

**Final**  
**Site Management Plan**  
**Fiscal Years 2010 — 2011**  
Naval Weapons Station Yorktown Cheatham Annex  
Williamsburg, Virginia



Prepared for  
**Department of the Navy**  
**Naval Facilities Engineering Command**  
**Mid-Atlantic Division**

Contract No.  
N62470-08-D-1000  
CTO-0054

**April 2010**

Prepared by  
**CH2MHILL**

Final

**Site Management Plan  
Fiscal Years 2010-2011**

**Naval Weapons Station Yorktown Cheatham Annex  
Williamsburg, Virginia**

Contract Task Order 054

April 2010

Prepared for

**Department of the Navy  
Naval Facilities Engineering Command  
Mid-Atlantic**

Under the

**NAVFAC CLEAN 1000 Program  
Contract N62470-08-D-1000**

Prepared by



**CH2MHILL**

**Virginia Beach, Virginia**

# Contents

---

<b>Acronyms and Abbreviations .....</b>	<b>v</b>
<b>1 Introduction .....</b>	<b>1-1</b>
<b>2 Background and Regulatory Framework .....</b>	<b>2-1</b>
2.1 CAX Activity Description .....	2-1
2.2 CAX Environmental History .....	2-1
2.2.1 Regulatory History .....	2-1
2.2.2 Hydrogeologic Setting.....	2-2
2.3 CERCLA Process.....	2-3
2.3.1 MRP .....	2-3
2.3.2 Community Participation.....	2-4
<b>3 CAX Site and AOC Descriptions .....</b>	<b>3-1</b>
3.1 Base-Wide Studies.....	3-1
3.1.1 Initial Assessment Study (IAS) .....	3-1
3.1.2 Confirmation Studies .....	3-1
3.1.3 Pond Study.....	3-2
3.1.4 PCB Study .....	3-2
3.1.5 Community Involvement Plan (CIP) Update .....	3-2
3.1.6 Basewide Documents Available .....	3-3
3.2 Site Descriptions.....	3-3
3.2.1 Site 1 – Landfill Near Incinerator.....	3-3
3.2.2 Site 4 – Outdated Medical Supply Disposal Area .....	3-6
3.2.3 Site 7 – Old DuPont Disposal Area.....	3-8
3.2.4 Site 9 – Transformer Storage Area .....	3-10
3.2.5 Site 11 – Bone Yard .....	3-11
3.2.6 AOC 1 – Scrap Metal Dump .....	3-13
3.2.7 AOC 2 – Dextrose Dump .....	3-14
3.2.8 AOC 3 – CAD 11/12 Pond Bank.....	3-15
3.2.9 AOC 6 – Penniman AOC .....	3-16
3.2.10 AOC 7 – Drum and Can Disposal Area.....	3-19
3.2.11 AOC 8 – Area South of Site 7 .....	3-20
3.2.12 PCB Study Area.....	3-20
3.2.13 AOC 9 – Penniman Lake.....	3-22
3.3 MRP Sites .....	3-24
3.3.1 Other-than-Operational Marine Pistol and Rifle Range.....	3-24
<b>4 References .....</b>	<b>4-1</b>

## Tables

- 2-1 CAX Site Summary
- 2-2 WPNSTA Yorktown/CAX Partnering Team Consensus Statement Summary
- 2-3 Major Elements of the CERCLA Process
- 3-1 1999 Waste Source Sampling at AOC 6

## Figures

- 1-1 Location of WPNSTA Yorktown and CAX
- 2-1 Sites/ AOC Locations and CERCLA Status
- 3-1 Location of Major CAX Surface Water Bodies
- 3-2 Site 1- Landfill Near Incinerator
- 3-3 Site 4 – Outdated Medical Supply Disposal Area
- 3-4 Site 7 – Old DuPont Disposal Area
- 3-5 Site 9 – Transformer Storage Area
- 3-6 Site 11 – Bone Yard
- 3-7 AOC 1 – Scrap Metal Dump
- 3-8 AOC 2 – Dextrose Dump
- 3-9 AOC 3 – CAD 11/12 Pond Bank
- 3-10 AOC 6 – Penniman AOC
- 3-11 AOC 7 - Drum and Can Disposal Area
- 3-12 AOC 8 – Area South of Site 7
- 3-13 Polychlorinated Biphenyls (PCB) Site
- 3-14 Penniman Lake
- 3-15 Marine Pistol and Rifle Range

## Schedules

- 3-1 Site 4 FY10-11 Schedule
- 3-2 Site 7 FY10-11 Schedule
- 3-3 Site 9 FY10-11 Schedule
- 3-4 Site 11 FY10-11 Schedule
- 3-5 AOC 1 FY10-11 Schedule
- 3-6 AOC 2 FY10-11 Schedule
- 3-7 AOC 3 FY10-11 Schedule
- 3-8 AOC 6 FY10-11 Schedule
- 3-9 AOC 7 FY10-11 Schedule
- 3-10 AOC 8 FY10-11 Schedule
- 3-11 AOC 9 FY10-11 Schedule

# Acronyms and Abbreviations

---

AM	Action Memorandum
AOC	area of concern
bgs	below ground surface
CAX	Cheatham Annex
CCR	Construction Closeout Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
COPC	contaminant of potential concern
CTE	central tendency exposure
cy	cubic yard
DCE	dichloroethene
DD	Decision Document
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DoD	Department of Defense
DOI	Department of the Interior
EE/CA	Engineering Evaluation/Cost Analysis
ER	Environmental Restoration
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
ESI	Expanded Site Inspection
ESS	Explosives Safety Submission
ft	feet/foot
ft/day	feet per day
ft <sup>2</sup>	square feet
ft <sup>2</sup> /day	square feet per day
FFA	Federal Facilities Agreement
FS	Feasibility Study
FY	Fiscal Year
HHRA	human health risk assessment
HI	hazard index
HRS	Hazard Ranking System
IAS	Initial Assessment Study
µg/kg	micrograms per kilogram
µg/L	micrograms per liter

MCL	maximum contaminant level
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MRP	Munitions Response Program
NAVFAC	Naval Facilities Engineering Command
NCP	National Contingency Plan
NFA	no further action
NFRAP	No Further Response Action Plan
ng/kg	nanograms per kilogram
NPL	National Priorities List
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PP	Proposed Plan
ppm	parts per million
RA	Removal or Remedial Action
RAB	Restoration Advisory Board
RBC	risk-based concentration
RC	response complete
RD	Remedial Design
RDX	cyclotrimethylene trinitroamine
RI	Remedial Investigation
RIP	remedy in place
RME	reasonable maximum exposure
ROD	Record of Decision
SERA	Screening Ecological Risk Assessment
SI	Site Investigation
SMP	Site Management Plan
SSP	Site Screening Process
SVOC	semivolatile organic compound
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TCRA	Time-critical Removal Action
TM	Technical Memorandum
TNT	trinitrotoluene
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UFP-SAP	Uniform Federal Policy for Sample Analysis Plan
USEPA	United States Environmental Protection Agency
UU/UE	unlimited use and unrestricted exposure
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
WPNSTA	Naval Weapons Station

## SECTION 1

# Introduction

---

This document presents the fiscal years (FYs) 2010 through 2011 annual amendment to the Site Management Plan (SMP) for Naval Weapons Station (WPNSTA) Yorktown Cheatham Annex (CAX), Williamsburg, Virginia. This SMP meets the requirements of the Federal Facilities Agreement (FFA) (USEPA, 2005) between the Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division, Commonwealth of Virginia Department of Environmental Quality (VDEQ), and Region III of the United States Environmental Protection Agency (USEPA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This annual amendment to the SMP is being submitted in accordance with the requirements of the FFA. **Figure 1-1** illustrates the location of CAX within the southeast portion of the Commonwealth of Virginia.

The purpose of the SMP is to provide a management tool for NAVFAC Mid-Atlantic, WPNSTA Yorktown, CAX, VDEQ, USEPA, and their consultants to use in planning, reviewing, and setting priorities for all response activities at CAX. The SMP establishes schedules and conceptual approaches for continued CERCLA activities at CAX Environmental Restoration (ER) sites. The prioritization of activities, proposed schedules, and work descriptions were jointly developed by the Navy, USEPA, and VDEQ on the basis of goals agreed to by all parties.

The SMP is a working document that is updated annually. This annual SMP amendment will supersede the 2009-2010 SMP finalized in December 2008.



