THIRD FIVE-YEAR REVIEW

Defense Depot Memphis, Tennessee
TN4210020570

Department of the Army

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USACE Contract No. W90FYQ-09-D-0005
Task Order No. DS01

Revision 1
November 2012

THIRD FIVE-YEAR REVIEW

Defense Depot Memphis, Tennessee
TN4210020570

Prepared for:

U.S. Army Corps of Engineers, Tulsa District
Contract No. W90FYQ-09-D-0005
Task Order No. DS01

Prepared by:

HDR
9563 S. Kingston Court
Suite 200
Englewood, Colorado 80112

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Defense Depot Memphis Tennessee		
EPA ID: TN4210020570		
Region: 4	**State:** TN	**City/County:** Memphis/Shelby

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** Army Base Realignment and Closure Division
Author name (Federal or State Project Manager): Carolyn Jones
Author affiliation: Office of the Assistant Chief of Staff for Installation Management, Base Realignment and Closure Division
Review period: 7 May 2012 – 25 July 2012
Date of site inspection: 29 June and 13 July 2012
Type of review: Statutory
Review number: 3
Triggering action date: 22 January 2008
Due date *(five years after triggering action date)*: 22 January 2013

Five-Year Review Summary Form (continued)

The table below is for the purpose of the summary form and associated data entry and does not replace the two tables required in Section VIII and IX by the FYR guidance. Instead, data entry in this section should match information in Section VII and IX of the FYR report.

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU 1, Dunn Field

Issues and Recommendations Identified in the Five-Year Review:

OU (s): 2-4, Main Installation	**Issue Category: Changed Site Conditions**			
	Issue: Rebound in groundwater concentrations of chlorinated volatile organic compounds on the Main Installation (MI) and concentrations above MCLs in intermediate aquifer wells.			
	Recommendation: Restart Enhanced Bioremediation Treatment (EBT)			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	EPA/State	30 November 2012

OU (s): 2-4, Main Installation	**Issue Category: Monitoring**			
	Issue: Time required to achieve remedial action objectives on the MI			
	Recommendation: Re-evaluate in annual report following one year of additional EBT.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Federal Facility	EPA/State	11 March 2014

Five-Year Review Summary Form (continued)

Protectiveness Statement(s)
Include each individual OU protectiveness determination and statement. If you need to add more protectiveness determinations and statements for additional OUs, copy and paste the table below as many times as necessary to complete for each OU evaluated in the FYR report.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date* (if applicable):
Dunn Field (OU 1)	Protective	NA
Protectiveness Statement: The remedy at Dunn Field (OU 1) is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.		
Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date* (if applicable):
Main Installation (OUs 2, 3 and 4)	Protective	NA
Protectiveness Statement: The remedy at the MI (OUs 2, 3 and 4) is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.		

Site-wide Protectiveness Statement (if applicable)	
For sites that have achieved construction completion, enter a site-wide protectiveness determination and statement.	
Protectiveness Determination:	*Addendum Due Date (if applicable):*
Protective	*NA*
Protectiveness Statement: Because the RAs at all OUs for DDMT are protective, the site is protective of human health and the environment.	

AUTHORIZING SIGNATURES

27 NOV 2012 _____

Date

WILLIAM J. O'DONNELL, II
Chief, Reserve, Industrial and Medical Branch
Army Base Realignment and Closure Division

1/23/13 _____

Date

FRANKLIN E. HILL
Director, Superfund Division
U.S. EPA Region 4

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix

LIST OF TABLES

Table

LIST OF FIGURES

Figure

LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
AS/SVE	Air Sparging with Soil Vapor Extraction
BCT	BRAC Cleanup Team
bgs	Below Ground Surface
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
cDCE	cis-1,2-dichloroethene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	chloroform
CFR	Code of Federal Regulations
COC	Constituent of Concern
CVOC	Chlorinated Volatile Organic Compound
CWM	Chemical Warfare Material
CT	carbon tetrachloride
CY	cubic yard
DANC	Decontaminating Agent Non-Corrosive
DDC	Defense Distribution Center
DDMT	Defense Depot Memphis, Tennessee
DLA	Defense Logistics Agency
DoD	Department of Defense
DQE	Data Quality Evaluation
DRC	Depot Redevelopment Corporation
DRI	Design-related Investigation
EBT	Enhanced Bioremediation Treatment
EISR	Early Implementation of Selected Remedy
ET&D	Excavation, Transportation and Disposal
e^2M	engineering-environmental Management, Inc.
FFA	Federal Facilities Agreement
FOST	Finding of Suitability to Transfer
FS	Feasibility Study
FSVE	Fluvial Soil Vapor Extraction

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

FU	Functional Unit
HHRA	Human Health Risk Assessment
HI	Hazard Index
HRS	Hazard Ranking System
HSWA	Hazard and Solid Waste Amendment
IAQ	Intermediate Aquifer
IC	Institutional Control
IRA	Interim Remedial Action
IRACR	Interim Remedial Action Completion Report
IW	Injection Well
LTM	Long-term Monitoring
LUC	Land Use Control
LUCIP	Land Use Control Implementation Plan
MAQ	Memphis Aquifer
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
MI	Main Installation
MLGW	Memphis Light, Gas and Water
MMOA	Mutagenic Mode of Action
MNA	Monitored Natural Attenuation
MSCHD	Memphis Shelby County Health Department
MW	Monitoring Well
NCP	National Contingency Plan
NPDWR	National Primary Drinking Water Regulation
NPL	National Priorities List
ODB	Office of the Assistant Chief of Staff for Installation Management, Base Realignment and Closure Division
OE	Ordnance and Explosives
O&M	Operations and Maintenance
OU	Operable Unit
OPS	Operating Properly and Successfully
PAH	polycyclic aromatic hydrocarbon

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCP	pentachlorophenol
PID	Photoionization Detector
PMW	Performance Monitoring Well
POL	Petroleum/Oil/Lubricants
PP	Proposed Plan
PRB	Permeable Reactive Barrier
ppm	parts per million
QC	Quality Control
RA	Remedial Action
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDI	Remedial Design Investigation
RfD	Reference Dose
RfC	Reference Concentration
RI	Remedial Investigation
RIN	Regulatory Information Number
RG	Remediation Goal
ROD	Record of Decision
RW	Recovery Well
SF	Slope Factor
SLERA	Screening Level Ecological Risk Assessment
SVE	Soil Vapor Extraction
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
TA	Treatment Area
TCA	1,1,2-trichloroethane

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

TCE	trichloroethene
TDEC	Tennessee Department of Environment and Conservation
TeCA	1,1,2,2-tetrachloroethane
TSVE	Thermal Soil Vapor Extraction
TTA	Target Treatment Area
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VMP	Vapor Monitoring Point
VOC	Volatile Organic Compound
ZVI	zero-valent Iron
µg/L	micrograms per Liter
$\mu g/m^3$	micrograms per cubic meter

EXECUTIVE SUMMARY

The purpose of this five-year review is to determine whether the remedy at Defense Depot Memphis Tennessee (DDMT), site identification number TN4210020570, is or will be protective of human health and the environment. The lead agency for environmental restoration at DDMT is the Office of the Assistant Chief of Staff for Installation Management, Base Realignment and Closure Division (ODB). The regulatory oversight agencies are United States Environmental Protection Agency (USEPA) Region 4 and the Tennessee Department of Environment and Conservation. This is the third five-year review for DDMT; the initial statutory review was triggered by initiation of the Interim Remedial Action (IRA) groundwater recovery system on Dunn Field in 1998.

DDMT is located in southeastern Memphis and consists of approximately 632 acres, the Main Installation (MI) and Dunn Field. The MI contains open storage areas, warehouses, former military family housing, and outdoor recreational areas, and Dunn Field includes former mineral storage and waste disposal areas.

DDMT was activated in 1942 and was a principal distribution center until the facility closed under Base Realignment and Closure in September 1997. The facility received, warehoused, and distributed supplies common to all U.S. military services and some civilian agencies. Site activities resulted in the presence of metals, pesticides, and other less frequently detected chemicals in surface soil, surface water and sediment, and chlorinated volatile organic compounds (CVOCs) in groundwater.

Subsequent to receiving a Resource Conservation and Recovery Act Part B permit in 1990 and completion of a final Hazard Ranking System Scoring by USEPA, DDMT was added to the National Priorities List (NPL) in 1992. A Federal Facilities Agreement, completed in 1995, outlined the process for site investigation and cleanup. Several response actions, primarily soil excavation and off-site disposal, were conducted prior to completing the records of decision (RODs). Three RODs were executed at DDMT:

- IRA for groundwater at Dunn Field (1996) included installation of a groundwater recovery system;
- Main Installation (2001) included enhanced bioremediation treatment (EBT) of groundwater, long-term monitoring (LTM) and land use controls (LUCs); and
- Dunn Field (2004) included soil excavation from disposal sites, soil vapor extraction (SVE), injection of zero valent iron in groundwater source areas, installation of a permeable reactive barrier, monitored natural attenuation and LTM, and LUCs.

The Dunn Field remedies were modified in a ROD amendment (2009) which replaced the permeable reactive barrier with air sparging and SVE (AS/SVE), and clarified criteria for the area to be treated and the treatment objective.

At completion of the second five-year review in 2008, the selected remedies for the MI and Dunn Field were being implemented; several issues regarding implementation and recommended actions were identified. The issues did not affect current protectiveness because there was no current exposure, but future protectiveness was affected. All recommended actions have been successfully completed.

Since the second review, all remedies have been successfully implemented. The NPL status was revised to construction complete in May 2010. Interim remedial action completion reports were approved for the MI, Source Areas (Dunn Field) and Off Depot (Dunn Field). Operating properly and successfully demonstrations were approved for the MI and Source Areas. Soil remedial action objectives (RAOs) have been met and groundwater contaminant concentrations have been significantly reduced, especially at Dunn Field. Annual LUC inspections have been conducted with no significant deviations identified.

The SVE system at Dunn Field was shut down in July 2012 based on achieving soil remediation goals (RGs). The AS/SVE system in the Off Depot area continues to operate and is meeting treatment objectives. EBT on the MI was conducted from 2006 to 2009 and is being restarted due to rebound in groundwater contaminant concentrations. LTM is continuing at the MI and Dunn Field.

All Federal property has been made available for transfer through Findings of Suitability to Transfer (FOSTs) approved from February 2001 to August 2010. Property transfers have been completed for all the property, except 24.5 acres on Dunn Field (FOST 5), which is to be transferred through a competitive public sale.

Two issues with recommended actions have been identified for the MI (Operable Unit [OU] 2-4):

- Rebound in groundwater concentrations of CVOCs on the MI in treatment areas and concentrations above maximum contaminant levels in intermediate aquifer wells has resulted in a decision to restart EBT in November 2012; and
- The time required to achieve RAOs on the MI will be reevaluated following a year of EBT with findings in the annual report to be submitted in March 2014.

Attainment of RGs has been documented in the subsurface soils at Dunn Field. Attainment of cleanup goals in groundwater will be achieved through active treatment and natural attenuation. In the interim,

exposure pathways that could result in unacceptable risks are being controlled and LUCs are preventing exposure to, or the ingestion of, contaminants of concern. Long-term protectiveness will be verified by groundwater sampling performed during LTM and compliance monitoring at the MI and Dunn Field.

The remedy at Dunn Field (OU 1) is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The remedy at the MI (OUs 2, 3 and 4) is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Because the remedial actions at all OUs for DDMT are protective, the site is protective of human health and the environment.

1.0 INTRODUCTION

The lead agency for the environmental restoration activities at Defense Depot Memphis Tennessee (DDMT) is the Office of the Assistant Chief of Staff for Installation Management, Base Realignment and Closure Division (ODB). Responsibility for environmental restoration activities at DDMT transferred to ODB from the Defense Logistics Agency (DLA) in December 2010. The regulatory oversight agencies are United States Environmental Protection Agency (USEPA) Region 4 and the Tennessee Department of Environment and Conservation (TDEC). The site identification number for DDMT is TN4210020570.

The purpose of this five-year review is to determine whether the remedy at DDMT is, or upon completion will be, protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this report, and recommendations are provided to address issues identified during the review.

This Five-Year Review report is prepared pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states: *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

USEPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states: *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

HDR, the Remedial Action (RA) contractor at DDMT, performed the review and prepared this report under Contract No. W9126G-09-D-0069, Task Order 0019 to the U.S. Army Corps of Engineers (USACE), Fort Worth District. This review was performed in accordance with *Comprehensive Five-Year Review Guidance* (USEPA, 2001); the land use controls (LUCs) were reviewed in accordance with

Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance (USEPA, 2011).

This is the third five-year review for DDMT. The initial statutory review was triggered by initiation of the Interim Remedial Action (IRA) groundwater recovery system on Dunn Field at DDMT in 1998. The five-year review is required because hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE CHRONOLOGY

Year	Activity
1944 - 1997	Supply Distribution activities
1980s	Initial Installation Assessment completed in 1981. Compliance programs established for U.S. Army and Department of Defense (DoD) regulations and local, state, and federal regulatory programs including the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, Resource Conservation and Recovery Act (RCRA), and the Toxic Substances Control Act.
1990	On 28 September 1990, USEPA Region 4 and TDEC issued the Memphis Depot (Depot) a RCRA Part B permit for the storage of hazardous waste (No. TN4 210-020-570). The Hazardous and Solid Waste Amendment (HSWA) portion of the permit issued by USEPA included requirements for the identification and, if necessary, corrective action of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs). 49 SWMUs and 8 AOCs identified during a RCRA Facility Assessment (A.T. Kearney, 1990). Subsequent to issuing the permit, and in accordance with Section 120(d)(2) of CERCLA, and Title 42, Section 9620(d)(2), of the United States Code (USC), USEPA prepared a final Hazard Ranking System (HRS) Scoring Package for the facility.
1992	On 14 October 1992, based on the final HRS score of 58.06, USEPA added the Depot to the National Priorities List (NPL) (57 Federal Register 47180 No. 199).
1995	On 6 March 1995, USEPA, TDEC, and the Depot entered into an Federal Facilities Agreement (FFA) under CERCLA, Section 120, and RCRA, Sections 3008(h) and 3004(u) and (v). The FFA outlines the process for investigation and cleanup of the Depot sites under CERCLA. The parties agreed that investigation and cleanup of releases from the sites (including formerly identified SWMUs/AOCs) would satisfy any RCRA corrective action obligation under the USEPA HSWA permit and Tennessee Code -Annotated, Section 68-212-101 *et seq.* The Generic Remedial Investigation/Feasibility Study (RI/FS) Work Plan was prepared to indicate how the RI and FS would be accomplished. USEPA and TDEC approved RI/FS Field Sampling Plans for each operable unit (OU) and screening site. In July 1995, the Depot was identified for closure under the base realignment and closure (BRAC) process, which requires environmental restoration to comply with the requirements for property transfer. The City of Memphis and Depot Redevelopment Corporation (DRC) were given the responsibility of planning and coordinating the reuse of the Depot.
1996	USEPA and TDEC approved a Record of Decision (ROD) for an IRA for Groundwater at Dunn Field.
1997	Sampling at RI, screening, and BRAC sites was conducted on the Main Installation (MI).

Year	Activity
1997 - 1998	During 1997 and 1998, the Depot requested and received closure of its air permits, underground storage tank permits, stormwater discharge permit, and Nuclear Regulatory Agency storage permit. On 22 October 1998, TDEC terminated the RCRA Part B permit because the proposed storage unit was never constructed or operated.
1998	The Depot completed a dieldrin-contaminated soil removal action at the military family housing units and a polychlorinated biphenyl (PCB)-contaminated soil removal action at Bldg 274. Phase 1 of the IRA was completed with the installation of 7 recovery wells (RWs) and the discharge piping system; the system was expanded in 2001, with 4 additional RWs.
1999	The Depot completed a lead-contaminated soil removal project at the old paint shop and maintenance area (Parcels 35 and 28). Additional monitoring wells (MWs) were installed west of Dunn Field to provide more information regarding the hydrogeology of the area. Additional RWs for the IRA system were approved by the BRAC Cleanup Team (BCT) and installed by the end of 1999. The Depot completed RI fieldwork at the MI and started fieldwork for Dunn Field.
2000	The Depot began the removal action for chemical warfare material (CWM) disposal locations at Dunn Field. The Depot completed and provided to the public the MI RI Report, FSs for Soil and Groundwater, and the MI Proposed Plan (PP).
2001	The Depot completed the CWM removal action at Dunn Field. DLA signed the MI ROD on 22 February 2001; TDEC signed it on 1 March 2001; and USEPA signed it on 6 September 2001. Prior to final execution of the MI ROD, DLA exercised its removal authority under CERCLA Section 104, as delegated in Executive Order 12580, and removed lead-contaminated soil at the south end of Bldg 949. The Depot completed RI fieldwork and additional groundwater sampling at Dunn Field.
2002	The Depot began the Enhanced Bioremediation Treatability Study at the MI for use in the MI Remedial Design (RD). The Depot completed the early removal of lead in soil at the former pistol range (Site 60) on Dunn Field. The Depot completed a soil vapor extraction (SVE) treatability study at Dunn Field.
2003	The Depot provided the Dunn Field RI Report, FS, and PP to the public. DLA signed the Dunn Field Five Year Review on 17 January 2003 and USEPA concurred on 22 January 2003. Dunn Field PP public comment period held 8 May to 6 June 2003 and public meeting held 15 May 2003.

Year	Activity
2004	DLA signed the Dunn Field ROD on 22 March 2004; TDEC signed it on 6 April 2004; and USEPA signed it on 12 April 2004. MI Final RD with Land Use Control Implementation Plan (LUCIP) approved 10 August 2004. Dunn Field Disposal Sites Final RD approved 10 August 2004. Chlorinated volatile organic compound (CVOC) concentrations above 500 micrograms per liter (µg/L) in downgradient monitoring wells northwest of Dunn Field prompted the BCT to conduct Early Implementation of Selected Remedy (EISR) to reduce contamination levels in groundwater downgradient of Dunn Field. EISR Work Plan was completed and zero-valent iron (ZVI) injections began November 2004.
2005	MI Notice of Land Use Restrictions filed with Shelby County Registrar on 26 January 2005. Post-ROD Community Involvement Plan approved 10 February 2005. Notice of Dunn Field Disposal Sites mobilization provided 14 March 2005. ZVI injections completed January 2005 and EISR Interim Remedial Action Completion Report (IRACR) approved in August 2006. TDEC denied renewal of the Depot's Hazardous Waste Corrective Action Permit terminating Defense Distribution Center's (DDC's) requirement to continue corrective action under the hazardous waste regulations, as all correction action activities shall continue to be performed under CERCLA authority. MI Remedial Action Work Plan (RAWP) approved by USEPA on 12 September 2005.
2006	The Depot completed the Disposal Sites RA in March 2006 and received USEPA approval of the Disposal Sites Remedial Action Completion Report (RACR) on 25 August 2006. Dunn Field Source Areas RD investigation completed in March 2006. Construction for the ZVI Permeable Reactive Barrier (PRB) implementation study completed in June 2006. DLA provided Notice of MI RA mobilization on 2 May 2006. Enhanced bioremediation treatment (EBT) system construction completed and MI RA operations begun in September 2006.

Year	Activity
2007	Completed the ZVI PRB study in January 2007. Completed the Dunn Field Source Areas RD in April 2007 Completed the Source Areas Fluvial SVE (FSVE) RAWP in May 2007. DLA provided Notice of Dunn Field Source Areas RA mobilization on 15 May 2007. Began construction of the FSVE RA in May 2007; completed construction and began operations in July 2007. Completed the Dunn Field Source Areas Loess/Groundwater RAWP in August 2007. TDEC amended the Notice of Hazardous Substance Site deleting the Finding of Suitability to Transfer (FOST) 4 property on Dunn Field on 12 September 2007.
2008	DLA signed the Second Five-Year Review for DDMT on 13 December 2007 and USEPA signed it on 22 January 2008. MI Source Area Evaluation to propose compliance well networks and additional soil investigation to assess potential source areas for the identified groundwater plumes was completed in March 2008. Completed the Dunn Field Loess/Groundwater RAWP in May 2008. Completed construction of the Loess Thermal-enhanced SVE RA and began operations in May 2008. Final Dunn Field Revised PP was approved by USEPA on 24 October 2008 and by TDEC on 6 November 2008; thirty-day public comment period held 27 October to 25 November 2008.
2009	MI Source Area Investigation to identify soil contamination impacting shallow groundwater was completed February 2009. EBT on the MI completed February 2009. DLA signed the Dunn Field ROD Amendment on 5 February 2009; TDEC signed it on 3 March 2009; and USEPA signed it on 19 March 2009. Dunn Field Notice of Land Use Restrictions filed with the Shelby County Registrar on 11 June 2009. Completed Off Depot Groundwater RAWP in September 2008. DLA provided Notice of Off Depot RA mobilization on 17 June 2009. Construction of the Air Sparging/SVE (AS/SVE) system completed in October 2009 and operations begun in December 2009. DDMT Restoration Advisory Board (RAB) passed a motion to adjourn at the 29 October 2009 meeting. Dunn Field Source Areas IRACR approved by USEPA on 2 November 2009 and Operating Properly And Successfully (OPS) demonstration approved on 21 October 2009.

Year	Activity
2010	BCT concurred to adjourn at the 11 February 2010 meeting. MI IRACR approved by USEPA on 23 March 2010 and OPS demonstration approved on 15 March 2010. USEPA approved the Preliminary Close Out Report for all operable units effective 10 May 2010 and the NPL site status was revised to Construction Complete. Superfund Property Reuse Evaluation Checklist for Reporting the Sitewide Ready for Anticipated Use was effective 26 May 2010. IRA system was removed and the recovery wells abandoned in July 2010.
2011	Off Depot Groundwater IRACR approved by USEPA in August 2011.
2012	Fluvial SVE operations were shutdown 24 July 2012. AS/SVE operations in the Off Depot area continue. EBT operations on the Main Installation were re-started in November 2012. LTM for the Main Installation and Dunn Field continue.

3.0 BACKGROUND

3.1 PHYSICAL CHARACTERISTICS

DDMT is located in southeastern Memphis, Tennessee approximately 5 miles east of the Mississippi River and just northeast of Interstate 240 (Figure 1). The property consists of approximately 632 acres and includes two components: the Main Installation (MI) and Dunn Field (Figure 2). The property acreage has historically been listed as 642 acres; the revised acreage is based on recent surveys for deed transfers. The MI contains approximately 567 acres with open storage areas, warehouses, former military family housing, and outdoor recreational areas. Dunn Field, which is located across Dunn Avenue from the north-northwest portion of the MI, contains approximately 65 acres and includes former mineral storage and waste disposal areas. Approximately two-thirds of Dunn Field is grassed, and the remaining area is covered with crushed rock and paved surfaces.

The site terrain is relatively level, with elevations ranging from 282 to 300 feet above mean sea level. There are only two surface water bodies on DDMT, Lake Danielson and the golf course pond. No perennial streams, flood-prone areas or wetlands occur within the Depot. The lake and pond are fed by stormwater runoff and are too shallow to intercept the fluvial aquifer.

The geologic units of interest at DDMT are (from youngest to oldest): loess, including surface soil; fluvial deposits; Jackson Formation/Upper Claiborne Group; and Memphis Sand. The loess consists of wind-blown and deposited, brown to reddish-brown, low-plasticity clayey silt to silty clay. The loess deposits are about 20 to 30 feet thick and are continuous throughout the site area.

