J J, h	0.18 J J, h	0.33 J u	0.33 J u	<1	<1	< 0.7	< 0.7	< 1	--
2A46-DNT	0.8	1	0.2	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	<1	0.83	1.6 J, h	1.6	1.8	1.6	0.8 J	<2.5	< 0.7	< 0.8	<0.9	0.3
4A26-DNT	0.8	1	0.2	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	<1	1.5	2.5 J, h	2.2	2.3	1.9	1.1 J	<1.5	0.51 J	< 0.7	<1	0.14 J
Cadmium	5	--	--	2	0.28	1	0.28	1	0.062	5	0.062	5	0.056	0.530	0.160	1	0.11	--	5.2	5.3	6.3	5.3	5.4 J	4	2.3 J	2.6 J	0.8 J	3.0	2

PRG - Preliminary Remediation Goal; RL - Method Reporting Limit;
MDL - Method Detection Limit. Detection limits for data prior to 2002 are not available.
"--" Analyte was not tested.
< indicates analyte was not detected at the concentration listed left of the symbol.
Cadmium values for all sampling events except Jul03 are for filtered cadmium.
PCE=Tetrachloroethene; TCE=Trichloroethene

J- The datum should be considered an estimated value, more highly biased or variable than normal
UJ- The datum should be considered a non-detect, however the detection limit may be inaccurate
U- The datum should be considered a non-detect at the value reported due to blank contamination
B- Analyte was detected in the associated Method Blank
c-Calibration failure; poor or unstable response
g- Tuning failure or poor mass spec performance

h- Hold time violation
m- MS/MSD recovery failure
o- Calibration blank contamination
p- Poor chromatography
s- Surrogate failure
u- No confirmation column

Page Intentionally Left Blank

TABLE 4-4
ODA Historical Chemical Results
(concentrations in µg/L)

ODAMW-5

		2002		2003-2004		2005		2006		2007		2008		2009		2010													
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	10-Jul-03	24-Oct-03	9-Feb-04	29-Apr-04	20-Jul-04	25-Jun-05	3-Sep-06	17-Aug-07	1-Jul-08	30-Jun-09	28-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	<1
PCE	5	1	0.2	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<0.2	<0.15
TCE	5	1	0.2	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<0.2	<0.14
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	0.6	0.2	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	<0.6	<1	<1	<1	<1	<1	NS	<1	<1	<1	<0.2	<0.17
RDX	20	0.4	0.2	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	<0.4	<0.5	<0.5 UJ, h	<0.5	<0.5	<0.5	NS	<1	<0.7	<0.7	<0.9	--
TNT	3.4	0.2	1	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	<0.2	<0.2	<0.2 UJ, h	<0.2	<0.2	<0.2	NS	<1	<0.7	<0.7	< 1	--
2A46-DNT	0.8	1	0.2	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	<1	<0.2	<0.2 UJ, h	<0.2	<0.2	<0.2	NS	<2.5	<0.7	<0.8	<0.9	--
4A26-DNT	0.8	1	0.2	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	<1	<0.2	<0.2 UJ, h	<0.2	<0.2	<0.2	NS	<1.5	<0.7	<0.7	<1	--
Cadmium	5	--	--	2	0.28	1	0.28	1	0.062	5	0.062	5	0.056	0.530	0.160	1	0.11	--	0.29 B	0.34 B B o	0.4 B B o	<2	<2	NS	0.18 J B p	0.13 J	0.2 J	<0.53	<0.11

ODAMW-7

		2002		2003-2004		2005		2006		2007		2008		2009		2010													
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	11-Jul-03	22-Oct-03	9-Feb-04	28-Apr-04	20-Jul-04	25-Jun-05	31-Aug-06	17-Aug-07	30-Jun-08	30-Jun-09	23-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	<1
PCE	5	1	0.2	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<0.2	<0.15
TCE	5	1	0.2	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	<1	<1	<1	<1	<1	<1	NS	<1	<1	<1	<0.2	<0.14
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	0.6	0.2	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	<0.6	<1	<1	<1	<1	<1	NS	<1	<1	<1	<0.2	<0.17
RDX	20	0.4	0.2	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	NS	<1	< 0.7	< 0.7	<0.9	--
TNT	3.4	0.2	1	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NS	<1	< 0.7	< 0.7	< 1	--
2A46-DNT	0.8	1	0.2	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	<1	<0.2	<0.2	<0.2	<0.2	<0.2	NS	<2.5	< 0.7	< 0.8	<0.9	--
4A26-DNT	0.8	1	0.2	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	<1	<0.2	<0.2	<0.2	<0.2	<0.2	NS	<1.5	< 0.7	< 0.7	<1	--
Cadmium	5	--	--	2	0.28	1	0.28	1	0.062	5	0.062	5	0.056	0.530	0.160	1	0.11	--	0.39 B	0.38 B B o	0.71 B B o	0.43 B B o	<0.28	NS	0.21 J B p	0.16 J	0.4 J	0.41 J	<0.11

ODAMW-10

		2002		2003-2004		2005		2006		2007		2008		2009		2010													
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	10-Jul-03	22-Oct-03	5-Feb-04	30-Apr-04	21-Jul-04	25-Jun-05	3-Sep-06	16-Aug-07	1-Jul-08	1-Jul-09	21-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	<1
PCE	5	--	--	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.15
TCE	5	--	--	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.14
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	--	--	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.17
RDX	20	--	--	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	--	<0.5	<0.5	0.35 J	<0.5	0.33 J	<1	<1	< 0.7	< 0.7	<0.9	--
TNT	3.4	--	--	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	--	<0.2	<0.2	0.62	<0.2	<0.2	<1	<1	< 0.7	< 0.7	< 1	--
2A46-DNT	0.8	--	--	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	--	<0.2	<0.2	<0.2	<0.2	<0.2	< 2.5	< 2.5	< 0.7	< 0.8	<0.9	--
4A26-DNT	0.8	--	--	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	--	<0.2	<0.2	<0.2	<0.2	<0.2	<1.5	<1.5	< 0.7	< 0.7	<1	--
Cadmium	5	--	--	2	0.28	1	0.28	5	0.062	5	0.062	5	0.056	0.53	0.16	1	0.11	--	<0.28	0.37 B B o	<2	<2	<2	NS	0.22 J B p	0.29 J	0.1 J	<0.53	0.12 J

ODAMW-11

		2002		2003-2004		2005		2006		2007		2008		2009		2010													
Chemical	PRG	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	RL	MDL	9-May-02	11-Jul-03	22-Oct-03	5-Feb-04	29-Apr-04	21-Jul-04	25-Jun-05	3-Sep-06	16-Aug-07	1-Jul-08	30-Jun-09	23-Sep-10
cis12DCE	70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.24	--	--	--	--	--	--	--	--	--	--	--	<1
PCE	5	--	--	1	0.42	1	0.42	1	0.13	1	0.15	1	0.15	0.2	0.05	1	0.15	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.15
TCE	5	--	--	1	0.42	1	0.42	1	0.14	1	0.17	1	0.17	0.2	0.05	1	0.14	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.2	<0.14
Vinyl Chloride	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	0.23	--	--	--	--	--	--	--	--	--	--	--	<1
Chloroform	2	--	--	1	0.35	1	0.35	1	0.17	1	0.061	1	0.061	0.2	0.022	1	0.170	--	<1	<1	<1	<1	<1	<1	<1	<1	0.09 J	<0.2	<0.17
RDX	20	--	--	0.5	0.13	1	0.13	5	0.16	0.7	0.092	0.7	0.092	0.9	0.3	0.9	0.3	--	<0.5	<0.5	<0.5	<0.5	0.089 J J g	<1	<1	<0.7	<0.7	<0.9	--
TNT	3.4	--	--	0.2	0.08	1	0.08	5	0.075	0.7	0.1	0.7	0.1	1	0.3	1	0.3	--	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.7	<0.7	< 1	--
2A46-DNT	0.8	--	--	0.2	0.09	2.5	0.09	5	0.2	0.7	0.24	0.8	0.24	0.9	0.3	0.9	0.3	--	<0.2	<0.2	<0.2	<0.2	<0.2	<2.5	<2.5	<0.7	<0.8	<0.9	--
4A26-DNT	0.8	--	--	0.2	0.11	1.5	0.11	5	0.31	0.7	0.22	0.7	0.22	1	0.3	1	0.3	--	<0.2	<0.2	<0.2	<0.2	<0.2	<1.5	<1.5	<0.7	<0.7	<1	--
Cadmium	5	--	--	2	0.28	1	0.28	5	0.062	5	0.062	5	0.056	0.53	0.16	1	0.11	--	0.38 B	0.37 B B o	0.4 BJ B o	<0.28	<0.28	NS	0.34 J B p	0.16 J	0.4 J	0.16 J	<0.11

PRG - Preliminary Remediation Goal; RL - Method Reporting Limit;
MDL - Method Detection Limit. Detection limits for data prior to 2002 are not available.
"--" Analyte was not tested.
< indicates analyte was not detected at the concentration listed left of the symbol.
Cadmium values for all sampling events except Jul03 are for filtered cadmium.
PCE=Tetrachloroethene; TCE=Trichloroethene

J- The datum should be considered an estimated value, more highly biased or variable than normal
UJ- The datum should be considered a non-detect, however the detection limit may be inaccurate
U- The datum should be considered a non-detect at the value reported due to blank contamination
B- Analyte was detected in the associated Method Blank
c-Calibration failure; poor or unstable response
g- Tuning failure or poor mass spec performance

h- Hold time violation
m- MS/MSD recovery failure
o- Calibration blank contamination
p- Poor chromatography
s- Surrogate failure
u- No confirmation column

Page Intentionally Left Blank

the probability is high that a trend is based on random fluctuations (e.g., ≥5%), then the trend is considered statistically insignificant. In addition to the Mann-Kendall trend test, VSP was used to produce Lowess curves for analytes of interest in selected down gradient wells. These Lowess curves are presented in Appendix G.

Table 4-5 presents the statistical trend analysis that was performed using the previous 8 years of groundwater data (2002 through 2010) to evaluate the chemical results for possible trends. Earlier site data (1993 through 2001) was not used because of the high number of non-detections in the data set and the large variability (2 to 3 orders of magnitude difference) of the chemical reporting limits used to represent the non-detect concentrations. The data produced skewed Mann-Kendall statistical results when all the available groundwater data were used. The trend analysis was conducted using one round of sample data collected in May 2002 (USACE, 2002b) and the 2003 through 2010 LTM program data.

As shown in Table 4-5, the Mann-Kendall statistical analysis indicated an upward trend for TNT at ODAMW-1; downward trends for RDX, PCE, TCE, and cadmium at ODAMW-1; downward trends for cadmium at ODAMW-2, ODAMW-4, and ODAMW-10; and a downward trend for RDX at ODAMW-4. Otherwise, the Mann-Kendall statistical analysis reported "no trend" for the remaining results. To clarify possible trends, scatter plots were generated to visually examine the detected concentrations for the ODA LTM program. Appendix G presents the scatter plot and Lowess curve results.

Tables G-1 through G-3 in Appendix G show the scatter plot results for PCE and TCE at wells ODAMW-1, ODAMW-3, and ODAMW-4, respectively. The LTM results for PCE and TCE were all non-detect at ODAMW-2. In Table G-1, the TCE concentrations range from 0.45 to 1.6 µg/L and were all below the PRG of 5 µg/L. Even though the PCE concentrations fluctuate above the PRG during the 2006 through 2009 LTM events, the concentrations are generally decreasing and support the Mann-Kendall statistical results of a downward trend.

The PCE and TCE concentration lines generally have matching fluctuations for ODAMW-3 (See Table G-2) and ODAMW-4 (Table G-3). The TCE concentrations fluctuate closely around the PRG level at both wells. High PCE concentrations (60 µg/L and 39 µg/L, respectively) were reported during the 2007 LTM event for both wells. The Mann-Kendall results in Table 4-5

TABLE 4-5
Summary Statistics and Trend Analyses for ODA

Detected Analytes 2010	No. of Observ. (a)	No. of Non-Detects	Percent Non-Detects (%)	Shapiro-Wilk Distribution Test (b) Significant at alpha = 0.05	Mean (b) ug/L	Standard Deviation of the Mean (b) ug/L	Median (b) ug/L	Range (b) ug/L	Minimum (b) ug/L	Maximum (b) ug/L	Mann-Kendall Trend Test (c)		
											S value	MK Test Statistic (d)	Significant at alpha ≤0.05
ODAMW-1													
PCE	12	0	0%	normal	8.59	5.71	8.35	20.8	1.2	22	-38	-2.53718	Downward
TCE	12	1	8%	normal	1.18	0.58	1.15	2.25	0.15	2.4	-34	-2.27361	Downward
RDX	12	0	0%	normal	19.28	6.55	19.65	21	10	31	-32	-2.13582	Downward
TNT	12	7	58%	not normal	0.92	1.33	0.61	4.8	0.2	5	37	2.50217	Upward
2A46-DNT	12	2	17%	normal	0.94	0.61	0.86	2.34	0.16	2.5	-23	-1.51216	No trend
4A26-DNT	12	1	8%	normal	0.89	0.42	0.945	1.3	0.2	1.5	-22	-1.44002	No trend
Cd	11	0	0%	normal	2.94	1.67	2.9	4.54	0.36	4.9	-33	-2.49120	Downward
ODAMW-2													
PCE	12	6	50%	not normal	1.43	1.37	1	4.1	0.2	4.3	-12	-0.78571	No trend
TCE	12	10	83%	not normal	0.83	0.31	1	0.8	0.2	1	-8	-0.63724	No trend
RDX	12	0	0%	not normal	6.81	6.27	4.95	22.8	1.2	24	-2	-0.06890	No trend
2A46-DNT	12	9	75%	not normal	1.01	1.41	0.59	4.84	0.16	5	18	1.19024	No trend
4A26-DNT	12	8	67%	not normal	0.93	1.36	0.425	4.82	0.18	5	18	1.19024	No trend
Cd	10	2	20%	not normal	1.02	0.78	0.77	2.58	0.22	2.8	-27	0.0083 (e)	Downward
ODAMW-3													
PCE	12	0	0%	normal	17.68	17.09	14.35	58.8	1.2	60	-2	-0.06857	No trend
TCE	12	2	17%	not normal	5.56	7.58	3.6	27.62	0.38	28	3	0.13834	No trend
RDX	12	1	8%	normal	1.43	0.72	1.4	2.15	0.15	2.3	-35	-2.33697	Downward
Cd	11	2	18%	normal	2.47	1.79	2.1	5.51	0.49	6	-1	0.00000	No trend
ODAMW-4													
PCE	12	0	0%	normal	20.77	13.17	16.5	36.2	4.6	40.8	-11	-0.68734	No trend
TCE	12	0	0%	normal	2.58	1.80	1.95	5.77	0.33	6.1	-10	-0.61715	No trend
RDX	12	0	0%	normal	26.53	12.70	27.2	33.1	9.9	43	-34	-2.26289	Downward
2A46-DNT	12	5	42%	not normal	1.33	1.28	0.865	4.86	0.14	5	-8	-0.48536	No trend
4A26-DNT	12	4	33%	normal	1.60	1.33	1.3	4.8	0.2	5	-16	-1.02859	No trend
Cd	11	0	0%	normal	3.83	1.79	4	5.53	0.77	6.3	-30	-2.26452	Downward
ODAMW-10													
Cd	10	5	50%	not normal	0.96	0.90	0.45	1.89	0.11	2	-21	0.036 (e)	Downward

(a) Number of Observations beginning in 2002.
(b) Statistics from Visual Sampling Plan (VSP), Summary Statistics; VSP setting to account for non-detects was involked.
(c) Statistics from Visual Sampling Plan (VSP), Mann-Kendal Trend Analysis; VSP setting to account for non-detects was involked. Data were not required to be normally distributed.
(d) Mann-Kendall Critical Value = -1.95996
(e) Data labeled "Prob from Table" not "MK Test Statistic"
All calculations performed using Visual Sample Plan; field duplicates are treated as lab quality control samples and are not considered in this statistical evaluation.

indicate "no trend" for PCE and TCE at ODAMW-3 and ODAMW-4. The Lowess curve for PCE at ODAMW-4 begins and ends with the concentration of 11 µg/L, also indicating "no trend."

The scatter plot for RDX (see Table G-4 in Appendix G) indicates a downward trend in concentrations for wells ODAMW-1, ODAMW-3, and ODAMW-4; the Mann-Kendall statistical results support this conclusion. The RDX results for ODAMW-2 tend to fluctuate between 1.2 and 10 µg/L; no discernable trend is apparent. RDX was not detected from 2003 through 2010 in wells ODAMW-5, ODAMW-7, ODAMW-10, and ODAMW-11.

The other explosives (2A24-DNT, 4A26-DNT, and TNT) scatter plots are presented in Tables G-5 (ODAMW-1) and G-6 (ODAMW-4) in Appendix G. The Mann-Kendall statistical results indicate an upward trend for TNT at well ODAMW-1. However, the detected concentrations for TNT range from 0.2 to 0.5 µg/L during July 2003 to July 2004 of the LTM program; from 2005 to 2010, no detections of TNT are reported. All the LTM program results for TNT are below the PRG of 3.4 µg/L. The Mann-Kendall results for 2A24-DNT and 4A26-DNT report "no trend" for wells ODAMW-1 and ODAMW-4. At ODAMW-4, the detected results for both explosives remain below the PRG of 0.8 µg/L from 2006 to 2010.

As shown in Table G-7, cadmium concentrations exceed its PRG at wells ODAMW-3 and ODAMW-4. The Mann-Kendall statistical results report a downward trend for cadmium at wells ODAMW-1, ODAMW-2, ODAMW-4, and ODAMW-10. The Mann-Kendall results show no trend for cadmium at ODAMW-3 and the scatter plot results in Table G-7 support the Mann-Kendall results.

In conclusion, PCE remains a VOC of concern at the ODA. PCE was detected above its PRG at well ODAMW-4. The Mann-Kendall analysis indicated a downward trend for PCE at ODAMW-1, but "no trend" was reported for the other wells. Trace detections of daughter product cis-1,2DCE were reported at wells ODAMW-1, ODAMW-2, ODAMW-4. No VOCs were detected at side gradient well ODAMW-5, up gradient well ODAMW-7, and down gradient wells ODAMW-10 and ODAMW-11. Therefore, the VOC groundwater contamination remains within the demolition grounds at the ODA.

The trend analysis reports downward trends for RDX at wells ODAMW-1, ODAMW-3, and ODAMW-4. The detected results for RDX at the demolition grounds have remained at or below the PRG of 20 µg/L from 2006 to 2010. Similar to the VOCs, the LTM results for RDX,

2A24-DNT, and 4A26-DNT were all non-detect for side gradient well ODAMW-5, up gradient well ODAMW-7, and down gradient wells ODAMW-10 and ODAMW-11. The LTM results were below the PRG of 0.8 µg/L for 2A24-DNT and 4A26-DNT since the 2007 and 2008 LTM events, respectively. The LTM results for TNT were all below its PRG of 3.4 µg/L.

Dissolved cadmium was last reported above the PRG of 5 µg/L in 2007 at ODAMW-3. The Mann-Kendall analysis reports a downward trend for cadmium concentrations at the demolition ground wells ODAMW-1, ODAMW-2, ODAMW-4, and downgradient well ODAMW-10. The LTM program has reported trace concentrations of cadmium in all the ODA wells; the detections of cadmium are more likely attributed to background rather than site-related contamination, but this cannot be substantiated without stakeholder-approved background screening criteria.

4.4.4 IDW Characterization and Disposal

As noted in Section 3.5, the purge water was not sampled; it is considered to be IDW water with trace explosives (i.e., not hazardous). The 55-gallon drums containing the purge water will be collected and disposed of by Potomac Environmental, Inc. All disposable sampling material, including tubing and personal protective equipment, was collected in trash bags and disposed of as directed by Post personnel.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The groundwater RAOs developed for the ODA are as follows:

(1) **To prevent human exposure to groundwater COPCs that exceed remedial goals established at levels that satisfy the NCP requirements for the protection of human health and the environment.** Only PCE was detected above its PRG for the 2010 LTM event. The other VOCs, explosives, and cadmium detections were below PRGs.

(2) **To clean up the groundwater above the Arundel Clay to numerical PRGs defined as MCLs and non-zero MCLGs and to meet site-specific, risk-based remedial goals.** The groundwater trend analyses indicate that RDX and cadmium concentrations are decreasing. Additional MNA parameters were collected during the 2010 LTM event to better evaluate whether contaminant concentrations are naturally attenuating at the site. However, more MNA data are needed to discern any natural attenuation trends. Meanwhile, LUCs are used to prevent unlimited groundwater exposure at the ODA. The Army plans to write a LUCIP to formalize the LUCs at the site.

(3) **To prevent groundwater migration of contaminants beyond the current monitoring network.** The site contamination remains primarily within the demolition grounds. There is no evidence of off-site migration of contamination.

The well inspection revealed that the protective casings of most LTMP wells were in serviceable condition, but the paint was faded on many well casings and the exterior well ID was difficult to read. Extensive, fine root systems obstructed ODAMW-1 and ODAMW-2, but were removed prior to sampling. The concrete pads at ODAMW-1 and ODAMW-3 are broken and should be considered for replacement.

Because PCE remains in the groundwater at concentrations greater than its PRG it is appropriate to continue the annual monitoring at the site. VOC, explosives, and cadmium are still detected primarily within the demolition grounds of the site. More MNA data are needed to discern whether natural attenuation is occurring at the ODA and address EPA's concerns regarding this issue.

5.2 RECOMMENDATIONS

Constituents remain in the ODA groundwater at concentrations higher than the PRGs therefore the following recommendations are made to ensure that the remedy continues to be protective of human health and the environment and meets the RAOs:

- Continue groundwater monitoring under the LTMP, but update the LTMP using the feedback from stakeholders from previous ODA LTM Report (USACE, 2010) and the Revised Draft Proposed Plan (USACE, 2009).
- Continue sampling the eight LTM wells (ODAMW-1, ODAMW-2, ODAMW-3, ODAMW-4, ODAMW-5, ODAMW-7, ODAMW-10, and ODAMW-11) for MNA parameters in future LTM events.
- Sample all locations in the existing LTM network for selected explosives (RDX, TNT, 2A46-DNT, and 4A26-DNT), a select RCRA metal (cadmium), and selected VOCs (PCE, TCE, Chloroform, cis-1,2-DCE, and vinyl chloride) as a supplemental effort to the LTM program (i.e., one-time event during the next planned LTM round) to 1) provide present day data, 2) identify potential background wells, 3) identify LTM program data gaps, and 3) revise the LTMP.
- Discuss the background data gap issue with the FGGM stakeholders to better determine whether metal concentrations at the ODA are attributed to background rather than site-related contamination. The supplemental sampling effort (see bullet above) will provide data for this discussion.
- Install a well, one shallow (screened at the same depth as ODAMW-4) and one deep monitoring well (screened above the clay) proximate to where the seep and intermittent drainage intersect. These wells will 1) re-confirm that contamination has not penetrated the surficial sands and penetrated to the top of the Middle Patapsco Confining Clay, and 2) assess potential shallow eastward contaminant migration toward the unnamed intermittent drainage.
- Collect an up gradient and down gradient surface water sample from the seep and from the unnamed intermittent drainage adjacent to ODAMW-4 (four total samples) to determine whether ODA groundwater contaminants are migrating off site.