- Legend**
-  Activity Boundaries
  -  City/County Boundaries

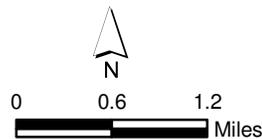


Figure 1-1  
Location of WPNSTA Yorktown and CAX  
Site Management Plan for FY 2010 to 2011  
WPNSTA Yorktown, Yorktown, Virginia  
CAX, Williamsburg, Virginia

# Background and Regulatory Framework

---

## 2.1 CAX Activity Description

CAX is located on the site of the former Penniman Shell Loading Plant, which was a large powder- and shell-loading facility operated during World War I. The Penniman facility closed in 1918 and between 1918 and 1923 was dismantled. Between 1923 and 1943, the property was used for farming or left idle, until CAX was commissioned in 1943 as a satellite unit of the Naval Supply Depot to provide bulk storage facilities and serve as an assembly and overseas shipping point throughout World War II. CAX is bordered to the east by the York River, to the north by Queen Creek, to the west by the Queens Lake neighborhood, and to the south by King Creek and WPNSTA Yorktown ([Figure 1-1](#)). At inception, CAX occupied approximately 3,349 acres; however, several portions of the original base were declared surplus and transferred to other government jurisdictions, including the Department of Interior (DOI) (i.e., National Park Service), the Commonwealth of Virginia, and York County. CAX is currently comprised of 2,300 acres and is divided into two separate parcels, with the larger parcel situated along the banks of the York River and the smaller parcel located south of the Colonial Parkway and encompassing Jones Pond ([Figure 1-1](#)). Included in this 2,300 acres is the 786 acre former DOI property which was reacquired by the Navy in July 2004. Almost all of the activities at CAX (administration, training, maintenance, support, and housing) take place in the larger portion of the Installation. The smaller parcel is used mainly as a watershed protection area. In July 1987, CAX was designated the Hampton Roads Navy Recreational Complex. Today, the mission of CAX includes supplying Atlantic Fleet ships and providing recreational opportunities to military and civilian personnel.

## 2.2 CAX Environmental History

### 2.2.1 Regulatory History

The first environmental investigation completed at CAX was conducted by the Navy prior to state and federal regulatory oversight of environmental activities at the installation. A Navy Initial Assessment Study (IAS) was conducted in 1984 and identified 12 potentially contaminated areas (C.C. Johnson & Associates and CH2M HILL, 1984). The IAS recommended additional investigation at Sites 1, 9, 10, and 11. In 1998, the Navy, USEPA, and VDEQ performed a site visit and identified five additional potential source areas and designated them as Areas of Concern (AOCs) 1 through 5. In 1999, USEPA identified potential sources associated with the past Penniman Facility and designated this area as AOC 6. CAX was included on the National Priorities List (NPL) in January 2001 with a Hazard Ranking System (HRS) score of 48.7. Additional investigations and activities were conducted in 2002. In 2003, the Navy, USEPA, and VDEQ agreed that no further action (NFA) was necessary for some of the sites and a No Further Response Action Planned

(NFRAP) Decision Document (DD) for Sites 2, 3, 5, 6, 8, and 10 was signed (Baker, 2003a). The response complete (RC) decision for Site 12 was documented in a 2004 NFRAP DD (Baker, 2004a). In 2004, the Navy also identified AOC 7 (Drum and Can Disposal Area) as an area of concern for desktop audit. This AOC was included in Appendix B of the FFA which was signed in March 2005 and identified the 12 sites and seven AOCs (USEPA, 2005). Sites 1, 4, 7, and 11 are identified in the FFA Findings of Fact for CERCLA implementation with ultimate closure under a Record of Decision (ROD). During field investigations in 1999, it was determined that the area thought to be Site 7 (a World War I era disposal site) was actually a more recent disposal area. The actual location of Site 7 was later identified approximately 500 feet (ft) to the north, thus the more recent disposal area was re-designated as AOC 8. In 2006, the Navy initiated investigations of numerous Munitions Response Program (MRP) sites including the other-than-operational Marine Pistol and Rifle Range at CAX.

**Table 2-1** identifies both active sites and AOCs addressed under CERCLA at CAX and those in which it was determined that no action or NFA is required. **Figure 2-1** shows the location of each site/AOC at CAX. Active sites and AOCs are discussed in Section 3. Additional background information for sites and AOCs with no action or NFA decisions prior to 2007 (Site 2, Site 3, Site 5, Site 6, Site 8, Site 10, Site 12, AOC 4, and AOC 5) is provided in the FY08-09 SMP, which was identified as a “baseline” SMP in the FY09-10 SMP.

## Partnering

The Navy works in partnership with USEPA and VDEQ and has established a formal CAX Partnering Team to implement CERCLA. Partnering Team decisions are documented through consensus statements; a summary of Team<sup>1</sup> consensus statements is presented in **Table 2-2**.

## 2.2.2 Hydrogeologic Setting

CAX is situated within the Virginia Coastal Plain Physiographic Province, which is underlain by unconsolidated sediment of the Quaternary, Tertiary, and Cretaceous ages. These sediments dip to the southeast, with a combined thickness of 1,900 ft in the vicinity of CAX. Deposition and erosion associated with fluctuating sea levels resulted in terraces that decrease in topographic elevation in a stair-step pattern with scarps, oriented north to south, that delineate the eroded shoreline along the toe of each terrace.

A total of ten geologic formations have been identified (Brockman et al., 1997) beneath CAX. The upper most geologic formations consists of alluvial, colluvial, and marsh deposits composed of silt, sand, and pebbles with some clay. The geologic units are grouped into hydrostratigraphic units based upon hydraulic characteristics. The aquifers separated by confining/semi-confining units relevant to CERCLA investigations at CAX are, from youngest to oldest; the Columbia aquifer, the Cornwallis Cave aquifer, and the Yorktown-Eastover aquifer. Groundwater flow is locally controlled by topography with discharge to nearby surface water bodies and a primary flow and discharge direction toward the York River.

---

<sup>1</sup> WPNSTA Yorktown and CAX conducted joint Partnering between 2000 and September 2008, when the bases split into separate Partnering Teams.

Where present, the Columbia aquifer ranges in thickness from 5 to 10 ft thick, with horizontal hydraulic conductivity between about 0.4 to 8 feet per day (ft/day) and vertical hydraulic conductivity between  $1.7 \times 10^{-4}$  to  $1.7 \times 10^{-1}$  ft/day (Brockman et al., 1997). The hydraulic properties of the Cornwallis Cave aquifer are highly variable due to depositional effects and physical and geochemical weathering. In general, horizontal hydraulic conductivity ranges from 0.3 to 9 ft/day and vertical conductivity ranges from  $6.2 \times 10^{-4}$  to  $2.4 \times 10^{-1}$  ft/day (Speiran and Hughes, 2001).

The Yorktown-Eastover aquifer extends across all of CAX and ranges from 60 to 100 ft thick. Horizontal hydraulic conductivity ranges from 0.004 to 3 ft/day and vertical hydraulic conductivity ranges from  $1.7 \times 10^{-5}$  to  $4.8 \times 10^{-1}$  ft/day. Transmissivity of the aquifer ranges from 0.5 to 40 square feet per day (ft<sup>2</sup>/day), with groundwater flow from west-to-east.

## 2.3 CERCLA Process

The following sections provide an overview of the CERCLA process. The objectives of the CERCLA process are to evaluate the nature and extent of contamination at a site, and to identify, develop, and implement appropriate remedial actions (RAs) in order to protect human health and the environment. The major elements of the CERCLA process are identified below and described in greater detail in [Table 2-3](#):

- Preliminary Assessment (PA)
- Site Investigation (SI)
- Remedial Investigation/Feasibility Study (RI/FS)
- Treatability Study
- Engineering Evaluation/Cost Analysis (EE/CA) and Removal Action (may be implemented at any time in the CERCLA process)
- Proposed Plan (PP) and ROD
- Five-Year Review
- Remedial Design (RD) and RA
- Post-RA Monitoring and Reporting
- RC/Remedy In Place (RIP)

### 2.3.1 MRP

The Department of Defense (DoD) has established the MRP under the Defense Environmental Restoration Program (ERP) to address munitions and explosives of concern (MEC) at locations other than operational ranges. The DoD and the Navy are establishing policy and guidance for response actions under the MRP; however, the key program drivers developed to date conclude that munitions response actions will be conducted under the process outlined in the National Contingency Plan (NCP) as authorized by CERCLA.

### 2.3.2 Community Participation

In conjunction with WPNSTA Yorktown, CAX has developed a Community Involvement Plan (CIP) and established a Restoration Advisory Board (RAB) comprised of members of the community, local environment group members, and state and federal officials who meet semi-annually (May and November) to keep the community informed on environmental issues at WPNSTA Yorktown/CAX.