The fluvial (terrace) deposits consist of two general layers. The upper layer is a silty, sandy clay that transitions to a clayey sand and ranges from about 10 to 36 feet thick. The lower layer is composed of interlayered sand, sandy gravel, and gravelly sand, and has an average thickness of approximately 40 feet. The uppermost aquifer is the unconfined fluvial aquifer, consisting of saturated sands and gravelly sands in the lower portion of the deposits. The saturated thickness of the fluvial aquifer ranges from 3 feet to 50 feet and is controlled by the configuration of the uppermost clay in the Jackson Formation/Upper Claiborne Group. This uppermost clay layer does not appear to be present at the base of the fluvial deposits in the northwestern part of the MI and the southwestern part of Dunn Field. Water level data indicate that there also may be gaps in the clay west and northwest of Dunn Field. Where present, these gaps create connections to the underlying intermediate aquifer (IAQ) from the fluvial deposits.

Groundwater contour maps for the fluvial aquifer on the MI and on Dunn Field are shown on Figures 3 and 4, respectively. Water from the fluvial aquifer is not currently used as a source of drinking water by the City of Memphis.

The Jackson Formation/Upper Claiborne Group consists of clays, silts, and sands. The IAQ is locally developed in deposits of the Jackson Formation/Upper Claiborne Group. The Memphis Aquifer (MAQ) primarily consists of thick-bedded, white to brown or gray, very fine-grained to gravelly, partly argillaceous and micaceous sand. The MAQ ranges from 500 to 890 feet in thickness and begins at a depth below ground surface (bgs) of approximately 120 to 300 feet. The MAQ is confined by overlying clays and silts in the Cook Mountain Formation (part of the Jackson/Upper Claiborne Group) and contains groundwater under artesian (confined) conditions regionally. The City of Memphis obtains the majority of its drinking water from this unit. The Allen Well Field, which is operated by Memphis Light, Gas and Water (MLGW), is located approximately 2 miles west of Dunn Field.

3.2 LAND AND RESOURCE USE

The DDMT property was used for cotton farming prior to purchase by the U.S. Army in 1940. DDMT was officially activated on January 26, 1942 as the Memphis General Depot. Its initial mission was to provide stock control, storage and maintenance services for the Army Engineer, Chemical and Quartermaster Corps. During World War II, DDMT served as an internment center for 800 prisoners of war and performed supply missions for the Signal and Ordnance Corps. From 1963 until closure, the facility was a principal distribution center for DLA (formerly the Defense Supply Agency) for shipping and receiving a variety of materials including hazardous substances; textile products; food products; electronic equipment; construction materials; and industrial, medical, and general supplies. In 1995, DDMT was placed on the list of the Department of Defense (DoD) facilities to be closed under Base Realignment and Closure (BRAC). Storage and distribution of material continued until the facility closed in September 1997.

DDMT is located in an area of mixed residential, commercial and industrial land use. The surrounding area contains small commercial and manufacturing uses to the north and east and single-family residences to the south and west. Airways Boulevard, located on the east border of the MI, is the most heavily traveled thoroughfare in the vicinity and is developed with numerous small, commercial establishments, particularly in the area from the Depot south to the Interstate 240 interchange. MLGW operates a large substation located northwest of Dunn Field along Person Avenue. CN Railroad rail lines border Dunn Field on the north. A number of large industrial and warehousing operations are located along the rail

lines in this area. A triangular area located immediately north of the MI along Dunn Road also contains several industrial firms. Zoning controls and subdivision requirements are under the jurisdiction of the Memphis and Shelby County Office of Planning and Development. DDMT is currently zoned for Light Industrial (I-L) uses.

After DDMT was placed on the BRAC closure list, the City of Memphis and County of Shelby established the Memphis Depot Redevelopment Agency, now the Depot Redevelopment Corporation (DRC), to plan and coordinate the reuse of the Depot. The DRC conducted several public meetings to obtain community feedback on future land use plans. The DRC board of directors, the City of Memphis, and Shelby County approved the *Memphis Depot Redevelopment Plan* in 1997. The intended land use is industrial for the MI and the majority of Dunn Field; the northeast section of Dunn Field was identified for recreational use.

DDMT property has been made available for transfer through six Findings of Suitability to Transfer (FOSTs) approved by ODB from February 2001 to August 2010. These FOSTs include all property within DDMT; the area covered by each FOST is shown on Figure 5. Following approval of FOST 6, USEPA issued the *Superfund Property Reuse Evaluation Checklist for Reporting the Site Wide Ready for Anticipated Use* (USEPA, 2010b). Property transfers through deed or letter of assignment have been completed for property in all FOSTs, except FOST 5; the FOST 5 property is to be transferred through a competitive public sale. The acreage, type of conveyance, type of transfer, receiving party and date of transfer are listed on Table 1.

3.3 HISTORY OF CONTAMINATION

Starting in the 1940s, DDMT received, warehoused, and distributed supplies common to all U.S. military services and some civilian agencies. Activities at the MI included storing and shipping various materials (e.g., food, clothing, medical supplies) and industrial supplies (e.g., hazardous materials). Hazardous materials that were used or stored at the Depot during its operational period included flammables, solvents, petroleum/oil/lubricants (POL), paints, pesticides, herbicides, wood treating products, oxidizers, corrosives, and reactives. During the 1940s and 1950s, a pistol range was located in the present golf course area.

Types of past activities that could result in the presence of hazardous materials in environmental media at the MI include hazardous substance repackaging for storage or shipment, pesticide application, painting and sandblasting, vehicle maintenance and hazardous material handling/storage. Other historical

activities in open and enclosed storage areas included storing transformers with polychlorinated biphenyls (PCBs), storing and using pesticides/herbicides, and treating wood products with pentachlorophenol (PCP). These industrial activities resulted in the presence of metals, pesticides, and other less frequently detected chemicals in surface soil, surface water and sediment, and chlorinated volatile organic compounds (CVOCs) in groundwater above background concentrations at the MI.

Historically, Dunn Field was used as a landfill; as a pistol range; for storage of mineral stockpiles; and for periodic testing of flamethrowers, smoke generators, and smoke pots using diesel fuel and fog oil. The pistol range building also was used for pesticide and herbicide storage. Mineral stockpiles were maintained for many years as part of the Defense National Stockpile, but were removed following closure.

Disposal activities at Dunn Field began in July 1946 when 29 mustard-filled German bomb casings and mustard-contaminated items (railcar wood, clothing, etc.) were decontaminated, destroyed (via burning) and buried. This activity included the use of Decontaminating Agent Non-Corrosive (DANC), an organic N-chloroamide compound in solution with 1,1,2,2-tetrachloroethane (TeCA). A mixture similar to DANC formulations (S-210 suspension formulation) contained tetrachloroethene (PCE).

During the early to mid-1950s, Chemical Agent Identification Sets were allegedly buried at Dunn Field (USATHAMA, 1982). A search of the archived records also indicated that the remains of destroyed (burned or detonated) ordnance and explosives (OE) consisting of military souvenirs, such as a 3.2-inch mortar round, smoke pots, chloroacetophenone (also known as tear gas agent) canisters, and smoke grenades, were occasionally buried in pits in the Disposal and Stockpile Areas. Based on completion of early response actions, the USACE issued a Statement of Clearance for chemical warfare material (CWM) and OE at Dunn Field in August 2003.

Other chemicals were reported buried in Dunn Field. Use and disposal of unknown quantities of chlorinated lime, super topical bleach and calcium hypochlorite is documented. Food stocks, paints/thinners, POL, acids, herbicides, mixed chemicals and medical waste were also reportedly destroyed or buried in pits and trenches at Dunn Field.

The Depot was a Resource Conservation and Recovery Act (RCRA) generator of hazardous wastes in Tennessee under generator No. TN 4210020570. The majority of hazardous wastes generated by the Depot consisted of hazardous substances that reached shelf-life expiration dates and could no longer be

used. The Depot also generated hazardous wastes from the cleanup of small hazardous substance spills and from vehicle maintenance.

3.4 INITIAL RESPONSE

On 28 September 1990, USEPA Region 4 and TDEC issued the Depot a RCRA Part B permit for the storage of hazardous waste. The permit included requirements for the identification and, if necessary, corrective action of solid waste management units (SWMUs) and areas of concerns (AOCs). Subsequent to issuing the permit, and in accordance with Section 120(d)(2) of CERCLA, and Title 42, Section 9620(d)(2) of the United States Code (USC), USEPA prepared a final Hazard Ranking System (HRS) Scoring Package for the facility. On 14 October 1992, based on the final HRS score of 58.06, USEPA added the Depot to the National Priorities List (NPL) (57 Federal Register 47180 No. 199).

In March 1995, a Federal Facilities Agreement (FFA) under the CERCLA, Section 120, and RCRA, Sections 3008(h) and 3004(u) and (v), was executed by the agencies. The FFA outlined the process for site investigation and cleanup at DDMT under CERCLA.

The following response actions were taken at the MI prior to completion of the Record of Decision (ROD). The locations are shown on Figure 6.

- Approximately 602 cubic yards (CY) of soil from the PCP dip vat area (Building 737) in Functional Unit 4 (FU4) were removed by excavation, transport, and off-site disposal (ET&D) because of elevated levels of PCP (completed in 1985).
- Approximately 60,000 gallons of hazardous and POL materials from damaged drums were reclaimed and repackaged at Building 873 in 1985. Approximately 800 55-gallon drums were recouped in this open storage area and then returned to their original location for storage and distribution.
- Approximately 3,700 CY of soil in the Housing Area of FU6 were removed by ET&D because of the presence of dieldrin (completed in October 1998). The Housing Area is an exception to the overall industrial land use for the MI and is acceptable for residential reuse.
- Approximately 400 CY of surface soil surrounding the cafeteria (Building 274) in FU6 were removed by ET&D because of elevated levels of PCBs (completed in November 1998).

- Approximately 980 CY of surface and subsurface soil from near Buildings 1084, 1085, 1087, 1088, 1089 and 1090 were removed by ET&D because of elevated levels of metals and polycyclic aromatic hydrocarbons (PAHs) (completed in August 2000).

The following response actions were taken at Dunn Field prior to completion of the ROD. The locations are shown on Figure 7.

- Approximately 914 CY of soil contaminated with mustard degradation by-products, 19 CY of mustard-contaminated soil and 29 bomb casings were removed by ET&D (completed in March 2001).
- Approximately 930 CY of lead-contaminated surface soil from the former pistol range were removed by ET&D (completed in March 2003).

The original Part B RCRA permit issued by TDEC for a hazardous waste storage facility was terminated by TDEC on 22 October 1998 because DDMT had been closed and the storage facility had not been constructed or operated. The Hazard and Solid Waste Amendment (HSWA) portion of the RCRA permit issued by USEPA Region 4 for the purpose of RCRA corrective action for releases from SWMUs remained in effect. Based on requirements of TDEC and USEPA, DLA submitted a corrective action permit renewal application on 29 March 2004. On 19 January 2005, TDEC issued a Denial to Reissue the Hazardous Waste Corrective Action Permit, which terminated the Depot's requirement to continue corrective action under RCRA and noted that all corrective action activities shall continue to be performed under CERCLA authority.

3.5 BASIS FOR TAKING ACTION

To assist investigations conducted at DDMT under the requirements of CERCLA and the NCP, the facility was divided into four operable units (OUs). Dunn Field, OU-1, is the only known and documented burial area on the Depot. The MI was divided into three OUs (2 through 4). OU-2 is located in the southwestern quadrant of the MI area of the Depot and is characterized as an industrial area where maintenance and repair activities took place. OU-3 is located in the southeastern quadrant of the MI area and contains the entire southeastern watershed and golf course. OU-4 is located in the north-central section of the MI area where material storage took place. The MI was also divided into seven FUs based on similar historical use for conducting baseline risk assessments (Figure 6).

3.5.1 Main Installation

Field investigations as part of the Remedial Investigation (RI) were conducted from 1995 through 1999 to characterize the contamination in surface and subsurface soil, groundwater, surface water, and sediment at the MI and surrounding areas. Soil, surface water, and sediment samples were collected during the first sampling event from each site at locations and depths of most probable contamination. If analytical results indicated either that contamination was not present or that the nature and extent had been defined based on background or risk-based concentration of target compounds, no subsequent sampling was performed. Otherwise, additional samples were collected and analyzed to more fully assess the nature and extent of contamination.

A baseline risk assessment (BRA) conducted during the RI included a human health risk assessment (HHRA) for each FU at the MI and a screening level ecological risk assessment (SLERA) conducted across the MI. The constituents of concern (COCs) identified for surface soil were two metals (lead and arsenic) and a chlorinated pesticide (dieldrin). Overall BRA results indicate that, under current (limited) land use conditions at the MI, no threat to human health or ecological receptors exists above acceptable limits. Health risks to industrial workers were within acceptable levels for future industrial use of the property, except for lead in a limited surface soil area in FU3. However, the soil COCs were present at levels that do not allow for unrestricted use and unlimited exposure.

The COCs identified in groundwater were PCE and trichloroethene (TCE). Although contaminated groundwater poses an unacceptable risk through the ingestion pathway, none of the available RI or subsequent groundwater data indicated that dense nonaqueous phase liquids were present in groundwater at the MI. Specific sources of the volatile organic compound (VOC) plumes were not identified. Considering the nature of the operations at the MI, it is likely that the plumes resulted from multiple small volume, undocumented releases, both on- and off-site.

Results from the HHRA indicated that direct exposures by human receptors to sediment and surface water in the ponds in FU2 did not present risks above the acceptable levels and thus no COCs were identified. The SLERA did not identify significant ecological impacts and no ecological COCs were identified.

3.5.2 Dunn Field

From 1998 through 2002, DDMT conducted a RI (CH2M HILL, 2002) and a Feasibility Study (FS) (CH2M HILL, 2003a) for Dunn Field. The RI/FS identified the types, quantities, and locations of

substances detected in the environment and studied the feasibility of potential cleanup solutions. Dunn Field was divided into three geographic areas to facilitate the investigation (Figure 7).

- Northeast Open Area – Approximately 20 acres of land located in the northeast quadrant of Dunn Field. This area is mostly grass covered with some lightly wooded areas.
- Disposal Area – Approximately 14 acres of open land located in the northwest quadrant of Dunn Field, where the majority of disposal sites are located.
- Stockpile Area - Approximately 30 acres of open land located in the southeastern and southwestern portions of Dunn Field. This area includes the former bauxite and fluorspar stockpiles (removed in 1999) and burial areas in the eastern and southwestern portions of Dunn Field.

A BRA, consisting of an HHRA and an SLERA, was completed as part of the Dunn Field RI. The HHRA compared site- and chemical-specific risk estimates with the acceptable health risks and hazard index (HI) levels; the chemicals that exceeded those criteria and require RA were identified as COCs. No soil COCs were identified in the Northeast Open Area or the Stockpile Area. In the Disposal Area, VOCs were identified as COCs in subsurface soil for industrial land use, and PAHs, arsenic, antimony and CVOCs were identified as COCs in soil for residential land use. VOCs were identified as COCs in on-site and off-site groundwater. The groundwater in the fluvial aquifer is not a drinking water source for area residents and there is no current exposure to contaminated groundwater in the fluvial aquifer at Dunn Field.

The SLERA indicated little potential for significant ecological impacts or adverse effects to wildlife; no ecological COCs were identified.

Subsurface soils, including the disposal sites in the Disposal Area were considered to be principal threat wastes, which have significantly degraded groundwater quality in the shallow fluvial aquifer. Based on the highest observed concentration of TCE and TeCA in groundwater, free-phase solvents were suspected and would be considered principal threat wastes. However, free-phase solvents were not detected during the RI, subsequent remedial design-related investigations or performance monitoring for RAs.

The ROD identified the eastern portion of Dunn Field, including most of the Northeast Open Area and the Stockpile Area, as suitable for unrestricted use and unlimited exposure (Figure 7). The selected remedy addresses buried wastes and associated soil within disposal sites, VOCs in subsurface soils and CVOCs in groundwater.

Disposal Sites

The Disposal Sites were prioritized according to historical records indicating the estimated quantity of material within each site, potential hazards of the material, and form of the material (e.g., solid versus liquid). Sites designated as high or medium priority sites were identified for additional investigation during the Remedial Design (RD). The remaining low priority sites were determined to not require RA.

Disposal Area – Subsurface Soils

The following CVOCs were detected at elevated concentrations in subsurface soils in the Disposal Area:

- PCE
- TCE
- 1,2-Dichloroethene (cDCE)
- Vinyl Chloride (VC)
- TeCA
- 1,1,2-Trichloroethane (TCA)
- Carbon Tetrachloride (CT)
- Chloroform (CF)

VOCs detected in soil samples were consistent with results of a passive soil gas survey, and with historical information indicating the disposal pits and trenches were relatively small and separate. VOCs were detected from the base of disposal trenches (8 to 10 feet bgs) to the fluvial aquifer (up to 83 feet bgs) with a complete migration pathway from disposal area to subsurface soil and to groundwater.

Groundwater

The nature and extent of contamination in the fluvial aquifer at Dunn Field and to the west was assessed during the RI based on groundwater samples collected from January 1996 through February 2001. Groundwater samples were analyzed for explosives, herbicides, metals (total), pesticides, PCBs, semi-volatile organic compounds (SVOCs), and VOCs. Groundwater samples were also analyzed for CWM breakdown products, including Thiodiglycol, 1,4-Oxathiane, and 1,4-Dithiane. Of these parameters, VOCs, SVOCs, and total metals were the most frequently detected analytical constituents in groundwater samples. Based upon further review, metals and SVOCs were not selected as COCs for groundwater.

The investigation identified three major CVOC plumes in the shallow groundwater under Dunn Field: a northern plume, a central plume, and a southern plume. There was some mixing of the plumes, as expected from influence by the IRA groundwater extraction system, natural groundwater flow, and degradation processes. The plume along the northern boundary of the site was determined to have both on-site and off-site sources, based on CVOCs detected in off-site monitoring wells upgradient of Dunn Field. Additional investigations were performed by USEPA and TDEC, but the off-site source(s) has not been identified.

4.0 REMEDIAL ACTIONS

4.1 REMEDY SELECTION

DDMT is divided into four OUs: Dunn Field, OU 1; Southwest Quadrant MI, OU 2; Southeastern Watershed and Golf Course, OU 3; and North-Central Area MI, OU 4. The *Record of Decision for the Interim Remedial Action of the Groundwater at Dunn Field (OU-1)* (IRA ROD) (CH2M HILL, 1996) was the initial ROD. The *Main Installation Final Record of Decision* (MI ROD) (CH2M HILL, 2001) included OUs 2, 3, and 4. The *Dunn Field Final Record of Decision* (Dunn Field ROD) (CH2M HILL, 2004a) addressed OU 1, the only known and documented waste burial area. The Dunn Field ROD was modified through the *Dunn Field Record of Decision Amendment* (ROD Amendment) (e^2M, 2009a).

4.1.1 Interim Remedial Action

The IRA ROD was approved in April 1996. The IRA objectives were:

- Incrementally remove contamination from the Fluvial Aquifer,
- Decrease risk by mitigating the spread of contamination towards the Allen Well Field, and
- Create a hydraulic barrier to prevent contamination in the Fluvial Aquifer at Dunn Field from reaching the Allen Well Field.

The identified COCs were VOCs and metals. The final cleanup levels for groundwater were left to be addressed in the Dunn Field ROD. The major components of the selected IRA were:

- Evaluation of aquifer characteristics, which may include installation of a pump test well
- Installation of additional monitoring wells (MWs) to locate the western edge of the groundwater plume
- Installation of recovery wells (RWs) along the leading edge of the plume
- Obtaining discharge permit for disposal of recovered groundwater to the municipal sewer system
- Operation of the system of RWs until the risk associated with the contaminants is reduced to acceptable levels or until the final remedy is in place
- Chemical analysis to monitor the quality of the discharge in accordance with the city discharge permit requirements; the permit will include parameters to be monitored and frequency.

4.1.2 Main Installation

The MI ROD received final approval on September 6, 2001. The selected remedy addresses the remediation of surface soil and groundwater contamination to allow the transfer or lease of the MI property for its intended use. The selected surface soil remedy consists of LUCs for FUs 1 through 6, coupled with ET&D of surface soil in FU4. The selected groundwater remedy for FU7 is enhanced bioremediation, which includes LUCs and long-term monitoring (LTM).

The groundwater remedial action objectives (RAOs) are to prevent ingestion of water contaminated with VOCs in excess of USEPA maximum contaminant levels (MCLs) from potential, future on-site wells; restore groundwater to levels at or less than MCLs; and prevent migration horizontally and vertically off-site of groundwater contaminants in excess of MCLs for TCE (5 micrograms per liter [µg/L]) and PCE (5 µg/L).

The surface soil RAO for protection of industrial workers is to prevent direct contact/ingestion of surface soils contaminated with lead in excess of industrial worker risk-based criteria. The surface soil RAO for protection of future on-site residents is to prevent direct contact/ingestion of surface soils contaminated with dieldrin and arsenic in excess of HHRA criteria for residents; and prevent direct contact/ingestion of surface soils contaminated with lead in excess of risk-based criteria for protection of residential children.

The major components of the selected remedy are:

- ET&D at a permitted landfill of an estimated 7,200 ft^2 of surface soil containing lead concentrations equal to or greater than 1,536 milligrams per kilogram (mg/kg) near the southeast corner of Building 949 in FU4.
- Deed restrictions and site controls, which include the following:
  - Prevention of residential land use on the MI (except at the existing Housing Area).
  - Daycare restriction controls.
  - Production/consumptive use groundwater controls for the fluvial aquifer and for drilling into aquifers below the fluvial aquifer on the MI.
  - Elimination of casual access by adjacent off-site residents through maintenance of a boundary fence surrounding FU2.
- Enhanced bioremediation of CVOCs in the most contaminated part of the groundwater plume.
- Long-term groundwater monitoring to document changes in plume concentrations and to detect potential plume migration to off-site areas or into deeper aquifers.

The LUCs (deed restrictions and site controls) provide additional layers of protection above the existing land use and groundwater controls as established by the: (1) City of Memphis and Shelby County zoning regulations; (2) Federal Property Management Regulations; and (3) Ground Water Quality Control Board for the City of Memphis and Shelby County.

The MI ROD included explanation of two significant changes from the remedy presented in the Proposed Plan (PP). The plan called for deed restrictions in conjunction with land use controls in each FU, including deed restrictions prohibiting fishing or swimming in Lake Danielson and the Golf Course Pond in FU2; additional review of the Administrative Record indicated that human health risks from Lake Danielson and the Golf Course Pond did not materially increase the total risk at FU2 and those restrictions were deleted from the remedy. Lead contamination adjacent to Building 949 in FU4 was in a key area for BRAC reuse, and DLA removed the lead-contaminated soil prior to final execution of the MI ROD; although this action had no effect on protectiveness, the early completion of this action effectively eliminated it as part of the selected remedy.

4.1.3 Dunn Field

The Dunn Field ROD received final approval on 12 April 2004. The RAOs for Dunn Field are:

Surface soil

- Limit use of the surface soil in the Disposal Area to activities consistent with Light Industrial use and prevent residential use through institutional controls (ICs).

Disposal sites

- Prevent groundwater impacts from a release of buried containerized hazardous liquids and the leaching of contaminants from buried hazardous solids.
- Prevent unacceptable risk of direct contact with buried hazardous liquid and/or solids due to intrusive activities during future land use or site development.