Table 5-1: Proposed 2011 Sampling Analysis Plan for ODA

Well No./QC	Water Type	Well Type	VOCs [1] (8260B)	Explosives[2] (8330)	Cd & Mn[3] (6020A)	Nitrate/ Nitrite[3] (353.2)	Ferric/ Ferrous Iron (3500 FED)	Iron (6010B)	Sulfate (300)	Sulfite (377.1)	Alkalinity (2320B)	Total Chloride (300)	Total Organic Carbon (5310C)	Dissolved Organic Carbon (5310C)[3]
ODAMW-1	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
ODAMW-2	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-3	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-4	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-5	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-7	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-10	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-11	groundwater	Existing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-12	groundwater	NEW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODAMW-13D	groundwater	NEW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODA_Seep_up	surface water	na	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODA_Seep_down	surface water	na	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODA_UID_up	surface water	na	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ODA_UID_down	surface water	na	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

(1) PCE, TCE, Chloroform, cis-1,2-DCE, and vinyl chloride
(2) RDX, TNT, 2A46-DNT, 4A26-DNT
(3) Filtered Sample

Page Intentionally Left Blank

6.0 REFERENCES

Dyrland, Russ, PRR Facilities Manager, Personal Communication by telephone, January 26, 2007.

Freeze, R.A. and J.A. Cherry, 1979. *Groundwater*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 604, pp.

Gibbons, R.D., 1994. *Statistical Methods for Groundwater Monitoring*. New York, New York: John Wiley and Sons, Inc., 286 pp.

Army, 1995. *Interim Army policy on natural attenuation for environmental restoration*. Washington, DC, Department of the Army, Assistant Chief of Staff for Installation Management, DAIM-ED-R (200-1c), September 12, 1995.

U.S. Army Corps of Engineers (USACE), 2010. *Fort George G. Meade, Long-Term Monitoring Report, Ordnance Demolition Area, Patuxent Research Refuge-North Tract, Anne Arundel County, Maryland, Final.* Final document prepared for USACE, Baltimore District, Baltimore, Maryland by URS Group, Gaithersburg, Maryland, June, 2010.

USACE, 2009. *Fort George G. Meade, Revised Draft Proposed Plan, Ordnance Demolition Area, Patuxent Research Refuge-North Tract, Anne Arundel County, Maryland.* Revised Draft document prepared for USACE, Baltimore District, Baltimore, Maryland by URS Group, Gaithersburg, Maryland, December, 2009.

USACE, 2008. *Legacy Base Realignment And Closure Program, Long-Term Monitoring Report No. 6, Groundwater Sampling June and July 2008, Ordnance Demolition Area, Patuxent Research Refuge-North Tract, Anne Arundel County, Maryland*, September, 2008.

USACE, 2005a. *Fort George G. Meade, Decision Document, Ordnance Demolition Area, Patuxent Research Refuge-North Tract, Anne Arundel County, Maryland, Final,* December, 2005.

USACE, 2005b. *Preliminary Assessment/Site Investigation of Suspect Sites, Fort George G. Meade, Anne Arundel County, Maryland*. Draft report prepared for USACE, Baltimore District, Baltimore, Maryland by URS Corporation, Gaithersburg, Maryland, March 2005.

USACE, 2003. *Fort George G. Meade, Long-Term Monitoring Plan, Ordnance Demolition Area, Patuxent Research Refuge, Anne Arundel County, Maryland*. Final document prepared for USACE, Baltimore District, Baltimore, Maryland by URS Group, Bethesda, Maryland, July 2003.

USACE, 2002a. *Fort George G. Meade, Remedial Investigation Report, Ordnance Demolition Area, Volume 1 – Text*. Final Document prepared for USACE, Baltimore District, Baltimore, Maryland by IT Corporation, June 2002.

USACE, 2002b. *Fort George G. Meade, Focused Feasibility Study, Ordnance Demolition Area*. Final Document prepared for USACE, Baltimore District, Baltimore, Maryland by URS Group, Inc., November 2002.

USACE, 1998. *Fort George G. Meade, Inactive Landfills 1, 2, 3, and Clean Fill Dump Remedial Investigation Report.* Final Document. ICF Kaiser. August 1998.

U.S. Army Environmental Center (USAEC), 1994. *Site Inspection Addendum, Fort George G. Meade, Feasibility Study and Remedial Investigation/Site Inspection, Draft.* Arthur D. Little, Inc., Cambridge, MA, May.

APPENDIX A

Field Procedures and Calibration Requirements

Page Intentionally Left Blank

A.1 SAMPLE CONTAINERS, PACKING, AND SHIPMENT

Table A-1 provides information on the number and type of sample containers that will be used for each type of laboratory analysis. Table A-1 also presents sample preservation and holding times information.

Table A-1: Summary of Sample Containment and Preservation for Groundwater Samples

Parameter	Sample Container Quantity	Sample Container Type	Preservation Methods	Holding Times
VOCs	3	40-mL, amber glass vials, Teflon®-lined septum cap	HCl to pH<2 Cool, 4±2°C	14 days
SVOCs	2	1-liter, narrow-mouth amber glass, Teflon®-lined cap	Cool, 4±2°C	Extraction: 7 days Analysis: 40 days
Metals	1	1-liter, polyethylene bottle	HNO_3 to pH<2 Cool, 4±2°C	6 months, except Hg Hg - 28 days
PAHs	1	1-liter, narrow-mouth amber glass, Teflon®-lined cap	Cool, 4±2°C	7 days
Explosives	2	1-liter, narrow-mouth amber glass, Teflon®-lined cap	Cool, 4±2°C	7 days

Legend

HCl:	Hydrochloric Acid	SVOC:	Semivolatile Organic Compound
Hg:	Mercury	VOC:	Volatile Organic Compound
HNO_3:	Nitric Acid	PAH:	Polycyclic Aromatic Hydrocarbon

Preparations for sample shipment include:

1. The cap tightness will be checked and clear tape will be placed over the label, completely encircling the container;
2. Each sample container will be wrapped in bubble wrap or closed cell foam sheets; and
3. Each sample container will be enclosed in a clear zip seal plastic bag.

Subsequently, the following procedures will be followed:

1. Several layers of bubble wrap will be placed on the bottom of the cooler. The cooler will be lined with an open garbage bag, all samples will be placed upright inside the garbage bag, and the bag will be tied. A temperature blank will be placed in each cooler to monitor internal temperature.
2. Loose ice will be double-bagged and sealed to prevent melting ice from soaking the packing material. The ice will be placed outside the garbage bag containing the samples.
3. Appropriate sample documentation [i.e., Chain-of-Custody (COC) forms] will be placed in a waterproof plastic bag (zip seal bag), and the bag will be taped to the underside of the cooler lid. When more than one cooler is used, each cooler will include its own documentation.
4. Each cooler will be sealed with signed and dated custody seals so that if the cooler is opened, the custody seal will be broken. Clear tape will be placed over the custody seal to prevent damage to the seal.
5. Each cooler will be taped shut with packing tape over the hinges, and tape will be placed over the cooler drain in instances when the cooler has a drain plug.
6. Coolers will be shipped via overnight delivery on the same day the samples are collected.

A.2 LOW-FLOW GROUNDWATER SAMPLING

The groundwater monitoring wells will be sampled using the low-flow sampling method. Pre-sample purging will be accomplished using EPA low-flow sampling guidance. Purging will be accomplished using a peristaltic pump, bladder pump and/or whale pump, depending on the depth to groundwater. The groundwater samples will be collected once the water quality parameters are stabilized to the extent documented on the well purge forms in Appendix C. The following groundwater sampling procedures for the low-flow sampling method will be followed:

1. A clean piece of plastic sheeting will be spread on the ground around the well to protect the sampling equipment from possibly becoming contaminated.
2. After opening the well, headspace readings in the well and in the breathing zone immediately above the well will be taken with a PID.
3. If VOCs are measured in the well with the PID, the well will be ventilated for several minutes. If the readings are continuous (exceeding 1 parts per million [ppm] but not greater than 5 ppm), then Level C personal protective equipment (PPE) will be worn while purging and sampling the well. If the readings are continuously above 5 ppm, the site will be evacuated.
4. Prior to purging any of the wells, the depths to the top of the water and bottom of the well will be measured for each well, with an electric water level indicator with an accuracy of 0.01 ft, from a permanently marked reference point located on top of the polyvinyl chloride (PVC) riser pipe and recorded in the field logbook. Measurements will be taken three times to ensure accuracy. Alternatively, the total well depth will be measured one or several days prior to sampling which will reduce the chance that materials potentially disturbed at the bottom of the well may affect the sample turbidity measurements. The tape and probe will be decontaminated between measurements at different wells, as discussed in Section A.3. Each well will be inspected and the current condition of the well will be recorded on a well inspection sheet. The U.S. Army, EPA, and MDE will be notified of damaged wells, along with recommendations for well rehabilitation.
5. No minimum purge volume is specified in the EPA low-flow sampling guidance. However, it is useful to have an established minimum purge volume which must be removed in addition to satisfying the stabilization parameters. The minimum purge volume for each well will be calculated using the saturated well screen length multiplied by the gallons per foot for a given well diameter. For a typical 4-inch inner diameter 10 foot long well screen, the minimum volume is 6.5 gallons or 25 liters (10 foot screen x 0.653 gallons/foot in a 4-inch well).

6. The pump intake will be slowly lowered into the well until it is at the mid-point of the screened interval or at the mid-point of the water column if the static water level is below the top of the screen. The water level indicator is lowered to the top of the water column so that the water level will be monitored during the purging of the well.

7. Purging will begin at the lowest rate necessary to pump water out of the well and eliminate air bubbles from the tubing. As soon as the air bubbles are eliminated, the pumping rate will be adjusted to the lowest setting and then gradually increased until it matches the recharge rate. Stabilization parameters including turbidity, pH, temperature, conductivity, redox potential, and DO will be measured at the beginning of purging using an in-line monitoring system. Parameters will be measured and recorded approximately every ten minutes while pumping, using an in-line monitoring system. The readings will be recorded on a Groundwater Low-Flow Sampling Form (provided in Appendix C) along with the time of the reading, the water level reading, the flow rate, a description of the water, and the cumulative volume extracted. All purge water will be containerized for disposal as described in Section 4.2.

8. To prevent aeration of the sample, the water level will not be lowered below the top of the well screen during purging whenever possible. Every effort will be made to minimize drawdown and, consequently, minimize aeration and to promote laminar flow towards the well screen.

9. A sample will be collected when drawdown reaches equilibrium, the water quality parameters are stabilized, and at least one equivalent well volume of water is evacuated from the well (if practicable). The stabilization goal is three successive readings in which the pH changes by less than 0.1 pH unit; temperature changes 1°F or less; and conductivity, redox potential, DO, and turbidity change by less than 10%.

10. If the recharge rate of the well is very low and a steady pumping rate is not maintained without drawing down the water level, the well is purged to the top of the screened interval at a flow rate less than or equal to 1 Liter per minute (L/min).

Sampling will commence as soon as the volume in the well is recovered sufficiently to permit collection of samples.

11. Samples will be collected using polyethylene tubing attached to the discharge point of the pump with stainless steel clamps.
12. Sample bottles not containing preservatives will be triple-rinsed using sample water.
13. All monitoring wells will be sampled for the required parameters. The sample bottles will be filled in the order of decreasing volatility.
14. The number of sample bottles, sample container types, and sample preservation methods with respect to specific analytes will be recorded on the COC form.
15. Sample bottles will be labeled, enclosed in a plastic bag, and placed in a cooler maintained at 4±2°C immediately after sample collection and preservation.
16. A final measurement for turbidity, pH, temperature, conductivity, redox potential, and DO will be obtained for each sample.
17. Stabilization parameter readings, PID readings, purge volume, flow rate, and sample information will be entered onto a Groundwater Low-Flow Sampling Form.

Disposable sampling equipment will be discarded. The pump and tubing will be transported to the decontamination pad and decontaminated according to procedures outlined in Section A.3.

A.3 DECONTAMINATION PROCEDURES

Decontamination activities for the long-term groundwater monitoring will take place on plastic sheeting. Sampling equipment will be decontaminated in plastic tubs placed on the plastic sheeting.

Submersible pumps and hoses that are used to purge groundwater from monitoring wells and to sample groundwater will be decontaminated before their initial use, and between uses in different wells as outlined below:

a. A sufficient amount of non-phosphate detergent will be pumped through the pump and hose to flush out any residual water;

b. The exterior of the pump and hose will be scrubbed with non-phosphate detergent;

c. The outside of the pump and hose will be rinsed with water from a USACE approved source (i.e., unchlorinated water from FGGM water supply Well No. 5);

d. water from a USACE approved source will be pumped through the pump and hose to remove any remaining non-phosphate detergent;

e. The outside of the pump and hose will be rinsed with deionized, organic-free water; and

f. Plastic sheeting will be used to wrap the equipment to prevent contamination during storage/transit.

The water level indicator will be decontaminated between wells as outlined below:

a. Washed and scrubbed with non-phosphate detergent;

b. Rinsed with water from a USACE approved source;

c. Rinsed with deionized, organic-free water; and

d. Wrapped in plastic sheeting to prevent contamination during storage/transit.

Appendix A.2 Calibration Requirements

Page Intentionally Left Blank

3.3 Calibration

To obtain correct measurement values, the sensors need to be calibrated using standard solution before measurement. You can select simultaneous auto calibration of the pH, COND and TURB sensors in pH4 standard solution and DO and DEP sensors simultaneously in air, or manual calibration of individual measurement parameters. You can check the result of the previous calibration using the procedure on “ 3.5.4 Checking the calibration record ” (page 70).

Note

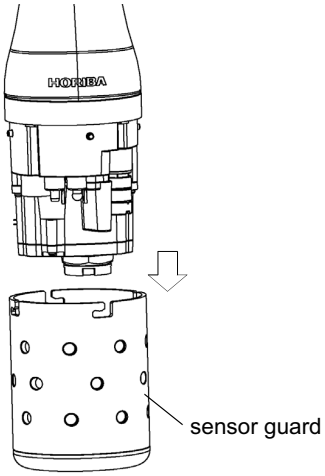
- **Wait at least 20 minutes after turning the system power ON before calibrating the DO sensor.**
- **Make the DO and COND compensation settings before calibration since these settings are applied during calibration.**
- **You can select only the desired parameters for calibration and calibrate just those parameters (see “ 3.2.4 Sensor selection ” (page 25)).**
- **Use about 200 mL of standard solution in the calibration cup.**
- **Calibration data is stored in the sensor probe.**

3.3.1 Auto calibration

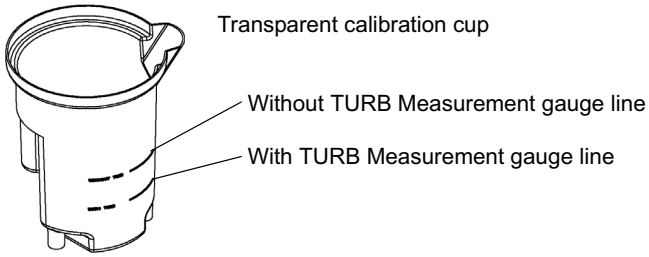
Tip

- **The following parameters are calibrated (at 25°C):**
  pH: Set to 4.01 (zero-point calibration); the span is adjusted to the factory default value.
  COND: 0.449 S/m (4.49 mS/cm, span calibration); the zero point is adjusted to the factory default value.
  TURB: 0 NTU (zero-point calibration); the span is adjusted to the factory default value.
  DO: 8.92 mg/L (span calibration); the zero point is adjusted to the factory default value.
  DEP: 0 m (zero-point calibration); the zero point is adjusted to the factory default value.
- **If the air temperature changes, the readout value may not be stable. Ensure that the ambient air temperature is the same temperature as the calibration solution, because the internal probe temperature sensor and external temperature sensor (in the calibration solution) are used for the auto calibration. Allow the probe and standard solution to equilibrate for 1 hour if a thermometer is not available to verify that these temperatures are the same.**
- **Do not hold the probe while performing the auto calibration. Body temperature may elevate the internal temperature sensor measurement creating DO calibration error.**

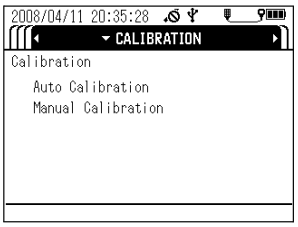
1. **Remove the sensor guard and wash the sensor probe 2 or 3 times with deionized water.**



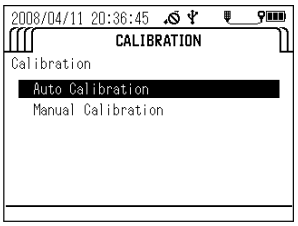
2. **Remove the transparent calibration cup.**
3. **Fill the transparent calibration cup to the line with pH 4 standard solution.**
   The transparent calibration cup has With TURB Measurement and Without TURB Measurement gauge lines.



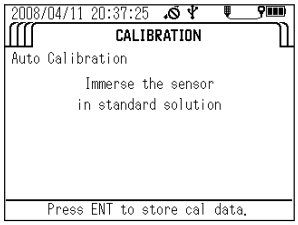
4. **Press the control unit's CAL key to set the calibration mode.**

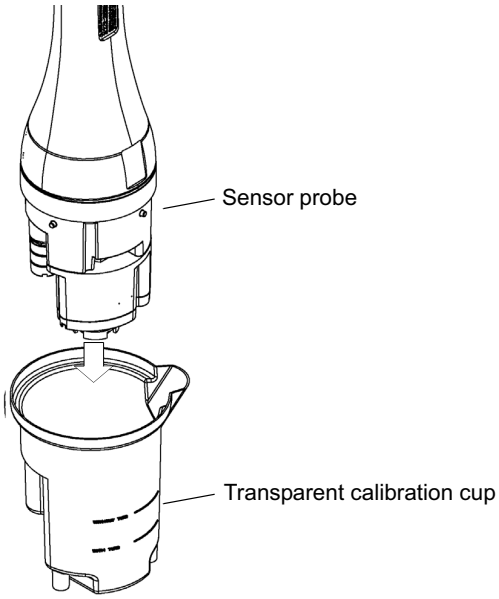


5. **Press the down (▽) key to move the cursor to "Auto Calibration", then press the ENTER key.**

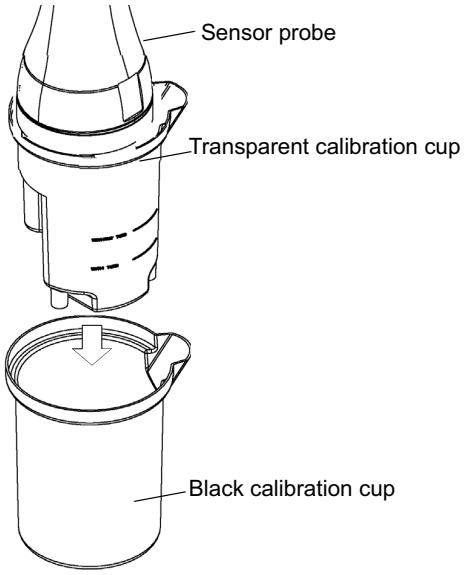


6. **Immerse the sensor probe in the transparent calibration cup.**
Check that the pH sensor, ORP sensor, reference electrode, COND sensor, TURB sensor and temperature sensor are submerged in the pH 4 standard solution and check that there are no air bubbles on the sensor.





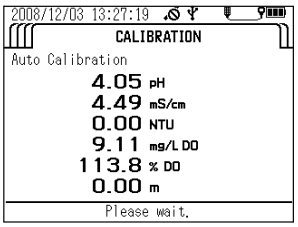
7. **With the sensor probe still in the transparent calibration cup, place the transparent calibration cup into the black calibration cup.**



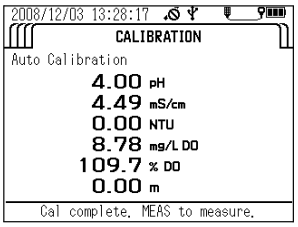
8. **When all the sensor values have stabilized, press the ENTER key to start calibration.**

Note

Do not remove the sensor probe from the calibration solution. U-53 turbidity data will display "----" until the calibration is completed.



Calibration is finished when the message "Cal complete. MEAS to measure." appears. Press the MEAS key to set the measurement screen, then start measurement.



If a calibration error occurs, start calibration after first resolving the issue according to the instructions in " 4.6 Troubleshooting " (page 89).

3.3.2 Manual calibration

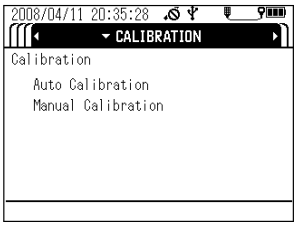
The procedures below describe how to calibrate each sensor individually.

Note

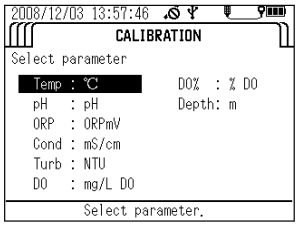
The displayed units are the units set by selecting "Unit for report" in the "SETTINGS" screen.

● **Temperature (TEMP) calibration**

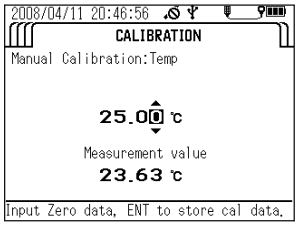
1. **Fill a bucket or similar container with water of a known temperature, and insert the sensor probe in it.**
   Wait 5 minutes before starting calibration to allow the sensor probe temperature to stabilize.
2. **Press the control unit's CAL key to set the calibration mode.**
3. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**



4. **In the parameter selection screen, move the cursor to “Temp”, then press the ENTER key.**



5. **Press the up (△) and down (▽) keys to set the calibration value - the temperature of the water containing the submerged sensor probe.**



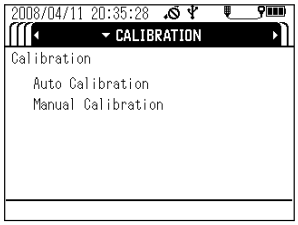
6. **Check that “Measurement value” has stabilized, then press the ENTER key to start calibration.**
   Calibration is finished when the message “Cal complete. CNT to measure.” appears.

● pH calibration

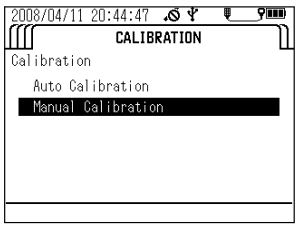
Note

You can select one calibration point (zero-point calibration) or two calibration points (zero-point calibration and span calibration). Carry out two calibration procedures to ensure good measurement precision throughout all measurement ranges.