The documents prepared for the program are maintained in the administrative record file for review by the public. The index of CAX Administrative Records is available at the information repository. Documents from the administrative record are available through the NAVFAC ATLANTIC Public Affairs Officer at:

**Public Affairs Officer**  
**Naval Facilities Engineering Command**  
**6506 Hampton Boulevard**  
**Norfolk, Virginia 23508-1278**  
**Phone: (757) 322-8005**  
**[NFECL\\_PMO@navy.mil](mailto:NFECL_PMO@navy.mil)**

Table 2-1  
CAX Site Summary  
FY 10-11 SMP

Site ID	Site Name	Site Description	EPA HRS (Source #)	FFA Status (1994) <sup>1</sup>	Current CERCLA Status	Comments/Notes
Site 1	Landfill Near Incinerator	1.3 acre landfill; 1999 removal action of river bank debris and stabilization and band; 2003 removal of surface debris; 2003 removal action of soil; 2005 removal action of soil & debris and breakwater construction; 2007 removal action of soil/SD	Source scored (1)	Findings of Fact CERCLA RI/FS/PP/ROD	ROD (all media)	NFA GW Risk Management TM (2008) Draft NFA soi/SD/SW Risk Management TM (2008) PP (2009)
Site 2	Contaminated Food Disposal Area	50 ft diameter food disposal pit; 12 to 15 feet deep No SW/SD associated with site	Not identified in HRS	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2003) for all media
Site 3	Submarine Dye Disposal Area	55 gallon drum storage area; 1970 removal action of drums No SW/SD associated with site	Source not scored	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2004) for all media
Site 4	Outdated Medical Supply Disposal Area	Ravine used as a disposal area covered with soil; 1998 removal action of surface debris	Source not scored	Findings of Fact CERCLA RI/FS/PP/ROD	SI (all media)	SI UFP-SAP (2009)
Site 5	Photographic Chemicals Disposal Area	Marl burrow pit used as a disposal area No SW/SD associated with site	Source not scored	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2003) for all media
Site 6	Spoiled Food Disposal Area	12 to 15 feet deep disposal pit No SW/SD associated with site	Source not scored	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2003) for all media
Site 7	Old DuPont Disposal Area	Large disposal area; 2004-2006 removal action of surface debris and geotube installation; 2008 removal action of soil/waste	Source not scored	Findings of Fact CERCLA RI/FS/PP/ROD	SI (all media)	SI UFP-SAP (2009)
Site 8	Landfill Near Building CAD 14	0.25 acre landfill No SW/SD associated with site	Source not scored	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2003) for all media
Site 9	Transformer Storage Area	7000 square foot storage area; 1980 area was graded and covered with gravel No SW/SD associated with site	Source scored (2)	Appendix A - CERCLA SI/SSP	SI (all media)	SI UFP-SAP (2009)
Site 10	Decontaminated Agent Disposal Area Near First Street	75 to 100 gallon decontamination agent disposal area No SW/SD associated with site	Source not scored	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2003) for all media
Site 11	Bone Yard	2.7 acre storage area; 1999 removal action of surface debris	Source scored (3)	Findings of Fact CERCLA RI/FS/PP/ROD	RI/FS/PP/ROD (all media)	EE/CA (2008) of soil Pending site characterization following removal action
Site 12	Disposal Site Near Water Tower	Scrap metal disposal area No SW/SD associated with site	Not identified in HRS	Appendix C - NFA	Response Complete (all media)	NFRAP (August 2004) for all media
AOC 1	Scrap Metal Dump	Consist of two areas: 0.2 acre northern area and 0.4 acre southern area	Source not scored	Appendix A - CERCLA SI/SSP	SI (all media)	SI - 2009
AOC 2	Dextrose Dump	1 acre disposal Area; 1998 housekeeping operation of surface debris No SW/SD associated with AOC	Source not scored	Appendix A - CERCLA SI/SSP	SI (all media)	SI - 2009
AOC 3	CAD 11/12 Pond Bank	Pile of metal banding, empty drums 99 FI; SW/SD associated with AOC investigated as Site 4	Not identified in HRS	Appendix A - CERCLA SI/SSP	SI (all media)	SI UFP-SAP (2009)
AOC 4	Outdated Medical Supply Disposal Area	Determined to be the same area as Site 4	Not identified in HRS	Not Identified	Response Complete Incorporated into Site 4	Response Complete
AOC 5	Debris Area	Determined to be the same area as Site 1	Not identified in HRS	Not Identified	Response Complete Incorporated into Site 1	Response Complete
AOC 6	Penniman AOC (Site 13) Penniman Shell Loading Plant operated by DuPont Corporation TNT manufacturing plant in 1916 (Plant demolished in 1925)	Earthen ammonia settling pits	Source scored (4)	Appendix A - CERCLA SSA/SSP	SI (all media)	SI - 2009
		Concrete-lined TNT graining house sump	Source scored (5)			
		Earthen and brick-lined TNT catch box ruins	Source scored (6)			
		Metallic waste slag material	Source scored (7)			
		1918 wooden drum storage	Source scored (8)			
AOC 7	Drum and Can Disposal Area	4800 ft <sup>3</sup> disposal area containing cans of PCE; 2006 removal action of surface debris	Not identified in HRS	Appendix B - Preliminary screening area	SI (all media)	SI - 2009
AOC 8	Area South of Site 7	Debris disposal area; formerly referred to as Site 7	Not Scored	Not Identified	SI (all media)	SI - 2009
Marine Pistol and Rifle Range	Marine Pistol and Rifle Range	7 acre small caliber munitions range	Not Scored	MRP	Response Complete (all media)	NFA Declaration (ESI, 2007)

Notes:

<sup>1</sup> - FFA Findings of Fact (pg 16) identified Sites 1, 4, 7, & 11 as RI/FS/PP/ROD for closure, but also identified these Sites in Appendix A as SSP

NA or NFA Sites

AOC - Area of Concern  
CAX - Cheatham Annex  
CERCLA - Comprehensive Environmental Response Compensation and Liability Act  
EE/CA - Engineering Evaluation/Cost Analysis  
ESI - Expanded Site Investigation  
FFA - Federal Facilities Agreement  
ft - feet  
FS - Feasibility Study  
FY - Fiscal Year

GW - Groundwater  
HRS - Hazard Ranking Score  
NA - No Action  
NFA - No Further Action  
NFRAP - No Further Response Action Planned  
PCE - Tetrachloroethene  
PP - Proposed Plan  
RI - Remedial Investigation  
ROD - Record of Decision

SAP - Sampling Analysis Plan  
SD - Sediment  
SI - Site Investigation  
SW - Surface Water  
TM - Technical Memorandum  
TNT - Trinitrotoluene  
UFP - Unified Federal Policy