Subsurface soil impacted with CVOCs

- Prevent direct inhalation of indoor air vapors from subsurface soils in excess of industrial worker criteria.
- Reduce or eliminate further impacts to the shallow fluvial aquifer from the CVOCs in the subsurface soil.

Groundwater

- Prevent exposure to groundwater contaminated with VOCs in excess of protective target levels from potential future on-site wells.
- Prevent further off-site migration of VOCs in groundwater in excess of protective target levels.
- Remediate fluvial aquifer groundwater to drinking water quality to be protective of the deeper MAQ.

Because there are no federal or state cleanup standards for soil contamination, target levels were established that would both reduce the risk associated with exposure to soil contaminants to an acceptable level, and ensure minimal migration of contaminants into the groundwater. The subsurface soils, primarily within the Disposal Area of Dunn Field, have residual CVOC levels that exceed the soil-to-groundwater migration-based screening levels, and that have potential for vapor intrusion to indoor air under possible future land use conditions. Site-specific target values calculated for the loess and fluvial deposits are shown on Table 2.

Since multiple CVOCs were detected in groundwater at the site and in the immediate downgradient area, targeting to meet the MCLs was not considerd adequately protective of a potentially exposed receptor due to the possibility of cumulative toxicity exceeding the upper-bound limit of the acceptable risk or HI. Upon completion of RAs, the residual risks are to be below target levels at points of compliance throughout the plume(s). The individual concentration of each CVOC will be below MCLs and combined concentration levels will not exceed a cumulative upper-bound target risk of 1 in 10,000 (1 $X10^{-4}$) and a HI of 1.0 in any given plume.

CVOCs in groundwater and their respective target concentration levels are included on Table 2. The ROD states new chemicals detected consistently will be added to the list of COCs. The individual groundwater target goals will change with the number and concentrations of chemicals present in a plume during remediation; however, the target risk level (e.g. 1 x 10^{-4}) will remain fixed.

The components of the selected remedy for Dunn Field are:

- ET&D of soil and material contained within disposal sites based upon results from a pre-design investigation.
- SVE to reduce VOC concentrations in subsurface soils to levels that are protective of the intended land use and groundwater.

- Injection of zero-valent iron (ZVI) within Dunn Field to treat CVOCs in the most contaminated part of the groundwater plume, and installation of a permeable reactive barrier (PRB) to remediate CVOCs within the off-site areas of the groundwater plume.
- Monitored natural attenuation (MNA) and LTM of groundwater to document changes in plume concentrations, to detect potential plume migration to off-site areas or into deeper aquifers, and to track progress toward remediation goals (RGs).
- Implementation of LUCs, which consist of the following institutional controls: deed and/or lease restrictions; Notice of Land Use Restrictions; City of Memphis/Shelby County zoning restrictions and the Memphis and Shelby County Health Department (MSCHD) groundwater well restrictions.

The selected remedies were modified through the ROD Amendment, which received final approval on 19 March 2009. The fundamental change was the use of air sparging with soil vapor extraction (AS/SVE) instead of a PRB for the Off Depot groundwater plume. The ROD Amendment also revised the criteria for extent of the AS/SVE system and clarified the treatment objective. The AS/SVE system was selected to cross the core of the plume near the downgradient end and to reduce the individual CVOC concentrations in groundwater to 50 µg/L or less. Groundwater modeling indicated the AS/SVE system in combination with natural attenuation processes would reduce groundwater concentrations to MCLs in accordance with the RAOs within a reasonable period of time. The RGs for the COCs, shown on Table 2, were not changed from the Dunn Field ROD.

4.2 REMEDY IMPLEMENTATION

4.2.1 Interim Remedial Action

The interim groundwater extraction system was to be installed in three phases: (1) installation of the initial seven RWs on Dunn Field; (2) installation of remaining recovery wells on Dunn Field; and (3) installation of off-site wells west of Dunn Field. The final design for Phase I was completed in August 1997 and included seven groundwater RWs, an underground conveyance system, flow measurement and control systems, and associated civil, electrical, and instrumentation/controls work. The system began operation in November 1998 with groundwater discharge to the city sewer system without treatment under an industrial discharge agreement.

The Phase II design was completed in January 2000, and included the addition of four extraction wells and associated electrical, mechanical, and instrumentation/controls components. The new RWs were

installed in late 1999 and early 2000. The expanded groundwater extraction system was constructed September 2000 to February 2001 and brought on-line in the first quarter of 2001. Location of the IRA components are shown on Figure 7.

Evaluation of IRA monitoring results and the Dunn Field RI showed that aquifer restoration could be accomplished more effectively by means other than expanding the interim groundwater extraction system. Phase III (off-site RWs) was not constructed. DLA, EPA, and TDEC agreed that the off-site groundwater plume in the fluvial aquifer would be addressed in the final remedy for Dunn Field and the groundwater extraction system would operate until the final remedy was implemented.

Based on reduction of CVOC concentrations in groundwater following implementation of the Source Areas RA, five RWs were shutdown in June 2008, and the remaining RWs were shutdown in January 2009. Effluent samples from the IRA discharge were used to monitor contaminant mass reduction; approximately 918 pounds of total VOCs were discharged by the IRA in just over 10 years of operation. The IRA system was removed and the RWs abandoned in July 2010. The final year of IRA groundwater monitoring and the closure activities were described in *2009 Operations and Closure Report, Dunn Field Groundwater Interim Remedial Action* (HDR, 2010).

4.2.2 Main Installation

The *Main Installation Final Remedial Design* (MI RD) (CH2M HILL, 2004b) was approved by USEPA on August 10, 2004. The MI RD incorporated an enhanced bioremediation treatment (EBT) treatability study with two electron donors (vegetable oil emulsion and sodium lactate solution) injected into the fluvial aquifer at two separate areas on the MI. Sodium lactate was chosen for injection using wells installed in target treatment areas (TTA) 1 and 2 (TTA-1 and TTA-2) where PCE plus TCE exceeded 100 µg/L, and in TTA-2 where CT exceeded 100 µg/L. Other design specification addressed well spacing, screen lengths, injection solution concentrations, injection volume, and injection interval. The MI RD also included a LTM plan and a Land Use Control Implementation Plan (LUCIP).

The Notice of Land Use Restrictions was recorded at the City of Memphis/Shelby County Register of Deeds Office on January 26, 2005 and deed restrictions have been included in property transfers. Annual inspections have been performed since 2005 and reports have been distributed in accordance with the LUCIP. One minor deficiency regarding perimeter fencing was identified and corrected in 2005. No other deficiencies or violations have been identified.

The *Remedial Action Work Plan, Main Installation* (MI RAWP) (MACTEC, 2005a) was approved by USEPA on September 12, 2005. A design-related investigation (DRI) to confirm site hydrogeology and contaminant concentrations was conducted in 2004 and included as an appendix to the RAWP. The Notice of Mobilization for the MI RA was submitted to USEPA and TDEC on 2 May 2006.

RA construction included 50 injection wells (IWs) and 30 performance monitoring wells (PMWs) in two TTAs (TTA-1 and TTA-2), the lactate storage and transfer facility, and the injection trailer; construction was completed in August 2006. A baseline monitoring event was completed and the initial lactate injection made in September 2006.

EBT

Sodium lactate was injected in all injection wells biweekly during Year One (September 2006 through August 2007) and monthly during Year Two (September 2007 through February 2009). Changes to injection procedures were made based on field observations and measurements. Performance monitoring was conducted quarterly from October 2006 through March 2009. System operations and monitoring results were described in annual reports. CVOC concentrations for parent compounds (PCE, TCE, CT and CF) were reduced over 90 percent in injection wells and over 80 percent in monitoring wells at locations with baseline concentrations above 100 µg/L.

The *Main Installation Interim Remedial Action Completion Report, Rev. 1* (MI IRACR) (HDR|e^2M, 2010), including an operating properly and successfully (OPS) determination, was submitted to USEPA and TDEC on 26 February 2010. Although EBT did not achieve the goal of reducing concentrations below MCLs, additional field investigation, groundwater modeling and trend analysis presented in the MI IRACR indicated that additional RA was not necessary. Additional monitoring wells in the upper portion of the MAQ were recommended to support the groundwater model results. If consecutive groundwater samples above MCLs are detected in an IAQ well on the property boundary or in a MAQ well, RA in the fluvial aquifer upgradient of the window will be evaluated to reduce those concentrations. The OPS determination and the IRACR were approved by USEPA in March 2010.

EBT components were planned to be removed following a period of monitoring after injections were halted; however, removal was not recommended due to rebound in contaminant concentrations observed in LTM. Baseline groundwater samples were collected from EBT IWs and PMWs in December 2011. Sample results were presented in *December 2011 Baseline Samples for the Enhanced Bioremediation Treatment System*; the report was submitted to USEPA and TDEC in February 2012.

The sample results indicated rebound in concentrations of parent compounds, with increasing concentrations of PCE in all areas, TCE in TTA-1S and CT in TTA-2. Concentrations had returned to pre-EBT baseline levels throughout TTA-1N. Concentrations in TTA-1S and TTA-2 averaged approximately one-third of pre-EBT baseline levels with varying rebound across those areas.

Additional EBT is planned to improve progress toward groundwater RAOs. EBT will be performed in areas where individual CVOC concentrations of parent compounds (PCE, TCE and CT) exceed 100 µg/L; this would include TTA-1, TTA-2, the west-central plume and the Bldg 835 plume.

Performance monitoring and LTM results have shown significant migration and diffusion of carbon source material downgradient of the treatment areas (TAs), and fewer IWs are considered necessary. Higher concentrations of sodium lactate in the injection solution will used to provide an equivalent mass of carbon through fewer wells and less frequent injections. Based on past EBT results, performance monitoring in the TA can also be limited with success determined through LTM outside the TAs.

Recommendations for wells to be used for EBT injections and performance monitoring and for abandonment of selected EBT wells were revised based on comments from USEPA and TDEC. Approved wells were abandoned in June 2012.

MI LTM

MI LTM is conducted to evaluate progress in meeting the RAOs and has been performed since 2004 in accordance with the LTM Plan in Appendix B of the MI RD. Recommendations for changes to LTM wells and sample frequency are made in annual LTM reports.

Additional deep monitoring wells to support groundwater modeling results were installed June-August 2010 in accordance with recommendations in the MI IRACR. The findings were included in the *Main Installation 2010 Annual Long-Term Monitoring Report* (HDR, 2011a). The hydrogeologic data for the new deep wells supported the conceptual model of a connection between the fluvial and deeper aquifers and indicated the IAQ and MAQ wells were appropriately located to serve as sentinel wells for vertical migration of contaminants. The analytical results were consistent with the groundwater modeling described in the IRACR, which indicated the potential for low CVOC concentrations in the IAQ and MAQ at the MI. The results did not indicate significant impact to the MAQ.

The latest MI LTM recommendations for new LTM wells and changes to well classification, sample frequency and sampling procedures were made in the *Main Installation Annual Long-Term Monitoring*

Report-2011, Rev.1 (HDR, 2012b) approved by USEPA on 30 April and TDEC on 4 May 2012. Concentrations of PCE, TCE and CT from April 2012 are shown on Figures 8, 9 and 10, respectively. While the majority of MI LTM wells have stable or decreasing CVOC concentrations, several IAQ wells had increasing concentrations and IAQ well MW-256 near the northwest property boundary exceeds the MCL for PCE and TCE. Additional EBT is to be initiated in the second half of 2012.

Three new LTM wells, installed in March 2012 and sampled in April 2012, provide additional information on extent of COCs in groundwater. In particular, plume migration for TTA-2 in the southeast MI was observed to be toward the southern property boundary rather than toward the window in the central MI. Existing wells near the boundary have not had COC concentrations above reporting limits in several years. The plume data indicates decreased potential for impact to deeper aquifers from TTA-2.

4.2.3 Dunn Field

Three RAs were performed to implement the selected remedies for OU 1, Dunn Field: Disposal Sites RA (ET&D); Source Areas RA (SVE, ZVI injections and LUCs); and Off-Depot Groundwater RA (AS/SVE, MNA, and LTM). Upon completion of the AS/SVE system for Off Depot groundwater in 2009, construction of the selected remedies for DDMT was complete. Locations of the Disposal Sites, Source Areas and Off-Depot Groundwater RAs are shown on Figure 11.

Disposal Sites

The *Disposal Sites Final Remedial Design* (Disposal Sites RD) (CH2MHILL, 2004c) was approved by USEPA on August 10, 2004. The Disposal Sites RD was based on an investigation of the 17 former disposal sites designated as medium and high priority. The investigation included a geophysical survey, excavating trenches and pits, and analysis of samples from the excavated materials. Observations from the excavations and analytical results indicated that benzene, copper, lead and polynuclear aromatic hydrocarbons were present above RGs and that possible principal threat wastes (glass bottles and 55-gallon drums) were present. Soil and debris from Disposal Sites 3, 4.1, 10, 13, and 31 were selected for excavation and off-site disposal.

The *Remedial Action Work Plan, Dunn Field Disposal Sites, Rev. 1* (MACTEC, 2004a) was approved by USEPA on 16 November 2004. The *Remedial Action Work Plan, Addendum 1, Rev. 1 (*Disposal Sites Addendum) (MACTEC 2006a) outlined additional procedures to excavate, characterize, transport, and properly dispose buried waste materials associated with liquid containers encountered during the

excavation of Disposal Site 3. The RAWP Addendum was approved by TDEC and USEPA on 17 February and 21 February 2006, respectively.

The Disposal Sites RA was performed during two separate mobilizations. During the first mobilization from 14 March through 7 May 2005, Disposal Sites 4.1, 13, 31, and the majority of Disposal Site 10 were completed. Disposal Site 3 and the remaining materials from Disposal Site 10 were completed 27 February through 8 March 2006. A total of 4,051 tons (approximately 2,700 CY) of non-hazardous materials from Disposal Sites 3, 4.1, 10, 13 and 31 were transported off-site and disposed of at the BFI South Shelby County Landfill. A total of 351 tons (approximately 234 CY) of hazardous materials from Disposal Site 3 were transported to the Clean Harbors Lambton Secure Landfill in Canada for disposal. The RAOs outlined in the ROD for these sites were achieved based on the confirmation sample results for each excavation. The *Dunn Field Disposal Site Remedial Action Completion Report* (MACTEC, 2006b) was approved by USEPA on August 26, 2006.

Source Areas

The *Source Areas Final Remedial Design* (Source Areas RD) (CH2M HILL, 2007) was approved by USEPA on 20 March and by TDEC on 23 March 2007. Three studies were performed on Dunn Field as part of the Source Areas RD: a field treatability study to evaluate the effectiveness of ZVI injection for remediation of CVOCs; an SVE pilot study to collect site-specific data for both the loess and the unsaturated fluvial deposits; and a remedial design investigation (RDI) was performed to delineate CVOC concentrations in the loess and to collect additional groundwater samples. The reports for the RDI and the SVE study were included as appendices to the Source Areas RD.

The SVE pilot study supported use of SVE in the fluvial deposits and indicated the RAOs could be met within 5 years in that unit. However, the study demonstrated limited vapor extraction rates and high applied vacuum requirements for the loess. The estimated times required to meet RAOs for the two primary CVOCs in the loess were up to 235 years for TeCA and up to 14 years for TCE. The RDI resulted in better delineation of CVOCs above RGs in the loess; the total area requiring SVE treatment was reduced to 1.3 acres from 5.5 acres in the ROD. The reduced area of loess requiring SVE treatment allowed cost-effective implementation of in situ thermal desorption or thermal SVE (TSVE). The use of TSVE was included as a significant change in the Dunn Field ROD Amendment.

The BRAC Cleanup Team (BCT) determined that the fluvial SVE (FSVE) component of the Source Areas RA should be implemented on an expedited basis while the ROD Amendment was finalized. The

Dunn Field Fluvial Soil Vapor Extraction Remedial Action Work Plan, Rev.1 was approved by USEPA on 3 July 2007. The RA mobilization occurred May 14, 2007.

FSVE system construction was completed in July 2007 and system operations began 25 July 2007. The system consists of two blowers connected to seven SVE wells with screened intervals at approximately 30 to 70 feet bgs, 20 vapor monitoring points (VMPs) located 15 to 80 feet from the SVE wells and an equipment building for the blowers, heat exchangers and controls. System operations began in July 2007 and approximately 4,020 pounds of VOCs were removed through July 2011. The VOC concentration in the extracted vapor has decreased asymptotically to less than 1 part per million (ppm). The FSVE operations through July 2011 are described in *Dunn Field Source Areas Fluvial Soil Vapor Extraction System Annual Operations Report, Year Four, Rev. 0* (HDR, 2011b).

The *Dunn Field Loess/Groundwater Remedial Action Work Plan, Rev. 1* was submitted on 27 August 2007. The RAWP received partial approval from USEPA on 2 October 2007. Mobilization of personnel and equipment for ET&D and site preparation of the TSVE treatment of the loess took place on 22 October 2007. The RAWP received final approval from USEPA on 5 June and TDEC on 7 July 2008 following the addition of procedures to demonstrate attainment of clean-up levels and the use of non-detect results in confirmation samples, and for ET&D at an additional area identified during FSVE construction.

The initial excavations at TA-1F and TA-3 were performed October 2007 to January 2008. Further excavation was delayed in order to proceed with construction and operation of the TSVE system. The excavations were completed February to June 2009. Approximately 7,400 CY of waste material were disposed as non-hazardous waste at the Waste Management, Inc. landfill in Tunica MS, a CERCLA-approved facility. Soil confirmation samples met RGs in both areas.

TSVE treatment was performed in four areas with a total area of about 1.25 acres and a treatment interval of approximately 5 to 30 feet bgs. System components included 367 heater-only wells; 68 vapor extraction wells, 62 multi-level temperature monitoring points, 25 pressure monitoring points and a Shotcrete surface cover to limit water infiltration and improve vapor capture. The system operated continuously from 27 May until the heaters were shutdown on 20 November 2008. The vapor extraction system was shut down on 4 December. Approximately 12,500 pounds of VOCs were removed during treatment. Confirmation soil samples, collected at various depths from 35 soil borings, demonstrated that clean-up standards were met; the average concentration for CVOCs in each TA was below the RG and none of the final samples exceeded an RG by a factor of 10 or more.

ZVI injections were not required because groundwater objectives for the Source Areas remedy were achieved through the subsurface soil remedies.

The memorandum, *Operating Properly and Successfully Demonstration, Source Areas Remedial Action* (e^2M, 2009b), was approved by USEPA in October 2009. The *Source Areas Interim Remedial Action Completion Report, Rev. 1* (HDR|e^2M, 2009) was approved by USEPA and TDEC in November 2009.

Off Depot Groundwater

DLA determined that an Early Implementation of Selected Remedy (EISR) was necessary to reduce contaminant mass downgradient of the planned PRB location to ensure that the portion of the plume slated for MNA in the ROD was not unduly extensive or high in concentration. The rationale and scope for this action were described in a technical memorandum, *Early Implementation of Selected Remedy Component to Address Groundwater Contamination West of Dunn Field* (CH2M HILL, 2004d), which was approved by the BCT on 21 October 2004.

ZVI injections were made following procedures in the *EISR Work Plan* (MACTEC, 2004b) from 18 November 2004 through 8 January 2005. Injections were made in 14 borings spaced 60 to 80 feet apart at depths of 70 to 100 feet bgs. The total mass of ZVI injected was approximately 192,500 pounds. The *Early Implementation of Selected Remedy Interim Remedial Action Completion Report, Rev. 1* (EISR IRACR) (MACTEC, 2005b) was submitted 19 September 2005. The injections did not achieve the goal of 90 percent or greater reduction of TCE and TeCA. The report included recommendations for decreased spacing between injection locations and a suitable ZVI mass-to-soil ratio to achieve increased reduction in CVOCs. The EISR IRACR was approved by USEPA on 22 September 2005.

The *Off Depot Groundwater Final Remedial Design* (Off Depot RD) (CH2M HILL, 2008) was approved by USEPA on 6 October and by TDEC on 8 October 2008. The Off Depot RD included results of a study to evaluate the vertical hydraulic connection between the fluvial aquifer, IAQ and MAQ, and provide hydrologic information for the groundwater model; groundwater modeling to evaluate various remediation scenarios and develop the LTM plan; and procedures for a vapor intrusion study to assess baseline soil vapor concentrations and potential impacts from AS/SVE. The Off Depot RD also included the LTM plan and the LUCIP for Dunn Field.

AS/SVE was implemented to volatilize CVOCs near the leading edge of the groundwater plume west of Dunn Field in order to remove CVOCs from groundwater and prevent further plume migration. The *Dunn Field Off Depot Groundwater Remedial Action Work Plan, Revision 2* (Off Depot RAWP) (e^2M,

2009c) was submitted to USEPA and TDEC 15 April 2009. TDEC approved Revision 0 of the Off Depot RAWP on 18 October 2008 and USEPA approved Revision 1 on 18 March 2009. In the approval letter, USEPA suggested two revisions regarding reporting requirements and contingency action; those changes were made in the final version.

The Notice of Mobilization for the Off Depot RA was submitted to USEPA and TDEC on 17 June 2009. The AS/SVE barrier includes 90 vertical AS points installed at the base of the fluvial aquifer (90 to 100 feet bgs) and 12 SVE wells on 50-foot centers with a 30-foot screened interval beginning at 35 to 45 feet bgs. The AS points and SVE wells are connected via buried piping to two equipment buildings; one housing the compressor for the sparge points and the other housing two blowers for the SVE wells. System controls were installed in a control room of the SVE building. Standard operation includes one-third of the AS points and all of the SVE wells running concurrently. System monitoring is conducted through ten nested VMPs and groundwater monitoring wells. System construction was completed in October 2009 and system operations began in December 2009 following startup testing.

The RA construction activities and Year 1 operations were described in the *Off Depot Groundwater Interim Remedial Action Completion Report, Rev.1* (Off Depot IRACR) (HDR, 2011c), which was approved by USEPA on 29 August and by TDEC on 15 November 2011. AS/SVE operations through December 2011 are described in *Off Depot Air Sparge - Soil Vapor Extraction System Annual Operations Report, Year Two, Rev. 0* (HDR, 2012c). Approximately 75 pounds of VOCs have been removed through December 2011.

The AS/SVE system will continue to operate until the upgradient concentrations from the Dunn Field plume do not exceed 50 µg/L for individual CVOCs for twelve months. Only three wells exceeded the treatment goal in September 2011 and only one well exceeded the treatment goal in April 2012; TCE was reported at 275 µg/L in MW-159, located upgradient of the AS/SVE system.

Groundwater monitoring results have indicated the plume is partially diverted around the southern edge of the AS/SVE system, probably due to decreased permeability from air sparging. Standard system operations with the AS compressor and both SVE blowers has been limited to about three days per week since November 2010 in order to limit plume diversion while maintaining sufficient treatment of groundwater. Following review of the April 2012 LTM results, air flow was closed at 24 AS points and limited to 12 hours per day at 18 AS points; two SVE wells near the closed AS points were also closed. The remaining AS points and SVE wells continue to operate as before. The AS/SVE layout and the operational changes are shown on Figure 12.

Dunn Field LTM

Groundwater monitoring at Dunn Field is conducted to evaluate effectiveness of the Source Areas and Off Depot RAs in meeting the RAOs. Since 2010, groundwater monitoring has been conducted in accordance with the LTM Plan in Appendix C of the Off Depot RD. Recommendations for changes to LTM wells and sample frequency are made in annual LTM reports. The latest Dunn Field LTM report was the *Off Depot Annual Groundwater Monitoring Report-2011, Rev.1* (HDR, 2012d) approved by USEPA on 30 April and TDEC on 2 May 2012.