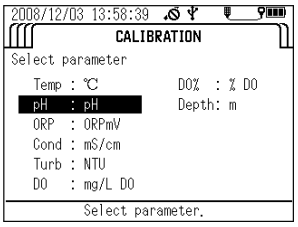
1. **Calibrate the zero point. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with pH 7 standard solution.**
2. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**
3. **Press the control unit’s CAL key to set the calibration mode.**



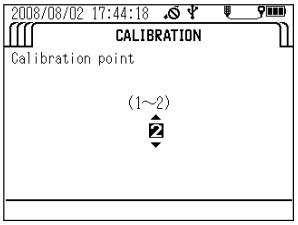
4. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**



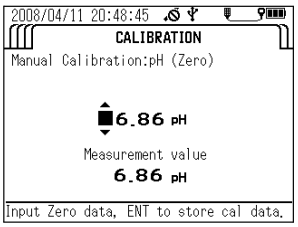
5. **In the parameter selection screen, move the cursor to "pH", then press the ENTER key.**



6. **Set the number of calibration points, then press the ENTER key.**



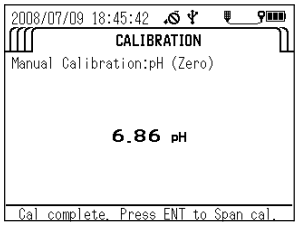
7. **Press the up (△) and down (▽) keys to set the pH value of the pH 7 standard solution containing the submerged sensor probe at the measurement temperature**



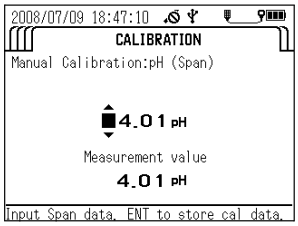
Temp. (°C)	pH 4 standard solution Phthalate	pH 7 standard solution Neutral phosphate	pH 9 standard solution Borate
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.84	9.04

8. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**

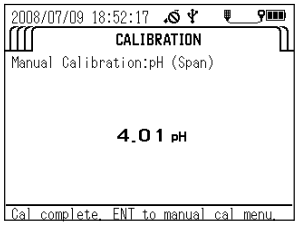
9. **Press the ENTER key to start the span calibration procedure when the message "Cal complete. Press ENT to Span cal." appears.**



10. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with pH 4 or pH 9 standard solution.**
11. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**
12. **Press the up (△) and down (▽) keys to set the pH value of the pH 4 or pH 9 standard solution containing the submerged sensor probe at the measurement temperature.**



13. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**
14. **Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter**

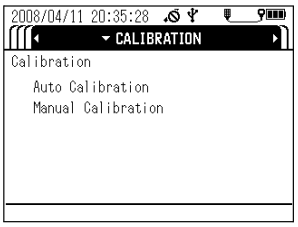


● ORP calibration

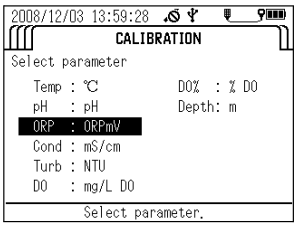
Note

- **If the prepared ORP standard solution is left in open air for one hour or more, the solution may be transformed. For this reason ORP standard solution cannot be stored.**
  Calibrate within one hour of preparing the solution.
- **When measuring sample with low concentrations of oxidants and reductants after conducting an operational check using a standard substance, the measured values may not stabilize or the results of measurement might not be repeatable. If this is the case, start the measurement after immersing the sensors in the sample water sufficiently.**
- **Note that when measuring the ORP of solution with extremely low concentrations of oxidants and reductants, such as tap water, well water, or water treated with purifying equipment, there may be less responsiveness, repeatability, and stability, in general.**
- **When alkaline ion water is left for 5 minutes, its ORP undergoes changes significantly. Always measure alkaline ion water promptly.**

1. **Fill a clean beaker with one bag of ORP standard powder No. 160-22 or No. 160-51. Add 250 mL of deionized water and agitate the solution thoroughly (there will be some excess quinhydrone (a black powder) that floats on the surface when agitating the solution). Fill the transparent calibration cup to the reference line with this standard solution.**
2. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**
3. **Press the control unit's CAL key to set the calibration mode.**
4. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**



5. **In the parameter selection screen, move the cursor to ORP, then press the ENTER key.**



6. **Press the up (△) and down (▽) keys to set the mV value of the ORP standard solution containing the submerged sensor probe at the measurement temperature.**

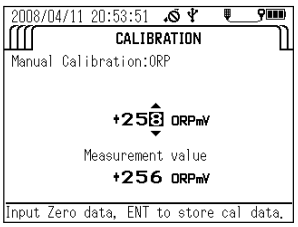


Table 1 Indicated value of ORP standard solution at various temperatures (mV)

Temperature	160-22	16051
5	+274	+112
10	+271	+107
15	+267	+101
20	+263	+95
25	+258	+89
30	+254	+83
35	+249	+76
40	+244	+69

7. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**
8. **Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.**

Conductivity (COND) calibration

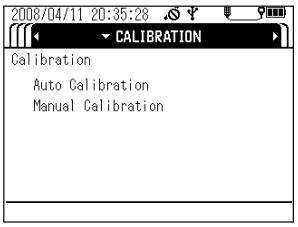
Note

- **To support a wide range of sample concentrations, electrical conductivity is divided into three measurement ranges: 0.0 mS/m to 99.9 mS/m, 0.090 S/m to 0.999 S/m, and 0.9 S/m to 9.99 S/m.**
- **When manually calibrating conductivity, you can select two calibration points (one zero-point calibration point and a span calibration point for one of the three measurement ranges) or four calibration points (one zero-point calibration point and span calibration points for all three measurement ranges). Carry out the four calibration points to ensure good measurement precision throughout all measurement ranges.**
- **Make the compensation setting before calibration since this setting is applied during calibration. (Refer to “ 6.5.3 Temperature coefficient ” (page 104)).**

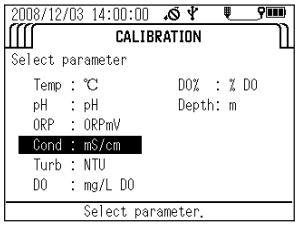
1. **Prepare the standard solution. Dry Potassium chloride (KCl) powder (high-grade commercially available) at 105°C for two hours, and leave it to cool in a desiccator.**
2. **Consult the following table and weigh potassium chloride (KCl), then prepare three standard potassium chloride (KCl) solutions following the procedure below.**

Potassium chloride (KCl) standard solution	Conductivity (COND) value	Potassium chloride (KCl) mass (g) at solution temperature of 25 °C	Calibration range
0.005 mol/L	71.8 mS/m (0.718 mS/cm)	0.373	0.0 mS/m to 99.9 mS/m (0.00 mS/cm to 0.999 mS/cm)
0.050 mol/L	0.667 S/m (6.67 mS/cm)	3.73	0.090 S/m to 0.999 S/m (1.00 mS/cm to 9.99 mS/cm)
0.500 mol/L	5.87 S/m (58.7 mS/cm)	37.2	0.9 S/m to 9.99 S/m (10.0 mS/cm to 99.9 mS/cm)

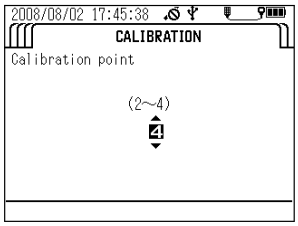
3. **Dissolve the weighed Potassium Chloride (KCl) in deionized water.**
4. **Put the dissolved Potassium Chloride (KCl) into a 1 L measuring flask, and fill to the 1 L mark with deionized water.**
5. **Calibrate the zero point. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then remove all moisture from the sensor probe (it will be calibrated in air).**
6. **Press the control unit’s CAL key to set the calibration mode.**
7. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**



8. **In the parameter selection screen, move the cursor to “Cond”, then press the ENTER key.**



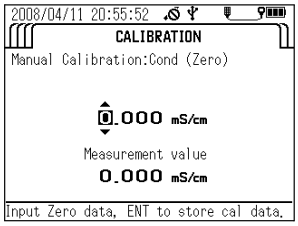
9. **Set the number of calibration points, then press the ENTER key.**



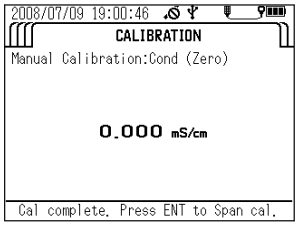
The instructions below assume that four calibration points have been set.

10. **Press the up (△) and down (▽) keys to set the "Cond" value to 0.0 mS/m (0.000 mS/cm).**

11. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**



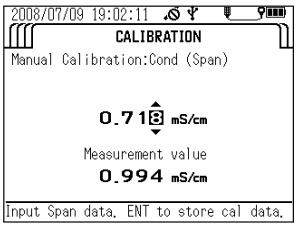
12. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the first span calibration procedure.**



13. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 71.8 mS/m (0.718 mS/cm) standard solution.**

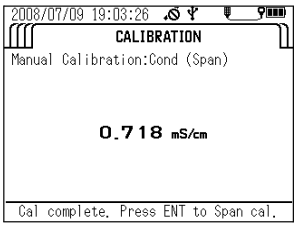
14. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**

15. **Press the up (△) and down (▽) keys to set the "Cond" value to 71.8 mS/m (0.718 mS/cm).**
Calibration range = 0 mS/m to 99.9 mS/m (0 mS/cm to 0.999 mS/cm)



16. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**

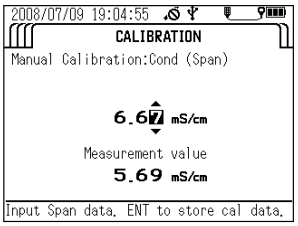
17. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.**



18. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 0.667 S/m (6.67 mS/cm) standard solution.**

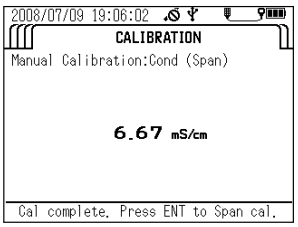
19. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**

20. **Press the up (△) and down (▽) keys to set the "Cond" value to 0.667 S/m (6.67 mS/cm).**
Calibration range = 0.100 S/m to 0.999 S/m (1.00 mS/cm to 9.99 mS/cm)



21. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**

22. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.**

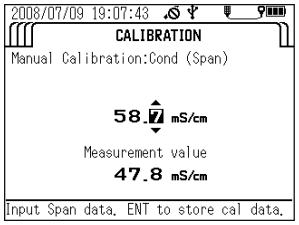


23. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 5.87 S/m (58.7 mS/cm) standard solution.**

24. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**

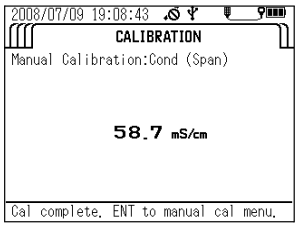
25. **Press the up (△) and down (▽) keys to set the "Cond" value to 5.87 S/m (58.7 mS/cm).**

Calibration range = 1.00 S/m to 10.00 S/m(10.0 mS/cm to 100.0 mS/cm)



26. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**

27. **Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.**



Turbidity (TURB) calibration

Note

- **To support a wide range of sample concentrations, turbidity is divided into three measurement ranges: 0.0 to 9.9 NTU, 10 to 100 NTU, and over 100 NTU.**
- **When manually calibrating turbidity, you can select two calibration procedures (one zero-point calibration procedure and a span calibration procedure for one of the three measurement ranges), three calibration procedures (one zero-point calibration procedure and a span calibration procedure for two of the three measurement ranges) or four calibration procedures (one zero-point calibration procedure and span calibration procedures for all three measurement ranges). Carry out the four calibration procedures to ensure good measurement precision throughout all measurement ranges.**
- **Always use the calibration cup provided. Using other containers can create effects from ambient light that cause incorrect calibration.**

Preparing the standard solutions

1. **Weigh out 5.0 g of hydrazine sulfate (commercial special grade or above), and dissolve it in 400 mL of deionized water. Dissolve 50 g of hexamethylene tetramine (commercial special grade or above) in 400 mL of deionized water in anther flask.**
2. **Mix the two solutions and add deionized water until the total solution volume is 1000 mL, and mix well. Store this solution at a temperature of 25°C ±3°C for 48 hours.**
   The turbidity value (TURB) of this solution is equivalent to 4000 NTU.
3. **Dilute 4000 NTU-solution 5 times (use a pipette to measure 50 mL of the 4000 NTU solution and pour it into a 250 mL measuring flask, and fill up to 250 mL meniscus)**
   The turbidity value (TURB) of this solution is equivalent to 800 NTU.
4. **Dilute 800 NTU solution 10 times (use a pipette to measure 25 mL of the 800 NTU solution and pour it into a 250 mL measuring flask, and fill up to 250 mL meniscus)**
   The turbidity value (TURB) of this solution is equivalent to 80 NTU.
5. **Dilute 80 NTU solution 10 times (use a pipette to measure 25 mL of the 80 NTU solution and pour it into a 250 mL measuring flask, and fill up to 250 mL meniscus)**
   The turbidity value (TURB) of this solution is equivalent to 8 NTU.

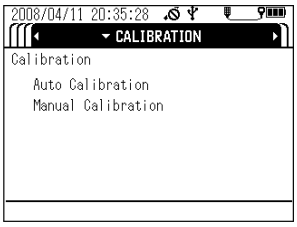
Note

Instead of the standard solutions above, you can use other standard solutions of known concentration measured with other standard instruments.

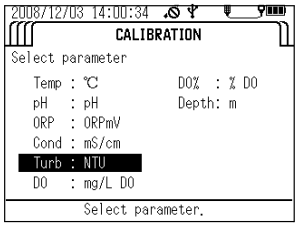
U-52, U-53 turbidity calibration

Set the number of calibration points.
You can set between 2 and 4 points.

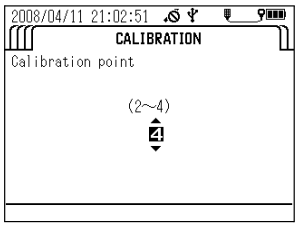
1. **Press the control unit's CAL key to set the calibration mode.**
2. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**



3. **In the parameter selection screen, move the cursor to "Turb", then press the ENTER key.**



4. **Press the up (△) and down (▽) keys to set the number of calibration points, then press the ENTER key.**

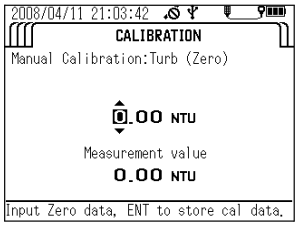


The instructions below assume that four calibration points have been set.

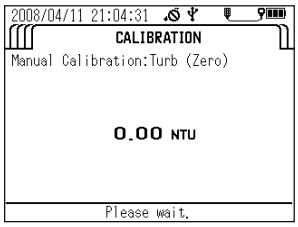
5. **Calibrate the zero point. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with deionized water.**

6. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**

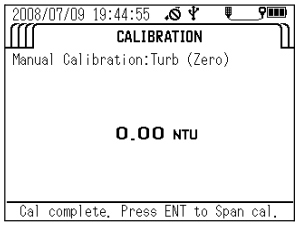
7. **Press the up (△) and down (▽) keys to set the "Turb" value to 0.0 NTU.**



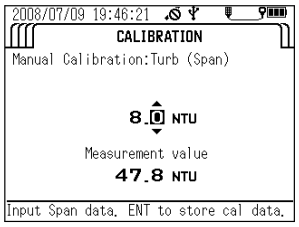
8. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**



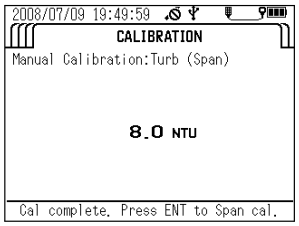
9. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the first span calibration procedure.**



10. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 8 NTU standard solution, or a standard solution of known concentration between 0.1 and 10 NTU.**
11. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**
12. **Press the up (△) and down (▽) keys to set the "TURB" value to 8 NTU, or to the known concentration of the standard solution between 0.1 and 10 NTU. (Input range = 0 NTU to 9.9 NTU (U-51) or 0 NTU to 9.99 NTU (U-52))**

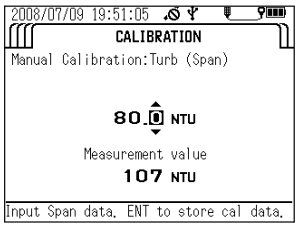


13. **Check that "Current measurement value" has stabilized, then press the ENTER key to start calibration.**
14. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.**



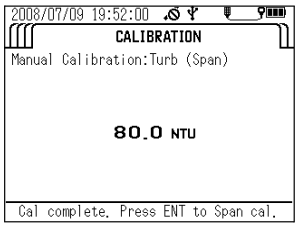
15. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 80 NTU standard solution, or a standard solution of known concentration between 10 and 100 NTU.**
16. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**

17. **Press the up (△) and down (▽) keys to set the "Turb" value to 80 NTU, or to the known concentration of the standard solution between 10 and 100 NTU. (Input range = 10.0 NTU to 99.9 NTU)**



18. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**

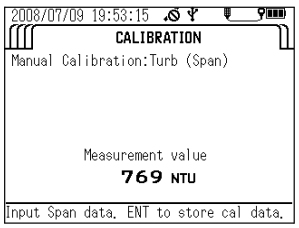
19. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.**



20. **Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 800 NTU standard solution, or a standard solution of known concentration 100 NTU above.**

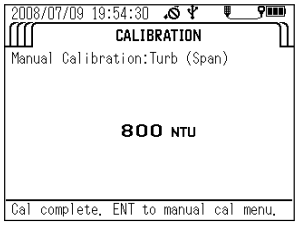
21. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.**

22. **Press the up (△) and down (▽) keys to set the "TURB" value to 800 NTU, or to the known concentration of the standard solution 100 NTU above.**
(Input range = 100 NTU to 800 NTU (U-51), 100 NTU to 1000 NTU (U-52))



23. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**

24. **Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.**

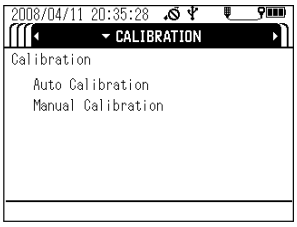


Dissolved oxygen (DO) calibration

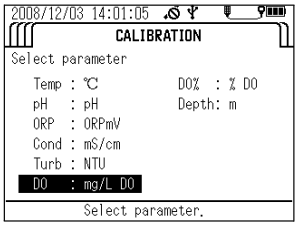
Note

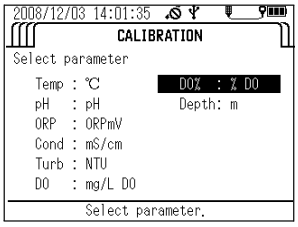
- **You can select one calibration procedure (span calibration) or two calibration procedures (zero-point calibration and span calibration). Carry out the two calibration procedures to ensure good measurement precision throughout all measurement ranges.**
- **It is necessary to prepare new solution before calibration of the Dissolved Oxygen (DO) sensor.**
- **The calibration cup (included) cannot be used to manually calibrate the DO sensor. Use a suitable bottle in which the DO sensor and the temperature sensor can be immersed.**
- **Wait at least 20 minutes after turning the system power ON before calibrating the DO sensor.**
- **Make the compensation setting before calibration since the setting is applied during calibration.**
- **The DO sensor is affected by flow. When performing span calibration with saturated dissolved oxygen water, move the cable slowly up and down (move the sensor probe at a rate of roughly 20 to 30 cm a second) or agitate the saturated dissolved oxygen water.**

1. **Prepare the standard solution.**
   - Add about 50 g of sodium sulfite to 1000 mL of water (either deionized water or tap water) and stir the mixture to dissolve the sodium sulfite in it.
   - Pour 1 to 2 liters of water into a suitable flask (either deionized water or tap water). Using a air pump, feed air into the water and aerate the solution until oxygen is saturated.
2. **First, calibrate the zero point. Press the control unit's CAL key to set the calibration mode.**
3. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**

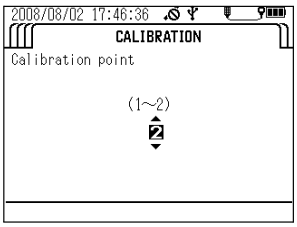


4. **In the parameter selection screen, move the cursor to DO or DO%, then press the ENTER key.**



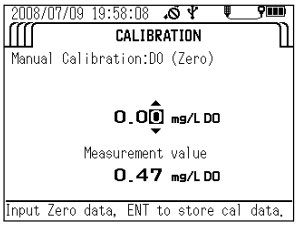


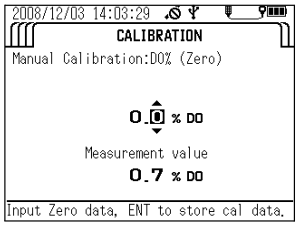
5. **Set the number of calibration procedures, then press the ENTER key.**



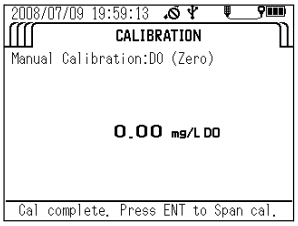
The instructions below assume that two calibration points have been set.

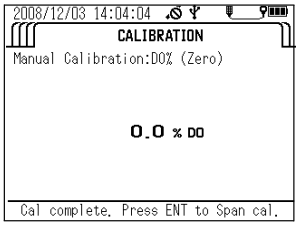
6. **Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the bottle.**
7. **Press the up (△) and down (▽) keys to set the DO value to 0.00 mg/L or 0.0%.**



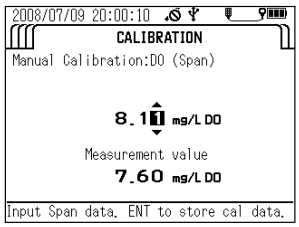


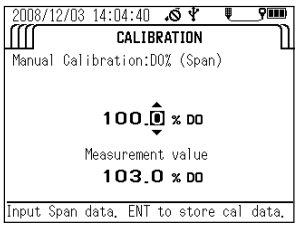
8. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**
9. **When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the span calibration procedure.**



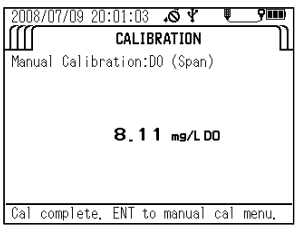


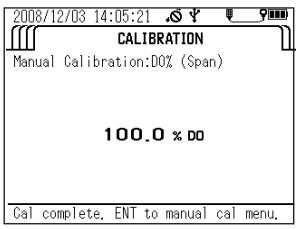
10. **Wash the sensor probe 2 or 3 times with deionized water to remove any dirt, then submerge the sensor probe in the container filled with the span solution.**
11. **Press the up (△) and down (▽) keys to set the DO value to the saturated dissolved oxygen value (mg/L) of the water at that temperature or the dissolved oxygen saturation ratio.**





12. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**
13. **Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.**





Amounts of saturated dissolved oxygen in water at various temperatures (salinity=0.0%)

JIS K0101

Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)
0	14.16						
1	13.77	11	10.67	21	8.68	31	7.42
2	13.40	12	10.43	22	8.53	32	7.32
3	13.04	13	10.20	23	8.39	33	7.22
4	12.70	14	9.97	24	8.25	34	7.13
5	12.37	15	9.76	25	8.11	35	7.04
6	12.06	16	9.56	26	7.99	36	6.94
7	11.75	17	9.37	27	7.87	37	6.86
8	11.47	18	9.18	28	7.75	38	6.76
9	11.19	19	9.01	29	7.64	39	6.68
10	10.92	20	8.84	30	7.53	40	6.59

ISO5814

Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)
0	14.62				
1	14.22	11	11.03	21	8.91
2	13.83	12	10.78	22	8.74
3	13.46	13	10.54	23	8.58
4	13.11	14	10.31	24	8.42
5	12.77	15	10.08	25	8.26
6	12.45	16	9.87	26	8.11
7	12.14	17	9.66	27	7.97
8	11.84	18	9.47	28	7.83
9	11.56	19	9.28	29	7.69
10	11.29	20	9.09	30	7.56

● **Span setting values for calibration in air**

The software should display these values when auto calibration is performed.
Use this table to input values for manual span calibrations in air.