**Table 2-2  
WPNSTA Yorktown/CAX Partnering Team Consensus Statement Summary  
FY 10-11 SMP**

NUMBER	CONSENSUS STATEMENT NUMBER	DATE	FACILITY	SITE	AOC	TOPIC	CONSENSUS STATEMENT
	NA	10/24/2001	CAX	2		Site 2 – Contaminated Food Disposal Area	The team thinks no further action (NFA) for site review site at end of site visit.
	NA	10/24/2001	CAX	3		Site 3 – Submarine Dye Disposal Area	The team decided to review the site at the end of the site visit.
	NA	10/24/2001	CAX	4		Site 4 – Outdated Medical Supply Disposal Area	The team wants to use the site visit to determine the extent of the debris. S. Milhalko stated that Virginia Department of Environmental Quality (VDEQ) would require that site would either have to have removal with backfill or cover such that it would not be uncovered again.
	NA	10/24/2001	CAX	6		Site 6 – Spoiled Food Disposal Area	The team agreed to drive by site to determine location at end of site visit.
	NA	10/24/2001	CAX	12		Site 12 – Disposal Site Near Water Tower	The team proposed that approach be a Site Screening Area (SSA) and during site visit evaluate need for this. For site visit, evaluate a proposed sampling plan to be evaluated during site visit, prepare site map for site visit.
	NA	10/24/2001	CAX		4	Area of Concern (AOC) 4 – IR Site 4 – Outdated Medical Supply Disposal Area	During the site visit, the approach will be evaluated and a decision is to be made.
	NA	10/24/2001	CAX		5	AOC 5 – Debris Area	Group decided to combine AOC 5 and Site 1, eliminate AOC 5.
	NA	10/24/2001	CAX			Site Update	Dave Martin, as topic leader, and other members wanted to focus on reviewing sites proposed for NFA, then review sites during site visit & what the team wants to do during the site visit (drive by versus walk the site).
	NA	10/24/2001	CAX			Site Update	For site visit, the team decided that a technical guide to the sites would be prepared that incorporates previous information on the site, the Partnering Team discussion, approach to the site, data gaps. This package is to include: site descriptions, maps, previous sampling locations, aerial photographs with site locations/approximate boundaries and for some sites a proposed sampling plan.
	NA	12/3/2001				Define Metrics in Partnering Deliverable	Keep as stated in deliverable.
	NA	12/4/2001	CAX	2		Site 2 – Contaminated Food Disposal Area	The team agreed that no further action is warranted at this site given that only spoiled food was disposed of at the site.
	NA	12/4/2001	CAX	4		Site 4 – Outdated Medical Supply Disposal Area	AOC-3 is part of AOC-4, AOC-4 is now Site 4- Outdated Medical Supply Disposal Area.
	NA	12/4/2001	CAX	5		Site 5 – Photographic Chemicals Disposal Area	Due to the small volume of photochemicals disposed in an area that can not be located using historical records and the disposal of these wastes in a "marl" pit consisting of clayey native soils that would prohibit transport of the photochemicals, no further action is warranted at this site.
	NA	12/4/2001	CAX	6		Site 6 – Spoiled Food Disposal Area	The team agreed that no further action is warranted at this site given that only spoiled food was disposed of at the site.
	NA	12/4/2001	CAX	8		Site 8 - Landfill Near Building CAD 14 Site Visit	On page 4-16 of handout, last paragraph, delete first sentence "The VDEQ....site."
	NA	12/4/2001	CAX	8		Site 8 - Landfill Near Building CAD 14 Site Visit	The team agreed that no further action is warranted at this site given that only non-hazardous materials such as spoiled meat, spoiled candy, and clothing were disposed at the site and all anecdotal records indicate that the clothing was not impregnated with any chemicals.
	NA	12/4/2001	CAX	11		Site 11 – Bone Yard	The team agreed to investigate Penniman Lake and Site 11 separately. Penniman Lake is already in the budget cycle as a separate site.
	NA	12/4/2001	CAX	12		Site 12 – Disposal Site Near Water Tower	The team agreed that further sampling is required at the site prior to making a NFA decision. The approach agreed to consist of a grid of five soil samples (1 center, 4 corner points). One sample will be analyzed for Target Analyte List (TAL)/Target Compound List (TCL) and the remaining 4 will be analyzed for TAL metals only. An additional three soil samples will be collected between the railroad tracks adjacent to the site. These analytical results will be compared to the grid analytical results to determine whether or not the railroad maybe a source area.
	NA	2/5/2002	CAX	9		Site 9 - Transformer Storage Area	Based upon review of polychlorinated biphenyl (PCB) confirmation data, proceed with NFA for Site 9.
	NA	2/5/2002	CAX	11		Site 11 – Bone Yard	The team agreed with the proposed sampling plan pending resolution of their comments.
		2/5/2002	CAX	12		Site 12 – Disposal Site Near Water Tower	The team agreed to analyze all soil samples for TCL organics in addition to the planned TAL Metals.
	NA	2/5/2002	CAX		1	AOC 1 - Scrap Metal Dump	AOC 1 will continue as an AOC, a Work Plan will be developed for the debris removal. If no significant contamination is found, based on confirmatory soil sampling, (i.e.: meet Eco/HH requirements), the AOC will be closed. The Work Plan will be flexible to allow for in-field adjustments.
	NA	2/5/2002	CAX			GIS Needs Assessment	The Draft Final CAX GIS Needs Assessment submitted in September 2001 will be considered final. Baker will proceed with the awarded CAX GIS Implementation.
		2/5/2002	WPNSTA/CAX	12		5-Year Review	The team agreed to form a subgroup to research and report out at the March meeting on this issue. The subgroup consists of Bob Stroud and Jennifer Davis.
	NA	2/5/2002	WPNSTA/CAX			2002 Goals Update	The team agreed to include the Goals as part of each meeting's minutes.
	NA	2/5/2002	WPNSTA/CAX			Consensus Statement Documentation	The team agreed to document Consensus Statements by site as an addendum to the Site Management Plan. Mary is to evaluate possible methods (by site, chronologically, etc.) and report back to the team during the March Meeting.

**Table 2-2  
WPNSTA Yorktown/CAX Partnering Team Consensus Statement Summary  
FY 10-11 SMP**

NUMBER	CONSENSUS STATEMENT NUMBER	DATE	FACILITY	SITE	AOC	TOPIC	CONSENSUS STATEMENT
	NA	2/5/2002	WPNSTA/CAX			Draft FFA	Scott Park/Jennifer Davis to prepare Draft FFA Addendum for counsel review and submittal to USEPA and VDEQ.
1	3/13/2002-1	3/13/2002	WPNSTA/CAX			Documentation of Consensus Statements	The team agreed to document Consensus Statements by site as an addendum to the Site Management Plan. A tracking number will be used to track the documents consisting of date and numerical sequence (i.e.: Month/Day/Year-Number – 3/13/02-1).
3	4/23/2002-3	4/23/2002	WPNSTA/CAX			Identification of new sites	The Team agrees that the Federal Facilities Agreement (FFA) (Sections 9.3a and 9.3b) gives the team the authority to add newly identified sites to the Site Management Plan (SMP).
4	4/24/2002-4	4/24/2002	WPNSTA/CAX			Site Management Plan	The team agreed to go final with the Fiscal Year (FY) 2002/2003 Draft SMP and revise text for the FY 2003/2004 submittal. Baker will provide Final covers for the FY 2002/2003 SMP.
5	4/24/2002-5	4/24/2002	CAX	11		Approval of Proposed Field Investigation Sampling Locations presented in the Project Plans for CTO 236	The team agreed with the sampling location revisions made during the site visit and agreed that the field investigation can be performed. The field activities will be scheduled for May 2002.
5	4/24/2002-6	4/24/2002	CAX		Penniman	Penniman AOC Sub-areas Investigation approach	The Team agrees to follow a general approach to the Penniman AOC sub-areas as follows: 1918 Drum Storage Area: Verify whether or not the kegs were used to store Ammonium Nitrate. Consider collecting surface soil samples between Buildings 225 and 113. Waste Slag Area: Based upon the understanding that the waste slag is most likely associated with maintenance activities along the rail line, a sampling approach will be developed.
7	4/24/2002-7	4/24/2002	WPNSTA/CAX			Community Relations Plan	The Team agrees to go final with the Community Relations Plan. If appropriate, final covers and spines will be submitted.
9	8/6/2002-9	8/6/2002	CAX	2, 3, 5, 8, 9, 10, 12		NFRAP Decision Document Format	The Team agreed to use the Quantico format for the NFRAP document. The team will review the No Further Response Action Plan (NFRAP) documents before finalizing them.
11	8/6/2002-11 <b>ON HOLD</b>	8/6/2002	CAX	3		Fluorescein Dye	The Team agrees that since Fluorescence Dye is still in use, is very water soluble hence dilutes infinitely.
12	9/18/2002-12	9/18/2002	WPNSTA/CAX			New technical team member	The Team agreed to add Marlene Ivester as a technical member to the team.
13	9/18/2002-13	9/18/2002	WPNSTA/CAX			Facilitator	The team agreed a facilitator is needed for a few meetings.
15	10/23/2002-15	10/23/2002	WPNSTA/CAX			N/A	The Team agreed to add a goal to the FY03 Team Goals to be self-facilitating by end of third Quarter 2003 (5 additional meetings).
17	10/23/2002-17	12/4/2002 Revised	WPNSTA/CAX			WPNSTA-SSAs 3-24; 23-26; 2, 8, 18 & SSA 14; GWOU I, 27-30 CAX-1, 4 & 9, 11, Background Study, NFRAP 2, 3, 5, 6, 9, 10 & 12	The WPNSTA Yorktown/CAX Partnering Team empowers the ecological technical support team to address and resolve ecological issues for various sites at WPNSTA Yorktown/CAX (see table below) to meet the dates and priority specified by the WPNSTA Yorktown/CAX Team, with Ed Corl to take the lead on meeting the schedule determined by the Team. WPNSTA: SSAs 3-24 Site Screening Process (SSP); 23-26 DF Remedial Investigation (RI); 2, 8, 18 & SSA 14 DF RI; Groundwater Operatable Unit (GWOU) I Draft WP: 27-30 Draft RI
18	12/5/2002-18	12/5/2002	WPNSTA/CAX	21, 22		WPNSTA Sites 21 & 22	Based upon EPA Region III comments, Sites 21 and 22 Record of Decisions (RODs) will be rewritten as RODs with no institutional controls (ICs) because they were remediated to residential levels.
19	12/5/2002-19	12/5/2002	WPNSTA/CAX			Site Action Status Report	The Team agrees to use the SASR as a tracking tool and add it to the standard meeting format.
20	12/5/2002-20	12/5/2002	WPNSTA/CAX			Action Item List	The Team agreed that the Action Item List will be addressed during the Agenda Building Call with respect to whether or not the Action Item has been completed. If completed, a "C" will be put in the Outcome column of the Action Item list and the item will not be addressed during the subsequent Partnering Team Meeting.
21	1/29/2003-21	1/29/2003	WPNSTA/CAX			CAX Site 1 Baseline Risk Assessment	The eco subgroup discussed the issues for the CAX Site 1 RI and determined that a baseline risk assessment was warranted for the wetland area based upon a conference call prior to the December Partnering Meeting. The Navy RPM determined that based upon the existing ROD schedule and funding execution for the site, it was determined that (revised per team concurrence by MM 3/12/03) the ROD and funding schedule could not be met. Therefore, the Navy recommended that an EECA for soils/debris removal at CAX Site 1 would be the best approach. The Team agrees upon this approach.
23	3/13/2003-23	3/13/2003	CAX	1		Site clean-up goals	The Team agrees that the Draft Final Engineering Evaluation/Cost Analysis (EE/CA) for CAX Site 1 can be distributed for public comment without specific site clean-up goals. Specific clean-up goals will be presented to the Team for review and approval, and final clean-up goals will be incorporated in the Final EE/CA.
25	4/29/2003-25	4/29/2003	CAX	1		Clean-up goals at CAX Site 1	The Team agrees to the clean-up goals for the planned removal action under the EE/CA for CAX Site 1 established during a conference call on April 14, 2003 (see the attached table).
27	6/11/2003-27	6/11/2003	CAX	1		Concurrence on CAX Site Removal	USEPA Region III, Virginia Department of Environmental Quality and Atlantic Division, Naval Facilities Engineering Division agree to the proposed removal action at Cheatham Annex Site 1 – Landfill Near the Incinerator as documented in the Draft Final April 2003 EE/CA and the Action Memorandum.