CVOC concentrations in ground water began to decrease significantly soon after FSVE operations began, indicating that capture zones of the SVE wells encompassed the contaminated areas. The reduction in ground water concentrations also indicated the ground water plumes resulted from continuing vertical migration of CVOCs from the vadose zone and that a continuing source of contamination, such as pockets of free product below the water table, are not present. Reduction in CVOC concentrations over time is shown in total CVOC plume maps for April 2007, April 2009, March 2010 and March 2011 on Figure 13. The highest total CVOC concentration in the Dunn Field monitoring wells decreased from 12,219 µg/L in April 2007 to 364 µg/L in March 2011.

The latest LTM results from April 2012 were similar to results from 2011 with decreased concentrations in most wells. Concentrations of TeCA, TCE and PCE are shown and contoured on Figures 14 through 16, respectively. As noted above, MW-159 was the only LTM well in the source areas on Dunn Field or the Off Depot area to exceed the treatment goal. The individual isopleths also show contaminant migration onto Dunn Field from the off-site source to the northeast.

4.3 SYSTEM OPERATION AND MAINTENANCE

Operation and maintenance (O&M) activities are currently conducted for the Off Depot AS/SVE system. The FSVE system on Dunn Field was shut down in July 2012. EBT on the MI is to be re-started in the second half of 2012. O&M activities for the AS/SVE system and anticipated activities for MI EBT are described in the following two sections.

4.3.1 AS/SVE

The Off Depot RD estimated the AS/SVE system should be operated up to 5 years, through December 2014, to meet the RAOs. The system was designed to operate continuously 24 hours per day with minimal operator interaction. Under normal operating conditions and while personnel are onsite for other

RA activities, the field technician conducts weekly inspections of the AS/SVE system. The system operations can also be monitored remotely.

O&M activities are intended to:

- Maintain system operations through regular field inspections, maintenance and repairs; and
- Monitor system effectiveness through air injection and vapor extraction flow rates, vacuum measurements, photoionization detector (PID) measurements, and laboratory analysis of system effluent samples.

Off Depot Groundwater Air Sparge and Soil Vapor Extraction Systems Operations and Maintenance Manual (AS/SVE O&M manual) (HDR, 2011d) was prepared to guide system maintenance and provide operating procedures for the AS/SVE system. The O&M manual includes record drawings of system components, and specifications and manufacturer equipment manuals provided by subcontractors.

AS/SVE operations include:

- Weekly system inspections with repair or replacement of components, as required;
- Weekly readings at AS compressor, SVE wells and system effluent for flow rate, vacuum, temperature, and operating hours;
- Weekly PID measurements at SVE wells and system effluent;
- Monthly PID and vacuum measurements at VMPs;
- Quarterly laboratory samples from system effluent analyzed for VOCs;
- Quarterly reports to describe O&M activities, system status, performance and monitoring results; and
- Annual operations report to summarize system operations and monitoring results with data validation and to provide recommendations for future operations.

Inspections include a visual inspection of the equipment compound (exterior and interior) and major system components. The operator records system flow rates and other operating parameters on field records provided in the O&M manual. Flow rates and operating parameters are read from one of the system computer display screens or directly from gauges and meters located within the equipment room. Original field sheets are maintained onsite in the project file.

General maintenance of AS/SVE system components is required to allow for longevity of system components. Manufacturer requirements are listed in the O&M manual.

Vapor samples for laboratory analysis are limited to the system effluent. Vapor samples are collected using SUMMA canisters and analyzed via EPA TO-15 for VOCs. The PID readings at SVE wells and system effluent and the effluent sampling results are used to assess VOC capture effectiveness, and the effluent sampling results are used to verify compliance with MSCHD air regulations.

Monthly field screening at the VMPs is performed to assess the vacuum radius of influence and vapor extraction effectiveness. Screening includes vacuum measurements and PID measurements for semi-quantitative VOC data. After the first two years, the measurements may be decreased to quarterly.

4.3.2 EBT

EBT operations will be described in an addendum or revision to the MI RAWP to incorporate procedures developed during the previous RA. Performance monitoring and LTM results showed significant migration and diffusion of carbon source material downgradient of the TAs and fewer IWs will be used. Higher concentrations of sodium lactate in the injection solution will provide an equivalent mass of carbon through fewer wells and less frequent injections. Based on past EBT results, performance monitoring in the TA will also be limited with success determined through LTM outside the TAs. Installation of additional IWs is not planned.

Injection procedures will follow the same general approach as in Year 2:

- Use of injection wells and selected monitoring wells to increase the area being treated.
- Initial injection of 10 percent sodium lactate solution. Pre-injection oxidation reduction potential measurements will be used to adjust the lactate concentration in later quarterly injections.
- Additives to sodium lactate (sugar and cellulose) or proprietary mixtures from supplier.

Each injection event will include the following activities:

- Clear access to injection and performance monitoring well locations;
- Calibration of equipment and field measurements in injection and performance monitoring wells prior to sodium lactate injection;
- Filling of the trailer-mounted storage tank with sodium lactate injection fluid; and
- Injection of sodium lactate at designated wells.

At the completion of each injection event, the trailer-mounted injection system is returned to the storage and transfer facility and rinsed with potable water to minimize biological growth on sodium lactate injection fluid remaining in the components.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

5.1 PREVIOUS FIVE-YEAR REVIEWS

5.1.1 Initial Five-Year Review

The initial review, *Memphis Depot Dunn Field Five-Year Review, Rev 2* (CH2M HILL, 2003b), was completed in January 2003. The only remedy implemented at the time was the IRA groundwater extraction system. The review was completed to confirm that performance standards associated with the IRA were being achieved and existing site conditions were protective of human health and the environment.

The review concluded that over 300 pounds of VOCs had been removed by the IRA from 1998 to 2002. However, the extraction system did not adequately control groundwater flow and plume migration in the fluvial aquifer. An increase in CVOC concentrations was observed in monitoring wells west of Dunn Field. The IRA was found to be protective in the short term, because there is no current or planned use of the fluvial aquifer as a drinking water supply and local ordinances restrict installation of private wells. The review stated that monitoring data from the IRA and the RI suggested that aquifer restoration could be accomplished effectively by other technologies rather than expanding the groundwater extraction system. USEPA concurred with the initial review on 22 January 2003.

5.1.2 Second Five-Year Review

The *Second Five Year Review* (e^2M, 2007b) was completed in January 2008. The following major actions had been completed since the initial review:

- Final remedies were selected in the MI and Dunn Field RODs
- One year of MI EBT was completed
- Dunn Field disposal site excavations were completed and soil confirmation samples met RGs
- FSVE operations had begun
- Dunn Field ROD amendment was in preparation

The second five-year review concluded that the selected remedies were expected to be protective of human health and the environment upon completion of RAs for subsurface soil at Dunn Field and for groundwater at the MI and Dunn Field. In the interim, exposure pathways that could result in unacceptable risks were being controlled, and ICs were preventing exposure to, or ingestion of,

contaminated groundwater. Long-term protectiveness of the RA would be confirmed by soil sampling after RAs are completed on Dunn Field and by groundwater sampling performed during LTM and compliance monitoring at the MI and Dunn Field.

The second five-year review identified the following issues regarding implementation of the selected remedy at Dunn Field and groundwater contamination at the MI and at Dunn Field.

- Changes to Dunn Field selected remedy
- Additional groundwater plume delineation at the MI
- Hydraulic connectivity of fluvial and intermediate aquifers
- Source of off-site plume northeast of Dunn Field

The issues did not affect current protectiveness because there was no current exposure to COCs in subsurface soil or groundwater; however, future protectiveness was affected because of the potential for vertical migration of COCs from the fluvial aquifer. Follow-up actions were recommended to increase protectiveness through improvements to the RAs or providing additional information on areas possibly needing RA. All actions have been completed as shown on Table 3.

5.2 ACTIONS TAKEN

The actions taken since the second review are summarized below. Additional information is provided in Section 2.0, Site Chronology and Section 4.0, Remedial Actions.

5.2.1 Site-Wide

- DDMT Restoration Advisory Board (RAB) passed a motion to adjourn in October 2009
- BCT concurred to adjourn in February 2010.
- USEPA submitted the Preliminary Close Out Report for all OUs effective May 2010 and NPL site status was revised to Construction Complete.
- Superfund Property Reuse Evaluation Checklist for Reporting the Sitewide Ready for Anticipated Use was effective May 2010.

5.2.2 Main Installation

- MI Source Area Evaluation to propose compliance well networks and additional soil investigation to assess potential source areas for the identified groundwater plumes completed; approved by USEPA and TDEC.
- MI Source Area Investigation to identify soil contamination impacting shallow groundwater completed; approved by USEPA and TDEC.
- Year Two EBT monthly injections and quarterly performance monitoring in TTAs completed.
- MI IRACR and OPS demonstration completed; approved by USEPA.
- LTM conducted with annual reports approved by USEPA and TDEC; additional wells installed in the intermediate and Memphis aquifers to validate groundwater model results and in the fluvial aquifer to provide information on site hydrogeology and contaminant extent.
- Additional EBT planned to aid progress toward RAOs; new baseline samples collected from injection and monitoring wells in EBT areas, and wells not needed for EBT abandoned.
- Annual LUC inspection reports submitted.

5.2.3 Dunn Field

- Revised PP completed; approved by USEPA and TDEC; no comments received at public meeting.
- Dunn Field ROD Amendment completed; approved by USEPA and TDEC.
- Dunn Field Notice of Land Use Restrictions filed with the Shelby County Registrar.
- Annual LUC inspection reports submitted.

<u>IRA</u>

- IRA system removed and RWs abandoned in July 2010.
- Final operations and closure report submitted; approved by USEPA and TDEC.

<u>Source Areas</u>

- FSVE operations continued; 4,049 pounds of VOCs removed through July 2012; annual reports submitted.

- Fluvial soil confirmation samples met RAOs; FSVE shutdown July 2012.
- Loess/Groundwater RAWP completed; approved by USEPA and TDEC.
- TSVE operations conducted May-December 2008; 12,500 pounds of VOCs removed; soil confirmation samples met RAOs.
- Additional ET&D activities completed at TA-1 and TA-3; 7,400 CY removed for Off-site disposal; soil confirmation samples met RAOs.
- Dunn Field Source Areas IRACR approved by USEPA in November 2009 and OPS demonstration approved in October 2009.

Off Depot

- Off Depot RD completed; approved by USEPA and TDEC.
- Off Depot Groundwater RAWP completed; approved by USEPA and TDEC.
- AS/SVE system construction completed and operations begun in December 2009.
- Off Depot Groundwater IRACR approved by USEPA in August 2011 and TDEC in November 2011.
- AS/SVE operations continued; 79 pounds of VOCs removed through September 2012; annual reports submitted.

Dunn Field LTM

- Dunn Field LTM implemented; annual reports submitted.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 REVIEW COMPONENTS

The DDMT Third Five-Year Review was led by Tom Holmes, Project Manager for HDR, the RA contractor at DDMT. The review process was discussed with USEPA and TDEC in November 2011 during preparation of the *Site Management Plan, Rev. 0* (HDR, 2011e).

This review included the following components:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Interviews;
- Report Development and Review.

The report is scheduled to be completed 22 January 2013.

6.2 COMMUNITY INVOLVEMENT

The Memphis Depot has conducted public participation activities throughout the site cleanup process. Activities include RAB meetings from 1994 to 2009, Community Information Sessions and public meetings, a regular newsletter, and the establishment of information repositories.

The DDMT RAB voted to adjourn on 29 October 2009 due to the final selection and implementation of all remedial actions. The information repository was transferred to the TDEC Memphis field office on 20 June 2012 due to closure of the project office at the Memphis Depot Business Park. The community information line remains open to receive comments and inquiries from the public.

The community was initially informed of the Five Year Review through an announcement in the Winter 2011/2012 EnviroNews, the annual newsletter prepared for the community. EnviroNews is mailed to approximately 4,000 addresses, primarily in the area surrounding DDMT.

A notification letter for the Five Year Review was sent to former DDMT RAB members and local elected officials on 29 March 2012. Notice for the review was also published in the Memphis *Commercial*

Appeal on 11 April 2012; the advertisement was included in the Memphis metro zone distribution, which includes all of the City of Memphis. The notice and letter invited recipients to call the Community Involvement Line (901-774-3683) to comment on the protectiveness of the selected remedy or the remedial actions at DDMT; the comment period ran through 31 May 2012. Copies of the advertisement and the letter are included in Appendix A.

One comment was received in response to the notification letter. A city council member sent an email on 12 April asking if any meeting were scheduled regarding the former Memphis Depot restoration program. HDR replied that no meetings were planned but information on restoration was available through the information repository. One comment was received following publication of the notice. A Memphis resident left a message on the Community Involvement Line; when contacted, she made suggestions on proposed land use and establishment of an employment apprenticeship program. She was informed that the property was being transferred for re-use and was added to the EnviroNews mailing list at her request.

The community will be notified when the report is final and copies will be placed in the information repository.

6.3 DOCUMENT REVIEW

This Five Year Review consisted of a review of relevant documents including decision documents and reports completed since the second review:

- MI and Dunn Field RODs and the ROD Amendment;
- IRACRs for the MI, Source Areas and Off Depot;
- Current annual operations reports for the FSVE and AS/SVE systems; and
- Current annual LTM reports for the MI and Dunn Field.

A complete list of references is provided in Section 12.

6.4 DATA REVIEW

Success of the RAs at DDMT is determined through comparison of soil and groundwater analytical results with RGs established in the RODs. The RGs were established through risk assessments to be protective of human health and the environment. Analytical results presented in the RA reports and the annual operations and monitoring reports have been qualified relative to the project data quality objectives. The data quality evaluation (DQE) process involved assessment of field and laboratory

procedures, including independent data validation per the project guidelines. The DQE consisted of review of laboratory Quality Control (QC) data and field QC parameters, and flagging of the data as usable, usable with qualification, or unusable in accordance with the DQE standard operating procedures using the criteria for each analytical method performed.

The analytical results for confirmation samples are presented in the Disposal Sites Remedial Action Completion Report (RACR); in IRACRs for the MI, Source Areas and Off Depot Groundwater; and in annual reports for FSVE and AS/SVE operations and for LTM at the MI and Dunn Field. In all reports, the soil and groundwater results are compared to the RGs; vapor results for FSVE and AS/SVE are only used to evaluate system operations and compliance with the operating permit.

Soil confirmation samples were determined to meet the RAOs in each action. Attainment of soil clean-up levels for the disposal sites excavations was based on comparison of individual confirmation samples directly to the RGs. Attainment of clean-up levels for the TSVE, FSVE and Source Areas excavations was based on both individual results and calculated average concentrations for each TA. In each treatment or excavation area, the soil cleanup standard was met if the average concentration for each analyte was below the RG, and no individual analyte in a sample exceeded the RG by a factor of 10 or more. For samples that were non-detect, the average was calculated using one-half the sample quantitation limit or reporting limit.

Groundwater samples collected at the MI for performance monitoring and LTM are compared directly to the MCLs. MI EBT injections did not reduce concentrations of primary CVOCs, PCE and TCE, below MCLs; however, concentrations were reduced more than 90 percent in injection wells and over 80 percent in monitoring wells at locations with baseline concentrations above 100 µg/L. EBT injections were halted based on the reduced concentrations in the TAs, the lack of significant contaminant concentrations in soil source areas, decrease in CVOC concentrations outside the EBT areas and relatively stable CVOC plumes. Groundwater monitoring since completion of EBT in February 2009 has demonstrated rebound in concentrations of PCE, TCE and CT in the EBT areas, and PCE concentrations above the MCL in the IAQ. Additional EBT injections are planned to begin in the second half of 2012.

As discussed in Section 4.1.3, MCLs may not be adequately protective of a potentially exposed receptor when multiple CVOCs are present. Upon completion of RA, the individual concentration of each COC will be below the MCL and combined risk will not exceed a cumulative upper-bound target of 1 $X10^{-4}$ and HI of 1.0 within the plumes.

The RAs at Dunn Field in combination with natural attenuation processes are expected to reduce groundwater concentrations to MCLs within a reasonable period of time. The treatment goal for the AS/SVE system is to reduce groundwater concentrations downgradient of AS/SVE barrier below 50 µg/L for individual CVOCs. Based on that goal, individual CVOC concentrations in wells on Dunn Field are not to exceed 50 µg/L after RA unless the groundwater will pass through the AS/SVE system. The AS/SVE system will continue to operate until the influent (upgradient) concentrations from the Dunn Field plume do not exceed 50 µg/L for individual CVOCs for twelve months. In the latest Dunn Field LTM results from April 2012, only one well within or downgradient to the Source Areas on Dunn Field had an individual CVOC concentration above the treatment goal. With the exception of wells in the northern part of Dunn Field, known to be impacted by a CVOC plume from an off-site source, no wells on Dunn Field had concentrations above MCLs; several wells downgradient of the Source Areas exceeded MCLs, although concentrations continue to decrease.

6.5 SITE INSPECTION

Inspections were not conducted specifically for this Five-Year Review. Weekly inspections have been made at Dunn Field as part of RA actions since October 2006. Regular mowing of Dunn Field and maintenance of the perimeter fence are performed to maintain site appearance and security. Site photographs were taken in November 2012 to document current conditions; the photographs are provided with a location key in Appendix B.

Annual inspections have been conducted at the MI since approval of the LUCIP in the MI RD in August 2004. The inspections are performed to:

- Verify that boundary fence surrounding golf course area in FU2 remains intact.
- Verify that no residential housing/development or child daycare activities are occurring at the site (except Parcels 1 and 2 of FU6).
- Verify that no groundwater wells have been installed at the site (except for monitoring and injection wells that were done as part of the remedy) and that no production/consumptive use of groundwater is occurring.

The only deficiency noted was damage to a fence post and section of fence in 2005; the fence was repaired prior to the next inspection.

Annual inspections have been conducted at Dunn Field since approval of the LUCIP in the Off Depot RD in October 2008. The inspections are performed to:

- Verify that no residential housing/development or child daycare activities are occurring in the Disposal Area/western portion of Dunn Field.
- Verify that no groundwater wells have been installed at the site (except for wells that were done as part of the remedy) and that no production/consumptive use of groundwater is occurring.

No deficiencies have been identified.

6.6 INTERVIEWS

Interviews were not conducted for this Five-Year Review.

7.0 TECHNICAL ASSESSMENT

7.1 IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review indicates that the selected remedies are functioning as intended. All selected remedies have been implemented and the NPL site status was changed to Construction Complete in 2010. The RA reports for all remedies have been approved by USEPA and TDEC, and the OPS demonstrations for the MI and Source Areas on Dunn Field have been approved by USEPA.

Opportunities for optimization of system operations and LTM are considered during evaluation of system operating parameters and monitoring results, and recommendations are presented in quarterly and annual reports. Operational and monitoring changes since the last review have included:

- Installing additional FSVE wells during confirmation sampling and incorporating the wells into system operations
- Adjusting AS/SVE operations to address plume diversion around the treatment system and reduced CVOC concentrations
- Changes to monitoring frequency at LTM wells based on trends
- Increased use of passive diffusion bags for groundwater monitoring
- Updated baseline sampling performed in EBT areas and additional sodium lactate injections over a wider area begun on the Main Installation.

The selected remedies, as amended, are listed below with their status.

Main Installation

Remedy	*Deed restrictions and site controls, including prevention of residential land use on MI (except at existing Housing Area); Daycare restrictions; production/consumptive use groundwater controls for the fluvial aquifer and for drilling into aquifers below the fluvial aquifer on the MI; and elimination of casual access by off-site residents through maintenance of a boundary fence surrounding FU2.*
Status	Notice of land use restrictions was recorded; restrictions were incorporated in deeds; annual inspections have not identified violations.
Remedy	*Enhanced bioremediation of CVOCs in the most contaminated part of the groundwater plume.*
Status	EBT implemented from 2006 to 2009 and then halted based on reduced concentrations in treatment areas, lack of significant contaminant concentrations in soil source areas, decreased CVOC concentrations outside the treatment areas, and relatively stable CVOC plumes. Rebound in groundwater concentrations since completion of EBT and increased concentrations in some IAQ wells; additional EBT injections began in November 2012.

Remedy	*Long-term groundwater monitoring to document changes in plume concentrations and to detect potential plume migration to off-site areas or into deeper aquifers.*
Status	LTM is being performed with 112 wells monitored on a semiannual to biennial basis; additional wells have been installed to confirm groundwater model results and to evaluate contaminant migration. LTM will be used to evaluate success of additional EBT and overall progress in reducing concentrations below MCLs.

Dunn Field

Remedy	*ET&D of soil and material contained within disposal sites based upon results from a pre-design investigation.*
Status	ET&D of disposal sites completed in March 2006; soil confirmation samples met the RGs.
Remedy	*SVE to reduce VOC concentrations in subsurface soils to levels that are protective of the intended land use and groundwater with conventional SVE in the fluvial soils from roughly 30 to 70 feet bgs and TSVE (in situ thermal desorption) in the loess at 0 to 30 feet.*
Status	TSVE was completed in December 2008 and removed 12,500 pounds of VOCs; FSVE has operated since July 2007 and removed 4,049 pounds of VOCs through July 2012; soil confirmation samples met the RGs for both systems; fluvial SVE was shutdown in July 2012.
Remedy	*Injection of ZVI within Dunn Field to treat CVOCs in the most contaminated part of the groundwater plume and reduce individual concentrations to <50 µg/L for CVOCs.*
Status	ZVI injections not required because groundwater objectives were achieved through subsurface soil remedies.
Remedy	*AS/SVE to reduce CVOCs within the off-site areas of the groundwater plume to <50 µg/L for individual CVOCs.*
Status	AS/SVE has operated since December 2009 and removed 79 pounds of VOCs through September 2012; treatment goal was met in the first year of operations and only one upgradient well exceeded the concentration required for system shutdown in April 2012.
Remedy	*MNA and LTM of groundwater to document changes in plume concentrations, to detect potential plume migration to off-site areas or into deeper aquifers, and to track progress toward RGs.*
Status	LTM is being performed with 87 wells monitored on a semiannual to biennial basis. LTM results have demonstrated the success of remedial actions and absence of a continuing source in groundwater. LTM will be used to evaluate rebound following shutdown of the FSVE in July 2012, to document conditions for shutdown of the AS/SVE system and for overall progress in reducing concentrations below target concentrations.
Remedy	*Implementation of LUCs, which consist of the following ICs: deed and/or lease restrictions; Notice of Land Use Restrictions; City of Memphis/Shelby County zoning restrictions and the MSCHD groundwater well restrictions.*
Status	Notice of land use restrictions was recorded; restrictions will be incorporated in deed for final parcel; annual inspections have not identified violations.

7.2 ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOS) USED AT THE TIME OF THE REMEDY SELECTION STILL VALID?

The applicable or relevant and appropriate requirements (ARARs) identified in the MI and Dunn Field RODs and the Dunn Field ROD Amendment are listed on Table 4, which includes the applicable requirements and citation for each established ARAR. An online search of the citations was made to review pertinent updates of laws, regulations, or guidance. There have been no significant changes in these ARARs and no new standards affecting the protectiveness of the remedy.