Tip

The DO measurement value of "air-saturated water" and air are different.
Due to the pressure difference against the membrane in air versus the membrane in water, the measurement value in air is about 10% higher than the value of air-saturated water on average.

Amounts of saturated dissolved oxygen in air at various temperatures

Following tables are applicable only to the air calibration of the U-50 DO sensor. Do not use them for other purpose.

Air calibration value in adopting evaluation based on JIS K0101

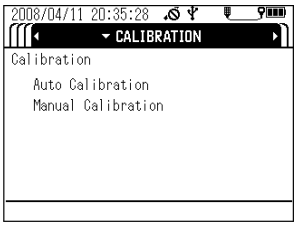
Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
0	15.58						
1	15.15	11	11.74	21	9.55	31	8.16
2	14.74	12	11.47	22	9.38	32	8.05
3	14.34	13	11.22	23	9.23	33	7.94
4	13.97	14	10.97	24	9.08	34	7.84
5	13.61	15	10.74	25	8.92	35	7.74
6	13.27	16	10.52	26	8.79	36	7.63
7	12.93	17	10.31	27	8.66	37	7.55
8	12.62	18	10.10	28	8.53	38	7.44
9	12.31	19	9.91	29	8.40	39	7.35
10	12.01	20	9.72	30	8.28	40	7.25

Air calibration value in adopting evaluation based on ISO5814

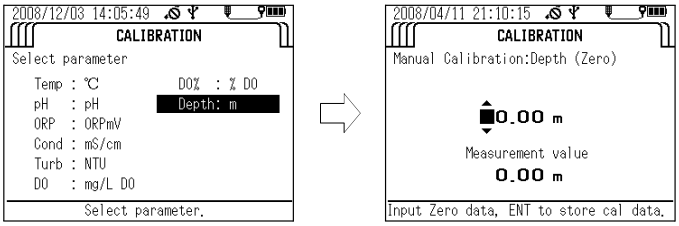
Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)
0	16.08				
1	15.64	11	12.13	21	9.80
2	15.21	12	11.86	22	9.61
3	14.81	13	11.59	23	9.44
4	14.42	14	11.34	24	9.26
5	14.05	15	11.09	25	9.09
6	13.70	16	10.86	26	8.92
7	13.35	17	10.63	27	8.77
8	13.02	18	10.42	28	8.61
9	12.72	19	10.21	29	8.46
10	12.42	20	10.00	30	8.32

Water depth (DEPTH) calibration

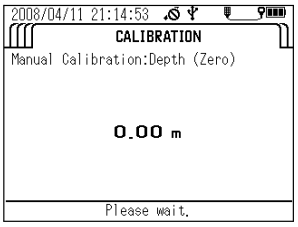
1. **Calibrate the zero point. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then remove all moisture from the sensor probe (it will be calibrated in air).**
2. **Press the control unit's CAL key to set the calibration mode.**
3. **Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.**



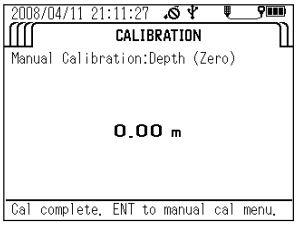
4. **In the parameter selection screen, move the cursor to "Depth", then press the ENTER key.**



5. **Press the up (△) and down (▽) keys to set the "Depth" value to 0.00 m.**
6. **Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.**



7. **Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.**



APPENDIX B

FIELD NOTES

Page Intentionally Left Blank

FT. MEADE 9/20/10

SUNNY 80°F J. CHISHOLMSKI

0630 RICH M - CALLED - VEHICLE BROKEN DOWN OVERNIGHT - WILL NOT BE WORKING TODAY

0800 BK, JM, AH ON SITE - SIGN IN AT VISITOR CENTER - RM HAS HASP

0900 JC OFF SITE TO PICKUP HASP

1100 JC RETURN TO SITE

1130 UXO CLEARANCE AT AOD AREA SEVERAL METALLIC OBJECTS IDENTIFIED AND FLAGGED

9/20/10

WELL	PID	DTW to TOC	DTB to TOC	NOTES
ODAMW-1	0	8.28	16.12	Rusted casing, pad cracked label faded, soft bottom
ODAMW-2	0	DRY	9.85	RUSTED CASING, CUT LOCK LABEL WORN AWAY
ODAMW3	0	9.55	17.62	cracked pad, rusted casing, faded label, soft bottom, sediment on probe
ODAMW-4	0			ANT colony
ODAMW-5	0	11.87	14.39	Soft bottom, sediment on probe
ODAMW-6D	0	24.84		RUSTED CASING LABEL WORN AWAY
ODAMW7	0	15.00	22.14	
ODAMW8D	0	26.41	91.94	
ODAMW9D	0	23.03		Rusted casing
ODAMW10	0	11.93	17.12	Slight rust
ODAMW11	0	4.61	17.28	cracked pad, sed on probe Slight rust, soft bottom
CFD-1	0	49.5	57.6	needs new lock rusted casing and hinge faded label
CFD-2	0	3.04	10.2	label faded, rusted casing hinge broken
CFD-3S	0	3.00	12.12	faded marking, rusted casing soft bottom
CFD-3D	0	2.62	72.71	faded marking, rusted casing WASP
CFD-4	0	3.06	11.39	rusted hinge, lock replaced soft bottom, label faded
CFD-5	1.2	4.72	10.19	Rusted, broken hinge, soft bottom w/ sed
WP-1	0	3.04	8.63	need cap replaced
WP-2	0	4.08	8.59	lock replaced
WP-3	0	2.76	8.00	soft bottom, well cap broken
WP-4	0	5.11	8.41	soft bottom, key doesn't turn lock - Need replaced
WP-5	0	4.24	7.62	soft bottom
WP-6	0	39.89	56.59	soft bottom

9/20/10

BK

well	PID	DTW to TOC	DTB to TOC	Notes
~~CFD BK~~ ~~MWC-1~~	~~0~~	~~49.5~~	~~57.6~~	~~rusted casing and hinge faded label~~
MWC-2	0	14.81		Rusted casing, empty wasp
MWC-3	0	3.11	40.91	marking faded, rusted casing soft bottom
MWC-4	0	29.68	42.67	rusted, faded marking, cut lock, soft bottom with sed
MWC-5	0	30.44	43.27	rusted, faded marking, soft bottom, lock rusted
MWC-1	0	10.42	30.12	soft bottom, rusted casing probe covered in brown silt need lock

Used PID #: 110-004540

Ft. Meade 9/21/10

Sunny 80°F B. Keller

0800 BK, RH, JC arrive on site, checkin at visitors center
Hold Health and Safety meeting

0900 BK, RH travel to the CEF to gauge the wells
JC remains at ODA area to begin sampling
RH BK calibrate PID
Smelled faint petrol odor on interface probe

0930 Drove back to JC to pick up Alkinox cleaner to decon to equipment

0950 washed interface probe/tape in bucket with Alkinox cleaner

1005 Leave truck to locate WP-2

1015 WP-2 PID (0), DTW (4.05), DTB (8.59) measurements taken
Decon Interface probe and tape
replaced lock that was cut

1028 measurements taken at CFD-4
Decon Interface probe and tape
Replace rusted lock

1056 measurements taken at MWC-5
Decon Interface probe and tape need lock

1112 WP-4 measurments taken
Decon Interface probe and tape need lock

1128 measurements taken at ~~MWC-1~~ BK CFD-1
Decon Interface probe and tape
1153 measurements taken at MWC-1 need new lock
Decon Interface Probe which had
come up with brown silty very fine sand
1225 measurements taken of CFD-2
Decon equipment after use
1250 loop to lock broke while opener
lock with lock cutter at WP-1 → Need cap
measurements recorded at WP-1, Decon
1259 Readings taken at MWC-3
Light Brown silty sediment on tip. soft bottom
1309 Decon equip.
1311 Readings taken at MWC-3S
Soft bottom, hinge corroded
Decon Equip.
1315 Wasp Nest in MWC-3D casing - flew away
1319 Readings Taken and Recorded MWC-3D
Decon Equip.
1346 Readings taken and Recorded WP-3
New well cap needed - the current is
broken New Cap
well found under tall pine
Decon equip.

MWC-2
1400 Metal casing has bulge that has
appeared to have fractured PVC
pipe, empty wasp nest in casing
Readings taken and recorded
Decon Equip.
1414 WP-5
Readings taken and recorded
Soft Bottom
Decon Equip.

Note: USACE onsite from 0900 to 1400.

1600 Check out at Visitor Center
Off site

Sunny 90° 9/22/10

0800 RM, BK, JC arrive on site and check in at Visitor Center
Drive to ODA area

0825 Preform Health and Safety meeting

0835 started calibration of Horibas and PIDs

Horiba SN: 01450
PH = 3.96 DO = 9.04
COND = 4.43 ORP = 263

Horiba SN: 11857
PH = 4.00 DO = 9.06
COND = 4.49 ORP = 275

PID SN: 110-004840
cal 103 at 100 ppm cal gas

PID SN: 110-011871
PID reading after calibration slightly elevated, will use other PID for readings

0910 Decon. all equipment

9/22/10

0925 ODAmw-~~1~~ BK
Pid head space reading 0 ppm

0955 ODAmw1 DTW 8.35

1025 ODA MW-4 Pid head space reading: 0 ppm
ODAmw-4 DTW 6.98
DTB 15.02
felt obstructions w/ water level meter when gauging DTB

1319 ODAmw-3
Head Space Reading PID 0.0 ppm
DTW 9.61'

1600 Rick M, Jeff C, Bethany K
check out at welcome center and depart from site

FT. MEADE 9/20/10

SUNNY 80°F J. CHISHOLMSKI

0630 RICH M - CALLED - VEHICLE BROKEN DOWN OVERNIGHT - WILL NOT BE WORKING TODAY

0800 BK, JM, AH ON SITE - SIGN IN AT VISITOR CENTER - RM HAS HASP

0900 JC OFF SITE TO PICKUP HASP

1100 JC RETURN TO SITE

1130 UXO CLEARANCE AT AOD AREA SEVERAL METALLIC OBJECTS IDENTIFIED AND FLAGGED

9/20/10

WELL	PID	DTW to TOC	DTB to TOC	NOTES
ODAMW-1	0	8.28	16.12	Rusted casing, pad cracked label faded, soft bottom
ODAMW-2	0	DRY	9.85	RUSTED CASING, CUT LOCK LABEL WORN AWAY
ODAMW3	0	9.55	17.62	cracked pad, rusted casing, faded label, soft bottom, sediment on probe
ODAMW-4	0			ANT colony
ODAMW-5	0	11.87	14.39	Soft bottom, sediment on probe
ODAMW-6D	0	24.84		RUSTED CASING LABEL WORN AWAY
ODAMW7	0	15.00	22.14	
ODAMW8D	0	26.41	91.94	
ODAMW9D	0	23.03		Rusted casing
ODAMW10	0	11.93	17.12	Slight rust
ODAMW11	0	4.61	17.28	cracked pad, sed on probe Slight rust, soft bottom
CFD-1	0	49.5	57.6	needs new lock rusted casing and hinge faded label
CFD-2	0	3.04	10.2	label faded, rusted casing hinge broken
CFD-3S	0	3.00	12.12	faded marking, rusted casing soft bottom
CFD-3D	0	2.62	72.71	faded marking, rusted casing WASP
CFD-4	0	3.06	11.39	rusted hinge, lock replaced soft bottom, label faded
CFD-5	1.2	4.72	10.19	Rusted, broken hinge, soft bottom w/ sed
WP-1	0	3.04	8.63	need cap replaced
WP-2	0	4.08	8.59	lock replaced
WP-3	0	2.76	8.00	soft bottom, well cap broken
WP-4	0	5.11	8.41	soft bottom, key doesn't turn lock - Need replaced
WP-5	0	4.24	7.62	soft bottom
WP-6	0	39.89	56.59	soft bottom

9/20/10

BK

well	PID	DTW to TOC	DTB to TOC	Notes
~~CFD BK~~ ~~MWC-1~~	~~0~~	~~49.5~~	~~57.6~~	~~rusted casing and hinge faded label~~
MWC-2	0	14.81		Rusted casing, empty wasp
MWC-3	0	3.11	40.91	marking faded, rusted casing soft bottom
MWC-4	0	29.68	42.67	rusted, faded marking, cut lock, soft bottom with sed
MWC-5	0	30.44	43.27	rusted, faded marking, soft bottom, lock rusted
MWC-1	0	10.42	30.12	soft bottom, rusted casing probe covered in brown silt need lock

Used PID #: 110-004540

Ft. Meade 9/21/10

Sunny 80°F B. Keller

0800 BK, RH, JC arrive on site, checkin at visitors center
Hold Health and Safety meeting

0900 BK, RH travel to the CEF to gauge the wells
JC remains at ODA area to begin sampling
RH BK calibrate PID
Smelled faint petrol odor on interface probe

0930 Drove back to JC to pick up Alkinox cleaner to decon to equipment

0950 washed interface probe/tape in bucket with Alkinox cleaner

1005 Leave truck to locate WP-2

1015 WP-2 PID (0), DTW (4.05), DTB (8.59) measurements taken
Decon Interface probe and tape
replaced lock that was cut

1028 measurements taken at CFD-4
Decon Interface probe and tape
Replace rusted lock

1056 measurements taken at MWC-5
Decon Interface probe and tape need lock

1112 WP-4 measurments taken
Decon Interface probe and tape need lock

1128 measurements taken at ~~MWC-1~~ BK CFD-1
Decon Interface probe and tape
1153 measurements taken at MWC-1 need new lock
Decon Interface Probe which had
come up with brown silty very fine sand
1225 measurements taken of CFD-2
Decon equipment after use
1250 loop to lock broke while opener
lock with lock cutter at WP-1 → Need cap
measurements recorded at WP-1, Decon
1259 Readings taken at MWC-3
Light Brown silty sediment on tip. soft bottom
1309 Decon equip.
1311 Readings taken at MWC-3S
Soft bottom, hinge corroded
Decon Equip.
1315 Wasp Nest in MWC-3D casing - flew away
1319 Readings Taken and Recorded MWC-3D
Decon Equip.
1346 Readings taken and Recorded WP-3
New well cap needed - the current is
broken New Cap
well found under tall pine
Decon equip.

MWC-2
1400 Metal casing has bulge that has
appeared to have fractured PVC
pipe, empty wasp nest in casing
Readings taken and recorded
Decon Equip.
1414 WP-5
Readings taken and recorded
Soft Bottom
Decon Equip.

Note: USACE onsite from 0900 to 1400.

1600 Check out at Visitor Center
Off site

Sunny 90° 9/23/10

800 Jeff C, Rick M, Bethany R arrive on site and check in at welcome Center

810 Tim F arrived at welcome center to deliever needed coolers

815 Jeff C, RM, BK travel to ODA to begin work

835 JC conducted Health and Safety meeting JC, RM, BK signed HASP & Decon equipment

845 Calibrated both sensors to an Autocal Solution (pH 4.00, 00 NTU, 4.49 mS/cm)

SN: 01450

SN: 11857

PID SN: 110-004840

cal 101 at 100 ppm cal gas

PID SN: 110-011871

PID ppm reading slightly elevated after calibration, will use other PID today.

915 BK, JC set up at ODAMW-7

PID head space reading 0.0 ppm

DTW 15.13

930 Begin well purging + sampling ODAMW-7

935 DaTonia Moore (USACE) onsite

1300 Complete Sampling of ODAMW-7

9/23/10

1000 RM begin purging and sampling of ODAMW-11

PID: 0 ppm

DTW: 4.4'

Battery/Pump Problems during the purging event.

1300 RM went to Home Depot to try to find new fuse for voltage gauge - unable to find new fuse

1500 RM back on site

Jeff called Pine. Pine will replace 1 pumpe, 1 gauge, 1 battery and delieve the equipment to his house this evening

1530 DaTonia Moore (USACE) offsite

1545 end sampling of ODAMW-11

1600 Check out at welcome Center

1700 Leave site after packing cooler / decon equipment

Sunny 95° 9/24/10

0800 Arrive on site, check in at visitor center, Rick M, Bethany K, and Jeff C.
Meet up with Wildlife Refuge Ranger Jeffries B. so he can open gate to CFD area.

830 Tree blocking road, Jeff C. uses chain and truck to pull it off road, RM, JC, BK, Jeff B continue on road to CFD

915 Jeffries B open gate, provides us with key to let ourselves in and out the rest of the project, He also granted us permission to work before/after hours of the welcome center hours.

920 ~~RM~~ BK JC preforms Health and Safety meeting for JC, BK, RM. All signed HASP.

930 Calibrated Equipment
PID SN: 110-004840
cal at 100ppm at 100 ppm cal gas
Horibas calibrated to an autocal solution (pH 4.00, 00 NTUs, 4.49 mS/cm)
SN #s: 01450 and 11857

9/24/10

0940 Decon all equipment needed for purging and sampling of wells

1014 CFD-3S
PID: 0 ppm
DTW: 2.63'

1015 MWC-3
PID: 0 ppm
DTW: 3.6'

10:55 sampled MWC-3

12:30 packed up all pumping and sampling gear

12:55 Rick M went to go replace locks and/or locking caps for:
WP-4, MWC-5, MWC-1, WP-1, ~~WP-3BK~~

13:10 Sampled CFD 3S and took a Dup which was labled CFD-22

13:30 Rick M back on site
we had no 2in well caps so WP-1 and WP-3 caps/locks not replace. will replace on monday

9/24/10

13:35 black moccasin slithered by

13:40 started packing up rest of field gear

15:00 ~~Chet~~ BK Pack up coolers for shipping (1 to Pittsburgh) and RM, JC, BK depart from site

Rain 70° 9/27/10

0700 BK arrive on site

0745 Rick M, Jeff C arrive on sit (late due to traffic)

0815 Preform Health and Safety meeting. RM, JC, BK sign HASP

0830 Calibrate and Decon all equipment necessary for daily work PID: 102 ppm 100 ppm cal gas
JC constructing shelters to shield wells from rain

0845 BK set up at CFD-S
Lock cut because didn't have keys
Needs new lock

0905 PID headspace reading 0.0 ppm
DTW: 4.49'
DTB: 10.19'
Trouble reaching the bottom of well-
obstructed bottom ~5 feet
possibly screen failure.
Water initally dark Brown

0937 Purging of CFD-S began

1047 End purging

1050 Sampling of CFD-5

1030 DaTonia Moore (USACE) on site

Rain 75° 9/27/10

Rm at WP-6
PID: Ø ppm
DTW:
Purging
1234 Sample WP-6
1200 BK at MWC-5 - decon equip.
1211 PID reading Ø ppm
1227 DTW: 30.71
DTB: 43.27
1355 Purging end and sampling of MWC-5 occured
1500 BK, RM, JC offsite after pack up field gear (no cooler sent today)
1300 DaTonia Moore offsite (USACE)

Scattered Rain 70° 9/28/10

0700 Bethany K, Rick M on site
0720 Jeff C arrive on site - all three travel back to ODA
0735 JC preformed H&S meeting All participants sign HASP
0750 JC fished out ~ 4' long collection of roots from ODAMW-2
0800 BK, RM decon and calibrate all equipment necessary for the daily activities and set up tarp to sheild ODAMW-5 from rain
0845 ODAMW-5 PID: Ø ppm
DTW: 12.02
DTB: 14.39
0850 Purging of ODAMW-5 begins
0900 well NOT recovering well - BK pumping at lowest rate possible
0950 USACE (DaTonia Moore) onsite
1015 Turned off pump as water approached pump depth
1020 JC called Bill E to inform him of the situation

Partly Sunny 75° 9/28/10

1040 Gauge well depth
DTW: 12.71'

1125 Gauge well again
current DTW: 12.30'
In accordance with Scope of Work, samplers will wait until ODAMW-3 recovers and will collect samples

1250 Well recovered to 12.02, Samples collected

1011 RM at ODAMW-2
PID reading 0ppm
DTW: 10.73'
Purging began

1129 sampling of ODAMW-2

1128 DUP was taken - labled ODAMW-12

1400 DaTonia Moore (USACE) offsite

1405 RM, BK, JC clean up site, pack up gear and Three coolers for samples

1530 RM, BK, JC offsite

Sunny 70° 9/29/10

0730 Jeff C and Bethany Keller onsite

0810 Road Blocking road - Jeff moved it to side so we could pass

0830 JC conducted Health and Safety meeting
JC, BK sign HASP

0912 WP-2
DTW: 3.96'
PID: 0 ppm

1035 Sampling of WP-2 occured
BK and JC cleaned up area and equipment
packed sample cooler

1140 JC and BK replace lock/lock caps (only necessary for WP-3) on the following wells:

MWC-4
WP-3
WP-6
CFD-5
ODAMW-2
ODAMW-3

cloudy 70° 9-29-10

1210 Secured Drums on site
Drum location: On side of dirt road going to OAA "circle" of wells.
4 drums (55-gal) on site

1245 Return Key to Gate (CFD) and Truck pass to Welcome center

1300 OFF site

Page Intentionally Left Blank

APPENDIX C

WELL INSPECTION LOGS

Page Intentionally Left Blank

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	September-22-2010	Weather Conditions:	blue bird day
Inspection Date:	Richard Munschauer	Air Temperature (°F):	85°
Inspection Time:	11:00	Well ID:	ODAMW-1

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? yes
2. Is the well ID clearly labeled? No paint has faded in sun
3. Is the well casing or cap damaged? No
4. Is the well locked? Yes
5. Is the measuring point on the well casing clearly marked? Yes
6. Does the well appear functional? Yes
7. Any signs of insect infestation (bees, wasps, etc.)? some spider sacks
8. Any evidence of heaving? NO
9. Any other evidence of well damage? cracked Pad
10. Other comments: when pump was removed from well roots were found on top of pump

MEASUREMENTS:

Total depth of well (from as builts): 13.5

Top and bottom of screened interval (from as builts): 3.5' 13.5'

Total depth of well (measured): 16.12 Silt accumulation? soft bottom

Depth to groundwater (measured): 8.38' TOC

SUMMARY:

1. Summarize any deficiencies noted.
   well ID might need to be repainted. and roots might need to be cleared out of pvc casing
2. Summarize potential causes of deficiency.
   Sun
3. Summarize potential corrective actions.
   re paint ID on outer casing

Inspector's Signature:

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	Richard Munschauer	Weather Conditions:	sunny / overcast
Inspection Date:	September-28-2010	Air Temperature (°F):	75°
Inspection Time:	11:15	Well ID:	ODAMW2

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Yes
2. Is the well ID clearly labeled? No sun has faded label
3. Is the well casing or cap damaged? No
4. Is the well locked? Yes
5. Is the measuring point on the well casing clearly marked? Yes
6. Does the well appear functional? Yes
7. Any signs of insect infestation (bees, wasps, etc.)? NO
8. Any evidence of heaving? NO
9. Any other evidence of well damage? No
10. Other comments: well was filled with roots upon arrival and roots had to be fished out of well

MEASUREMENTS:

Total depth of well (from as builts): _____

Top and bottom of screened interval (from as builts): _____ _____

Total depth of well (measured): 16.60' from TOC Silt accumulation? soft ~~bottom~~

Depth to groundwater (measured): 10.73' from TOC

SUMMARY:

1. Summarize any deficiencies noted.
   roots grow through screen / faded well Id
2. Summarize potential causes of deficiency.
   trees / sun
3. Summarize potential corrective actions.
   reprint lable on outer casing and ~~coate~~ frequently clean out well w/ mechanics ~~[illegible]~~ wire

Inspector's Signature: RJW MAU

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	Richard Munschauer	Weather Conditions:	Sunny no clouds
Inspection Date:	September-22-2010	Air Temperature (°F):	90°
Inspection Time:	13:55	Well ID:	ODA MW.3

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? yes
2. Is the well ID clearly labeled? no paint has faded from sun exposer
3. Is the well casing or cap damaged? NO
4. Is the well locked? yes (but no key would work replaced lock)
5. Is the measuring point on the well casing clearly marked? yes
6. Does the well appear functional? yes
7. Any signs of insect infestation (bees, wasps, etc.)? no
8. Any evidence of heaving? no
9. Any other evidence of well damage? yes cracked pad
10. Other comments: N/A

MEASUREMENTS:

Total depth of well (from as builts): 15'

Top and bottom of screened interval (from as builts): 5' 15'

Total depth of well (measured): 17.62' Silt accumulation? soft bottom

Depth to groundwater (measured): 9.61' from TOC

SUMMARY:

1. Summarize any deficiencies noted.
   well ID has faded in sunlight
2. Summarize potential causes of deficiency.
   sun
3. Summarize potential corrective actions.
   re paint ID onto outer casing

Inspector's Signature:

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	Bethany Keller	Weather Conditions:	Sunny, no clouds
Inspection Date:	9-22-10	Air Temperature (°F):	90°
Inspection Time:	1030	Well ID:	ODAmw-4

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Yes
2. Is the well ID clearly labeled? Yes
3. Is the well casing or cap damaged? No
4. Is the well locked? Yes
5. Is the measuring point on the well casing clearly marked? Yes
6. Does the well appear functional? Yes
7. Any signs of insect infestation (bees, wasps, etc.)? Ant infestation
8. Any evidence of heaving? No
9. Any other evidence of well damage? No
10. Other comments: felt some obstruction while gauging DTB, possible roots

MEASUREMENTS:

Total depth of well (from as builts): _____

Top and bottom of screened interval (from as builts): 2' – 12'

Total depth of well (measured): 15.02 Silt accumulation? Yes

Depth to groundwater (measured): 6.98

SUMMARY:

1. Summarize any deficiencies noted.
   Ant colony and obstructed well column.
2. Summarize potential causes of deficiency.
   Roots growing into well column
3. Summarize potential corrective actions.
   Fish roots out, Cement around PVC in casing to not allow ants

Inspector's Signature: B. Keller

Inspection Log for LTGM Wells
Clean Fill Dump

Inspector's Name:	Bethany Keller	Weather Conditions:	Partly Sunny
Inspection Date:	9-28-10	Air Temperature (°F):	70°F
Inspection Time:	1025	Well ID:	ODAMW-5

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Yes
2. Is the well ID clearly labeled? Yes
3. Is the well casing or cap damaged? Slight rusting
4. Is the well locked? Yes
5. Is the measuring point on the well casing clearly marked? Yes
6. Does the well appear functional? Yes
7. Any signs of insect infestation (bees, wasps, etc.)? No
8. Any evidence of heaving? No
9. Any other evidence of well damage? No
10. Other comments: — —

MEASUREMENTS:

Total depth of well (from as builts): 12

Top and bottom of screened interval (from as builts): 2-12'

Total depth of well (measured): 14.39 Silt accumulation? Yes

Depth to groundwater (measured): ~~14.39~~ BK 12.02

SUMMARY:

1. Summarize any deficiencies noted.
   Slight Rusting of casing
2. Summarize potential causes of deficiency.
   Weather / chipped paint
3. Summarize potential corrective actions.
   Re paint casing

Inspector's Signature: B. Keller

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	Bethany Keller	Weather Conditions:	sunny
Inspection Date:	9-20-10	Air Temperature (°F):	80°
Inspection Time:	0900	Well ID:	ODAMW-6D

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Y
2. Is the well ID clearly labeled? N
3. Is the well casing or cap damaged? rusted
4. Is the well locked? Y
5. Is the measuring point on the well casing clearly marked? N
6. Does the well appear functional? Y
7. Any signs of insect infestation (bees, wasps, etc.)? N
8. Any evidence of heaving? N
9. Any other evidence of well damage? Rusted casing
10. Other comments:

BK

MEASUREMENTS:

Total depth of well (from as builts):

Top and bottom of screened interval (from as builts):

Total depth of well (measured): >100

Silt accumulation?

Depth to groundwater (measured): 24.84

SUMMARY:

1. Summarize any deficiencies noted.
   Rusted casting, faded label
2. Summarize potential causes of deficiency.
   Weather, sun
3. Summarize potential corrective actions.
   Repaint and label

Inspector's Signature: [signature]

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	Bethany Keller	Weather Conditions:	Sunny ~~80°~~
Inspection Date:	9-23-10	Air Temperature (°F):	80°
Inspection Time:	0930	Well ID:	ODAMW-7

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Yes
2. Is the well ID clearly labeled? Yes
3. Is the well casing or cap damaged? minimal rust on casing
4. Is the well locked? Yes
5. Is the measuring point on the well casing clearly marked? Yes
6. Does the well appear functional? Yes
7. Any signs of insect infestation (bees, wasps, etc.)? NO
8. Any evidence of heaving? No
9. Any other evidence of well damage? NO
10. Other comments: — —

MEASUREMENTS:

Total depth of well (from as builts):

Top and bottom of screened interval (from as builts): 9.5 – 19.5'

Total depth of well (measured): 22.14 Silt accumulation?

Depth to groundwater (measured): 15.13

SUMMARY:

1. Summarize any deficiencies noted.
   Rust on casing
2. Summarize potential causes of deficiency.
   Sun, general weathering.
3. Summarize potential corrective actions.
   Re paint

Inspector's Signature: B. Kun

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	B. Keller	Weather Conditions:	SUNNY
Inspection Date:	9-20-10	Air Temperature (°F):	80°
Inspection Time:	0930	Well ID:	ODAMW - 8D

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Y
2. Is the well ID clearly labeled? Y
3. Is the well casing or cap damaged? N
4. Is the well locked? Y
5. Is the measuring point on the well casing clearly marked? Y
6. Does the well appear functional? Y
7. Any signs of insect infestation (bees, wasps, etc.)? N
8. Any evidence of heaving? N
9. Any other evidence of well damage? N
10. Other comments: BK

MEASUREMENTS:

Total depth of well (from as builts): _____

Top and bottom of screened interval (from as builts): _____ _____

Total depth of well (measured): 91.94

Silt accumulation? _____

Depth to groundwater (measured): 26.41

SUMMARY:

1. Summarize any deficiencies noted.

   /

2. Summarize potential causes of deficiency.

   /

3. Summarize potential corrective actions.

   /

Inspector's Signature: B. Keller

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	B. Keller	Weather Conditions:	SUNNY
Inspection Date:	9-20-10	Air Temperature (°F):	80°F
Inspection Time:	1000	Well ID:	ODAMW-9D

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Y
2. Is the well ID clearly labeled? Y
3. Is the well casing or cap damaged? Rusted
4. Is the well locked? Y
5. Is the measuring point on the well casing clearly marked? Y
6. Does the well appear functional? Y
7. Any signs of insect infestation (bees, wasps, etc.)? N
8. Any evidence of heaving? N
9. Any other evidence of well damage? Rusted
10. Other comments: BK

MEASUREMENTS:

Total depth of well (from as builts): _____

Top and bottom of screened interval (from as builts): _____ _____

Total depth of well (measured): >100 Silt accumulation? _____

Depth to groundwater (measured): 23.03

SUMMARY:

1. Summarize any deficiencies noted.
   Rusted Casing
2. Summarize potential causes of deficiency.
   Weather, Sun
3. Summarize potential corrective actions.
   Repaint

Inspector's Signature: B. Kum

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	JEFF CHASKOWSKI	Weather Conditions:	SUNNY
Inspection Date:	9/21/10	Air Temperature (°F):	95F
Inspection Time:	1200	Well ID:	ODAMW10

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? YES
2. Is the well ID clearly labeled? YES
3. Is the well casing or cap damaged? NO
4. Is the well locked? YES
5. Is the measuring point on the well casing clearly marked? YES
6. Does the well appear functional? YES
7. Any signs of insect infestation (bees, wasps, etc.)? NO
8. Any evidence of heaving? NO
9. Any other evidence of well damage? NO
10. Other comments:

MEASUREMENTS:

Total depth of well (from as builts): 15

Top and bottom of screened interval (from as builts): 5 15

Total depth of well (measured): 17.12 Silt accumulation? YES

Depth to groundwater (measured): 12.01

SUMMARY:

1. Summarize any deficiencies noted.
2. Summarize potential causes of deficiency.
3. Summarize potential corrective actions.

Inspector's Signature:

Inspection Log for LTM Wells
Ordnance Disposal Area

Inspector's Name:	Bethany Keller	Weather Conditions:	Sunny - No clouds
Inspection Date:	9-23-10	Air Temperature (°F):	90°
Inspection Time:	1440	Well ID:	ODAMW-11

GROUNDWATER MONITORING WELL INSPECTION:

1. Has the well been located? Yes
2. Is the well ID clearly labeled? Starting to fade
3. Is the well casing or cap damaged? Slighty rusted
4. Is the well locked? Yes
5. Is the measuring point on the well casing clearly marked? Yes
6. Does the well appear functional? Yes
7. Any signs of insect infestation (bees, wasps, etc.)? No
8. Any evidence of heaving? No
9. Any other evidence of well damage? No
10. Other comments: N/a BK

MEASUREMENTS:

Total depth of well (from as builts): 15 ft.

Top and bottom of screened interval (from as builts): 5-15 ft.

Total depth of well (measured): 17.28 ft. Silt accumulation? Yes

Depth to groundwater (measured): 4.44

SUMMARY:

1. Summarize any deficiencies noted.
   Faded label, rusted casing
2. Summarize potential causes of deficiency.
   general weathering
3. Summarize potential corrective actions.
   Repaint

Inspector's Signature: B. Kuu

APPENDIX D

WELL PURGE AND SAMPLING FORMS

Page Intentionally Left Blank

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW~~#~~1	DEPTH TO GW (FT): ~~8.48~~ 8.38' TOC	DATE & TIME OF WL MEASUREMENT: 09:50 8.38' TOC
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
Ordnance Demolition Area	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE: September-22-2010
LOCATION:	SURFACE: 93.52 ~~95.53~~ NAVD 1988	
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: 95.40 ~~97.45~~ NAVD 1988	TECHNICIAN: Richard Munschever

DEPTH OF WELL (FT): AS DRILLED: AS MEASURED AT TIME OF SAMPLING: 16.12

Well Construction Details

Well Diameter (in) 4	Screened Interval (ft) 3.5 - 13.5 ~~4-14~~	Top of Filter Pack (ft) 3 ~~4~~
Borehole Diameter (in) 12	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = (gals)

Description of Well Condition: See Inspection log. Note: Pump came up with roots on the top

Well Sampling Information

PID Reading: 0.0 ppm
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pumping Depth(s): 12' toc
Start Time: 09:58
Stop Time: 11:53

Physical Appearance of Water
Initial: clear
During: clear
Final: clear
Total Quantity of Water Removed: 5.5 gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)		Depth to water (ft)	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	~~Redox (mV)~~ ORP
0958	Ø		8.47	58.7	18.66	4.45	0.092	6.37	287
10:08	.75		8.47	30.7	18.51	3.98	0.088	5.68	34-3
10:18	1.25		8.50	28.7	18.47	3.98	0.088	5.67	34-3
10:28	1.66		8.50	24.8	18.56	4.19	0.087	5.63	340
10:38	2.10		8.48	30.4	18.78	4.33	0.087	5.63	33-7
10:48	2.45		8.48	18.3	18.80	4.37	0.087	5.63	33-8
10:58	2.75		8.48	14.7	18.78	4.40	0.088	5.64	339
11:08	3.25		8.48	12.9	18.90	4.42	0.088	5.66	340
11:18	3.75		8.47	11.1	19.10	4.43	0.088	5.67	341
11:28	4.25		8.47	9.6	19.23	4.45	0.088	5.68	341
11:38	4.75		8.46	9.0	19.46	4.47	0.089	5.74	341
11:48	5.25		8.44	7.6	19.58	4.47	0.089	5.75	341
12:28	—		8.48	9.3	18.97	4.45	0.095	6.68	326

[after sampling

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW02 1		HCL pH<2
Explosives (b)	SW-846 8330	ODAMW02 1		None
Cadmium	SW-846 6010B	ODAMW02 1		HNO_3 pH<2

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,

sulfite test kit one drop added; less than .64 mg/L

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW~~#~~1

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-~~05~~ 2	DEPTH TO GW (FT): 10.73	DATE & TIME OF WL MEASUREMENT 9:59 September-28
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
Ordnance Demolition Area	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE:
LOCATION:	SURFACE: ~~96.51 NAVD 1988~~	September-28-2010
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: ~~98.76 NAVD 1988~~	TECHNICIAN: ~~Boza~~ Rick Muschamp

DEPTH OF WELL (FT): AS DRILLED: AS MEASURED AT TIME OF SAMPLING: 16.60 (50ft)

Well Construction Details

Well Diameter (in) 2	Screened Interval (ft) ~~2~~ 2	Top of Filter Pack (ft) 1.5
Borehole Diameter (in) 4 1/2	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = _____ (gals)

Description of Well Condition: _____

Well Sampling Information

PID Reading: 0.0 ppm
Purge Method: Low-flow purge
Pumping Rate: ~~[illegible]~~ ml/min
Pumping Depth(s): 14 toc
Start Time: 10:11
Stop Time: 11:27

Physical Appearance of Water
Initial: clear
During: clear
Final:
Total Quantity of Water Removed: 9 gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)		Depth to water (ft)	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)
10:~~[illegible]~~	Ø-	.25	10.79	75.5	18.28	4.29	0.067	3.45	113
10:22	.75*		10.76	75.~~[illegible]~~9	18.95	4.83	0.066	3.51	81
10:32	~~[illegible]~~2.00		10.87	81.9	17.90	4.82	0.065	4.27	80
10:42	3.50		10.91	70.5	17.70	4.90	0.064	5.58	75
10:52	~~[illegible]~~	5.00	10.91	70.4	17.66	4.61	0.065	6.44	92
11:02	6.50**		10.86	68.6	17.95	4.40	0.065	6.48	100
11:12	7.50		10.78	68.5	18.73	4.45	0.066	6.43	104
11:22	8.50		10.79	68.3	~~[illegible]~~18.97	4.39	0.066	6.76	109
	–		10.85	71.5	18.32	3.33	0.066	7.73	176

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW05	NA	HCL pH<2
Explosives (b)	SW-846 8330	ODAMW05	NA	None
Cadmium	SW-846 6010B	ODAMW05	NA	HNO_3 pH<2

SAMPLE THE ODAMW2-9/29
Sulfate test kit
One drop less than -64 9/29/2

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,
* turned up ~~[illegible]~~ pump slightly
** turned down ~~[illegible]~~ pump slightly

equipment blank ODAMW2 @ 10:00
field Dup ODAMW-1128 12

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW-~~05~~ 2

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-3	DEPTH TO GW (FT): 9.61' toc	DATE & TIME OF WL MEASUREMENT 13:14 Sept-22-2010
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
Ordnance Demolition Area	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE: September 22 - 2010
LOCATION:	SURFACE: 96.32 NAVD 1988	
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: 98.36 NAVD 1988	TECHNICIAN: Richard Munschauer

DEPTH OF WELL (FT): AS DRILLED: AS MEASURED AT TIME OF SAMPLING: 17.62

Well Construction Details

Well Diameter (in) 4	Screened Interval (ft) 5 - 15	Top of Filter Pack (ft) 3.5
Borehole Diameter (in) 12	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = _____ (gals)

Description of Well Condition: _____

Well Sampling Information

PID Reading: 0.0 ppm
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pumping Depth(s): 13.5' toc
Start Time: 13:19
Stop Time: 15:13

Physical Appearance of Water
Initial: clear
During: clear
Final: Cloudy
Total Quantity of Water Removed: 5.50 gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)		Depth to water (ft)	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)
13:20	0		9.96*	20.5	20.16	5.82	0.106	0.00	78
13:30	.50		10.12**	16.8	22.32	5.47	0.104	0.00	78
13:40	1.00		10.45**	14.9	22.77	5.43	0.104	0.00	77
13:50	[illegible]	1.25	10.52**	14.1	22.70	5.73	0.104	0.00	54
14:00	1.66		10.61**	12.8	22.27	6.00	0.110	0.00	40
14:10	2.25		10.59**	12.6	22.03	6.04	0.110	0.00	39
14:20	2.60		10.61**	12.5	23.99	5.97	0.108	0.00	43
14:30	3.25		10.88**	15.4	21.42	5.94	0.107	0.00	47
14:40	4.00		10.97**	16.4	21.57	5.90	0.111	0.00	49
14:50	4.50		10.94**	17.6	23.77	5.96	0.108	0.00	44
15:00	5.00		10.94**	18.4	22.10	6.02	0.109	0.00	37
15:10	5.50		11.04**	29.7	21.15	5.96	0.112	0.00	55
15:47			11.31	[illegible] 260.0	19.60	5.92	0.112	0.00	

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW03		HCL pH<2
Explosives (b)	SW-846 8330	ODAMW03		None
Cadmium	SW-846 6010B	ODAMW03		HNO_3 pH<2

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,
* Turned down rate
** can't be turned down any further

Sulfite test kit one drop; less than .64 mg/L

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW-3

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-4	DEPTH TO GW (FT): 6.98	DATE & TIME OF WL MEASUREMENT 9/22/10 1025
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
LOCATION: Ordnance Demolition Area, Patuxent Research Refuge, Laurel, Maryland	REFERENCE ELEVATIONS (FT MSL): SURFACE: 92.44 NAVD 1988; TOP OF PVC CASING: 94.72 NAVD 1988	SAMPLE DATE: 9/22/10
		TECHNICIAN: Bethany Keller
DEPTH OF WELL (FT): AS DRILLED:	AS MEASURED AT TIME OF SAMPLING: ~~6.98~~ 15.02	

Well Construction Details

Well Diameter (in)	Screened Interval (ft)	Top of Filter Pack (ft)
4	2 - 12	1.5
Borehole Diameter (in)	**Volume of Water in Screen & Riser (gals)**	**Volume of Water in Filter Pack (gals)***
12		

*Use 30% for porosity of filter sand

One Well Volume = _____ (gals)

Description of Well Condition: _____

Well Sampling Information

PID Reading: 0.0
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pumping Depth(s): toc
Start Time: 1043
Stop Time: 1400

Physical Appearance of Water
Initial: cloudy
During: clear
Final: clear
Total Quantity of Water Removed: 14.0 gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)		Depth to water (ft)	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)
1043	0		6.98	105.0	19.62	3.30	0.110	5.93	329
1053	0.75		7.08	87.1	19.90	2.97	0.108	5.01	351
1103	1.5		7.08	94.5	20.19	2.70	0.104	4.64	378
1113	2.5		7.13	70.3	19.10	2.45	0.104	4.82	396
1123	4.5		7.53	50.6	18.64	3.72	0.104	4.35	286
1133	2		7.24	68.3	19.04	3.22	0.103	5.33	311
1143	3		7.10	~~55.0 BK~~	19.04	2.60	0.102	5.48	371
1153	3.75		7.22	56.0	19.66	2.52	0.101	5.44	392
1203	5		7.26	64.3	18.98	2.30	0.101	5.25	408
1213	6.25		7.27	31.8	19.21	2.24	0.101	5.36	414
1223	8		7.34	35.4	19.16	2.17	0.101	5.66	419
		BK							
				CONTINUED ON BACK →					

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW04		HCL pH<2
Explosives (b)	SW-846 8330	ODAMW04		None
Cadmium	SW-846 6010B	ODAMW04		HNO_3 pH<2

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,
Sulfite Test Kit: Sulfite color change at one drop; less than .64 mg/L

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area, Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW-4

9/22/10
ODAMW-4
purging & sample record
p. 2

Time	Vol purged (gal)	O_2 to W (ft)	Turb. NTUs	Temp °C	pH	cond	DO	Redox
1233	9.5	7.34	26.6	19.01	2.19	0.101	6.45	419
1243	11.5	7.28	32.0	19.23	2.22	0.11	5.42	419
1253	12.0	7.22	31.4	19.65	2.24	.102	5.32	419
1303	13.0	7.21	32.0	19.79	2.28	.100	5.25	415
1313	14.0	7.27	32.0	19.45	2.24	.100	5.23	418
End		7.41	46.6	19.42	2.6	.101	6.27	378

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-5	DEPTH TO GW (FT): 12.02	DATE & TIME OF WL MEASUREMENT 9-28-10 0845
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of Casing	
Clean Fill Dump	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE: 9-28-10
LOCATION:	SURFACE: _____ NAVD 1988	
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: NAVD 1988	TECHNICIAN: B. Keller

DEPTH OF WELL (FT): Driller: AS MEASURED AT TIME OF SAMPLING: 14.39

Well Construction Details

Well Diameter (in) 4	Screened Interval (ft) 2-12	Top of Filter Pack (ft)
Borehole Diameter (in)	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = _____ (gals)

Description of Well Condition: _____

Well Sampling Information

Initial PID Reading: 0 ppm
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pump Depth: TOC
Start Time: 0850
Stop Time: 1010

Physical Appearance of Water
Initial: clear
During: clear
Final: cloudy
Total Quantity of Water Removed: gallons
Method of Water Disposal:

Time:	Purge Rate	Cum Volume Purged (gals)	Depth to water (ft) *	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)
0850		0	12.02	95.1	17.64	3.06	0.047	5.78	174
0900		1.25	12.72	91.5	18.12	5.26	0.051	0.00	96
0910		2.25	12.78	80.2	18.97	4.99	0.051	0.00	100
0920		3.25	13.01	105.0	17.54	5.06	0.050	0.00	96
0930		3.75	13.11	92.3	18.56	5.19	0.048	0.00	93
0940		4	13.19	86.0	18.41	5.37	0.048	0.00	90
0950		4.25	13.17	87.5	18.80	5.35	0.047	0.00	97
1000		4.5	13.25	91.0	18.71	5.38	0.048	0.00	105
1010		4.6	13.28	83.3	19.41	5.35	0.047	0.10	117
After Sample 1315		--	13.69	502.0	17.20	5.31	0.047	2.10	189

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
TCL VOCs	SW-846 8260B			HCL pH<2
TAL Metals	SW-846 6010B			HNO_3 pH<2

Note: Metals samples are filtered in the field. HNO_3 is added after filtering.