**Table 2-2  
WPNSTA Yorktown/CAX Partnering Team Consensus Statement Summary  
FY 10-11 SMP**

NUMBER	CONSENSUS STATEMENT NUMBER	DATE	FACILITY	SITE	AOC	TOPIC	CONSENSUS STATEMENT
28	6/17/2003-28	6/17/2003	CAX	1		CAX Site 1 RI Schedule	For CAX Site 1, the Team agrees: 1. Issue RI as a Final Round I RI with replacement pages and cover letter explaining the decision rationale. 2. Defer the Proposed Plan (PP) & ROD for the site until after completion of wetlands Baseline Ecological Risk Assessment (BERA) and Round II RI for sediments. 3. Issue a letter to file that the Feasibility Study (FS) will be deferred until completion of the Round II RI.
29	6/17/2003-29	6/17/2003	CAX	2, 3, 5, 6, 8, 10		CAX Sites 2, 3, 5, 6, 8 & 10, No further action decision	The Team agrees with the NFA remedy for CAX Sites 2, 3, 5, 6, 8 and 10 based upon the information presented for the Draft NFRAP Decision Document.
31	10-30-03-31	10/30/2003	CAX	7		CAX Site 7 TCRA	Based upon the landfill's proximity to the York River and the erosional damage associated with Hurricane Isabel, the team agrees that additional funding is necessary for a Time Critical Removal Action (TCRA) at CAX Site 7 in order to stabilize the shoreline. If additional FY 2004 funds can be obtained, the team agrees to delineate and characterize the landfill and determine the feasibility of landfill removal in the near term.
35	3-9-04-35	3/11/2004	CAX	12		Site 12 NFRAP	The team agrees with the NFA remedy for CAX Site 12 – Disposal Site Water Tower based upon the no further action remedy recommended in the Technical Memorandum submitted for review on January 12, 2004. NFRAP Decision Document with a Final Technical Memorandum as an appendix will be prepared for submittal by March 31, 2004 in accordance with the annual team 2004 goals.
36	3-22-04-36	3/22/2004	CAX	7		CAX Site 7	Based upon the field investigation conducted at CAX Site 7N, as summarized in the Draft Trenching Letter Report dated 19 March 2004, the team has agreed to move forward with a TCRA Action Memorandum as an interim action that will recommend appropriate erosion control and shoreline stabilization for the site. The team also agrees that removal of the CAX Site 7N landfill will be accomplished under an EE/CA when funding is available. While the team agreed that an esthetic clean up of the beach in the vicinity of the landfill does little to mitigate risk, the team agreed to move forward with a beach cleanup at the request of the Navy.
38	5-19-04-38	5/19/2004	WPNSTA/CAX			BTAG	The Yorktown/CAX Partnering Team agrees that the role of USEPA Biological Technical Assistance Group (BTAG) members will be changed from Adjunct Member to Technical Member.
48	4-28-08-48	4/28/2008	CAX	1		CAX Site 1	The Partnering Team agrees potential groundwater risks at CAX Site 1 to be acceptable for unrestricted use/unrestricted exposure as presented in the Groundwater Risk Management Technical Memorandum.
		5/22/2008	CAX	1		CAX Site 1	The Partnering Team agrees that NFA is warranted for waste, soil, and sediment at CAX Site 1 as presented in the Documentation for No Further Action (NFA) Regarding Site Waste, Soil, and Sediment.

Notes:  
Decisions # 2,6,8,10,14,16,22,24,26,30,32-34,37,39-47 were strictly for WPNSTA

AOC - Area of Concern	PP - Proposed Plan
BERA - Baseline Ecological Risk Assessment	RI - Remedial Investigation
BTAG - Biological Technical Assistance Group	ROD - Record of Decision
CAX - Cheatham Annex	SERA - Screening Ecological Risk Assessment
EE/CA - Engineering Evaluation/Cost Analysis	SMP - Site Management Plan
FFA - Federal Facilities Agreement	SSA - Site Screening Area
FY - Fiscal Year	SSP - Site Screening Process
GWOU - Groundwater Operable Unit	TAL - Target Analyte List
IC - Institutional Controls	TCL - Target Compound List
NA - Not Applicable	TCRA - Time Critical Removal Action
NFA - No Further Action	USEPA - United States Environmental Protection Agency
NFRAP - No Further Response Action Planned	VDEQ - Virginia Department of Environmental Quality
PCB - Polychlorinated Biphenyl	WPNSTA - Naval Weapons Station Yorktown

**Table 2-3  
Major Elements of the CERCLA Process  
FY 10-11 SMP**

<b>Preliminary Assessment (PA)</b>	Initiation of concern about a site, area, or potential contaminant source. The PA is a limited-scope assessment designed to distinguish between sites that clearly pose little or no threat to human health or the environment and sites that may pose a threat and require further investigation. Environmental samples are rarely collected during a PA. The PA also identifies sites requiring assessment for possible response actions. If the PA results in a recommendation for further investigation, an SI is conducted.
<b>Site Investigation (SI)</b>	Some sites warrant preliminary or interim investigations, studies, or removal/remedial actions. If it is unclear as to whether a site should be included in the CERCLA RI/FS process, an SI is sometimes conducted to make a general determination if activities at the site have impacted environmental media. SIs typically include the collection of environmental and waste samples to determine which hazardous substances are present at a site and to determine if these substances have been released to the environment.
<b>Remedial Investigation (RI)</b>	During an RI, data is collected to characterize site conditions, determine the nature of the waste, assess risk to human health and the environment, and, if necessary, conduct treatability testing to evaluate the potential performance and cost of the treatment technologies being considered.
<b>Treatability Study (TS)</b>	Treatability studies may be conducted at any time during the CERCLA process. The need for a treatability study generally is identified during the FS. Treatability studies may be classified as either bench-scale (laboratory study) or pilot-scale (field studies). For technologies that are well-developed and tested, bench-scale studies are often sufficient to evaluate performance. For innovative technologies, pilot tests may be required to obtain the desired information. Pilot tests simulate the physical and chemical parameters of the full-scale process, and are designed to bridge the gap between bench-scale and full-scale operations. Treatability studies are performed to assist in the evaluation of a potentially promising remedial technology. The primary objectives of treatability testing are to provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the FS and support the remedial design of a selected alternative.
<b>Engineering Evaluation/Cost Analysis (EE/CA) and Interim Removal Action (IRA)</b>	Removal actions are implemented to clean up or remove hazardous substances from the environment at a specific site in order to mitigate the spread of contamination. Removal actions may be implemented at any time during the CERCLA process. Removal actions are classified as either time-critical or non-time-critical actions. Actions taken immediately to mitigate an imminent threat to human health or the environment, such as the removal of corroded or leaking drums, are classified as time-critical removal actions. Removal actions that may be delayed for 6 months or more without significant additional harm to human health or the environment are classified as non-time-critical removal actions (NTCRA). For a NTCRA, an EE/CA is prepared rather than the more extensive FS. The public has an opportunity to comment on the EE/CA during an announced formal public comment period. An EE/CA focuses only on the substances to be removed rather than on all contaminated substances at the site. It is possible for a removal action to become the final remedial action if the risk assessment results indicate that no further remedial action is required in order to protect human health and the environment.
<b>Feasibility Study (FS)</b>	The FS is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions. The RI and FS can be conducted concurrently; data collected in the RI influences the development of remedial alternatives in the FS, which in turn affect the data needs and scope of treatability studies and additional field investigations. This phased approach encourages the continual scoping of the site characterization effort, which minimizes the collection of unnecessary data and maximizes data quality.
<b>Proposed Plan (PP)</b>	A PP presents the remedial alternatives developed in the FS and recommends a preferred remedial alternative. The public has an opportunity to comment on the PP during an announced formal public comment period. Site information is compiled in an administrative record and placed in the general IR program information repositories established at local libraries for public review. The public comments are reviewed and the responses are recorded in a document called a Responsiveness Summary. At the end of the public comment period, an appropriate remedial alternative is chosen to protect human health and the environment. All parties directly involved in the restoration program (Navy, EPA, and VDEQ) must agree on the selected alternative.
<b>Record of Decision (ROD)</b>	The ROD document is issued to explain the selected remedial action. Public comments received during the PP are addressed as part of the responsiveness summary in the ROD. A notice to the public is issued when the ROD is signed by Navy and EPA following State concurrence.
<b>Remedial Design/Remedial Action (RD/RA)</b>	The final stage in the process is the RD/RA. The technical specifications for cleanup remedies and technologies are designed in the RD phase. If land use controls are a component of the remedy, the Land Use Control Remedial Design is generated during this phase. The RA is the actual construction or implementation phase of the cleanup process.
<b>Remedy In Place</b>	For long-term remedies where it is anticipated that remedial action objectives will be achieved over a long period, the RIP milestone signifies the completion of the remedial action construction phase, and that the remedy has been implemented and has been demonstrated to be functioning as designed (i.e., all testing has been accomplished and the remedy will function properly). Once all RCs and RIPs have been documented for every site at the facility and the terms of the FFA have been met, site closeout and NPL deletion is completed.
<b>Response Complete</b>	Within the CERCLA process there are multiple points at which a decision can be made that no further response action is required; properly documented (necessary regulatory notification or application for concurrence has occurred) these decisions constitute response complete and/or site closeout. RC is the point at which the remedy has achieved the required reduction in risk to human health and the environment (cleanup goals have been met). Response complete is followed by site closeout.
<b>Five Year Review</b>	Five-year reviews generally are required by CERCLA or program policy when hazardous substances remain on site above levels that permit unrestricted use and unlimited exposure. Five-year reviews provide an opportunity to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. Generally, reviews are performed 5 years after the initiation of a CERCLA response action, and are conducted every 5 years as long as future uses remain restricted. Five-year reviews for Cheatham Annex are performed by the Navy, the lead agency for the site, but EPA retains responsibility for determining the protectiveness of the remedy.