Drinking water standards for VOCs, including some of the DDMT COCs, are currently under review by USEPA. In February 2011, EPA announced that it plans to develop one national primary drinking water regulation (NPDWR) covering up to 16 carcinogenic VOCs (Regulatory Information Number (RIN) 2040-AF29). PCE and TCE, which EPA determined were candidates for regulatory revision under the second six-year review of the existing NPDWRs, will be included in the VOC drinking water standard. The group may include up to six additional regulated VOCs and up to eight unregulated VOCs from the EPA's Contaminant Candidate List 3. A notice of proposed rule making is scheduled for October 2013.

There have been no changes in the physical condition of the site or the current and planned land use that would change the exposure assumptions and no new exposure pathways have been identified.

There have been groundwater contaminants detected on the MI in addition to PCE and TCE, the COCs identified in the MI ROD. Concentrations of cDCE and VC have increased in groundwater within and downgradient of the TAs due to reductive dechlorination resulting from EBT. CT and CF are also present, primarily in the TTA-2 area in the southeast section of the MI. MCLs are the RGs for all identified groundwater contaminants on the MI, in accordance with the ROD.

Several CVOCs were identified in the Dunn Field ROD as COCs for groundwater at Dunn Field. An additional CVOC, VC, has been detected in well MW-159 located in close proximity to the AS/SVE system. MW-159 has the highest concentration of CVOCs on Dunn Field, including TCE at 275 µg/L in April 2012. VC is not considered a COC at present due to its temporary presence in only one well, apparently as a result of treatment.

USEPA has published new risk assessment guidance documents since the Second Five-Year Review was prepared, as follows:

- *Framework for Determining a Mutagenic Mode of Action for Carcinogenicity: Using EPA's 2005 Cancer Guidelines and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, External Peer Review Draft (USEPA, 2005a & 2005b)*
- *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual - Part F, Supplemental Guidance for Inhalation Risk Assessment (USEPA, 2009b)*
- *Handbook for Implementing the Supplemental Cancer Guidance at Waste and Cleanup Sites - USEPA (on-line)*

These guidance documents include changes to EPA's risk assessment methodology as it relates to evaluation of inhalation risks and effects of chemicals having a mutagenic mode of action (MMOA), e.g., VC. A vapor intrusion study was performed in September 2009 during the Off Depot RA; the results demonstrated the loess provides a good barrier to vertical migration of soil vapor preventing vapor intrusion problems above the groundwater plume in the Off Depot area. The study was presented in the Off Depot IRACR and approved by USEPA and TDEC. The MMOA revisions do not apply, as there are no MMOA constituents included in the Dunn Field COCs.

Several changes to toxicity factors for COCs, which may affect protectiveness, have been identified:

- EPA issued a toxicity reassessment on 28 September 2011 changing TCE from a "possible human carcinogen" to a "known human carcinogen". TCE has been determined to be carcinogenic through ingestion, inhalation, and dermal exposure routes. A non-carcinogenic reference dose (RfD) of 5.0E-04 mg/kg-day and reference concentration (RfC) of 2 micrograms per cubic meter ($\mu g/m^3$) were derived. The carcinogenic assessment includes an oral slope factor of 4.6E-02 mg/kg-day and inhalation unit risk is 4.1E-06 $\mu g/m^3$.
- PCE criteria, revised as of 10 February 2012, include a current oral RfD of 6E-03 mg/kg-day. An inhalation RfC has been established for the first time, at 40 $\mu g/m^3$. A carcinogenic assessment is also provided for the first time, with an oral slope factor of 2.1E-03 mg/kg-day. The inhalation unit risk is 2.6E-07 $\mu g/m^3$ up to 60 ppm, above which level this toxicity criterion should not be used.
- CT criteria, revised as of 3 March 2010, include an oral RfD of 3.9E-03 mg/kg-day, revised from the previous 7.0E-04 mg/kg-day. The RfC is 100 $\mu g/m^3$; no RfC was available previously. The current oral slope factor, revised in 2008 is7.0E-02 mg/kg-day, which was previously 1.3E-01 mg/kg-day.

- TeCA criteria was updated as of 30 September 2010 from having no RfD previously to a RfD of 0.02 mg/kg-day for non-carcinogenic effects and an oral slope factor of 2E-01 mg/kg-day, respectively. The carcinogenicity was reassessed using EPA's Benchmark Dose Technical Guidance; the derived value remained the same.
- cDCE had no RfD previously, a RfD of 2E-03 mg/kg-day was added on 9/30/10. There is no RfC, oral or inhalation carcinogenic slope factor available.

7.3 HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

There is no other new information that calls into question the protectiveness of the remedy.

7.4 TECHNICAL ASSESSMENT SUMMARY

According to the data reviewed and the site inspections conducted as part of the RAs, the remedies are functioning as intended by the RODs. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. There have been no changes to the ARARs cited in the ROD that would call into question the protectiveness of the remedy.

Groundwater contaminants, in addition to the COCs identified in the MI ROD (PCE and TCE), have been detected persistently on the MI. Concentrations of cDCE and VC have increased due to reductive dechlorination resulting from EBT. CT and CF are present in the TTA-2 area. Some of these contaminants were present at lower levels when the ROD was prepared and all were detected in baseline sampling for the MI RD. Additional wells installed during RA have improved knowledge of site hydrogeology and the contaminant plumes. The contaminants are amenable to EBT and MCLs are the RGs; therefore, their presence does not call into question the protectiveness of the remedy.

There have been changes to the standardized risk assessment methodology; based on the COCs and the studies completed to date, these changes do not call into question the protectiveness of the remedy.

Changes in toxicity factors for the contaminants of concern were identified. The RGs for groundwater on the MI are the MCLs, which have not changed. Therefore, the revised toxicity information does not affect the protectiveness of the selected remedy for the MI.

The RGs for groundwater at Dunn Field ROD incorporate a comparison to both MCLs and calculated, site-specific, risk-based target levels, with adjustments made to reflect site conditions. As noted

previously, the Dunn Field ROD states the individual concentration of each groundwater COC will be below the MCL and combined risk will not exceed a cumulative upper-bound target of $1X10^{-4}$ and HI of 1.0 within the plumes. In order to evaluate the impact of the revised toxicity factors, risk-based concentrations were calculated for each COC based on carcinogenic risks via the oral route of exposure, as shown in Appendix G, Exhibit G-5: 'Hypothetical Scenario for a Change in Toxicity' from *Comprehensive Five Year Review Guidance* (USEPA, 2001), reflecting a $1X10^{-4}$ carcinogenic risk level. The results shown on Table 5 can be used to evaluate progress toward the groundwater RAO. If all groundwater COCs with carcinogenic risks were each present at 10% of the 'Revised 10^{-4} Risk Screening Level' shown on the table, the combined risk would be less than 1 $X10^{-4}$. Based on these results, the MCLs, which are generally less than 10% of revised screening level, will be the primary determinant in meeting the RAO. TeCA is the only COC without an MCL and thus could meet the RAO at a concentration above the RG in the Dunn Field ROD, depending on the concentrations of other COCs at each location. Based on this review, the revised toxicity factors do not affect the protectiveness of the selected remedy for Dunn Field.

Rebound in CVOC concentrations in groundwater has been observed through MI LTM since the last EBT injection in 2009 and concentrations have increased in some IAQ wells. The overall plume stability and the CVOC rebound in TAs on the MI call into question the schedule stated in the second five-year review, which estimated RAOs would be achieved in 2016, ten years after the start of EBT. Additional EBT is to commence in the second half of 2012. The EBT results presented in the MI IRACR indicate CVOC concentrations can be reduced to MCLs over time.

Significant progress has been made toward achieving groundwater RAOs at Dunn Field, and with reduced costs since the ZVI injections were not necessary. The FSVE system has met soil RAOs and was shutdown as planned after five years of operation; the AS/SVE system is in the third year of operations and is close to meeting requirements for shutdown. AS/SVE performance objectives are being met and shutdown is dependent on continued reduction in upgradient concentrations resulting from the Source Areas RA. Dunn Field LTM results will be evaluated for rebound in CVOC concentrations following shutdown of the FSVE in July 2012. Rebound in concentrations would impact the schedule for achieving groundwater RAOs at Dunn Field in 2018, as projected in the second Five-Year Review. Vadose zone leaching model results, presented in the FSVE Year Four report (HDR, 2011b), indicated the maximum groundwater impact due to leachate from the loess may occur up to four years after FSVE shutdown, which would be 2016.

8.0 ISSUES

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Rebound in groundwater concentrations of CVOCs on the MI in TAs and concentrations above MCLs in IAQ wells	N	N
Time required to achieve RAOs on the MI	N	N

All selected remedies have been implemented at DDMT. The identified issues address groundwater contamination in the fluvial and intermediate aquifers and progress toward RAOs. Water from the fluvial and intermediate aquifers is not used as a source of drinking water but contaminant migration could impact the MAQ which is the primary drinking water source for the City of Memphis. The issues do not affect current protectiveness because there is no current exposure to COCs in groundwater. The issues do not affect future protectiveness because the remedies were shown to be effective in the IRACRs.

9.0 RECOMMEDATIONS AND FOLLOW-UP ACTIONS

Issues	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Rebound in groundwater concentrations of CVOCs on the MI in TAs and concentrations above MCLs in IAQ wells	Restart EBT	ODB	USEPA/ TDEC	11/30/12	N	N
Time required to achieve RAOs on the MI	Re-evaluate in annual report following one year of additional EBT	ODB	USEPA/ TDEC	3/11/14	N	N

10.0 PROTECTIVENESS STATEMENT

All selected remedies have been implemented at DDMT. Attainment of RGs has been documented in the subsurface soils at Dunn Field. Attainment of cleanup goals in groundwater will be achieved through active treatment and natural attenuation. In the interim, exposure pathways that could result in unacceptable risks are being controlled and ICs are preventing exposure to, or the ingestion of, COCs. Long-term protectiveness will be verified by groundwater sampling performed during LTM and compliance monitoring at the MI and Dunn Field.

The remedy at Dunn Field (OU 1) is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The remedy at the MI (OUs 2, 3 and 4) is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Because the RAs at all OUs for DDMT are protective, the site is protective of human health and the environment.

11.0 NEXT REVIEW

The next five-year review for DDMT is required by January 2018, or five years from the date this review is approved by USEPA, whichever is sooner. The due date will remain the same for subsequent five-year reviews.

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TABLES

TABLE 1
PROPERTY TRANSFER STATUS
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

FOST No.	Area	Date FOSTsigned	Acres	Type of Conveyance	Type of Transfer (Transferee)	Date of Transfer/Deed
1	MI	23-Feb-01	6.52	PBC	Deed (Alpha Omega Veterans)	18-Sep-01
2	MI	27-Sep-01	4.67	PBC	Deed (Memphis Police Department)	6-Feb-02
			13.36	EDC	Deed (DRC)	6-May-02
3	MI	1-Jul-04	302.48	EDC	Deed (DRC)	14-Apr-06
			46.74	PBC	Letter of Assignment (DOI/NPS)	29-Sep-05
4	DF	4-Mar-05	1.57	PBC	Deed (Memphis)	2-Sep-05
			39.35	CPS	Deed (Dunn Field Business Park, LLC)	24-Oct-07
5	DF	12-Jul-10	24.5	CPS	Not transferred	
6	MI	2-Aug-10	193.0	EDC	Deed (DRC)	30-Mar-11

CPS: Competitive Public Sale
DF: Dunn Field
DOI/NPS: Department of Interior/National Parks Service
DRC: Depot Redevelopment Corporation
EDC: Economic Development Conveyance
MI: Main Installation
PBC: Public Benefit Conveyance

TABLE 2
DUNN FIELD REMEDIATION GOALS
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

	Remedial Goal Objectives				
	Site-Specific Soil Screening Levels to be Protective		Protective Soil Vapor Concentration		Groundwater Target Concentrations at 10-4 Target Risk Levels and Target HI=1.0 (µg/L)
Parameter	Loess Specific Values (mg/kg)	Fluvial Deposit Specific Values (mg/kg)	Loess Specific Values (ppbv)	Fluvial Deposit Specific Values (ppbv)	
Carbon Tetrachloride	0.2150	0.1086	28.14	14.22	3
Chloroform	0.9170	0.486	61.57	32.63	12
Dichloroethane, 1,2-	0.0329	0.0189	1.12	0.64	—
Dichloroethene, 1,1-	0.1500	0.0764	57	29.03	7/340
Dichloroethene, cis-1,2-	0.7550	0.404	73.86	39.52	35
Dichloroethene, trans-1,2-	1.5200	0.791	256.53	133.5	50
Methylene Chloride	0.0305	0.0169	5.14	2.85	—
Tetrachloroethane, 1,1,2,2-	0.0112	0.0066	0.03	0.55	2.2
Tetrachloroethene	0.1806	0.092	15.18	0.99	2.5
Trichloroethane, 1,1,2	0.0627	0.0355	0.84	2.03	1.9
Trichloroethene	0.1820	0.0932	10.56	2.06	5
Vinyl Chloride	0.0294	0.015	28.94	14.77	—

Notes:
mg/kg: milligrams per kilogram
µg/L: micrograms per liter
ppbv: parts per billion per volume
MCL: maximum contaminant level
HI: hazard index
—: Not available for groundwater cleanup goals because of low number of detections or detected values consistently less than MCLs.

TABLE 3
FOLLOW-UP ACTIONS FROM SECOND FIVE-YEAR REVIEW
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Issues	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)		Completion Date	Document
					Current	Future		
Changes to Dunn Field selected remedy	1) Complete Public Comment period for Proposed Plan	DLA	USEPA/ TDEC	10/29/2008	N	Y	11/25/2008	*Dunn Field Record of Decision Amendment, Rev. 3* (e^2M, 2009a)
	2) Complete ROD Amendment			4/27/2009			3/19/2009	
Additional groundwater plumes delineation at MI	Determine treatment requirements	DLA	USEPA/ TDEC	6/30/2008	N	Y	2/20/2009	*Main Installation Source Area Investigation Report, Rev. 0* (e^2M, 2009d)
Hydraulic connectivity of Fluvial and Intermediate aquifers	1) Intermediate Aquifer Study Report	DLA	USEPA/ TDEC	1/11/2008	N	Y	4/14/2008	*Results of the Memphis Depot – Dunn Field Intermediate Aquifer Investigation* (CH2M HILL, 2008b)
	2) Incorporate results in Final Off Depot Groundwater RD			5/17/2008			9/10/2008	*Memphis Depot Dunn Field Off Depot Groundwater Final Remedial Design, Rev. 1* (CH2M HILL 2008a)
Source of offsite plume NE of Dunn Field	Installation of offsite monitoring wells	TDEC	USEPA	6/30/2008	N	Y	9/26/2007	*Site Investigation Narrative Report (PASI) Cintas Site* (TDEC, 2007)

Notes:
DLA: Defense Logistics Agency
MI: Main Installation
RD: Remedial Design
ROD: Record of Decision
TDEC: Tennessee Department of Environmental Conservation
USEPA: United State Environmental Protection Agency

TABLE 4
ARARS AND TBC GUIDANCE
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Action/medium	Requirements	Prerequisite	Citation(s)
Chemical-Specific			
Restoration of groundwater to its designated uses(s)	May not exceed MCLS and MCLGs above zero established under the Safe Drinking Water Act for public water systems	Presence of contaminants in ground water of the State designated as *General Use* as defined in TDEC 1200-4-3-.07(4)(b) **- relevant and appropriate**	TDEC 1200-5-1-.06 40 CFR 141 *et seq.*
	Except for naturally occurring levels, shall not contain constituents that exceed those levels specified in Rules 1200-04-03-.03(1)j and k; and		TDEC 1200-4-3-.08(2)(a)
	Except for naturally occurring levels, shall contain no other constituents at levels and conditions which pose an unreasonable risk to the public health or the environment..		TDEC 1200-4-3-.08(2)(b)
Action-Specific	***General Construction standards - all land-disturbing activities (i.e., excavation, trenching, clearing, etc.)***		
Activities causing fugitive dust emissions	Shall take reasonable precautions to prevent particulate matter from becoming airborne; reasonable precautions shall include, but are not limited to, the following:	Fugitive emissions from demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land -**applicable**	TDEC 1200-3-8-.01(1)
	• use, where possible, of water or chemicals for control of dust; and		TDEC 1200-3-8-.01(1)(a)
	• application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts.		TDEC 1200-3-8-.01(1)(b)
	Shall not cause or allow fugitive dust to be emitted in such a manner as to exceed 5 minute/hour or 20 minute/day beyond property boundary lines on which emission originates.		TDEC 1200-3-8-.01(2)
Activities causing storm water runoff (e.g., clearing, grading, excavation)	Implement good construction management techniques (including sediment and erosion controls, vegetative controls, and structural controls) in accordance with the substantive requirements of General Permit No. TNR10-0000 Appendix F, (see updated requirements at http://www.state.tn.us/environment/wpc/stormh2o/TNR100000.pdf) to ensure that storm water discharge	Dewatering or storm water runoff discharges from land disturbed by construction activity - disturbance of ≥5 acres total -**applicable**; <5 acres - **relevant and appropriate**	TCA 69-3-108(j) TDEC 1200-4-10-.03(2)

TABLE 4
ARARS AND TBC GUIDANCE
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Action/medium	Requirements	Prerequisite	Citation(s)
	• does not violate water quality criteria as stated in TDEC 1200-4-3-.03, including but not limited to prevention of discharges that causes a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of waters of the state for any of the designated uses for that water body by TDEC 1200-4-4;	Storm water discharges from construction activities **– TBC**	*General Permit No. TNR10-0000* Part III D.2.a
	• does not contain distinctly visible floating scum, oil, or other matter;		*General Permit No. TNR10-0000* Part III D.2.b
	• does not cause an objectionable color contrast in the receiving stream; and		*General Permit No. TNR10-0000* Part III D.2.c
	• results in no materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.		*General Permit No. TNR10-0000* Part III D.2.d
Action-Specific	***Underground injection well construction and operation***		
Injection of nutrients (or other treatments) into groundwater	Wells shall be designed, constructed, and operated in such a manner that does not present a hazard to existing or future use of groundwater and may not cause a violation of either drinking water or water quality standards.	Class V injection well for innovative or experimental technologies – **relevant and appropriate**	TDEC 1200-4-6-.14(1)(b)
Action-Specific	***Groundwater Monitoring well installation and closure***		
Installation and maintenance of groundwater monitoring well(s) and soil borings	All wells shall be constructed in a manner that will guard against contamination of the groundwater aquifers underlying Shelby County.	Construction, modification, and repair of groundwater monitoring well(s) and boreholes - **relevant and appropriate**	*Rules and Regulations of Wells* in Shelby County Section 6 and Section 7 *et. seq.*
Closure of groundwater monitoring well(s)	Well shall be completely filled and sealed in such a way as to prevent vertical movement of water from one aquifer to another.	Permanent plugging and abandonment of a well - **relevant and appropriate**	*Rules and Regulations of Wells* in Shelby County Section 9 *et. seq.*
Action-Specific	***SVE treatment system -*** *air emissions control*		
Emissions from SVE treatment system	Discharge of air contaminants must be in accordance with the appropriate provisions of Rules of the TDEC Chapter 1200-3 et seq., any applicable measures of control strategy and provisions of the Tennessee Air Quality Act.	Emissions of air pollutants from new air contaminant sources - **applicable**	TDEC 1200-3-9-.01(1)(d) Memphis Code 16-77

TABLE 4
ARARS AND TBC GUIDANCE
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Action/medium	Requirements	Prerequisite	Citation(s)
Action-Specific	***Waste generation, characterization, segregation, and storage - primary remediation wastes (excavated contaminated soil, disposal pit materials) and secondary wastes (wastewaters, spent treatment media, etc.)***		
Characterization of solid waste	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) -**applicable**	40 CFR 262.11(a) TDEC 1200-1-11-.03(1)(b)(1)
	Must determine if waste is listed as a hazardous waste in subpart D of 40 CFR Part 261; or		40 CFR 262.11(b) TDEC 1200-1-11-.03(1)(b)(2)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.		40 CFR 262.11(c) TDEC 1200-1-11-.03(1)(b)(3)
	Must refer to Parts 261, 264, 265, 266, 267, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous – **applicable**	40 CFR 262.11(d); TDEC 1200-1-11-.03(1)(b)(4)
Characterization of hazardous waste	Must obtain a detailed chemical and physical analysis of a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.	Generation of RCRA-hazardous waste for storage, treatment or disposal - **applicable**	40 CFR 264.13(a)(1) TDEC 1200-1-11-.06(2)(d)(1)
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the waste	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal **– applicable**	40 CFR 268.9(a) TDEC 1200-1-11-.10(1)(i)(1)
	Must determine if the waste is restricted from land disposal under 40 CFR 268 et seq. by testing in accordance with prescribed methods or use of generator knowledge of waste.		40 CFR 268.7 (a) TDEC 1200-1-11-.10(1)(g)(1)(i)
	Must determine each EPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under subpart D of CFR 268.9.		40 CFR 268.9(a) TDEC 1200-1-11-.10(1)(i)(1)

TABLE 4
ARARS AND TBC GUIDANCE
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Action/medium	Requirements	Prerequisite	Citation(s)
Temporary storage of hazardous waste in containers	A generator may accumulate hazardous waste on-site for 90 days or less without a permit or without having interim status, provided that:	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 - **applicable**	40 CFR 262.34(a); TDEC 1200-1-11-.03(4)(e)
	• waste is placed in containers that comply with applicable requirements of subparts I, AA, BB, and CC of 40 CFR part 265; and/or		40 CFR 262.34(a)(1)(i); TDEC 1200-1-11-.03(4)(e)(2)(i)(I)
	• the date upon which each period of accumulation begins is clearly marked and visible for inspection on each container;		40 CFR 262.34(a)(2); TDEC 1200-1-11-.03(4)(e)(2)(ii)
	• container is marked clearly with the words “hazardous waste” or		40 CFR 262.34(a)(3) TDEC 1200-1-11-.03(4)(e)(2)(iii)
	• container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation - **applicable**	40 CFR 262.34(c)(1)(ii) TDEC 1200-1-11-.03(4)(e)(5)(i)(II)
Use and management of hazardous waste in containers	If container is not in good condition (e.g. severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition.	Storage of RCRA hazardous waste in containers – **applicable**	40 CFR 265.171 TDEC 1200-1-11-.05(9)(b)
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired.		40 CFR 265.172 TDEC 1200-1-11-.05(9)(c)
	Keep containers closed during storage, except to add/remove waste.		40 CFR 265.173(a) TDEC 1200-1-11-.05(9)(d)(1)
	Open, handle and store containers in a manner that will not cause containers to rupture or leak.		40 CFR 265.173(b) TDEC 1200-1-11-.05(9)(d)(2)
Storage of hazardous waste in container area	Area must have a containment system designed and operated in accordance with 40 CFR 264.175(b).	Storage of RCRA-hazardous waste in containers with free liquids – **applicable**	40 CFR 264.175(a) TDEC 1200-1-11-.06(9)(f)(1)
	Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or	Storage of RCRA-hazardous waste in containers that do not contain free liquids - **applicable**	40 CFR 264.175(c)(1) TDEC 1200-1-11-.06(9)(f)(3)(i)
	Containers must be elevated or otherwise protected from contact with accumulated liquid.		40 CFR 264.175 (c)(2)

TABLE 4
ARARS AND TBC GUIDANCE
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Action/medium	Requirements	Prerequisite	Citation(s)
Action-Specific Treatment/disposal of wastes - primary and secondary wastes			
Disposal of RCRA-hazardous waste in a land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste - **applicable**	40 CFR 268.40(a) TDEC 1200-1-11-.10(3)(a)(1)
	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or according to the UTSs [specified in 40 CFR 268.48 Table UTS] applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils **- applicable**	40 CFR 268.49(b) TDEC 1200-1-11-.10(3)(j)(2)
Disposal of RCRA wastewaters in an CWA wastewater treatment unit	Are not prohibited, unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40, or are D003 reactive cyanide.	Restricted RCRA characteristic hazardous wastewaters managed in a wastewater treatment system which is NPDES permitted - **applicable**	40 CFR 268.1(c)(4) TDEC 1200-1-11-.10(1)(a)(3)(iv)
Action-Specific	***Transportation***		
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material - **applicable**	49 CFR 171.1(c)
Transportation of hazardous waste off site	Must comply with the generator requirements of 40 CFR 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding and Sect. 262.40, 262.41(a) for record keeping requirements and Sect. 262.12 to obtain EPA ID number.	Off-site transportation of RCRA hazardous waste – **applicable**	40 CFR 262.10(h) TDEC 1200-1-11-.03(1)(a)(8)
	Must comply with the requirements of 40 CFR 263.11– 263.31.	Transportation of hazardous waste within the United States requiring a manifest **– applicable**	40 CFR 263.10(a) TDEC 1200-1-11-.04(1)(a)(1)
	A transporter who meets all applicable requirements of 49 CFR 171–179 and the requirements of 40 CFR 263.11 and 263.31 will be deemed in compliance with 40 CFR 263.		