*pumping at lowest rate possible

-Sulfite Test Kit color change at one drop ; 2.64 mg/L

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Clean Fill Dump Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER:

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-7	DEPTH TO GW (FT): 15.13	DATE & TIME OF WL MEASUREMENT 9-23-10 0915
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
Ordnance Demolition Area	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE: 9/23/10
LOCATION:	SURFACE: 99.95 NAVD 1988	
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: 102.82 NAVD 1988	TECHNICIAN: Bethany Keller
DEPTH OF WELL (FT): AS DRILLED:	AS MEASURED AT TIME OF SAMPLING: 22.14	

Well Construction Details

Well Diameter (in) 4	Screened Interval (ft) 9.5 - 19.5	Top of Filter Pack (ft) 6
Borehole Diameter (in) 12	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = _____ (gals)

Description of Well Condition: _____

Well Sampling Information

PID Reading: 0 ppm
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pumping Depth(s): toc
Start Time: 0930
Stop Time: 1208

Physical Appearance of Water
Initial: clear
During: clear
Final: clear
Total Quantity of Water Removed: gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)		Depth to water (ft)	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)
0930	0		15.33	4.0	15.28	4.34	.066	8.31	292
0940	1.25		15.35	1.1	15.51	3.31	.066	7.24	384
0950	2.25		15.39	1.0	15.42	3.56	.065	7.38	384
1000	3.25		15.45	0.9	15.30	4.09	.063	7.28	361
1010	4.00		15.49	0.8	15.56	4.29	.063	7.33	355
1020	5.25		15.42	0.7	15.77	4.32	.061	7.61	354
1030	6.25		15.42	0.9	15.81	4.35	.060	7.58	353
1040	7.25		15.42	1.1	15.82	4.36	.060	7.98	355
1050	8.25		15.41	3.4	15.90	4.35	.061	7.64	357
1100	9.5		15.52	3.7	16.10	4.36	.060	7.55	361
1110	10.25		15.41	3.7	16.01	4.38	.061	7.98	360
1120	11.25		15.41	3.8	16.07	4.36	.060	7.78	362
End (After Sampling (Reading): 1208	11.25		15.59	1.8	15.77	4.16	.060	7.85	373

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW07		HCL pH<2
Explosives (b)	SW-846 8330	ODAMW07		None
Cadmium	SW-846 6010B	ODAMW07		HNO_3 pH<2

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,

SULFATE IS NOW LESS THAN 0.64 mg/L

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW-7

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-10	DEPTH TO GW (FT): 12.01	DATE & TIME OF WL MEASUREMENT 9/21/10 1035
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
Ordnance Demolition Area	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE: 9/21/10
LOCATION:	SURFACE: 84.43 NAVD 1988	
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: 86.70 NAVD 1988	TECHNICIAN: J. CHISKOWSKI

DEPTH OF WELL (FT): AS DRILLED: AS MEASURED AT TIME OF SAMPLING: 17.12

Well Construction Details

Well Diameter (in) 4	Screened Interval (ft) 5 - 15	Top of Filter Pack (ft) 2.8
Borehole Diameter (in) 12	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = ~~10~~ 11 (gals)

Description of Well Condition:

Well Sampling Information

PID Reading: 0.0
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pumping Depth(s): toc
Start Time: 1035
Stop Time: 1330

Physical Appearance of Water
Initial: CLEAR
During: CLEAR
Final: CLEAR
Total Quantity of Water Removed: gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)	DESCR	Depth to water (ft)	10% Turbidity (NTUs)	1 Temp (°C)	0.1 pH	10% Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)
1035	0	CLEAR	12.01	~~130~~ 63.0	16.18	4.09	0.068	0.54	272
1045	1.5	CLEAR	12.51	26.1	16.17	4.21	0.062	0.00	295
1055	2.5	CLEAR	12.37	24.2	16.55	4.35	0.061	0.00	295
1105	4.5	CLEAR	12.48	12.4	16.28	4.38	0.059	0.00	304
1115	6.0	CLEAR	12.32	7.0	16.74	4.46	0.057	0.00	305
1125	7.0	CLEAR	12.37	4.7	16.43	4.48	0.057	0.00	309
1135	8.0	CLEAR	12.24	3.5	16.90	4.52	0.055	0.00	311
1145	9.5	CLEAR	12.30	2.9	16.64	4.49	0.055	0.00	313
1155	11.0	CLEAR	12.27	1.8	16.41	4.46	0.054	0.00	321
1205	12.5	CLEAR	12.30	1.5	16.97	4.50	0.054	0.00	320
1215	14.0	CLEAR	12.29	1.3	16.36	4.47	0.054	0.00	325
1330	20	CLEAR	12.29	1.5	16.86	4.29	0.055	0.00	320

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW10	ODAMW-1020	HCL pH<2
Explosives (b)	SW-846 8330	ODAMW10	ODAMW-1020	None
Cadmium	SW-846 6010B	ODAMW10	ODAMW-1020	HNO_3 pH<2
SULFITE				

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,

SULFITE 1 DROP FOR COLOR CHANGE, LESS THAN 0.64 mg/L

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW-10

MONITORING WELL PURGING & SAMPLING RECORD

MONITORING WELL NUMBER: ODAMW-11	DEPTH TO GW (FT): 4.44	DATE & TIME OF WL MEASUREMENT 09:59 Sept-23-10
PROJECT: Long-Term Monitoring Program	MEASURED FROM: Top of PVC casing	
Ordnance Demolition Area	REFERENCE ELEVATIONS (FT MSL):	SAMPLE DATE: Sept-23-2010
LOCATION:	SURFACE: 75.73 NAVD 1988	
Patuxent Research Refuge, Laurel, Maryland	TOP OF PVC CASING: 77.81 NAVD 1988	TECHNICIAN: Richard Musselman

DEPTH OF WELL (FT): AS DRILLED: AS MEASURED AT TIME OF SAMPLING: 17.28

Well Construction Details

Well Diameter (in) 4	Screened Interval (ft) 5 - 15	Top of Filter Pack (ft) 2.8
Borehole Diameter (in) 12	Volume of Water in Screen & Riser (gals)	Volume of Water in Filter Pack (gals)*

*Use 30% for porosity of filter sand

One Well Volume = (gals)

Description of Well Condition:

Well Sampling Information

PID Reading: 0.0 ppm
Purge Method: Low-flow purge
Pumping Rate: ml/min
Pumping Depth(s): 11 toc
Start Time: 10:19
Stop Time: 1453

Physical Appearance of Water
Initial: Clear
During: Clear
Final:
Total Quantity of Water Removed: gallons
Method of Water Disposal: FGGM sanitary sewer

Time:	Cumulative Volume Purged (gals)		Depth to water (ft)	Turbidity (NTUs)	Temp (°C)	pH	Conductivity (u-mohs/cm)	DO (ppm)	Redox (mV)	
10:19	Ø		4.75	–	–	–	–	–	–	→ lost flow
10:27	.1		4.73	56.3	21.08	3.18	0.055	2.26	343	
10:37	.25		4.60	53.6	21.48	3.41	0.052	1.65	331	
10:47	.50		4.51	89.8	21.48	3.49	0.051	1.45	326	
10:57	1.50		5.27	81.9	20.67	3.38	0.049	2.97	321	
~~11:07~~	~~[illegible]~~	2.5	4.48	–	–	–	–	–	–	→ lost flow
11:17	4.0		5.19	99.8	20.87	3.68	0.047	2.43	304	→ are going flow @ 11:10
11:27	–		–	–	–	–	–	–	–	
11:31	8.0	can't	5.14	90.6	20.85	3.85	0.047	2.80	290	started gushing H2O turned down lost flow @ 11:14 regained @ 11:16
11:43	10.0	get	5.46	98.5	20.86	3.84	0.048	2.05	286	
11:57	12.0	any	5.41	96.5	20.80	4.05	0.046	1.55	273	
*		water w/ pump								

Have issues with batteries for pump not consistent flow rate trying to decrease rate of flow

→ constantly losing flow then getting flow that is too fast

→ battery keeps fluctuating and increasing and decreasing flow and voltage

Sampling Record

Parameter	Method Number	Sample Number	QA/QC Sample Number	Preservative
VOCs (a)	SW-846 8260B	ODAMW11		HCL pH<2
Explosives (b)	SW-846 8330	ODAMW11		None
Cadmium	SW-846 6010B	ODAMW11		HNO_3 pH<2

Comments: (a) Only TCE, PCE, and chloroform
(b) Only RDX, TNT, 2A46,

~~*~~ = no flow at time of measurment
* = stoping pump going to try and Hook it to car battery

USACE - Baltimore District

PROJECT: Long-Term Monitoring Program, Ordnance Demolition Area Patuxent Research Refuge, Laurel, Mayland	MONITORING WELL NUMBER: ODAMW-11

ODAMW-11
9-23-10

Time	gal	DTW	NTN Turb	Temp	pH	Cond	DO	ReVa
1337	0	4.55	96.1	21.21	4.06	0.053	2.97	274
1342	2.5	4.75	94.0	21.24	4.07	0.046	2.07	271
1358	5	4.81						

Pump Issues!!

1413	0	4.85	78.1	21.54	4.19	0.045	2.59	262
1423	1.00	4.73	87.8	21.86	4.25	0.045	1.49	258
1433	2.00	4.72	96.0	21.67	4.28	0.045	1.39	254
1443	3.5	5.04	87.1	21.04	4.27	0.045	1.34	254
1453	4.25	4.41	90.1	21.14	4.36	0.045	1.34	258

After Sample Reading

1537			45.8	20.89	4.40	0.052	3.70	253

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: _____

Regulatory program: ☐ DW ☐ NPDES ☑ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS CORP	Client Project Manager: BILL EATON	Site Contact: BILL EATON	Lab Contact: CARRIE GAMBER
Address: 200 ORCHARD RIDGE DR	Telephone: 301 258-5804	Telephone:	Telephone: 412-963-7058
City/State/Zip: GAITHERSBURG MD 20878	Email: BILL_EATON@URSCORP.COM		
Phone: 301 258 9780			
Project Name: FT. MEADE ODA ICFD	Method of Shipment/Carrier: FEDEX		
Project Number: 15302389.30000	Shipping/Tracking No:		
PO #			

COC No: 003883

1 of 1 COCs

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☒ 1 day

For lab use only

☐ Walk-in client
☐ Lab pickup
☐ Lab sampling

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y/N)	Composite=C / Grab=G	Analyses: Sm 3500 Fe D Ferrous Iron										Sample Specific Notes / Special Instructions:
ODA MW 10	9/21/10	1215		X						1					Y		X										
ODA MW 10	9/21/10	1215		X						1					N		X										

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

24 HOUR TAT

Relinquished by:	Company: URS CORP	Date/Time: 9/21/10 1700	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: ST. LOUIS

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact				
Company Name: URS CORP	Client Project Manager: BILL EATON	Site Contact: BILL EATON	Lab Contact: CARRIE GAMBER	COC No: 003891
Address: 200 ORCHARD RIDGE DR	Telephone: 301 258 3804	Telephone:	Telephone: 412 963 7058	1 of 1 COCs
City/State/Zip: GAITHERSBURG MD 20878	Email: BILL_EATON@URSCORP.COM	Analysis Turnaround Time (in BUS days)	Analyses	For lab use only
Phone: 301 258 9780		TAT if different from below _____ ☐ 3 weeks ☐ 2 weeks ☐ 1 week ☐ 2 days ☐ 1 day		Walk-in client ☐ Lab pickup ☐ Lab sampling ☐
Project Name: FT. MEADE ODA KFD	Method of Shipment/Carrier: FEDEX			
Project Number: 15302389.30000	Shipping/Tracking No: 8737 7144 6631			Job/SDG No:
PO #				

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y/N)	Composite=C / Grab=G	Analyses: SEE DELIV EXPLOSIVES 8330									Sample Specific Notes / Special Instructions:
ODA MW10	9/21/10	1215		X									2		N	G	X									
ODA MW1	9/22/10	1153		X									2		N	G	X									
ODA MW4	9/22/10	1329		X									2		N	G	X									
ODA MW3	9/22/10	1513		X									2		N	G	X									

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:
EXPLOSIVES: RDX, TNT, 2A4 6DNT, AND 1A2 6DNT

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/22/10 2000			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: NASHVILLE

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS CORP	Client Project Manager: BILL EATON	Site Contact: BILL EATON	Lab Contact: CARRIE GAMBER
Address: 720 ORCHARD RIDGE DR	Telephone: 3012585804	Telephone:	Telephone: 412 963 7058
City/State/Zip: GAITHERSBURG MD 20878	Email: BILL_EATON@URSCORP.COM		
Phone: 3012589780			
Project Name: FT. MEADE ODAKFD	Method of Shipment/Carrier: FEDEX		
Project Number: 15302389.30000	Shipping/Tracking No: 8737 7144 6610		
PO #			

COC No: 003889

1 of 1 COCs

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☒ 1 day

For lab use only

Walk-in client ☐
Lab pickup ☐
Lab sampling ☐

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y/N)	Composite=C / Grab=G	Analyses: SW 3500 FED Fecal Coliforms Dup DLSS	3M 7500 FED Fecal Coliforms 24hr hold									Sample Specific Notes / Special Instructions:
ODAMW1	9/22/10	1153		X						1					Y	G	X										
ODAMW1	9/22/10	1153		X						1					N	G		X									
ODAMW4	9/22/10	1329		X						1					Y	G	X										
ODAMW4	9/22/10	1329		X						1					N	G		X									
ODAMW3	9/22/10	1513		X						1					Y	G	X										
ODAMW3	9/22/10	1513		X						1					N	G		X									

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

24 HOUR TAT

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/22/10 2000			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: PITTSBURG

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS CORP	Client Project Manager: BILL EATON	Site Contact: BILL EATON	Lab Contact: CARRIE GAMBER
Address: 201 ORCHARD RIDGE DR	Telephone: 301 258 5804	Telephone:	Telephone: 412 963 7058
City/State/Zip: GAITHERSBURG MD 20878	Email: BILL_EATON@URSCORP.COM		
Phone: 301 258 9780			
Project Name: FTMEADE ODA/CFD	Method of Shipment/Carrier: FEDEX		
Project Number: 15302389.30000	Shipping/Tracking No: 8757 7144 6697		

COC No: 003888

1 of 1 COCs

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

For lab use only

☐ Walk-in client
☐ Lab pickup
☐ Lab sampling

Job/SDG No:

P O #

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y/N)	Composite=C / Grab=G	Analyses: Cd & Mn 6020	SEE BELOW SELECT VOCs 8260B	NITRATE NITRITE 353.2	SULFATE 300.0	ALKALINITY SM2320B	TOTAL CHLORIDE 300	SM5310C TOTAL ORGANIC CARBON	SM5310C DISS ORGANIC CARBON			Sample Specific Notes / Special Instructions:
ODAMW10	9/21/10	1215		X				3	1						Y	G	X		X					X			
ODAMW10	9/21/10	1215		X				2		3			1		N	G		X		X	X	X	X				
ODAMW1	9/22/10	1153		X				3	1						Y	G	X		X					X			
ODAMW1	9/22/10	1153		X				2		3			1		N	G		X		X	X	X	X				
ODAMW4	9/22/10	1329		X				3	1						Y	G	X		X					X			
ODAMW4	9/22/10	1329		X				2		3			1		N	G		X		X	X	X	X				
ODAMW	9/22/10	1513		X				3	1						Y	G	X		X					X			
ODAMW	9/22/10	1513		X				2		3			1		N	G		X		X	X	X	X				

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

SELECT VOCs: TCE, PCE, CHLOROFORM, CIS-12-DCE, AND VINYL CHLORIDE

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
	URS	9/22/10 2000			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: NASHVILLE

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS CORP	Client Project Manager: BILL EATON	Site Contact: BILL EATON	Lab Contact: CARRIE GAMBER
Address: 200 ORCHARD RIDGE DR	Telephone: 301 258 5804	Telephone:	Telephone: 412 963 7058
City/State/Zip: GAITHERSBURG MD 20878	Email: BILL_EATON@URSCORP.com		
Phone: 301 258 9780			
Project Name: FT. MEADE ODA KFD	Method of Shipment/Carrier: FEDEX		
Project Number: 15302389.30000	Shipping/Tracking No: 873771446610		
PO #			

COC No: 003886

_____ of _____ COCs

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

For lab use only

Walk-in client ☐
Lab pickup ☐
Lab sampling ☐

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y / N)	Composite=C / Grab=G	Analyses: IRON TOTAL EPA 6010B	IRON DISSOLVED EPA 6010B								Sample Specific Notes / Special Instructions:
ODAMW10	9/21/10	1215		X					1						Y	G		X								
ODAMW10	9/21/10	1215		X					1						N	G	X									
ODAMW1	9/22/10	1153		X					1						Y	G		X								
ODAMW1	9/22/10	~~1325~~ 1153		X					1						N	G	X									
ODAMW4	9/22/10	1329		X					1						Y	G		X								
ODAMW4	9/22/10	1329		X					1						N	G	X									
ODAMW3	9/22/10	1513		X					1						Y	G		X								
ODAMW3	9/22/10	1513		X					1						N	G	X									

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/22/10 2000			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

SAMPLE CHAIN OF CUSTODY/AGREEMENT FORM

TEST AMERICA - NASHVILLE

~~PHASE SEPARATION SCIENCE, INC.~~

LAB CONTACT: CARRIE GAMBER

412-963-7058

~~www.phaseonline.com~~

~~email: info@phaseonline.com~~

(1)

CLIENT: NRS CORP OFFICE LOC. GAITHERSBURG MD

PROJECT MGR: BILL EATON PHONE NO.: (301) 258 5804

EMAIL: BILL_EATON@NRSCORP.com FAX NO.: ( )

PROJECT NAME: FT MEADE ODA ICFP PROJECT NO.: 15302389.30000

SITE LOCATION: P.O. NO.:

SAMPLERS: JEFF CHISKOWSKI

PSS Work Order #: PAGE 1 OF 1

Matrix Codes:
SW=Surface Wtr **DW**=Drinking Wrt **GW**=Ground Wtr **WW**=Waste Wtr **O**=Oil **S**=Soil **WL**=Waste Liquid **WS**=Waste Solid **W**= Wipe

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX (See Codes)	No. CONTAINERS	SAMPLE TYPE C = COMP G = GRAB	Preservatives Used												REMARKS
							Analysis/ Method Required (3)	1 IRON TOTAL 6010B	(SOLUBLE) 6010B 2 IRON DISSOLVED										
	ODA MW 7	9/23/10	1125	GW	1	G		X											
	ODA MW 7	9/23/10	1125	GW	1	G	X												
	ODA MW 11	9/23/10	1500	GW	1	G		X											
	ODA MW 11	9/23/10	1500	GW	1	G	X												

(5)

Relinquished By: (1)	Date	Time	Received By:
	9/23/10	1700	FEDEX 8737 7144 6642
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received By:

(4)

Requested Turnaround Time
☐ 5-Day ☐ 3-Day ☐ 2-Day
☐ Next Day ☐ Emergency ☐ Other

Data Deliverables Required:

# of Coolers:

Custody Seal:

Ice Present: Temp:

Shipping Carrier:

Special Instructions:

6630 Baltimore National Pike • Route 40 West • Baltimore, Maryland 21228 • (410) 747-8770 • (800) 932-9047 • Fax (410) 788-8723

The client (Client Name), by signing, or having client's agent sign, this "Sample Chain of Custody/Agreement Form", agrees to pay for the above requested services per the latest version of the Service Brochure or PSS-provided quotation including any and all attorney's or other reasonable fees if collection becomes necessary.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: NASHVILLE

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact

Company Name:	Client Project Manager:	Site Contact:	Lab Contact:	COC No:
URS CORP	BILL EATON	BILL EATON	CARLIE GAMBER	003890
Address: 200 ORCHARD RIDGE DR	**Telephone:** 301 258 5804	**Telephone:**	**Telephone:** 412 963 7058	___ of ___ COCs
City/State/Zip: GAITHERSBURG MD 20878	**Email:** BILL_EATON@URSCORP.com			
Phone: 301 258 9780				
Project Name: FT. MEADE ODAKFD	**Method of Shipment/Carrier:** FEDEX			
Project Number: 153 02389.30000	**Shipping/Tracking No:** 8737 7144 6642			
P O #				

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

- ☐ 3 weeks
- ☐ 2 weeks
- ☐ 1 week
- ☐ 2 days
- ☒ 1 day

Analyses

For lab use only

- Walk-in client ☐
- Lab pickup ☐
- Lab sampling ☐

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y / N)	Composite=C / Grab=G	DS SOLID 8270 FAB FERRICHLORIDE IRON	PPM 8270 FAB FERRICHLORIDE IRON								Sample Specific Notes / Special Instructions:
ODA MW 7	9/23/10	1125		X						1					Y		X									
ODA MW 11	9/23/10	1500		X						1					Y		X									
ODA MW 7	9/23/10	1125		X						1					N			X								
ODA MW 11	9/23/10	1500		X						1					N			X								

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

24 HOUR TAT

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/23/10 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	**Received in Laboratory by:**	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

SAMPLE CHAIN OF CUSTODY/AGREEMENT FORM

TEST AMERICA - ST LOUIS

LAB CONTACT: CARRIE GAMBER 412 963 7058

PHASE SEPARATION SCIENCE, INC.

www.phaseonline.com

email: info@phaseonline.com

(1)

CLIENT: URS CORP — OFFICE LOC. GAITHERSBURG MD

PROJECT MGR: BILL EATON — PHONE NO.: (301) 258 5804

EMAIL: BILL_EATON@URSCORP.COM — FAX NO.: ( )

PROJECT NAME: FT MEADE ODA IRFD — PROJECT NO.: 30000 (13.302389)

SITE LOCATION: — P.O. NO.:

SAMPLERS: JEFF CHISHOLM

PSS Work Order #: — PAGE 1 OF 1

Matrix Codes:
SW=Surface Wtr **DW**=Drinking Wrt **GW**=Ground Wtr **WW**=Waste Wtr **O**=Oil **S**=Soil **WL**=Waste Liquid **WS**=Waste Solid **W**= Wipe

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX (See Codes)	No. CONTAINERS	SAMPLE TYPE C = COMP G = GRAB	Preservatives Used	Analysis/ Method Required (3) SEE BELOW EXPLOSIVES 8330											REMARKS
	ODAMW 7	9/23/10	1125	GW	2	G		X											
	ODAMW11	9/23/10	1500	GW	2	G		X											

(5)

Relinquished By: (1)	Date	Time	Received By:
	9/23/10	1700	FEDEX 8737 7144 6653
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received By:

(4)

Requested Turnaround Time
☐ 5-Day ☐ 3-Day ☐ 2-Day
☐ Next Day ☐ Emergency ☐ Other

Data Deliverables Required:

# of Coolers:

Custody Seal:

Ice Present: Temp:

Shipping Carrier:

Special Instructions:
EXPLOSIVES: RDX, TNT, 2A4 6DNT, AND 4A2 6DNT

6630 Baltimore National Pike • Route 40 West • Baltimore, Maryland 21228 • (410) 747-8770 • (800) 932-9047 • Fax (410) 788-8723

The client (Client Name), by signing, or having client's agent sign, this "Sample Chain of Custody/Agreement Form", agrees to pay for the above requested services per the latest version of the Service Brochure or PSS-provided quotation including any and all attorney's or other reasonable fees if collection becomes necessary.