**LEGEND**

- Active RI/FS Sites (one or more media)
- Active AOCs
- No Further Action RI/FS Sites and AOCs
- CAX Boundary

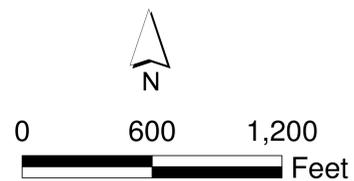


Figure 2-1  
 Sites/AOC Locations and CERCLA Status  
 Site Management Plan for FY 2010 to 2011  
 Cheatham Annex  
 Williamsburg, Virginia

# CAX Site and AOC Descriptions

---

This section provides a summary of base-wide investigations as well as a brief history of CERCLA activities (chronology of significant CERCLA documents and milestones), a summary of the nature and extent of potential contamination, a summary of potential unacceptable risks, and the CERCLA path forward for each of the sites and active AOCs at CAX. Active site and AOC figures and schedules follow each site description. Schedules illustrate planned CERCLA implementation activities through 2011.

## 3.1 Base-Wide Studies

### 3.1.1 Initial Assessment Study (IAS)

In the first phase of the Navy Assessment and Control of Installation Pollutants (NACIP) program (the precursor to the Environmental [nee Installation] Restoration Program), a team of engineers and scientists conducted an IAS at CAX in 1984 to identify and assess sites posing a potential threat to human health and/or the environment due to contamination from past operations. Twelve potentially contaminated sites were identified (Sites 1 through 12) based on information from historical records, aerial photographs, field inspections, and personnel interviews. The IAS concluded that four of the twelve sites (Sites 1, 9, 10, and 11) may pose a sufficient threat to human health or to the environment to warrant Confirmation Studies (phase two of the NACIP). However, none of the sites posed an immediate threat to human health or the environment. The results of the Confirmation Studies, which would involve actual sampling to confirm or deny the existence of the suspected contamination and to quantify the extent of any problems which may exist, would be used to evaluate the necessity to implement mitigative actions and/or clean up operations (C. C. Johnson & Associates, Inc. and CH2M HILL, 1984).

### 3.1.2 Confirmation Studies

Two Confirmation Studies were conducted, one in 1986 and one in 1988. The 1986 study (Step 1A - Verification) included the collection of groundwater samples at Site 1 (Landfill Near Incinerator), soil samples at Site 9 (Transformer Storage Area), and groundwater, soil, surface water/sediment, and drum content samples at Site 11 (the Bone Yard). No samples were collected at Site 10 (Decontamination Agent Disposal Area Near First Street), and the only reference to Site 10 in the report is in Table 1-1, which has the notation "Magnetometer Survey." Site 10 is not cited again, and if a magnetometer survey was conducted at Site 10, it was not documented in the report. Based on the results of the sampling that occurred at Sites 1, 9, and 11, a repeat of the first round of sampling and analysis was recommended for Sites 1 and 11 (minus drum samples), while for Site 9, the recommendation was to collect additional background information on the site before proceeding with a second round of sampling (Dames & Moore, 1986).

The Round Two Confirmation Study (Step 1A - Verification) sampling occurred in late 1987. Another round of groundwater samples were collected from Site 1 and another round

of groundwater, surface water and sediment samples were collected from Site 11; all samples were collected at the same locations as with the round one sampling. A second round of soil samples was not collected at Site 11 (no explanation why was provided), even though it was recommended in the round one report. No sampling occurred at Site 9, and neither Site 9 nor Site 10 is mentioned in the report. At Site 1, two semi-volatile organic compounds (SVOCs), three metals, total phenols, and oil and grease were detected in groundwater; however only zinc and total phenols exceeded the Virginia groundwater standards. At Site 11, two SVOCs and total phenols were detected in groundwater and surface water; however only total phenols exceeded the Virginia water standards. In addition, two volatile organic compounds (VOCs), total phenols, and oil and grease were detected in Site 11 sediment. No constituents exceeded their respective screening criteria (Dames & Moore, 1988).

In 1991, Dames and Moore finalized an RI Interim Report, which summarized the results of the two confirmation studies, including the geophysical survey conducted at Site 10 during round one. The report recommended further RI activities for Sites 1, 10, and 11 and no further action for Site 9 (Dames and Moore, 1991).

### 3.1.3 Pond Study

In 2000, surface water and sediment samples were collected from 19 stations within four, man-made surface water bodies located within CAX - Jones Pond, Cheatham Pond, Youth Pond, and Penniman Lake ([Figure 3-1](#)). Based on the results, COPCs, including polycyclic biphenyls (PCBs) and metals were identified as having the potential to cause risk to human and environmental receptors and further investigation into the potential sources of these bioaccumulative chemicals and their potential effects on human health and the environment was also recommended (Baker, 2001a). In addition, based on the presence of bioaccumulative chemicals (particularly PCBs) in the sediment of Youth Pond and Penniman Lake, fishing restrictions were recommended and signs for catch-and-release were posted.

### 3.1.4 PCB Study

As a result of the Pond Study and the CAX Site 11 RI, further investigation into the potential source(s) of PCBs and their potential effects on human health and the environment was recommended. A Uniform Federal Policy (UFP) Sampling Analysis Plan (SAP) to conduct this investigation was submitted to the Navy for review in April 2009, with a submission to the CAX Partnering Team to follow in the late-July/early August 2009 timeframe.

### 3.1.5 Community Involvement Plan (CIP) Update

A CIP assists the Navy in its community outreach efforts for disseminating information about, and public participation in, the ongoing investigation and remedial processes and identifies community concerns (if any). An update to the existing WPNSTA Yorktown and CAX CIP was conducted in 2008/2009 and included mailing a survey to residences within a one mile radius of WPNSTA Yorktown and CAX (~3,141 surveys were mailed and 489 responses received) and conducting interviews with representatives of municipal and County governments, environmental groups, business organizations, service organizations, churches, etc. (7 interviews conducted). In general, the public has a favorable attitude

towards CAX/the Navy and more information on environmental cleanup and RAB meetings were desired (CH2M HILL, 2009a).

### 3.1.6 Basewide Documents Available

Document Title /Milestone	Author/Date	AR Document Number
IAS	C.C. Johnson & Associates, Inc/ Hill, 1984	00247
Confirmation Study Round 1	Dames & Moore, 1986	00256
Confirmation Study Round 2	Dames & Moore, 1988	00259
RI Interim Report	Dames & Moore, 1991	00812
Pond Study Report	Baker, 2001a	01212
Community Involvement Plan	CH2M HILL, 2009a	AR No. Pending

## 3.2 Site Descriptions

The following sites and AOCs had a no action or NFA decision prior to the submission of the FY2010-2011 SMP amendment:

- Site 2 – Contaminated Food Disposal Area
- Site 3 – Submarine Dye Disposal Area
- Site 5 – Photographic Chemicals Disposal Area
- Site 6 – Spoiled Food Disposal Area
- Site 8 – Landfill Near Building CAD 14
- Site 10 – Decontaminated Agent Disposal Area Near First Street
- Site 12 - Disposal Site Near Water Tower
- AOC 4 – Outdated Medical Supply Disposal Area
- AOC 5 – Debris Area

Descriptions of these sites were included in the FY2008-2009 SMP amendment, but will not be included herein or in future SMP amendments. Information on these sites and AOCs is included in [Table 2-1](#). Information regarding CAX sites that need further action or investigation is provided below.