TABLE 4
ARARS AND TBC GUIDANCE
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Action/medium	Requirements	Prerequisite	Citation(s)
Management of treatability samples (i.e., contaminated soils, wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 263, nor are such samples included in the quantity determinations of 40 CFR 261.5 and 262.34(d) when:	Generation of samples of hazardous waste for purpose of conducting treatability studies as defined in 40 CFR 260.10 -**applicable**	40 CFR 261.4(e)(1) TDEC 1200-1-11-.02(1)(d)(5)(i)
	• The sample is being collected and prepared for transportation by the generator or sample collector;		40 CFR 261.4(e)(1)(i) TDEC 1200-1-11-.02(1)(d)(5)(i)(I)
	• The sample is being accumulated or stored by the generator or sample collector prior to transportation to a laboratory or testing facility; or		40 CFR 261.4(e)(1)(ii) TDEC 1200-1-11-.02(1)(d)(5)(i)(II)
	• The sample is being transported to the laboratory or testing facility for purpose of conducting a treatability study.		40 CFR 261.4(e)(1)(iii) TDEC 1200-1-11-

ARAR = applicable or relevant and appropriate requirement
CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
NPDES = National Pollutant Discharge Elimination System
CWA = Clean Water Act of 1972
DEACT = deactivation
HMR = Hazardous Materials Regulations
HMTA = Hazardous Materials Transportation Act
MCLs = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goals
RCRA = Resource Conservation and Recovery Act of 1976
TBC = to be considered
TCA = Tennessee Code Annotated
TDEC = Tennessee Department of Environment and Conservation
UTS = Universal Treatment Standard

TABLE 5
DUNN FIELD GROUNDWATER SCREENING LEVEL
THIRD FIVE-YEAR REVIEW
Defense Depot Memphis, Tennessee

Groundwater Contaminant of Concern	MCL (µg/L)	USEPA Region 9 Tap water RSL (µg/L)	ROD CSF (mg/kg-day)	Current CSF (mg/kg-day)	Remedial Goal from ROD (µg/L)	Revised 10^{-4} Risk Screening Level[1] (µg/L)
Carbon tetrachloride	5	0.39	1.30E-01	7.00E-02	3	120
Chloroform	80	0.19	6.10E-03	3.10E-02	12	270
1,1-Dichloroethene	7	260	6.00E-01	NC	7/340	NA
cis-1,2-Dichloroethene	70	28	NC	NC	35	NA
trans-1,2-Dichloroethene	100	86	NC	NC	50	NA
1,1,2,2-Tetrachloroethane	NA	0.066	2.00E-01	2.00E-01	2.2	43
Tetrachloroethene	5	9.7	NA	2.10E-03	2.5	4100
1,1,2-Trichloroethane	5	0.24	5.70E-02	5.70E-02	1.9	150
Trichloroethene	5	0.44	1.10E-02	4.60E-02	5	190

Notes:
µg/L: micrograms per liter
CSF: Oral Cancer Slope Factor
MCL: Maximum Contaminant Level
mg/kg: milligrams per kilogram
NC: Noncarcinogenic criteria only
NA: Not Available
RSL: Regional Screening Level, April 2012 (formerly referred to as Preliminary Remedial Goals (PRGs) and cited in Dunn Field ROD)
1) 10-^{4} Risk Calculation:

Conc. in Water (mg/L) = (R*BW*AT)/CSF*IR*EF*ED

= ($1X10^{-4}$*70kg*25550 days)/CSF*2L/day*350 days/year*30 years) = 178.85/CSF*21000

Result adjusted to µg/L

FIGURES

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Figure 1

SITE LOCATION MAP

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 0.6 1.2 1.8 2.4 3 Miles

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

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Figure 2

SITE AERIAL PHOTOGRAPHY

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Projection: NAD 1927 StatePlane Tennessee
Datum : WGS 84
Units: Feet

Photo Date: 2008

0 250 500 1,000 1,500
Feet

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

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Figure 3

MAIN INSTALLATION GROUNDWATER ELEVATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

- Monitoring Well Screened in the Fluvial Aquifer
- Monitoring Well Screened in the Intermediate Aquifer
- Monitoring Well Screened in the Transition Zone
- Potentiometric surface of the Fluvial Aquifer 1-ft. contour
- Potentiometric surface of the Fluvial Aquifer 5-ft. contour
- Potentiometric surface of the Intermediate Aquifer 5-ft. contour
- Clay Elevation Exceeds Groundwater Elevation
- MW-03 100.12 Blue: value used for Fluvial Aquifer groundwater contours
- MW-237 100.15 Black: value used for Intermediate Aquifer groundwater contours
- MW-254 156.83 Green: Memphis Aquifer, not contoured

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 250 500 1,000
Feet

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

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Notes:

1.Water level measurements made 4/16-17/2012.

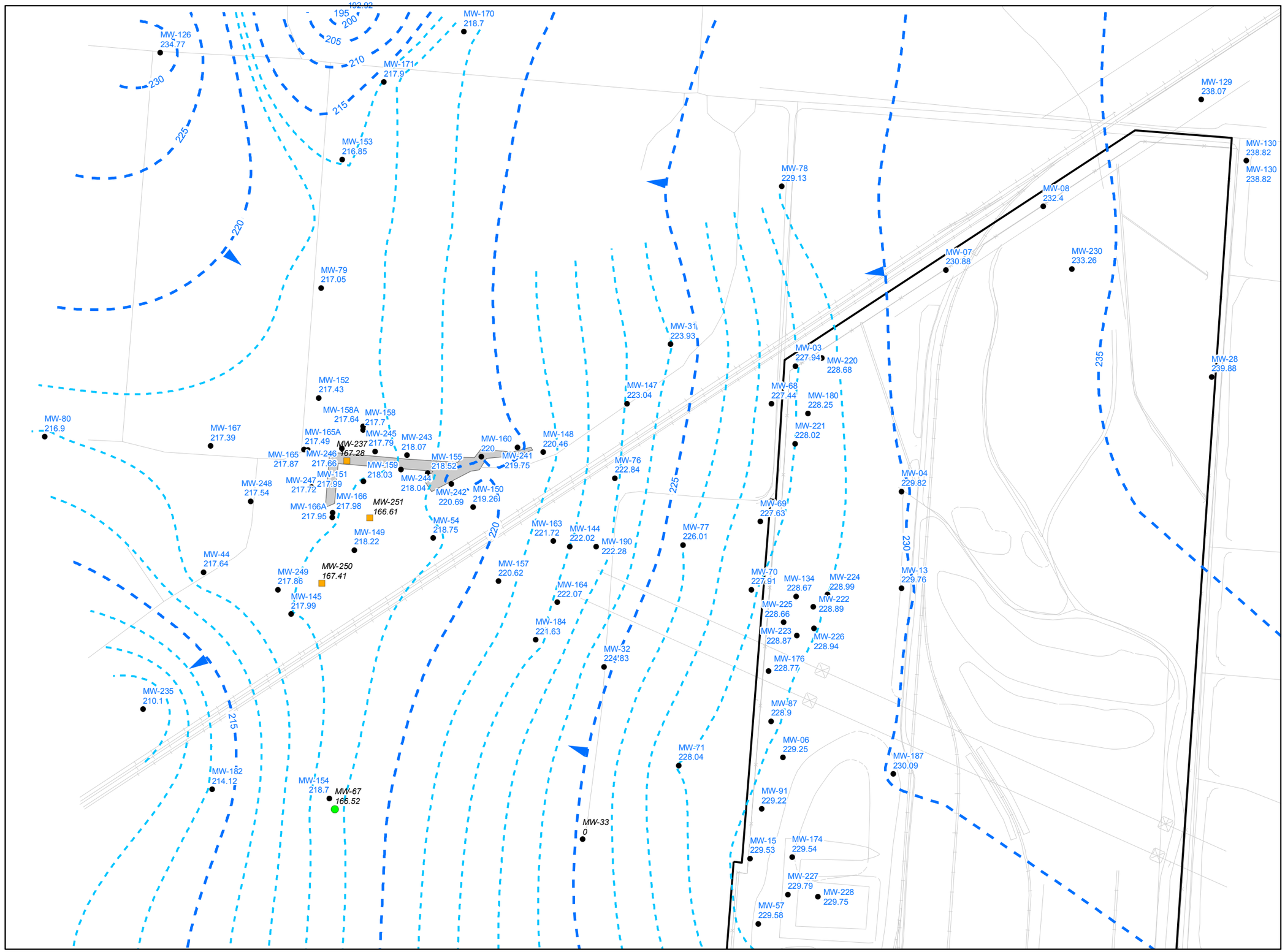

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Figure 4

DUNN FIELD GROUNDWATER ELEVATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

- Monitoring Well Screened in the Fluvial Aquifer
- Monitoring Well Screened in the Intermediate Aquifer
- Monitoring Well Screened in the Transition Zone
- Monitoring Well Screened in the Memphis Aquifer
- Dunn Field Boundary
- Air Sparge Area

MW-03
100.12 Blue non-italics: value used for groundwater contours

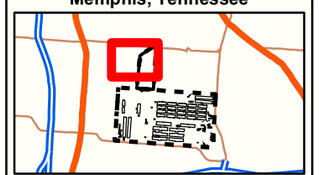
Groundwater Contours

- Potentiometric surface of the Fluvial Aquifer 1-ft. contour
- Potentiometric surface of the Fluvial Aquifer 5-ft. contour
- Groundwater Flow Direction

0 100 200 300

Feet

Installation Location
Memphis, Tennessee



Date: June 2012
Edition: Rev 0

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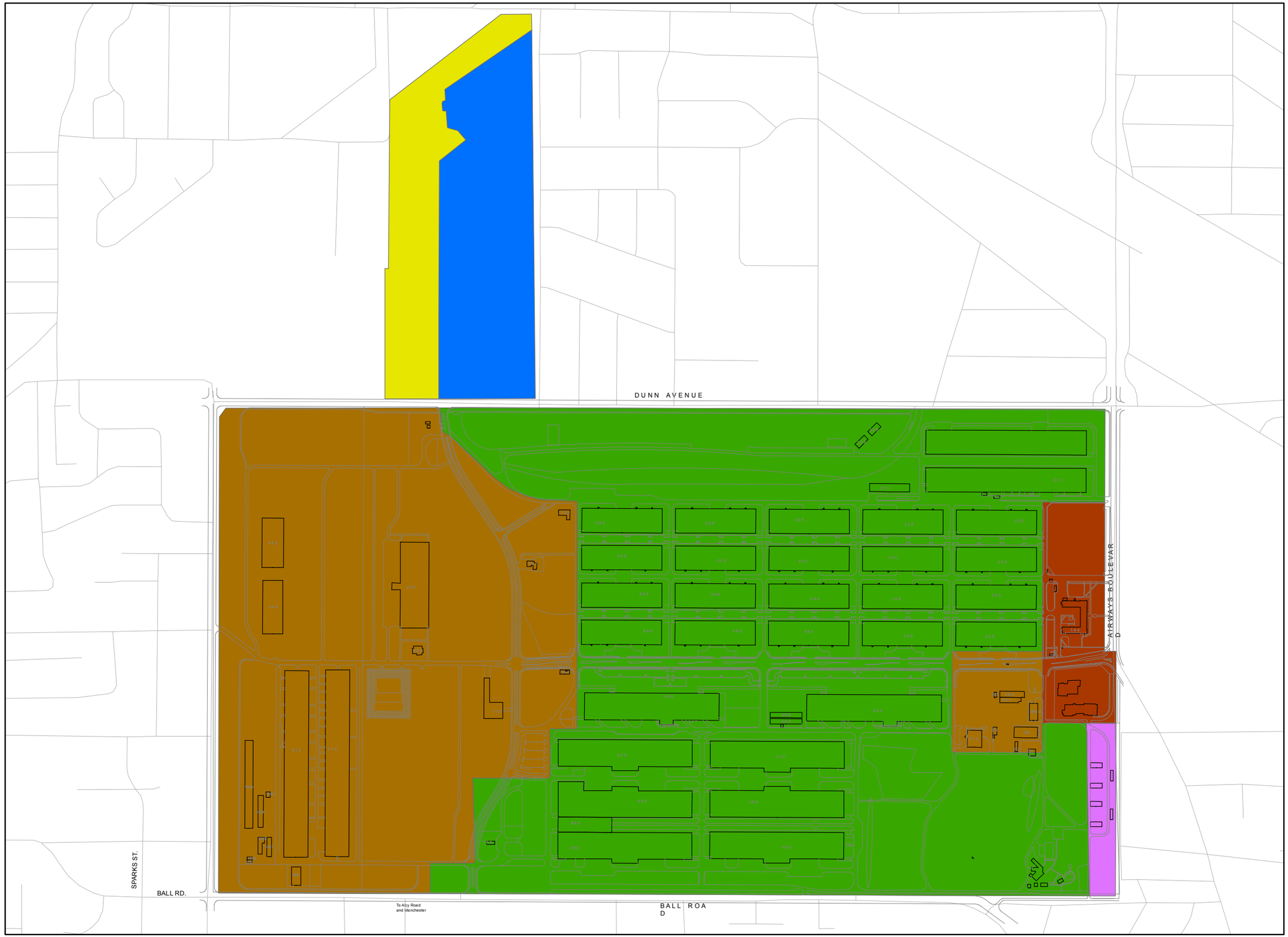

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Figure 5

FINDING OF SUITABILITY TO TRANSFER MAP

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

FOST
Fost Number

- FOST 1 *signed 02/23/01, deeds signed 02/06/02 and 05/06/02.*
- FOST 2 *signed 9/27/01, deed signed 9/18/01*
- FOST 3 *signed 07/01/04, deeds signed 04/04/05, 08/18/06 and 10/12/06.*
- FOST 4 *signed 03/04/05, deed signed 10/17/07.*
- FOST 5 *signed 7/12/10; property not transferred.*
- FOST 6 *signed 8/3/10; deed signed 3/30/11.*

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 250 500 1,000

Scale in Feet

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

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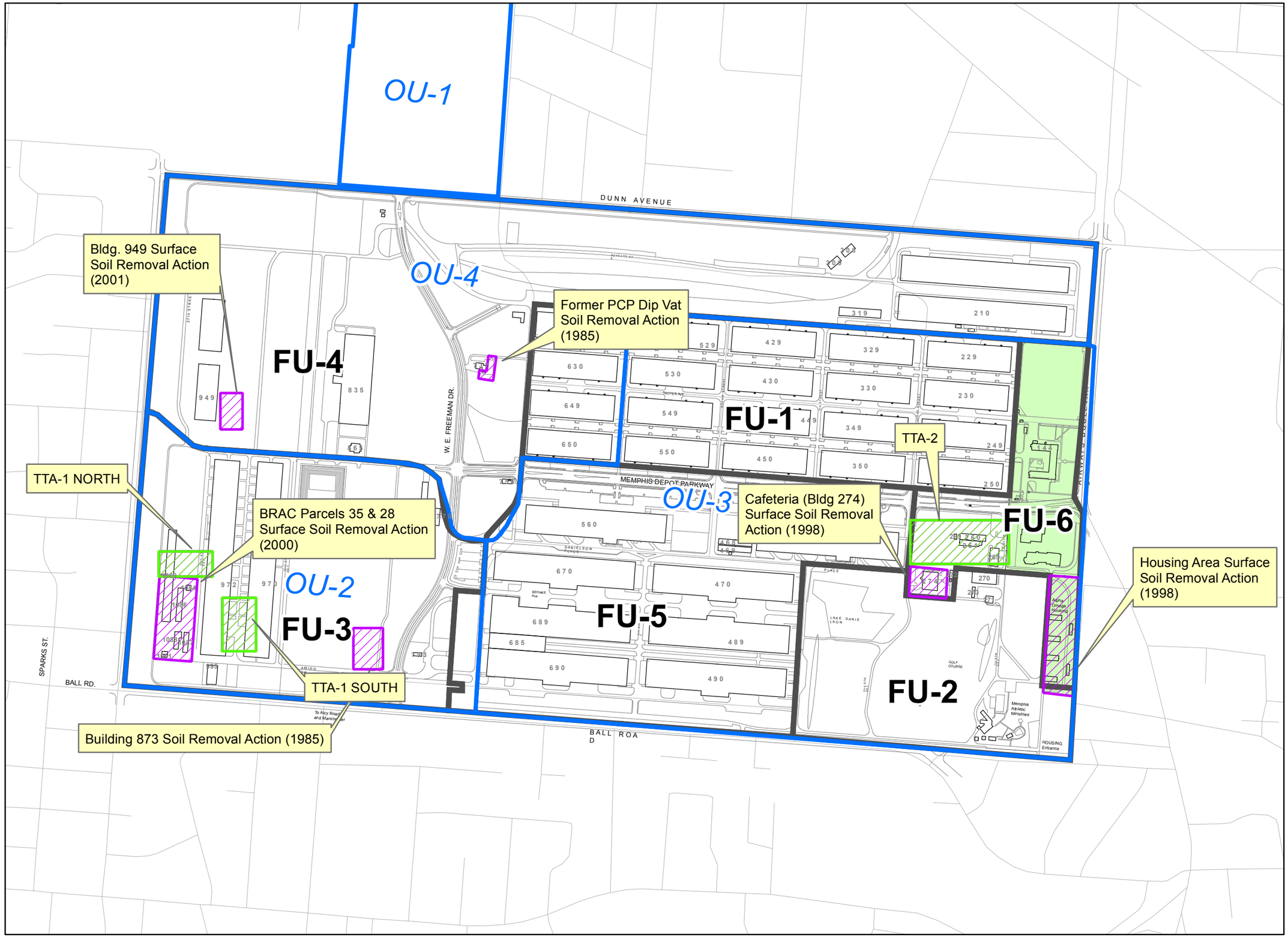

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Figure 6

MAIN INSTALLATION UNIT BOUNDARIES, RESPONSE ACTIONS AND REMEDIAL ACTIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

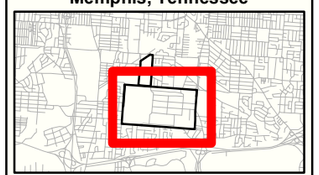
Legend
- Operable Units (OU-#)
- Functional Unit Boundary (FU-#)
- Areas Available for Unrestricted Use
- Past Response Actions
- Enhanced Bioremediation Treatment Areas

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 250 500 1,000

Scale in Feet

Installation Location
Memphis, Tennessee



Date: June 2012
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Figure 7

DUNN FIELD AREA DESIGNATIONS, REMOVAL ACTIONS AND INTERIM REMEDIAL ACTION

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

Legend

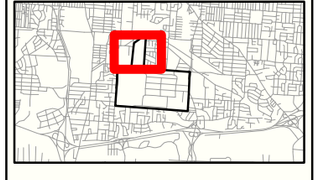
- Original Dunn Field Perimeter
- Unrestricted Use Area from ROD
- Area Designations
- IRA Recovery Well
- IRA Discharge Conveyance Line
- Removal Actions

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 150 300 600

Feet

Installation Location
Memphis, Tennessee



Date: June 2012
Edition: Rev 0

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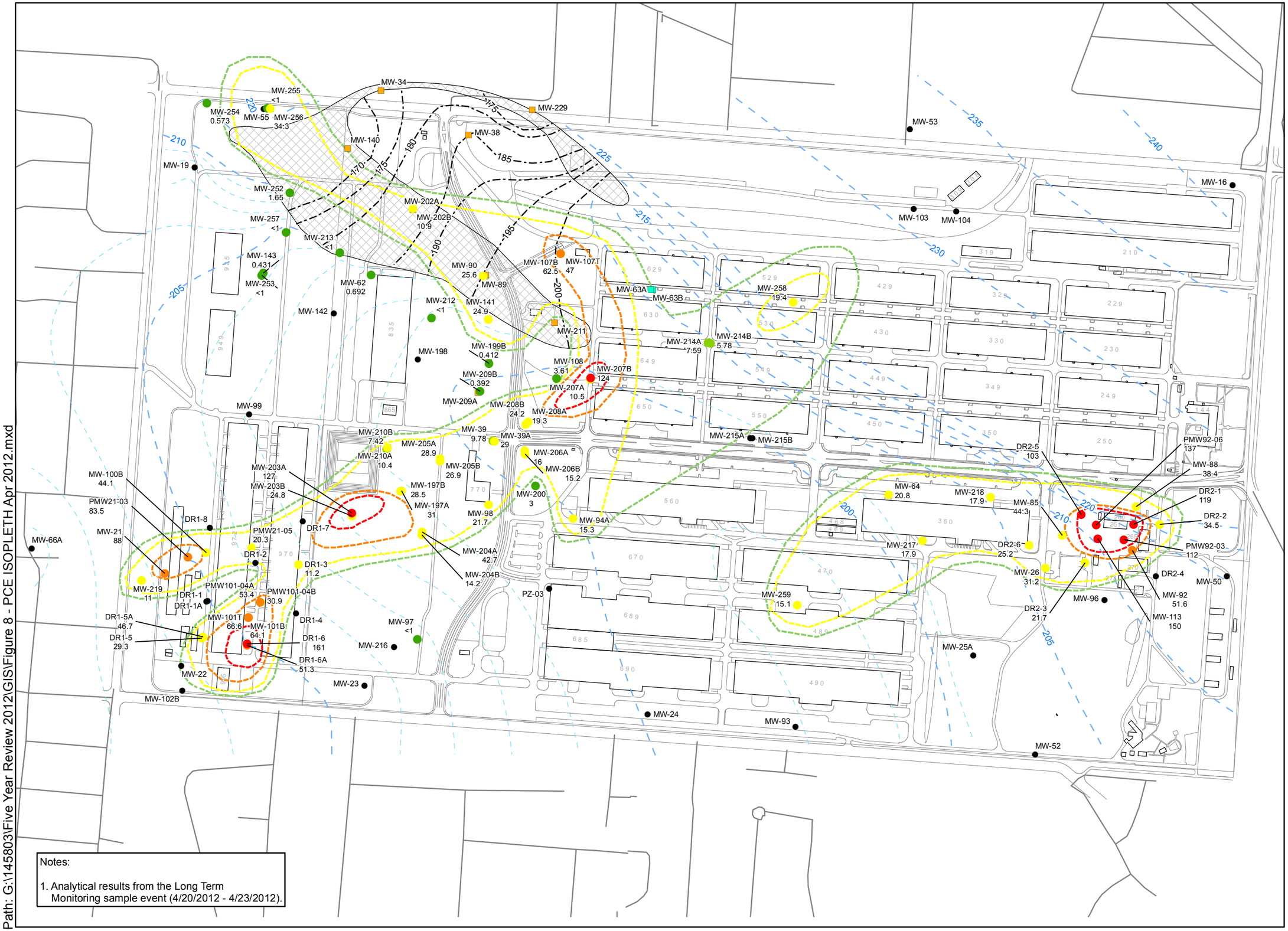