SAMPLE CHAIN OF CUSTODY/AGREEMENT FORM

TEST AMERICA - PITTSBURGH

PHASE SEPARATION SCIENCE, INC.

LAB CONTACT: CARRIE GAMBER
412 963 7058

www.phaseonline.com
email: info@phaseonline.com

(1)

CLIENT: URS CORP — OFFICE LOC. GAITHERSBURG MD

PROJECT MGR: BILL EATON — PHONE NO.: (301) 258 5804

EMAIL: BILL_EATON@URSCORP.com — FAX NO.: ( )

PROJECT NAME: FT. MEADE ODAKFD — PROJECT NO.: 15502389.3000

SITE LOCATION: ODA — P.O. NO.:

SAMPLERS: JEFF CHISKOWSKI

PSS Work Order #: — PAGE 1 OF 1

Matrix Codes:
SW=Surface Wtr **DW**=Drinking Wrt **GW**=Ground Wtr **WW**=Waste Wtr **O**=Oil **S**=Soil **WL**=Waste Liquid **WS**=Waste Solid **W**= Wipe

(2)

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX (See Codes)	No. CONTAINERS	SAMPLE TYPE C = COMP G = GRAB	Preservatives Used: HNO3	HCl	H2SO4	NaOH	NaOH	NaOH	H2SO4	H2SO4				REMARKS
Analysis/ Method Required (3)							CLP MO 6020	SEE BELOW	SELECT VOCs 8260B	NITRATE/NITRITE 353.2	SULFATE 300	ALKALINITY SM2320B	TOTAL CHLORIDE 300	SM5310C TOTAL ORGANIC CARBON	SM5310C DISSOLVED ORGANIC CARBON			
	ODAMW7	9/23/10	1125	GW	4	G	X		X					X				FILTERED
	ODAMW7	9/23/10	1125	GW	6	G		X		X	X	X	X					
	ODAMW11	9/23/10	1500	GW	4	G	X		X		~~X~~			X				FILTERED
	ODAMW11	9/23/10	1500	GW	6	G		X		X	X	X	X					
	TRIP BLANK																	

(5)

Relinquished By: (1)	Date	Time	Received By:
[signature]	9/24/10	1700	FEDEX 8737 7144 6664
Relinquished By: (2)	Date	Time	Received By:
Relinquished By: (3)	Date	Time	Received By:
Relinquished By: (4)	Date	Time	Received By:

(4)

Requested Turnaround Time
☐ 5-Day ☐ 3-Day ☐ 2-Day
☐ Next Day ☐ Emergency ☐ Other

Data Deliverables Required:

# of Coolers:
Custody Seal:
Ice Present: Temp:
Shipping Carrier:

Special Instructions:
VOCs: TCE, PCE, CHLOROFORM, CIS-1,2-DCE AND VINYL CHLORIDE

6630 Baltimore National Pike • Route 40 West • Baltimore, Maryland 21228 • (410) 747-8770 • (800) 932-9047 • Fax (410) 788-8723

The client (Client Name), by signing, or having client's agent sign, this "Sample Chain of Custody/Agreement Form", agrees to pay for the above requested services per the latest version of the Service Brochure or PSS-provided quotation including any and all attorney's or other reasonable fees if collection becomes necessary.

Chain of Custody Record

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: Pittsburgh

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS Corp	Client Project Manager: Bill Eaton	Site Contact: Bill Eaton	Lab Contact: Carrie Gamber
Address: 200 Orchard Ridge Dr	Telephone: 3012585804	Telephone:	Telephone: 412 963 7058
City/State/Zip: Gaithersburg MD 20878	Email: Bill-Eaton@urscorp.com		
Phone: 301258 9780			
Project Name: Ft. Meade ODA/CFD	Method of Shipment/Carrier: FedeX		
Project Number: 15302389.20000	Shipping/Tracking No: 8703 1364 5708		
PO #			

COC No: 004112

1 of 1 COCs

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

For lab use only

Walk-in client ☐
Lab pickup ☐
Lab sampling ☐

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y / N)	Composite=C / Grab=G	Analyses: EPA LLOYD KAHN TOTAL ORGANIC CARBON										Sample Specific Notes / Special Instructions:
ODA SEEP	9/28/10	1205				X							2		N	C	X										

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
	URS	9/28/10 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: Nashville

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS Corp	Client Project Manager: Bill Eaton	Site Contact: Bill Eaton	Lab Contact: Carrie Gamber
COC No: 004109			
Address: 200 Orchard Ridge Dr.	Telephone: 3012585804	Telephone:	Telephone: 412 9637058
1 of 1 COCs			
City/State/Zip: Gaithersburg MD 20878	Email: Bill_Eaton@URSCORP.com		
Phone: 301 258 9780			
Project Name: Ft. Meade ODA/CFD	Method of Shipment/Carrier: FEDEX		
Project Number: 15302389.30000	Shipping/Tracking No: 870313645660		
PO #			

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

- ☐ 3 weeks
- ☐ 2 weeks
- ☐ 1 week
- ☐ 2 days
- ☒ 1 day

For lab use only

- Walk-in client ☐
- Lab pickup ☐
- Lab sampling ☐

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y / N)	Composite=C / Grab=G	Analyses: Iron Total LPA6010B	Iron Dissolved LPA6010B								Sample Specific Notes / Special Instructions:
ODA MW2	9/28/10	1129		X					1						Y	G		X								
ODA MW2	9/28/10	1129		X					1						N	G	X									
ODA MW5	9/28/10	1250		X					1						Y	G		X								
ODA MW5	9/28/10	1250		X					1						N	G	X									

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/28/10 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: NASHVILLE

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact

Company Name:	Client Project Manager:	Site Contact:	Lab Contact:	COC No:
URS CORP	BILL EATON	BILL EATON	CARRIE GAMBER	004108
Address: 200 ORCHARD RIDGE DR	**Telephone:** 301 258 5804	**Telephone:**	**Telephone:** 412 963 7058	1 of 1 COCs
City/State/Zip: GAITHERSBURG MD 20878	**Email:** BILL_EATON@URSCORP.com	**Analysis Turnaround Time** (in BUS days)	**Analyses**	For lab use only
Phone: 301 258 9780		TAT if different from below _____ ☐ 3 weeks ☐ 2 weeks ☐ 1 week ☐ 2 days ☐ 1 day		Walk-in client ☐ Lab pickup ☐ Lab sampling ☐
Project Name: FT. MEADE ODAKFD	**Method of Shipment/Carrier:** FEDEX			
Project Number: 15302389.30000	**Shipping/Tracking No:** 8703 1364 5660			Job/SDG No:

PO #																												
			Matrix					Containers & Preservatives																				
Sample Identification	Sample Date	Sample Time	Air	Aqueous	Sediment	Solid	Other:	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Unpres	Other:	Filtered Sample (Y / N)	Composite=C / Grab=G	TOTAL FLEASE HEXANE 1L SM 3500 FED	TDSS SM 2540 FED FLEASE HEXANE 1L										Sample Specific Notes / Special Instructions:
ODAMW2	9/28/10	1129		X						1					N	6	X											
ODAMW5	9/28/10	1250		X						1					N	6	X											
ODAMW2	9/28/10	1129		X						1					Y	6		X										
ODAMW5	9/28/10	1250		X						1					Y	6		X										

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

24 HOUR TAT

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/28/10 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	**Received in Laboratory by:**	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: ST. LOUIS

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS CORP	Client Project Manager: BILL EATON	Site Contact: BILL EATON	Lab Contact: CARRIE GAMBER
COC No: 004107			
Address: 200 ORCHARD RIDGE DR	Telephone: 301 258 5804	Telephone:	Telephone: 412 963 7058
1 of 1 COCs			
City/State/Zip: GAITHERSBURG MD 20878	Email: BILL_EATON@URSCORP.COM		
Phone: 301 258 9780			
Project Name: FT. MEADE ODAKFD	Method of Shipment/Carrier: FED EX		
Project Number: 15302389.30000	Shipping/Tracking No: 8645 1691 0850		
P O #			

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

For lab use only

☐ Walk-in client
☐ Lab pickup
☐ Lab sampling

Job/SDG No:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y / N)	Composite=C / Grab=G	Analyses: EXPLOSIVES 8330 (SEE BELOW)	Sample Specific Notes / Special Instructions:
ODAMW2	9/28/10	1129		X									2		N	G	X	
EQUIPMENTBLANK MW2	9/28/10	1000		X									2		N	G	X	
ODAMW12	9/28/10	1128		X									2		N	G	X	
ODAMW5	9/28/10	1250		X									2		N	G	X	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

EXPLOSIVES: RDX, TNT, 2A46DNT, AND 4A26DNT

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/28/10 1700			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: PITTSBURGH

Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact			
Company Name: URS Corp	Client Project Manager: Bill Eaton	Site Contact: Bill Eaton	Lab Contact: Carrie Gamber
Address: 200 Orchard Ridge Dr.	Telephone: 301 258 5804	Telephone:	Telephone: 412 9637058
City/State/Zip: Gaithersburg MD 20878	Email: Bill_Eaton@URSCorp.com		
Phone: 301258 9786			
Project Name: Ft. Meade ODA/CFD	Method of Shipment/Carrier: Fed EX		
Project Number: 15302389.20000	Shipping/Tracking No: 87031364 5708		
PO #			

COC No: 004110

1 of 1 COCs

Analysis Turnaround Time (in BUS days)

TAT if different from below _____

☐ 3 weeks
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

For lab use only

☐ Walk-in client
☐ Lab pickup
☐ Lab sampling

Job/SDG No:

Sample Specific Notes / Special Instructions:

Sample Identification	Sample Date	Sample Time	Matrix: Air	Aqueous	Sediment	Solid	Other:	Containers & Preservatives: H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Unpres	Other:	Filtered Sample (Y/N)	Composite=C / Grab=G	Analyses: Cd9Mn 6020	SEE BELOW SELECT VOCs 8260B	NITRATE/NITRITE 353.2	SULFATE 300	ALKALINITY SM2320B	TOTAL CHLORIDE 300	SM5310C TOTAL ORGANIC CARBON	SM5310C DISSOLVED ORGANIC CARBON			
EQUIPMENT BLANK ODAMW2	9/28/10	1000		X					1	3					N	G	X	X									
ODAMW2	9/28/10	1129		X				2		3			1		N	G		X		X	X	X	X				
ODAMW12	9/28/10	1128		X						3					N	G		X									
ODAMW5	9/28/10	1250		X				2		3			1		N	G		X		X	X	X	X				
ODAMW2	9/28/10	1129		X				3	1						Y	G	X		X					X			
ODAMW12	9/28/10	1128		X					1						Y	G	X										
ODAMW5	9/28/10	1250		X				3	1						Y	G	X		X					X			

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

VOCs: TCE, PCE, CHLOROFORM, CIS-12-DCE, AND VINYL CHLORIDE

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	URS	9/28/10 1900			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

©2008, TestAmerica Laboratories, Inc. All rights reserved.
TestAmerica & Design ™ are trademarks of TestAmerica Laboratories, Inc.

APPENDIX E

GROUNDWATER LABORATORY ANALYTICAL RESULTS (CD ONLY)

(Due to the size of this appendix, it is presented only as an electronic copy on the Compact Disk included with the report)

Page Intentionally Left Blank

APPENDIX F

DATA VALIDATION REPORT

(CD ONLY)

(Due to the size of this appendix, it is presented only as an electronic copy on the Compact Disk included with the report)

Page Intentionally Left Blank

APPENDIX G

Scatter Plots and Lowess Curves

Page Intentionally Left Blank

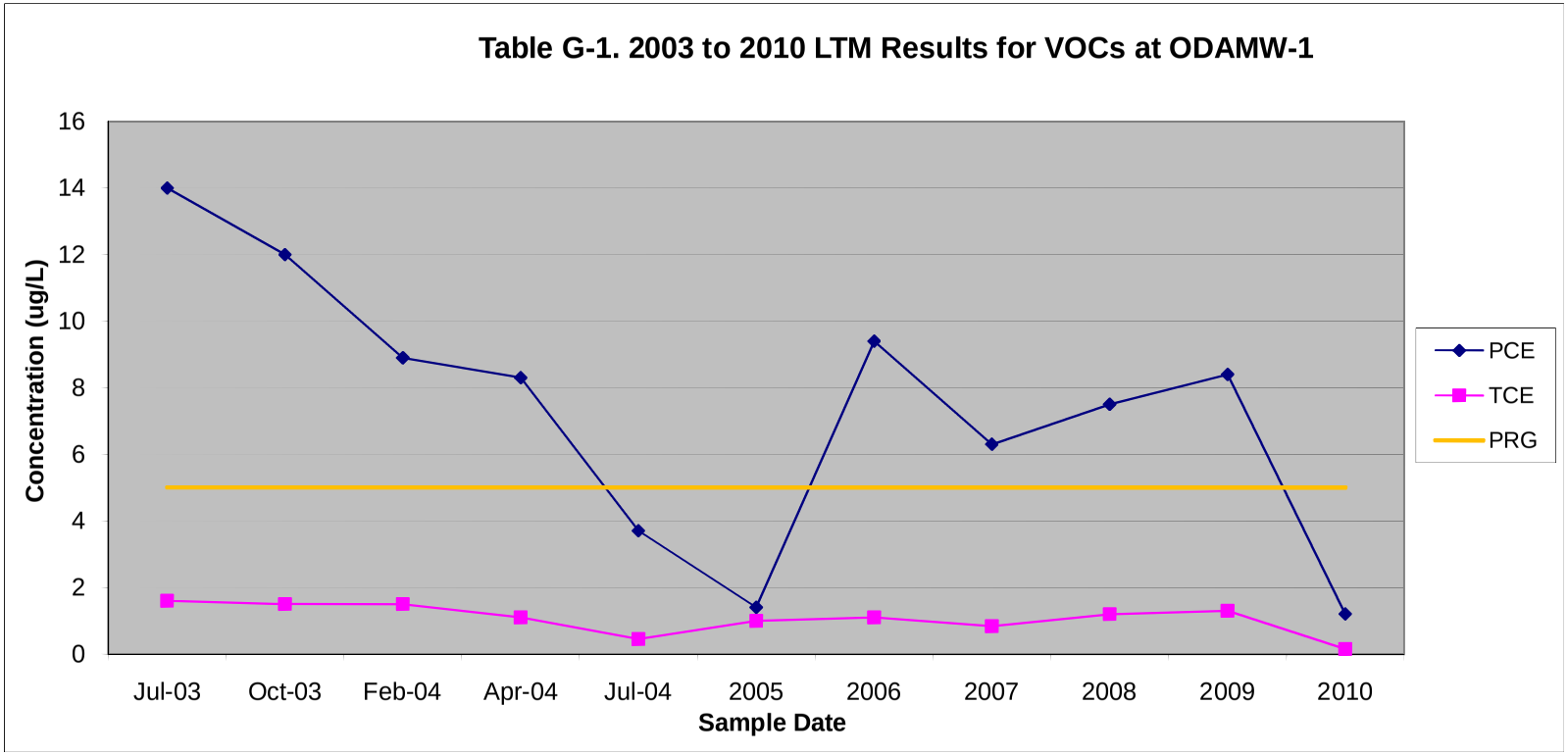


Table G-1. 2003 to 2010 LTM Results for VOCs at ODAMW-1
Concentration (ug/L)
16
14
12
10
8
6
4
2
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
PCE
TCE
PRG

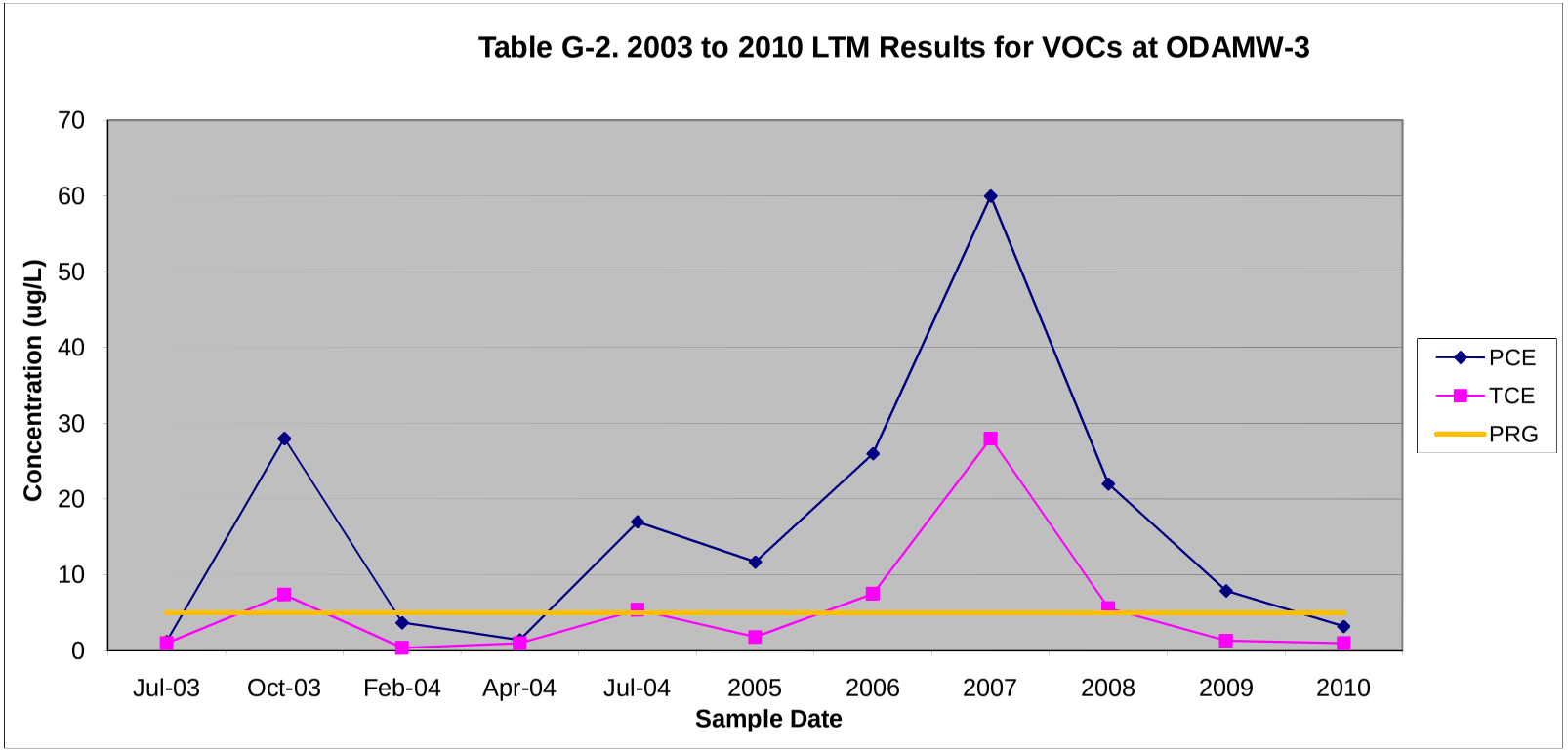


Table G-2. 2003 to 2010 LTM Results for VOCs at ODAMW-3
Concentration (ug/L)
70
60
50
40
30
20
10
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
PCE
TCE
PRG