### 3.2.1 Site 1—Landfill Near Incinerator

#### Site 1 Description

Site 1 was used for burn residues between 1942 and 1951, and as a general landfill between 1951 and 1981. Site 1 covers approximately 2 acres and is located along the York River and behind a former incinerator that was dismantled between sometime 1989 and 1992 ([Figure 3-2](#)). An unnamed tributary and associated wetland that discharges to the York River border the northwest edge of the landfill. A variety of wastes, including empty paint cans and paint thinner cans, cartons of ether and other unspecified drugs, railroad ties, tar paper, sawdust, rags, concrete, and lumber, were burned and disposed in the landfill until disposal activities ceased in 1981. During its operation, an estimated 34,500 tons of solid waste were

buried at the landfill. The landfill occupied approximately 1 acre. There was an additional northern area of impacted soils that occupied approximately three tenths of an acre. This area contained cables, metal storage containers, an empty storage tank, automobiles, airplane and boat parts, and other miscellaneous items and was initially designated as AOC 5-Debris Area. However, it was later incorporated into Site 1, as it was determined to actually be part of the site.

The edges of the landfill, along the wetland and the York River, were historically steep (approximately 20 ft high, nearly vertical in areas) and lacking in vegetation. Landfill contents (including metal scrap, wood, drums, containers, and other miscellaneous debris) were exposed along this perimeter. Continued erosion of bluff slopes caused by flooding and wave action may have caused exposure and migration of contaminated soil and debris to the adjacent wetland area. In 2000, Geotubes™ were installed to temporarily stabilize the toe of the bank of the erosion area. In 2003, two breakwaters were constructed along the shore of Site 1 to reduce the amount of erosion caused by wave action from the York River (Figure 3-2). A summary of relevant documents and action milestones is presented in the table below.

### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Site Investigation Report, Sites 1, 10, and 11	Baker, 1994	00140C
Site Screening Process (SSP) Report, Sites 1, 10, and 11	Baker, 1997	00131C
Action Memorandum (AM), Site 1 – Landfill Near Incinerator	Baker, 1999a	00176C
Field Investigation Report, Site 1 and AOC 2	Baker, 1999b	01217
Construction Close-Out Report, Site 1 Time Critical Removal Action	Baker, 2000a	00214C
Focused FS, Site 1 – Landfill Near Incinerator	Baker, 2000b	01124
Trenching Letter Report, Site 1, Site 4, and AOC 2	Baker, 2002	01234
EE/CA For Contaminated Soil, Site 1 – Landfill Near Incinerator	Baker, 2003b	01563
Memorandum: Yorktown, Cheatham Annex Site-1 Physical Changes Due To Hurricane Isabel	NAVFAC, 2003	01380
Round One Remedial Investigation Report for Site 1 – Landfill Near Incinerator	Baker, 2004b	01475
Screening-level Ecological Risk Assessment and Step 3A Refinement Report, Site 1 – Landfill Near Incinerator	Baker, 2005a	01669
Closeout Report, Site 1 – Landfill Near Incinerator, Southeast Wooded Area	Shaw, 2006a	01922
Technical Memorandum, Pre-Removal Characterization of Sediments, Site 1 – Landfill Near Incinerator	Baker, 2006	02014
Project Completion Report, Site 1 – Landfill Near Incinerator and Site 7 – Old DuPont Disposal Area	Bhate, 2007a	02195
Technical Memorandum (TM), Groundwater Risk Management	CH2M HILL, 2008a	02199
Hot Spot and Depression Pool Removal Action (Removal Action E) – 2007	Shaw, 2008a	02279

Document Title /Milestone	Author/Date	AR Document Number
TM, Documentation for NFA Regarding Site Waste, Soils, and Sediment	CH2M HILL, 2008b	02215
Proposed Plan, Site 1 – Landfill Near Incinerator	CH2M HILL, 2008c	AR No. Pending
Record of Decision, Site 1 – Landfill Near Incinerator	CH2M HILL, 2009b	AR No. Pending

## Nature and Extent of Potential Contamination

The waste at Site 1 was the source of potential contamination to soil, groundwater, sediment, and surface water. During the RI, several polycyclic aromatic hydrocarbons (PAHs) were detected in surface and subsurface soil within the landfill boundary at concentrations of up to 120,000 J micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ). Benzo(a)pyrene was the most frequently detected of these PAHs. The PCBs, Arochlor-1260 and Arochlor-1248, were also detected in surface and subsurface soil at concentrations of up to 5,400 J  $\mu\text{g}/\text{kg}$  within and around the landfill. Pesticides including 4,4- Dichlorodiphenyltrichloroethane (DDT), heptachlor epoxide, and dieldren were also detected in surface soils at a maximum concentration of 2,200  $\mu\text{g}/\text{kg}$ . Cyclotrimethylene trinitroamine (RDX) was the only explosive detected in soils. This chemical was detected in one subsurface sample collected in the landfill at a concentration of 7,200 K  $\mu\text{g}/\text{kg}$ . Antimony, arsenic, copper, iron, and lead were detected in surface and subsurface soil at maximum concentrations of 53.9 J milligrams per kilogram ( $\text{mg}/\text{kg}$ ), 39.9  $\text{mg}/\text{kg}$ , 13,700 L  $\text{mg}/\text{kg}$ , 91,400 L  $\text{mg}/\text{kg}$ , and 2,720  $\text{mg}/\text{kg}$ , respectively. VOC concentrations detected in soils were consistent with laboratory contamination. Arsenic, iron, and manganese concentrations in groundwater collected within the landfill boundary were above risk screening values at maximum total concentrations of 34.7 micrograms per liter ( $\mu\text{g}/\text{L}$ ), 29,800  $\mu\text{g}/\text{L}$ , and 505  $\mu\text{g}/\text{L}$ . The only organics detected in groundwater were low levels of phthalates (generally consistent with laboratory contamination) and one detection of 4-nitrotoluene at a concentration of 0.12 J  $\mu\text{g}/\text{L}$ . Arsenic was detected in surface water from the unnamed tributary at a maximum concentration of 14.1  $\mu\text{g}/\text{L}$ . There were no organics detected in surface water with the exception of low levels of common laboratory contaminants. Benzo(a)pyrene, Arochlor-1254, Arochlor-1260, and arsenic were detected in sediment in the portion of the unnamed tributary immediately adjacent to the landfill at maximum concentrations of 2400  $\mu\text{g}/\text{kg}$ , 740  $\mu\text{g}/\text{kg}$ , 2300 J  $\mu\text{g}/\text{kg}$ , and 44.6  $\text{mg}/\text{kg}$ , respectively. Several pesticides were also detected in sediment.

## Potential Risks

Prior to any removal actions, soil and waste posed unacceptable risks to human health and ecological receptors. However, these risks were mitigated by the completion of five removal actions (CH2M HILL, 2008b). No unacceptable human health risks were identified from exposure to surface water and sediment under the most conservative risk scenario, future child residents (cancer risk =  $3.9 \times 10^{-6}$  and hazard index [HI] = 0.39). However, risks were identified for aquatic ecological receptors based on exposure PCBs, PAHs, pesticides, and inorganics in sediment and surface water. These risks were also mitigated upon completion of the five removal actions (CH2M HILL, 2008b).

No unacceptable risks to future child residents were identified for nonpotable groundwater use (cancer risk =  $1.7 \times 10^{-6}$  and HI = 0.09) however unacceptable risks were identified for the potable use of groundwater (cancer risk =  $2.9 \times 10^{-4}$  and HI = 15.4). In 2008, human health risk for potable use of groundwater was reevaluated following completion of the five removal action; no unacceptable risk is present for the adult/child resident (iron HI = 0.066, manganese HI = 0.35, and arsenic HI = 0.77). The Navy, in agreement with USEPA and VDEQ, agreed potential groundwater risks at CAX Site 1 were acceptable for unlimited use and unrestricted exposure (UU/UE) as documented in the *Final CAX Site 1 Groundwater Data Review and Risk Management Consideration Technical Memorandum* (CH2M HILL, 2008a).

### Remedial Action(s)

Four removal actions (Removal Action A through D) conducted in 2003, 2004, and 2005 eliminated all landfill waste and associated soil from the site (Shaw, 2006a and Bhate, 2007a). Following the 2003 removal action, a “depression pool” was created east of the unnamed tributary that borders the northwest edge of the former landfill. A removal action (Removal Action E) conducted in 2007 excavated sediment contaminated with PAHs, metals, and pesticides from the depression pool and sediment with elevated PCBs in the marsh adjacent to the depression pool. In addition during Removal Action E, a riparian buffer was constructed adjacent to the depression pool to reduce erosion of the bank (Shaw, 2008a).