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Figure 8

MAIN INSTALLATION PCE CONCENTRATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

Legend

PCE Ranges
ug/L

- 0 - 5
- 5 - 10
- 10 - 50
- 50 - 100
- 100 - 300

PCE Isopleth
ug/L

- 5
- 10
- 50
- 100
- Clay Elevation Exceeds Groundwater Elevation
- Potentiometric surface of the Fluvial Aquifer 1-ft. contour
- Potentiometric surface of the Fluvial Aquifer 5-ft. contour
- Potentiometric surface of the Intermediate Aquifer 5-ft. contour

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 200 400 800

Feet

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

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Figure 9

MAIN INSTALLATION TCE CONCENTRATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

Legend

TCE Ranges
ug/L
- 0 - 5
- 5 - 10
- 10 - 50
- 50 - 100
- 100 - 300

TCE Isopleth
ug/L
- 5
- 10
- 50
- 100
- Clay Elevation Exceeds Groundwater Elevation
- Potentiometric surface of the Fluvial Aquifer 1-ft. contour
- Potentiometric surface of the Fluvial Aquifer 5-ft. contour
- Potentiometric surface of the Intermediate Aquifer 5-ft. contour

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 200 400 800
Feet

Installation Location
Memphis, Tennessee

Date: December 2011
Edition: Rev 0

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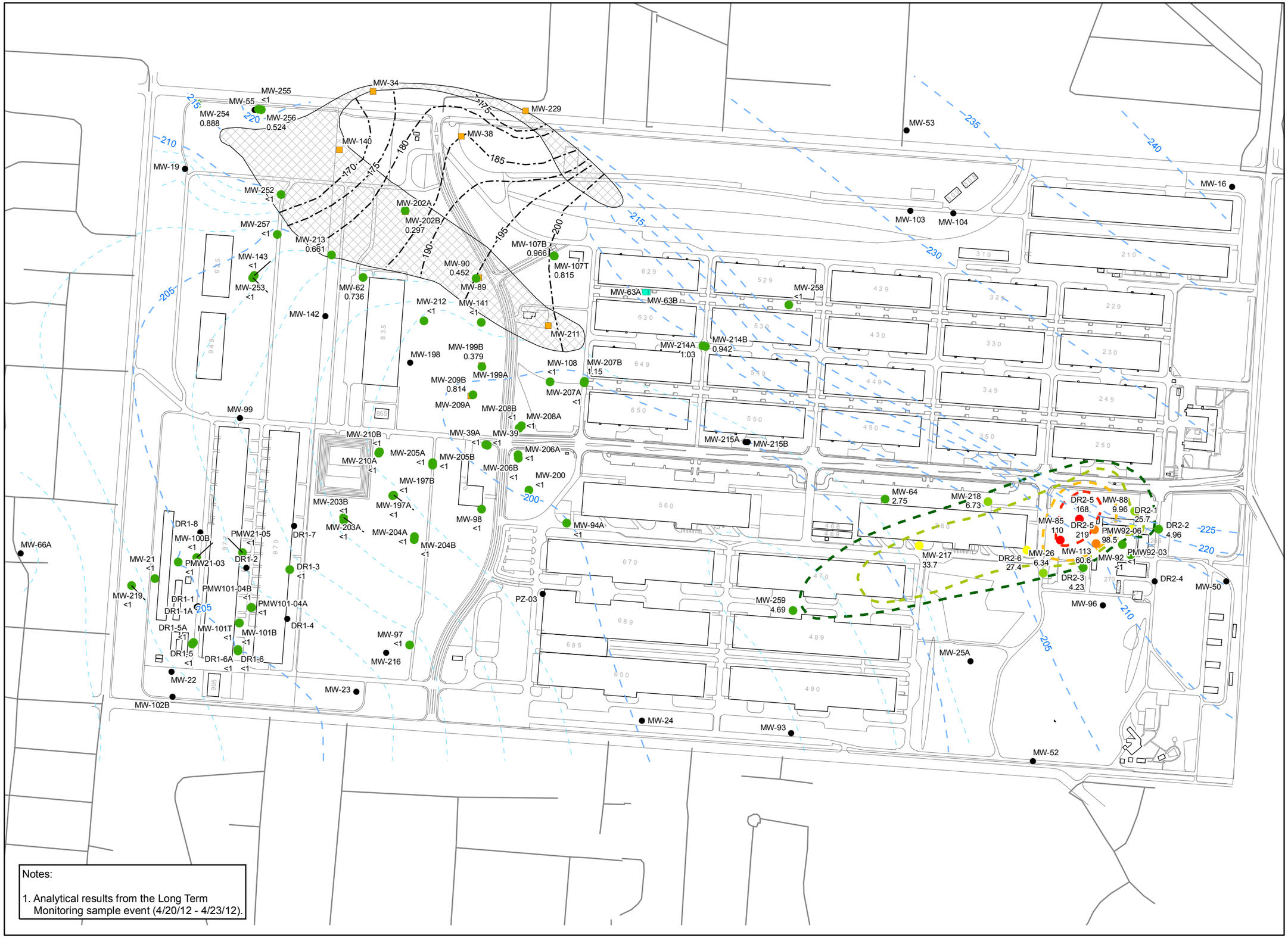

Notes:

1. Analytical results from the Long Term Monitoring sample event (4/20/12 - 4/23/12).

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Figure 10

MAIN INSTALLATION CT CONCENTRATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

Legend

CT Ranges
ug/L

- 0-5
- 5-10
- 10-50
- 50-100
- 100-200

CT Isopleth
ug/L

- 5
- 10
- 50
- 100

Clay Elevation Exceeds Groundwater Elevation

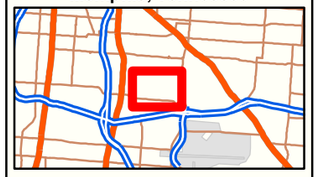
- Potentiometric surface of the Fluvial Aquifer 1-ft. contour
- Potentiometric surface of the Fluvial Aquifer 5-ft. contour
- Potentiometric surface of the Intermediate Aquifer 5-ft. contour

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 200 400 800

Feet

Installation Location
Memphis, Tennessee



Date: June 2012
Edition: Rev 0

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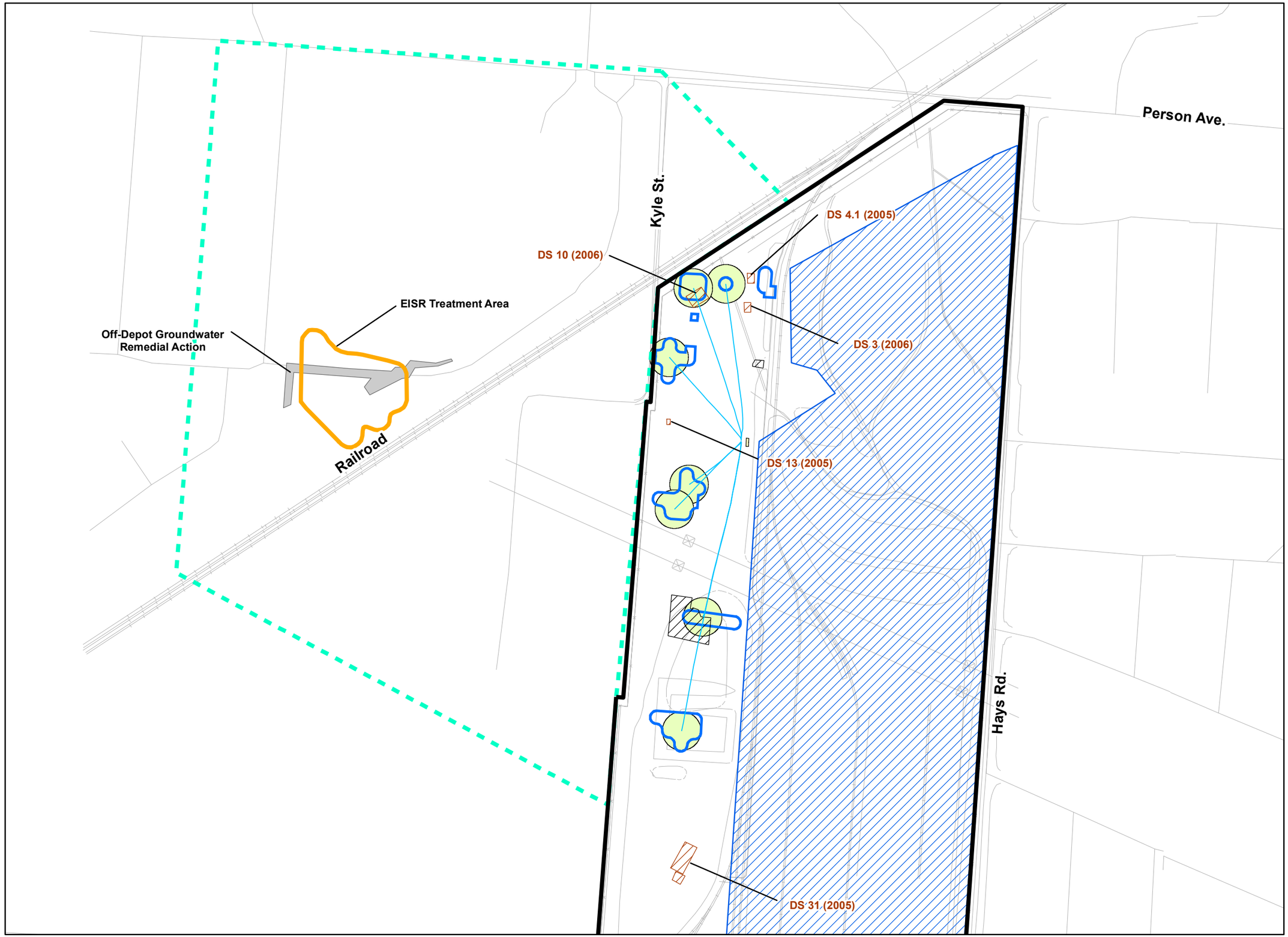

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Figure 11

DUNN FIELD REMEDIAL ACTIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

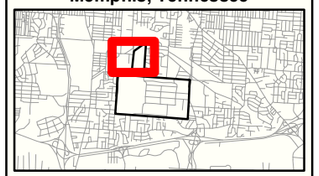
- Original Dunn Field Perimeter
- Unrestricted Use Area from ROD
- Off-Site Treatment Area
- EISR Treatment Area
- Disposal Sites Excavation Area
- Fluvial SVE Well - 60-foot radius of influence
- Fluvial SVE Conveyance Line
- SVE Control Building
- Loess Excavation Areas
- Loess Thermal-Enhanced SVE Treatment Areas
- Air Sparge-SVE Area

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

Aerial Photo Date: 2006

0 100 200 400
Feet

Installation Location
Memphis, Tennessee



Date: June 2012
Edition: Rev 0

HDR

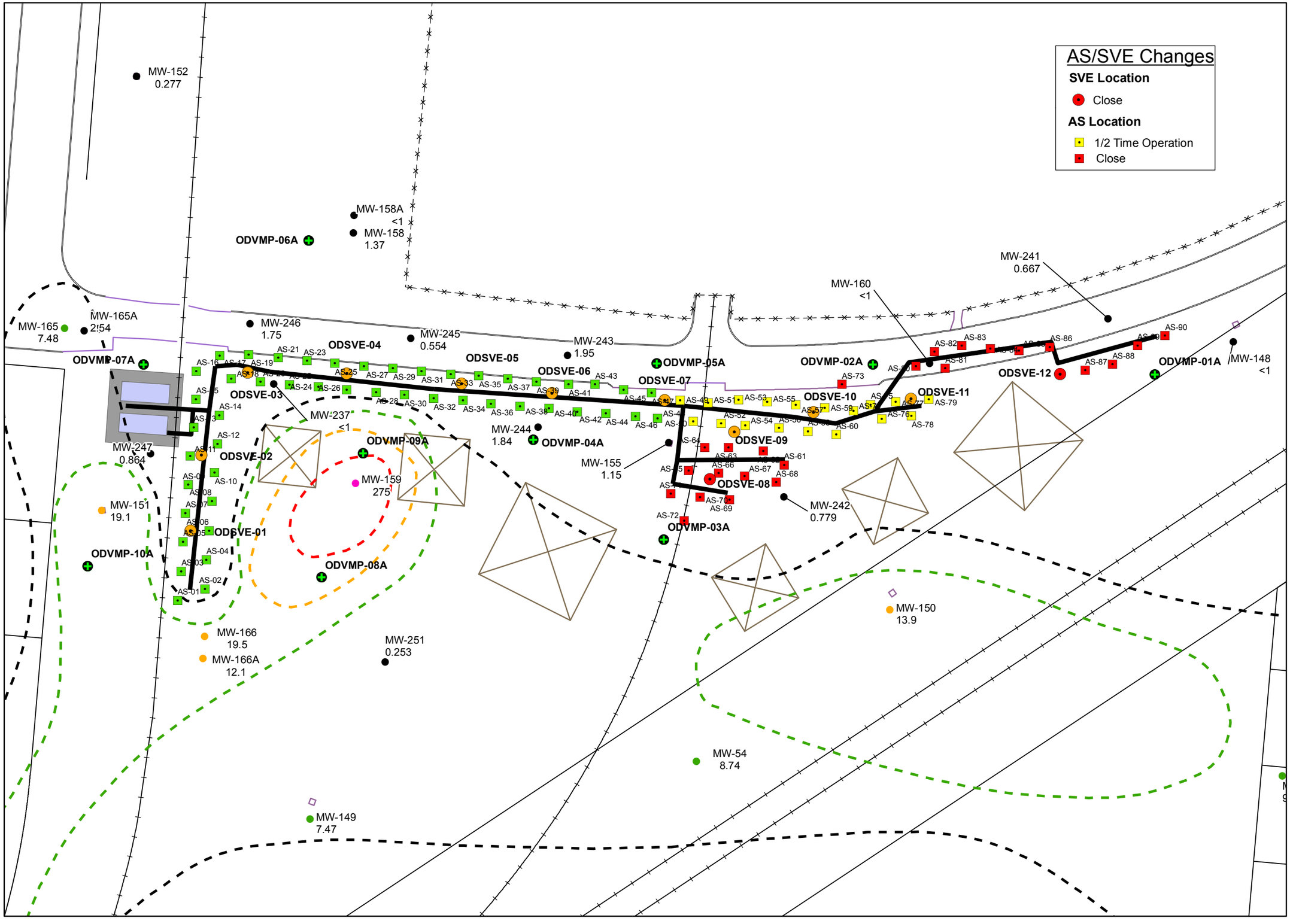


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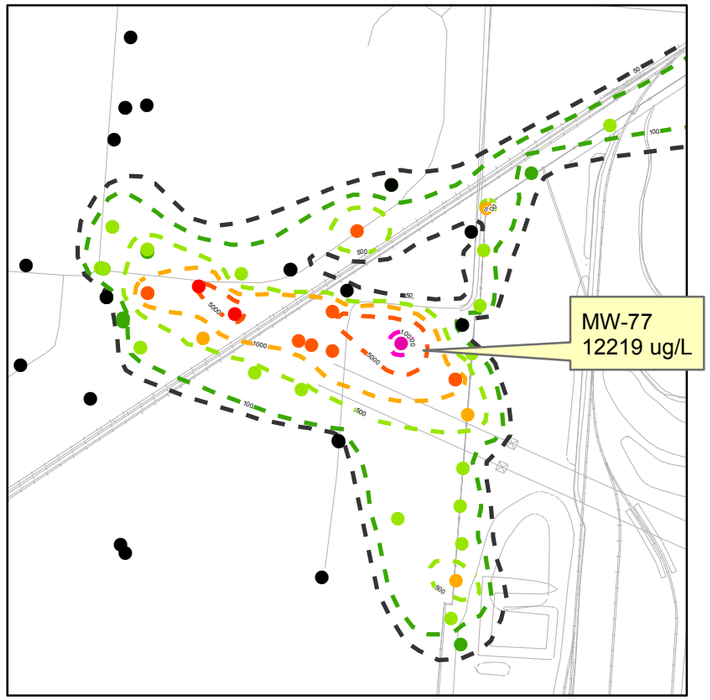
Figure 12

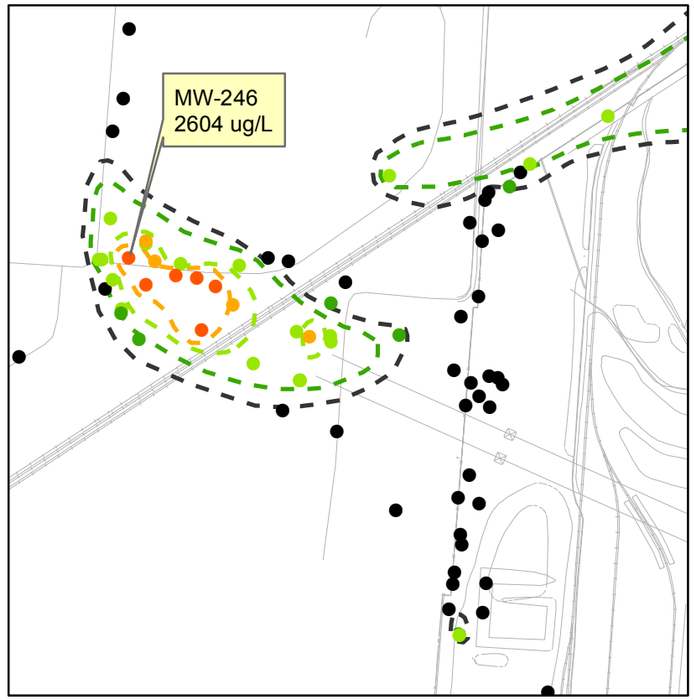
AS-SVE SYSTEM, APRIL 2012

THIRD FIVE-YEAR REVIEW

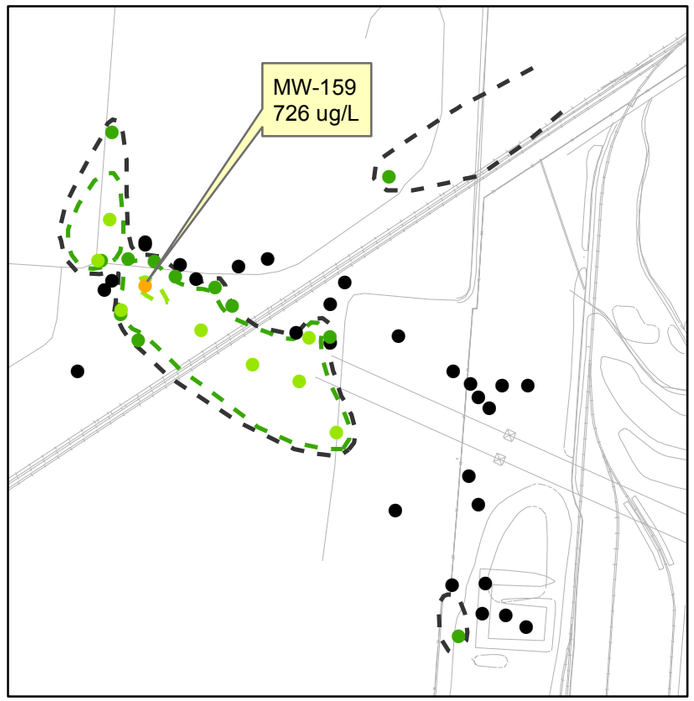
DEFENSE DEPOT MEMPHIS, TENNESSEE



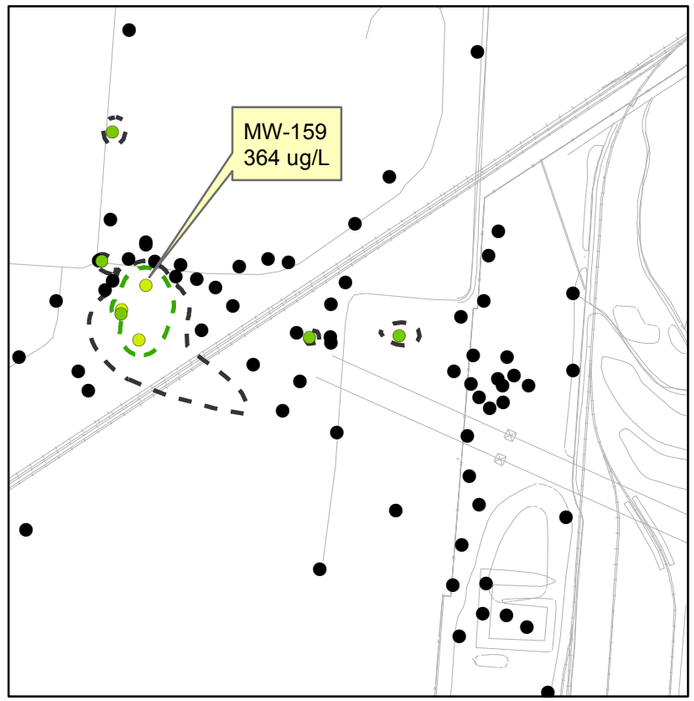
APRIL 2007



APRIL 2009



MARCH 2010



MARCH 2011

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Figure 13

DUNN FIELD TOTAL CVOC CONCENTRATIONS, 2007 - 2011

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

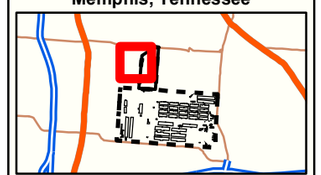
Legend

Total CVOC Isopleth (ug/L)
- 50
- 100
- 500
- 1000
- 5000
- 10000

Total CVOC Ranges (ug/L)
- 0 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- 1000 - 5000
- 5000 - 10000
- 10000 - 50000