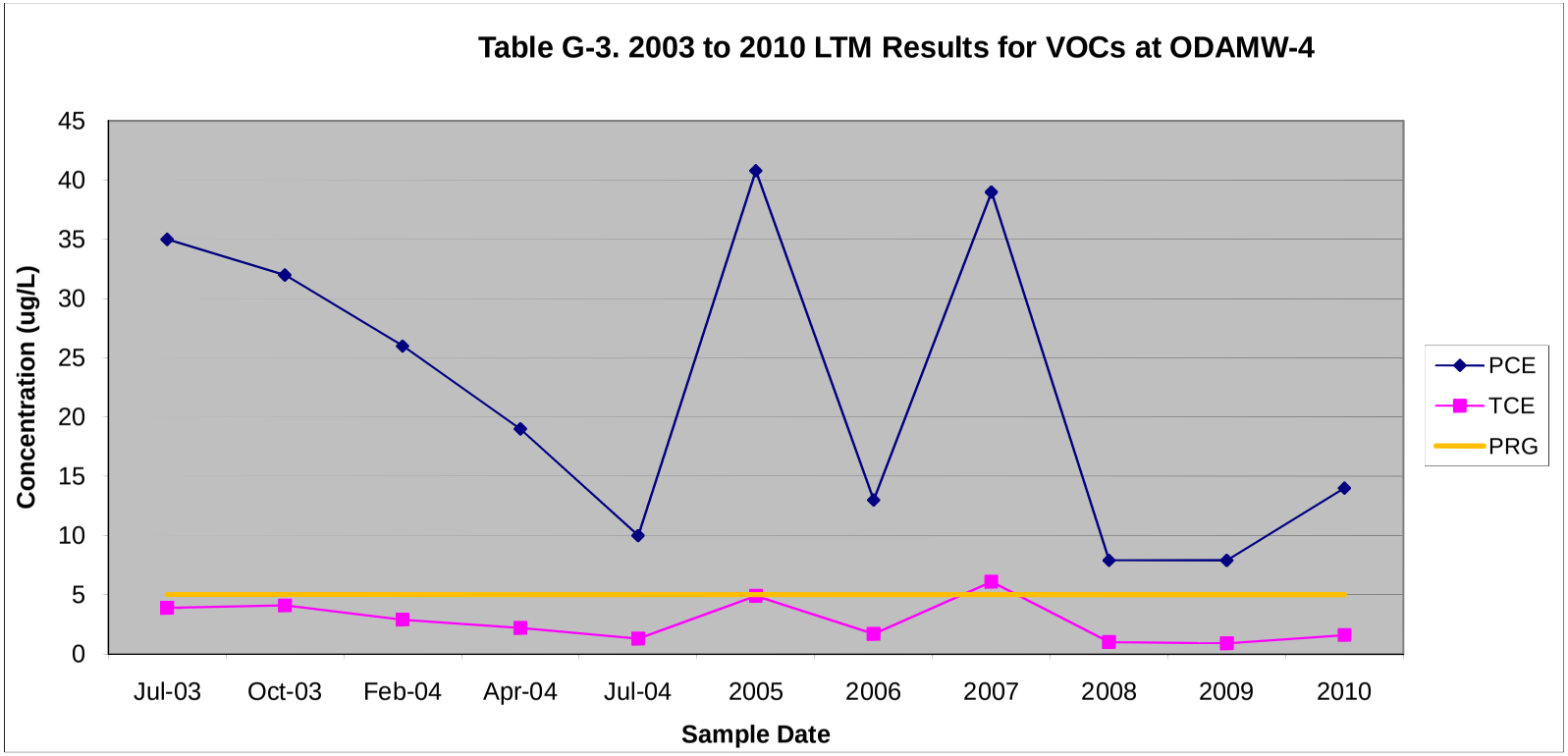
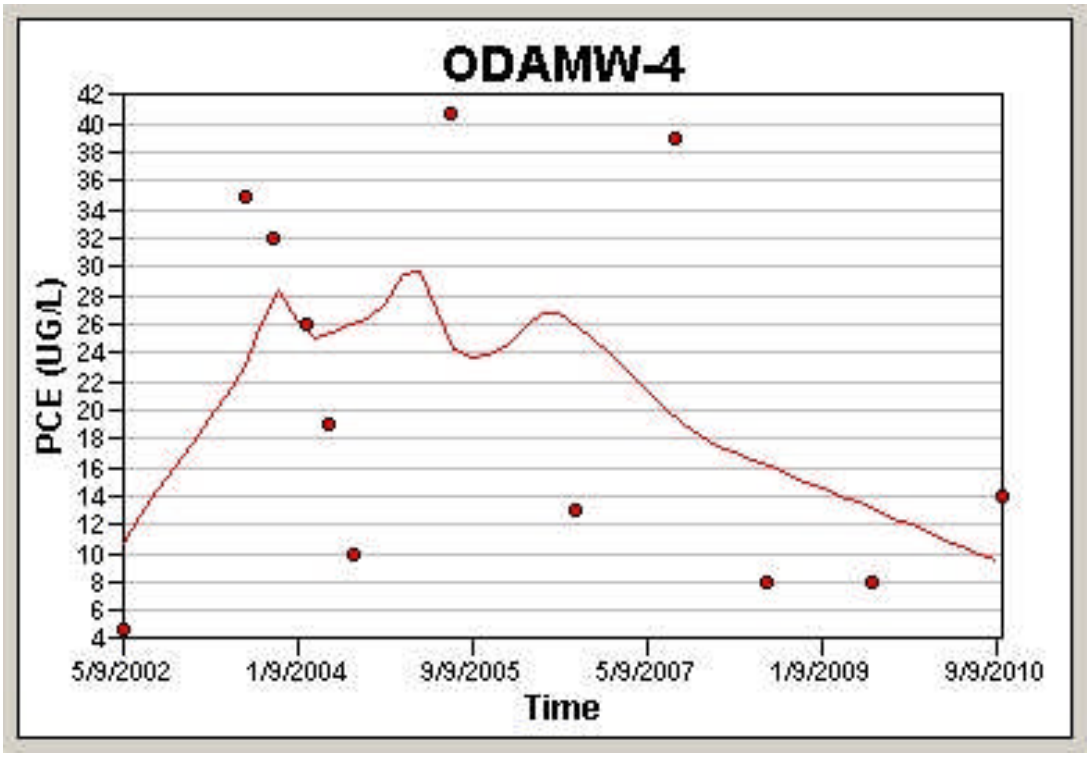


Table G-3. 2003 to 2010 LTM Results for VOCs at ODAMW-4
Concentration (ug/L)
45
40
35
30
25
20
15
10
5
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
PCE
TCE
PRG

Lowess Curve, Well ID: ODAMW-4

Analyte: Tetrachloroethene



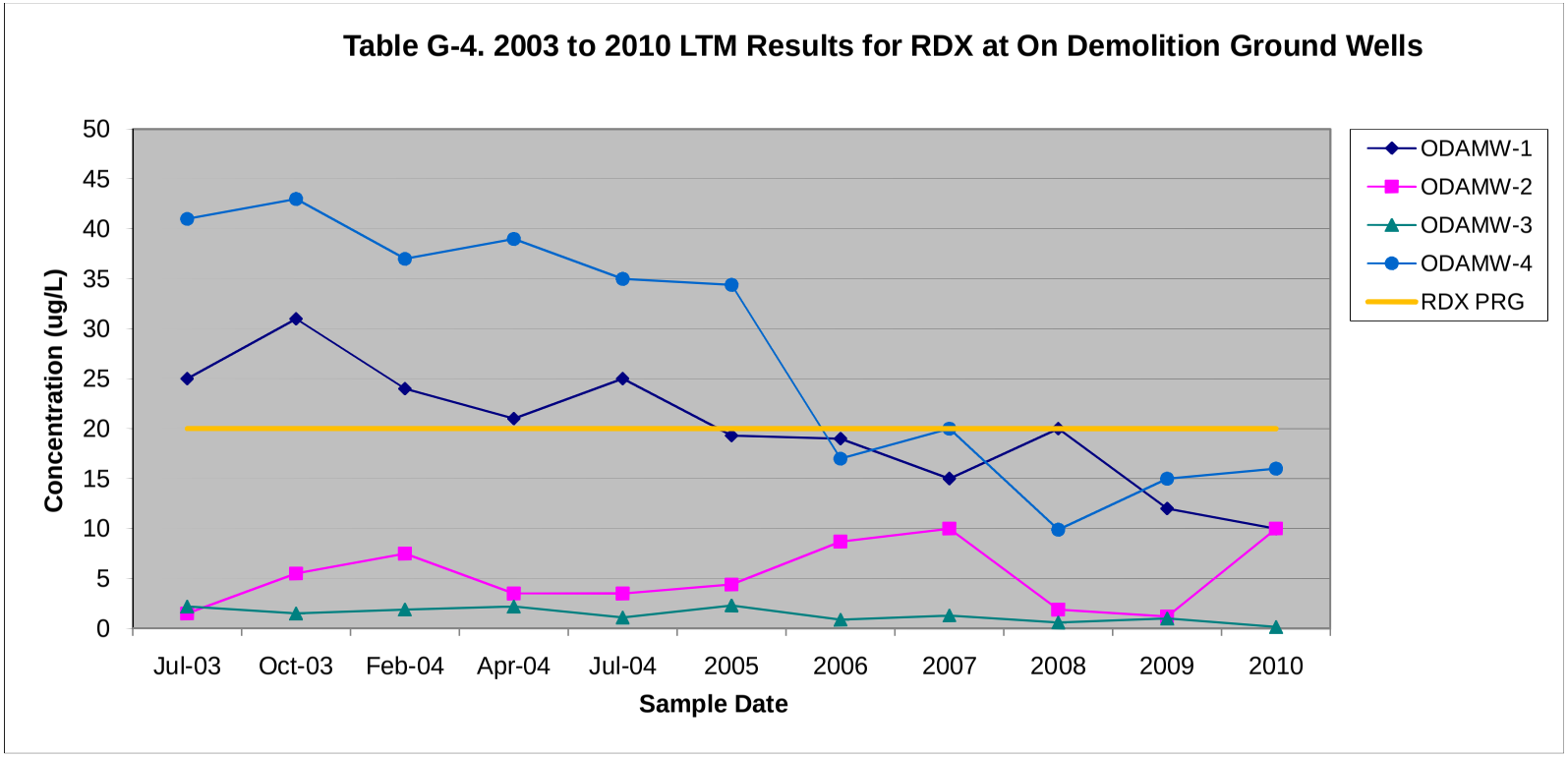


Table G-4. 2003 to 2010 LTM Results for RDX at On Demolition Ground Wells
Concentration (ug/L)
50
45
40
35
30
25
20
15
10
5
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
ODAMW-1
ODAMW-2
ODAMW-3
ODAMW-4
RDX PRG

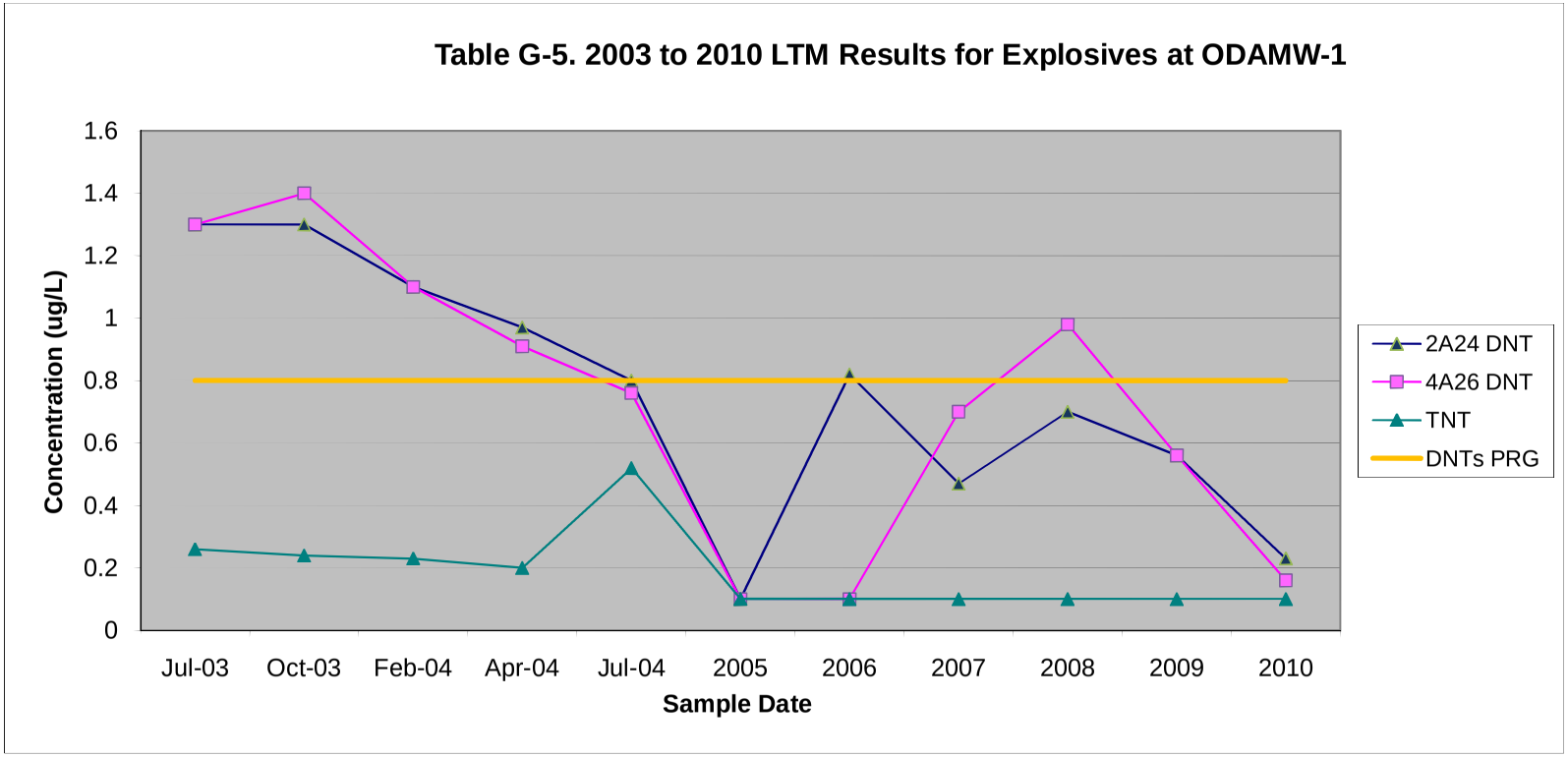


Table G-5. 2003 to 2010 LTM Results for Explosives at ODAMW-1
Concentration (ug/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
2A24 DNT
4A26 DNT
TNT
DNTs PRG

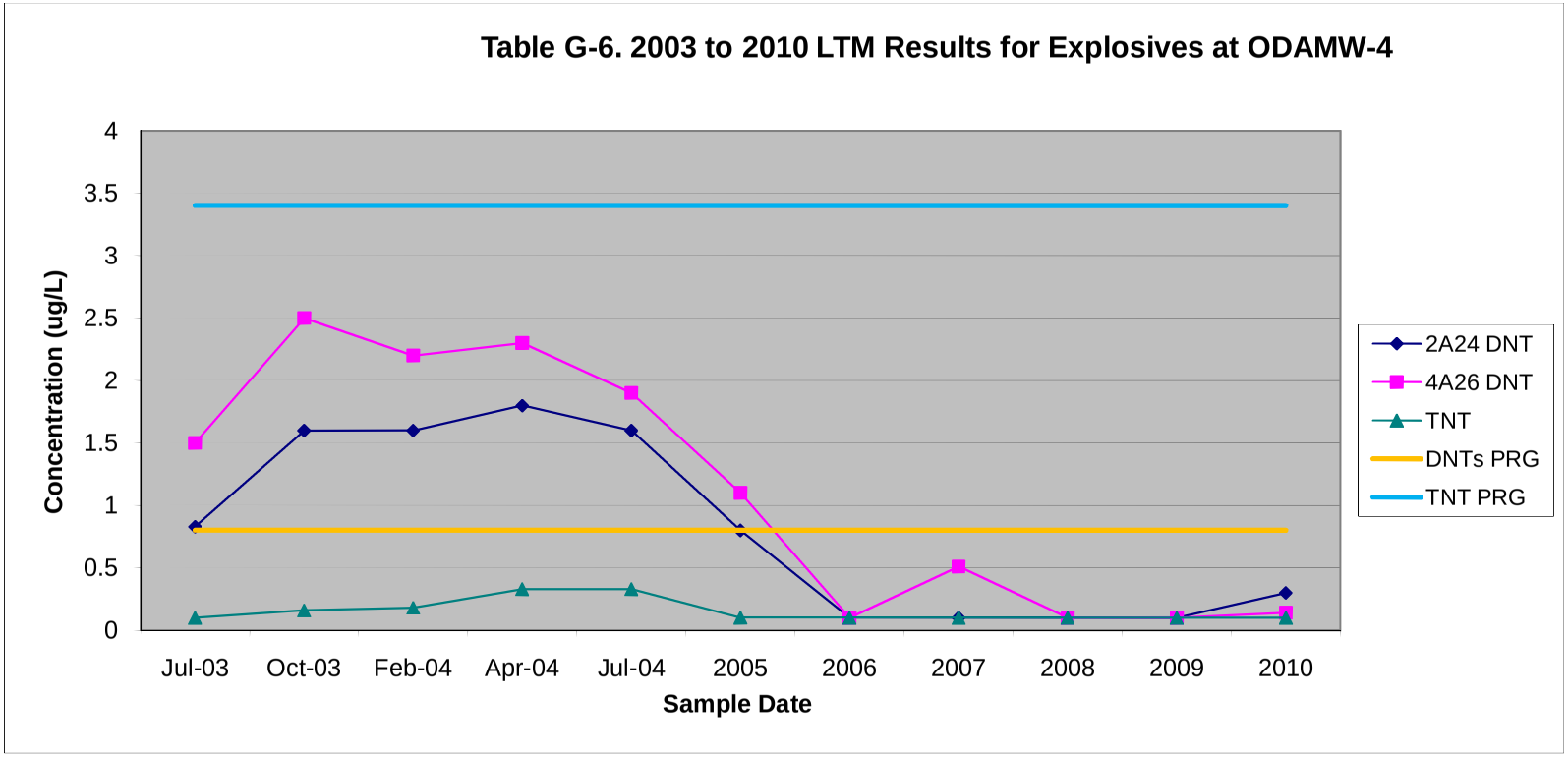


Table G-6. 2003 to 2010 LTM Results for Explosives at ODAMW-4
Concentration (ug/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
2A24 DNT
4A26 DNT
TNT
DNTs PRG
TNT PRG

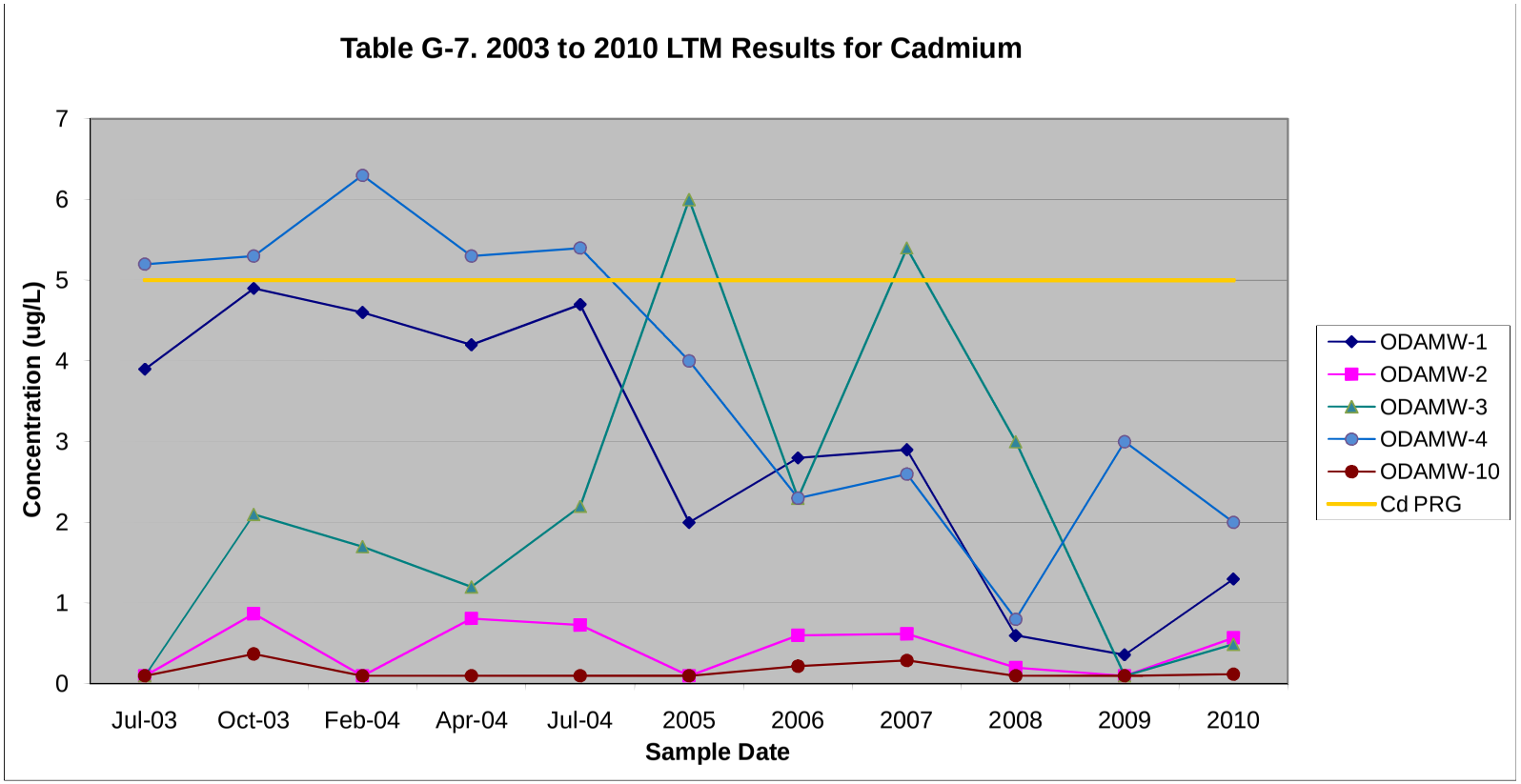


Table G-7. 2003 to 2010 LTM Results for Cadmium
Concentration (ug/L)
7
6
5
4
3
2
1
0
Jul-03
Oct-03
Feb-04
Apr-04
Jul-04
2005
2006
2007
2008
2009
2010
Sample Date
ODAMW-1
ODAMW-2
ODAMW-3
ODAMW-4
ODAMW-10
Cd PRG

APPENDIX H

Regulatory Acceptance Letters and Response to Comments

Page Intentionally Left Blank

Fort Meade Legacy BRAC Responses to Regulator Comments
Draft Regulator Review Long-Term Monitoring Report, Ordnance Demolition Area; Sampling Conducted September 2010
Report dated February 2011

Commenter / ORG	Comment Number	Comment Origin	Initial Comments	Fort Meade Legacy BRAC Initial Responses
U.S. Environmental Protection Agency Region III, Feb 24, 2011				
EPA RPM	1	General	EPA agrees with the conclusions and recommendations of this report.	Comment noted.
EPA RPM	2	General	Please revise the RAOs to the language that was agreed upon through the ODA PP comments and responses	The RAO text in the 2010 ODA LTM Report will be revised to accurately reflect the ODA PP agreed upon RAOs.
EPA Hydro	1	Executive Summary	The recommendations made by "Army" are acceptable. Please indicate how background data will be analyzed.	The Army will install one additional shallow and one additional deep monitoring well (screened above the clay) proximate to where the seep and intermittent drainage intersect. In addition to the LTM wells; a round of groundwater samples will be collected from ALL on-site shallow wells in 2011 and sampled for explosives, RCRA metals, and VOCs; this data will provide a better understanding of current Site conditions. That data will be provided to stakeholders and used to discuss identifying potential background wells.
EPA Hydro	2	Figure 3-2	Please clarify what the "(projected)" indicates.	The term "Projected" indicates that the relative position of the well screens to the water table at the Site. The figure will be replaced with the same figure from the ODA PP which has an additional explanation.
MDE Hazardous Waste Program Federal Facilities Division, March 8,2011				
Elisabeth Green MDE	1	General	The verbiage for the Remedial Action Objectives presented in this document should match exactly the Remedial Action Objectives agreed upon by stakeholders in the Proposed Plan for this site.	Comment noted. The verbiage for the Remedial Action Objectives in the 2010 ODA LTM Report will be revised to accurately reflect the ODA PP agreed upon RAOs.

Commenter / ORG	Comment Number	Comment Origin	Follow Up Comments	Fort Meade Legacy BRAC Follow Up Responses
U.S. Environmental Protection Agency Region III, May 24, 2011				
EPA Hydro Follow Up Comment	1	Executive Summary	The response indicates additional wells (Shallow and Deep) will be installed to the seep; and all wells (shallow) will be analyzed for the listed parameters. I believe the response I was looking for was what wells would be "analyzed" as background wells (I should have worded differently). I am assuming that MW-5 and MW-7 are the primary candidates.	The commenter is correct in assuming that ODAMW-5 and ODAMW-7 are the primary candidates for use as background wells based upon previous analytical data and their location as upgradient wells.

URS
tel. 301.258.9780
fax 301.869.8728
www.urscorp.com