0 200 400 600 800
Feet

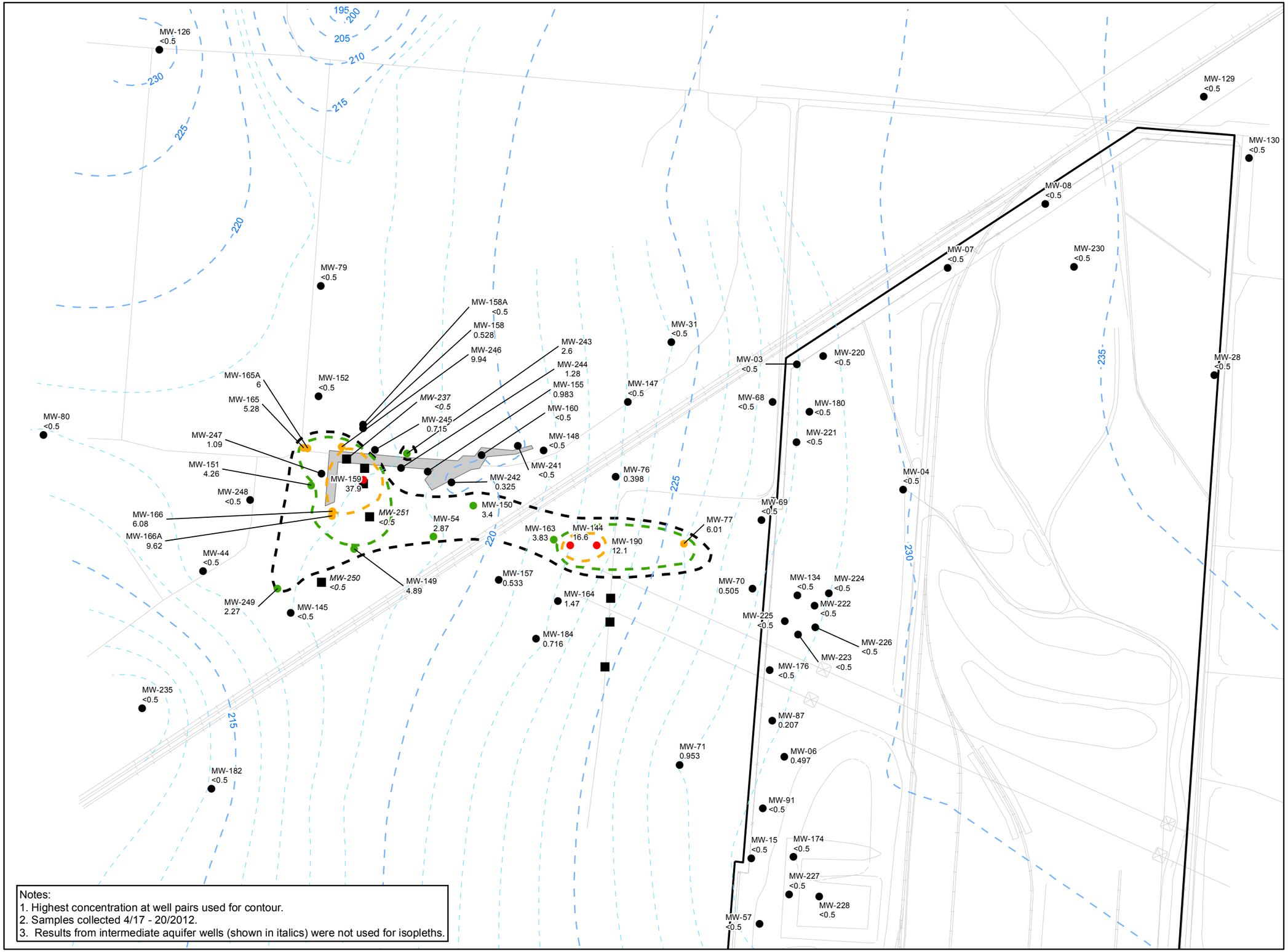
Installation Location
Memphis, Tennessee



Date: June 2012
Edition: Rev 0

HDR

Path: G:\145803\Five Year Review 2012\GIS\Figure 13 TOTAL CVOC Time Series.mxd



Notes:
1. Highest concentration at well pairs used for contour.
2. Samples collected 4/17 - 20/2012.
3. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

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Figure 14

DUNN FIELD
TeCA
CONCENTRATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Legend

TeCA Ranges (ug/L)
- 0-2
- 2-5
- 5-10
- 10-50
- 50-100

TeCA Isopleth (ug/L)
- 2.2
- 5
- 10
- 50

Air Sparge Well Area

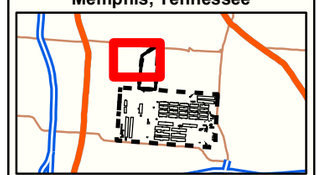
Original Dunn Field Property Boundary

Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

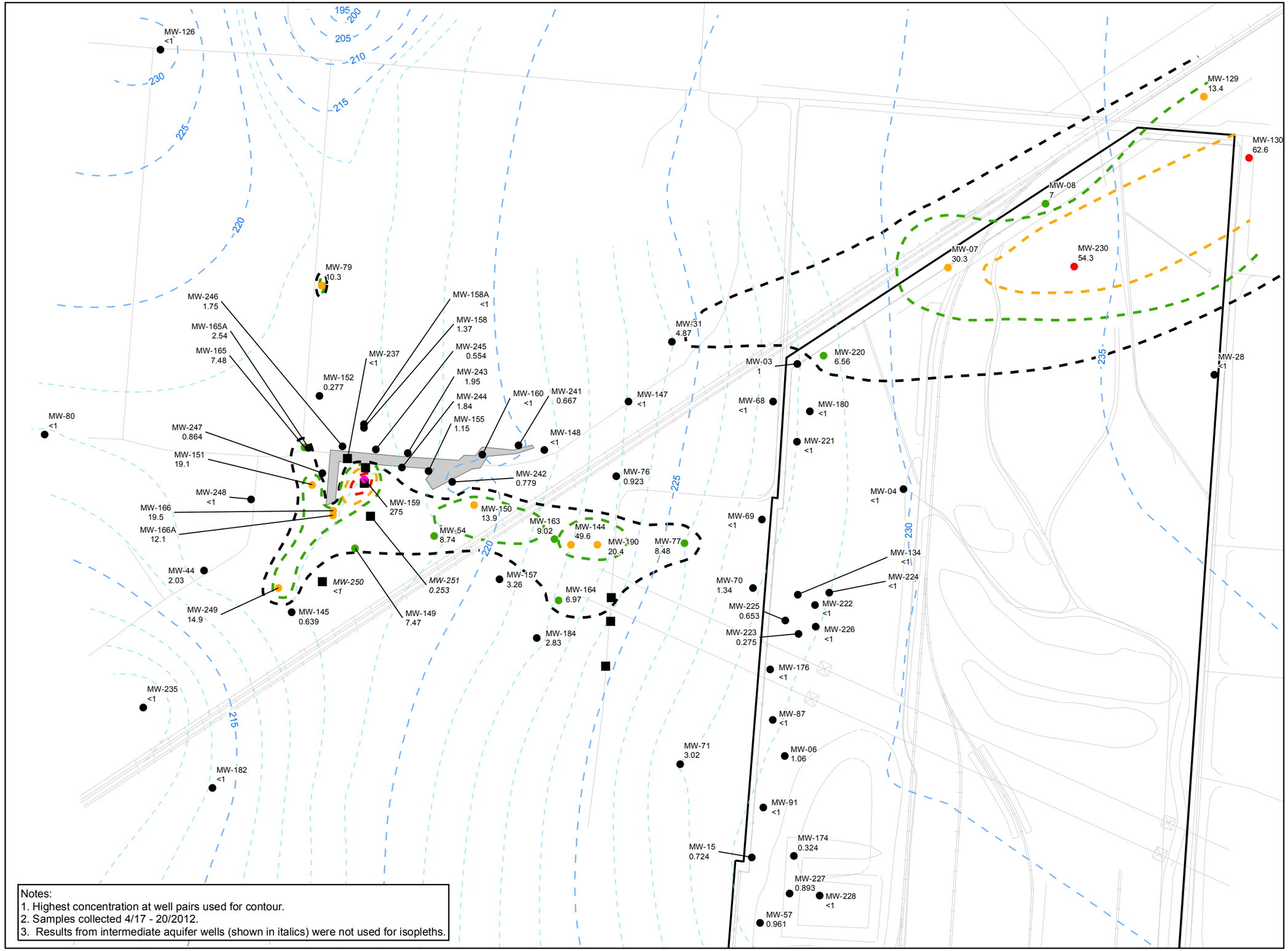
0 100 200 300
Feet

Installation Location
Memphis, Tennessee



Date: June 2012
Edition: Rev 0

HDR



Notes:
1. Highest concentration at well pairs used for contour.
2. Samples collected 4/17 - 20/2012.
3. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

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Figure 15

DUNN FIELD TCE CONCENTRATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT MEMPHIS, TENNESSEE

Legend

TCE Ranges (ug/L)
- 0-5
- 5-10
- 10-50
- 50-100
- 100-300

TCE Isopleth (ug/L)
- 5
- 10
- 50
- 100

Air Sparge Well Area

Original Dunn Field Property Boundary

Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

0 100 200 300

Feet

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

HDR

Figure 16

DUNN FIELD PCE CONCENTRATIONS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

MW-126 <1
MW-129 15
MW-130 72.5
MW-08 5.25
MW-07 35.1
MW-230 35.9
MW-79 12.1
MW-246 <1
MW-158A <1
MW-158 <1
MW-245 <1
MW-155 <1
MW-160 <1
MW-241 <1
MW-148 <1
MW-152 <1
MW-165A <1
MW-165 <1
MW-159 1.17
MW-243 <1
MW-237 0.259
MW-80 <1
MW-247 <1
MW-151 0.793
MW-248 <1
MW-166 1.02
MW-166A 0.617
MW-251 0.613
MW-54 0.48
MW-242 <1
MW-150 <1
MW-44 <1
MW-149 0.522
MW-249 1.02
MW-250 <1
MW-145 <1
MW-244 <1
MW-157 <1
MW-163 0.914
MW-144 0.829
MW-190 0.893
MW-164 0.284
MW-184 0.397
MW-235 <1
MW-182 <1
MW-31 4.75
MW-03 0.871
MW-220 4.61
MW-147 <1
MW-68 <1
MW-180 <1
MW-221 <1
MW-76 <1
MW-28 <1
MW-04 <1
MW-69 <1
MW-77 0.478
MW-134 0.531
MW-70 0.768
MW-224 <1
MW-222 <1
MW-225 0.538
MW-226 0.376
MW-223 0.503
MW-176 <1
MW-87 <1
MW-06 <1
MW-71 0.264
MW-91 <1
MW-15 0.62
MW-174 0.311
MW-227 0.463
MW-228 0.264
MW-57 <1
195
200
205
210
215
220
225
230
235

Notes:
1. Highest concentration at well pairs used for contour.
2. Samples collected 4/17 - 20/2012 .
3. Results from intermediate aquifer wells (shown in italics) were not used for isopleths.

Legend

PCE Ranges (ug/L)
- 0 - 2.5
- 2.5 - 5
- 5 - 10
- 10 - 50
- 50 - 250

PCE Isopleth (ug/L)
- 2.5
- 5
- 10
- 50

Air Sparge Well Area

Original Dunn Field Property Boundary

Potentiometric surface of the Fluvial Aquifer 1-ft. contour

Potentiometric surface of the Fluvial Aquifer 5-ft. contour

0 100 200 300
Feet

Installation Location
Memphis, Tennessee

Date: June 2012
Edition: Rev 0

HDR

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APPENDIX A

COMMUNITY NOTIFICATION

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

March 29, 2012

MEMORANDUM FOR: Former Memphis Depot Restoration Advisory Board Members and Elected Officials

SUBJECT: Notification of Five-Year Review, Defense Depot Memphis, Tennessee

1. This memorandum is provided to notify you that the Department of Army is conducting a Five-Year Review under Comprehensive Emergency Response, Compensation and Liability Act for the selected remedies at

Former Defense Depot Memphis, Tennessee (DDMT)
2163 Airways Boulevard
Memphis, Shelby County, Tennessee

2. The purpose of this Five-Year Review is to determine whether the remedies at the Former Memphis Depot remain protective of human health and the environment. The methods, findings, and conclusions of review will be documented in a Five-Year Review report, and if any issues are identified during the review, recommendations will be provided to address them.

3. The selected remedies for DDMT were described in the Main Installation Record of Decision approved in 2001, the Dunn Field Record of Decision approved in 2004, and the Dunn Field Record of Decision Amendment approved in 2009. The contaminants of concern are metals, hydrocarbons and volatile organic compounds in soil and chlorinated volatile organic compounds in groundwater. The selected remedy for the Main Installation was:

- Excavation, transportation, and off-site disposal of lead-contaminated surface soil near Building 949.
- Deed restrictions and site controls on residential land use, daycare facilities, drilling and groundwater use, and site access.
- Enhanced bioremediation of chlorinated volatile organic compounds (CVOCs) in the most contaminated part of the groundwater plume.
- Long-term groundwater monitoring.

The selected remedy, as amended, for Dunn Field was:

- Excavation, transportation, and disposal of soil and material within disposal sites.
- Soil vapor extraction (SVE) to reduce VOC concentrations in subsurface soils.
- Injection of zero-valent iron within Dunn Field to treat CVOCs in the most contaminated part of the groundwater plume and installation of an air sparging and SVE system to remediate CVOCs within the off site areas of the groundwater plume.
- Monitored natural attenuation and long-term groundwater monitoring.
- Implementation of land use controls consisting of deed and/or lease restrictions; Notice of Land Use Restrictions; zoning restrictions and groundwater well restrictions.

4. All selected remedies have been implemented and have either met cleanup standards or are making progress toward the standards. Construction, operation and performance

monitoring for the remedies are documented in interim remedial action completion reports, which were reviewed and approved by US Environmental Protection Agency and Tennessee Department of Environment and Conservation. Additional site information is available at the information repository in the Memphis Depot Business Park at 2245 Truitt Street, Memphis, TN 38114; please call (901) 774-3683 to make an appointment. You may also find information online at: http://www.epa.gov/region4/superfund/sites/fedfacs/memdedpttn.html

5. The National Contingency Plan requires that remedial actions that result in any hazardous substances, pollutants or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure be reviewed every five years to ensure the protection of human health and the environment. This is the third Five-Year Review for the Former Memphis Depot and is to be completed January 31, 2013. Notification of report completion and availability for public review will be provided at that time.

6. The Department of Army invites community participation in the Five Year Review process. If you would like further information or to comment on the protectiveness of the selected remedy or the remedial actions at DDMT, please call the Community Involvement Line at (901)774-3683 or send an email to denise.cooper@hdrinc.com. Comments will be accepted through May 31, 2012.

CAROLYN JONES
Program Manager
Base Realignment and Closure Division

Distribution:
Former RAB Members:

Community Representatives
Mr. Dave Bond
Ms. Doris Bradshaw
Ms. Peggy Brooks
Atty. Reginald Eskridge
Mr. Ulysses Truitt
Mr. Stanley Tyler
Mr. Mondell Williams
Ms. Elizabeth Young

Civic Representatives
Ms. Wanda Halbert, Memphis City Council
Dr. Tyler Zerwekh, Memphis/Shelby County Health Dept
Mr. Fred Von Hofe, Memphis Light, Gas and Water
Mr. Jim Covington, Depot Redevelopment Corporation

Regulatory Agency Representatives
Mr. Turpin Ballard, US Environmental Protection Agency, Region 4
Mr. Jamie Woods, Tennessee Department of Environment and Conservation

Elected Officials:
Mayor of Memphis: Mr. A.C. Wharton, Jr.
Mayor of Shelby County: Mr. Mark H. Luttrell, Jr.
Memphis City Council, District 8: Mr. Joe Brown, Ms. Janis Fullilove, Mr. Myron Lowery
Shelby County Commission, District 3: Mr. Sydney Chism, Mr. James Harvey, Sr., Mr. Justin Ford

Advertisement placed in the Memphis Metro Zone of the Commercial Appeal Wednesday, April 11, 2012

The Former Memphis Depot Five-Year Review Community Notification

The Department of Army is conducting a Five-Year Review under CERCLA for the former Memphis Depot, located adjacent to Airways Blvd. and Dunn Ave., to determine whether the selected remedies remain protective of human health and the environment. The selected remedies for soils contaminated with metals, hydrocarbons and volatile organic compounds were excavation, transportation and off-site disposal, and soil vapor extraction. The selected remedies for groundwater contaminated with chlorinated volatile organic compounds were enhanced bioremediation, air sparging, natural attenuation and long term monitoring. All remedies have been completed or are currently operating. In addition to environmental clean-up, site-wide land-use controls have been implemented to prevent residential land use, daycare facilities, drilling and groundwater use, and to control site access. Additional site information is available at the information repository in the Memphis Depot Business Park at 2245 Truitt Street; please call (901) 774-3683 to make an appointment. You may also find information online at: http://www.epa.gov/region4/superfund/sites/fedfacs/memdedpttn.html

The Department of Army invites comments from the community on the protectiveness of the selected remedies for the former Memphis Depot through May 31, 2012. The final report for the Five-Year Review will be completed and made available to the public by January 31, 2013.

To request additional information or to provide a comment, please call the Community Involvement Line at (901) 774-3683 or email denise.cooper@hdrinc.com.

APPENDIX B

SITE PHOTOGRAPHS, NOVEMBER 2012

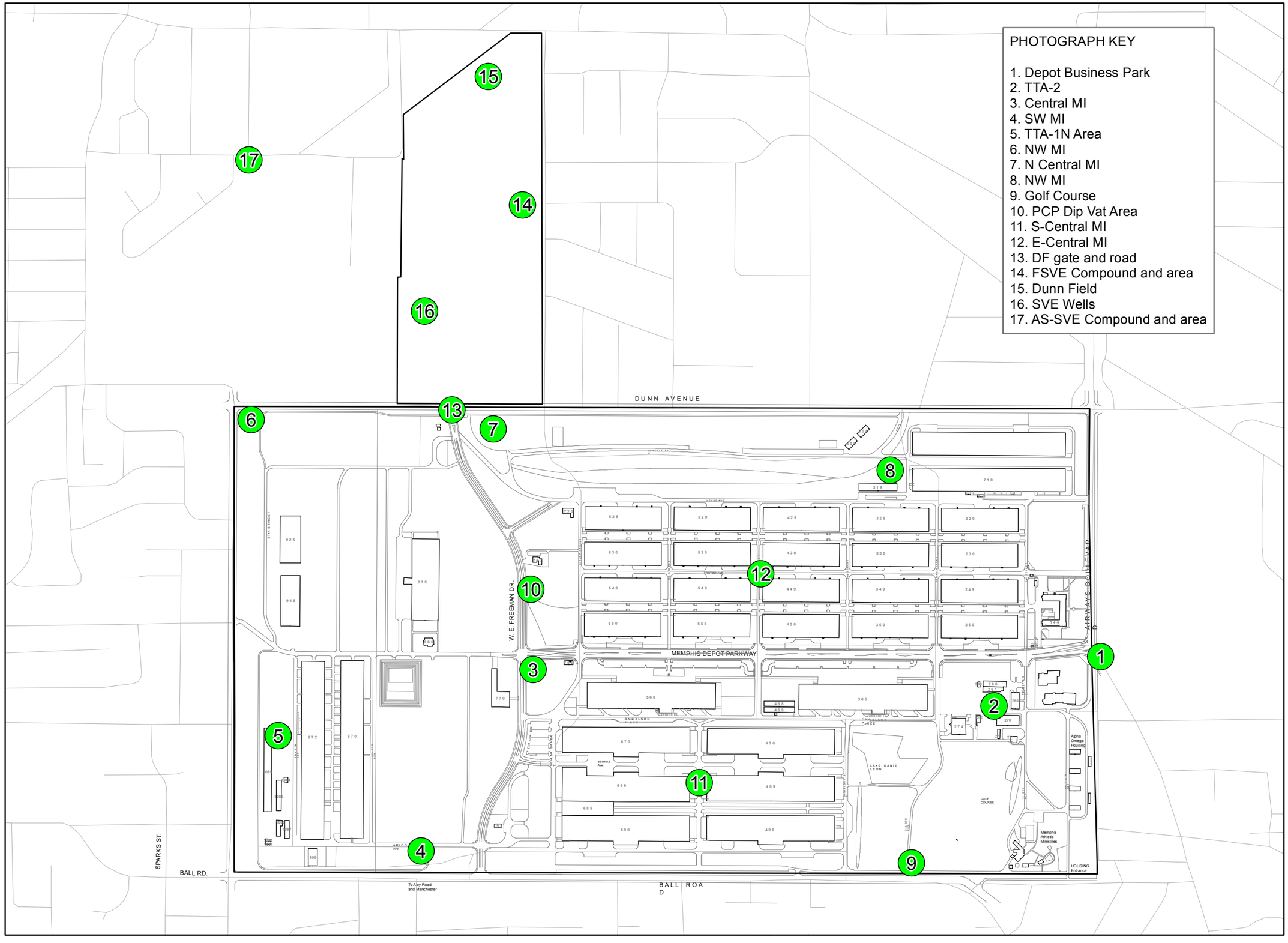

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Figure B-1

SITE PHOTOGRAPHS

THIRD FIVE-YEAR REVIEW

DEFENSE DEPOT
MEMPHIS, TENNESSEE

Projection: NAD 1927 StatePlane Tennessee
Units: Feet

0 250 500 1,000

Scale in Feet

Installation Location
Memphis, Tennessee

Date: October 2012
Edition: Rev 0

HDR

Path: G:\145803\Five Year Review 2012\GIS\Figure B-1 Photograph Locations.mxd

Location 1) Memphis Depot Industrial Park
Bldg 144, 2163 Airways Blvd
14 November 2012

Location 1) Memphis Depot Industrial Park (looking west)
Memphis Dept Parkway at Airways Blvd
14 November 2012

Location 2) TTA-2 (looking southwest)
Bldg 265, 2241 Truitt Street
EBT well vault in foreground, Bldg 274 in central background
14 November 2012

Location 3) Central MI (looking east)
Bldgs 650 and 560, WE Freeman Dr at Memphis Depot Parkway
14 November 2012

Location 4) SW MI (looking north)
Bldg 770 in central background and Bldg 865 in left background
Amido Ave west of Sitler St
14 November 2012

Location 5) TTA-1N area (looking south)
Bldgs 1086 and 1089, 25th St
EBT well vaults in gravel parking area for Barnhart Crane
15 November 2012

Location 6) NW MI (looking southeast)
27th St
Bollards and well pad for MW-254 in gravel staging area for Barnhart Crane
14 November 2012

Location 7) N-Central MI (looking east)
Gate 15 at WE Freeman Dr
14 November 2012

Location 8) NE MI (looking west)
North of Heyde Ave, west of Bldg 210
14 November 2012

Location 9) Golf Course (east side looking west)
2146 Ball Rd
15 November 2012

Location 9) Golf Course (north end looking south)
Lake Danielson, Danielson Place and Danielson St
14 November 2012

Location 10) Former PCP Dip Vat area (looking west)
Sitler St at Troyer Ave
Bldg 835 in background
14 November 2012

Location 11) S-Central MI (looking north)
Bldgs 689 and 670, Between Amido Ave and Danielson Place
14 November 2012

Location 12) E-Central MI (looking south)
Bldgs 449 and 349, Troyer Ave at 3rd St
14 November 2012

Location 13) Dunn Field gate and road (looking north)
1716 Dunn Ave
14 November 2012

Location 14) FSVE Compound and area (looking east)
Dunn Field, 1716 Dunn Ave
15 November 2012

Location 15) Dunn Field (looking southwest)
Dunn Field, 1716 Dunn Ave
Fence on right side is boundary of property sold after FOST 4
15 November 2012

Location 16) SVE wells (looking north)
Dunn Field, 1716 Dunn Ave
15 November 2012

Location 17) AS/SVE Compound and area (looking south)
Ragan St at Menager Rd
Concrete pads for well vaults in street and grassed area, Utility and AS/SVE enclosures in right foreground
15 November 2012