### Activities Completed 2008-2009

The Navy, USEPA, and VDEQ agreed that following the five removal actions NFA is necessary for protection of human health and the environment. An NFA PP for all site media (soil, sediment, surface water, and groundwater) was finalized in December 2008 (CH2M HILL, 2008c) after no public comments were received. An NFA ROD was signed in September 2009 (CH2M HILL, 2009c).

### Path Forward

CERCLA documentation is complete with signature of the NFA ROD (CH2M HILL, 2009c).

## 3.2.2 Site 4—Outdated Medical Supply Disposal Area

### Site Description

Site 4 is located at the headwaters of an upstream pond (upstream of Youth Pond) and between buildings CAD 11 and CAD 12 ([Figure 3-3](#)). In the late 1960's, out-of-date, unused, medical supplies, including syringes and empty intravenous bottles, and one-inch metal banding, were unloaded down a bank in this area and covered with soil. Reportedly, much of the material was removed from the site because stories were circulating about syringe needles getting stuck in deer hooves. After heavy rain events, syringes could sometimes be seen floating in the adjacent pond and in the downgradient Youth Pond. In addition, railroad ties and concrete debris were dumped along the main drainage channel to the upstream pond. Stormwater runoff from the surrounding industrial area is deposited to Site 4 via Outfall 2 ([Figure 3-3](#)). A summary of relevant documents and action milestones is below.

## Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Site Inspection Report, Site 4 and AOC 1	Baker, 2001b	01291
Trenching Letter Report, Site 1, Site 4, and AOC 2	Baker, 2002	01234
Screening Level Ecological Risk Assessment Report for Sites 4 and 9	Baker, 2005b	01565

## Nature and Extent of Potential Contamination

During the 2001 Site Inspection, several PAHs were detected in surface and subsurface soils. The PAH detected at the highest concentration was fluoranthene, at a concentration of 11,000 µg/kg. Several pesticides including 4,4-DDT, 4,4-dichlorodiphenyldichloroethylene (DDE), Aldrin, gamma chlordane, Endosulfan II, endrin, endrin aldehyde, and endrin ketone were detected in soil at concentrations less than 100 µg/kg. Arochlor-1260 and Arochlor-1242 were detected in soils at maximum concentrations of 1,600 L µg/kg and 2,300 L µg/kg, respectively. PAHs, PCBs, and pesticides were also detected in sediment at concentrations generally lower than those detected in soils.

Arsenic, iron, and manganese were detected across the site in surface and subsurface soil at maximum concentrations of 4.2 L mg/kg, 61,700 L µg/kg, and 302 mg/kg. Arsenic concentrations were also above screening values in sediment with a maximum detection of 12.2 L µg/kg. The Site Inspection Report recommended the extent of debris be determined and addressed through an EE/CA. Groundwater was not evaluated during the Site Inspection.

## Potential Risks

Potential non-cancer hazards were identified for the future resident (child or adult not specified) from exposure to iron in surface soils (HI = 1.4). In addition, the cumulative HI for surface soils was 2.0. As mentioned above, iron was the only chemical with an individual HI greater than 1; however the highest iron concentration detected at Site 4 was within base background levels. There were no other potentially unacceptable human health risks identified at the site. A Screening Ecological Risk Assessment (SERA) identified potential ecological risks associated with PAHs, pesticides, PBCs, and inorganics and recommended additional data collection to support a Step 3a Ecological Risk Assessment (ERA).

## Remedial Action(s)

Approximately 200 pounds of debris and 13 pounds of sharps (metal and plastic) found on the surface were removed by Reactives Management, Inc. in May 1998 (Reactivities Management, 1998).

## Activities Completed 2008-2009

A UFP-SAP was submitted to the Partnering Team in March 2009 for review. Comments were resolved and the UFP-SAP went final in October 2009, with fieldwork conducted in November and December 2009. The draft SI report preparation will occur in 2010.

## CERCLA Path Forward

- Expanded SI
- EE/CA and DD or RI/FS/PP/ROD

**Schedule 3-1** presents the FY10-11 schedule for Site 4.

### 3.2.3 Site 7—Old DuPont Disposal Area

#### Site Description

Site 7 is located along the York River, east of Chase Road (**Figure 3-4**); Davis Road transects the site. During the early 1900s, it was reported that non-hazardous and/or inert wastes from the City of Penniman and the DuPont Company Penniman facility were disposed along the York River. Site 7 was identified as a potential area of concern in the IAS (C. C. Johnson & Associates, Inc. and CH2M HILL, 1984).

Information on the types and quantities of wastes received are not available; however, as the shoreline eroded, site waste (e.g., dinner ware, incinerated bottles, metal) littered the beach. In 2003, Hurricane Isabel eroded approximately 15 to 20 ft of shoreline, causing a large amount of debris to cover the beach and action was taken to minimize the impact. In February 2004, trenching with limited soil sampling adjacent to former Cabin 169 was conducted to delineate the extent of debris. Additional soil sampling was conducted in April 2004 to further delineate the extent of debris near former Cabin 170. The trenching report identified potential soil contamination adjacent to and encompassing former Cabins 169 and 170 (Baker, 2004c). In addition, a volume of ash and debris was identified in the southwestern portion of the site where erosion of the slope has occurred. This area is highly vulnerable to further erosion into the York River by surface water runoff and intense wave action. Therefore, an Action Memorandum (AM) for a Time-critical Removal Action (TCRA) was signed to prevent further erosion of the disposal area contents into the York River. A summary of relevant documents and action milestones is below.

#### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Trenching and Limited Investigation Report, Site 7N	Baker, 2004c	01479
AM TCRA, Site 7N – Old DuPont Disposal Area	Baker, 2004d	01592
Explosive Safety Submission – Site 7	Bhate, 2005	01865
Project Completion Report Site 1 – Landfill Near Incinerator and Site 7 – Old DuPont Disposal Area	Bhate, 2007a	02195, 02196, 02197, and 02198
Unexploded Ordnance (UXO) Remediation After Action Report, Site 7	Bhate, 2007b	AR No. Pending
Construction Completion Report: Soil Debris Removal at Site 7	Shaw, 2009a	AR No. Pending

## Nature and Extent of Potential Contamination

The source of potential contamination is debris disposed of at Site 7. In 2004, test pits were excavated to identify the extent of the debris. Eight soil samples were collected for analysis of VOCs, SVOCs, pesticides, and PCBs and metals; no groundwater samples were collected. No significant concentrations (low levels estimated below reporting limits) of VOCs, SVOCs, pesticides, or PCBs were detected in soil. Metals including arsenic, chromium, lead, and zinc were detected in surface soil at maximum concentrations of 9.2mg/kg, 2,220 mg/kg, 6,420 mg/kg, and 2,240 mg/kg, respectively. These metals were also detected in subsurface soil at lower concentrations. In addition, one sample was collected from the ash pile within the slope along the York River and analyzed for dioxin, with a total tetrachlorodibenzo-p-dioxin of 325 nanograms/kilogram (ng/kg).

## Potential Risks

No risk assessments have been performed on Site 7 media.

## Remedial Action(s)

During the 2004 beach surface debris cleanup, an apparently unfired, unfused, three-inch projectile was discovered and removed from the site for proper disposal. Due to this discovery, the TCRA was put on hold while the Navy obtained an Explosives Safety Submission (ESS) Waiver. The Final ESS (Bhate, 2005) was submitted to the Partnering Team on January 4, 2006. According to the "UXO Remediation After Action Report" (Bhate, 2007b), approximately 86 pounds of munitions scrap (i.e., lifting lugs and fuse adapters) were recovered, certified safe (i.e., free from explosive hazards) and shipped to a recycle facility and smelted for reuse. No live ordnance was found and the action was completed by August 9, 2006. In November 2006, Geotubes™ were installed to stabilize the shoreline and protect it from further erosion. In addition, a presumptive removal action was initiated in December 2007 to remove visible debris from the previously identified disposal area and the former cabin site areas. Approximately 4,482 tons of debris and soil were removed (Shaw, 2009a).

## Activities Completed 2008-2009

The presumptive removal action for the debris was completed in FY08. Following the removal action, site restoration included backfilling the excavated areas with clay and topsoil, installing erosion control on slopes, and re-vegetation of the area. A Construction Closeout Report (CCR) was submitted in March 2009 to document the presumptive removal action. A Draft UFP-SAP to complete an SI at Site 7 will be submitted to the Partnering Team in early 2010, with fieldwork expected Summer 2010 followed by report preparation late 2010/early 2011.

## CERCLA Path Forward

- SI
- NFA DD or RI/FS/PP/ROD

[Schedule 3-2](#) presents the FY10-11 schedule for Site 7.

### 3.2.4 Site 9—Transformer Storage Area

#### Site Description

Site 9 is a former transformer storage area approximately 7,000 square feet (ft<sup>2</sup>) in size and located adjacent to the northwest corner of Building CAD 16 (Figure 3-5). Between 1973 and 1980, electrical transformers, some of which contained PCBs, were reportedly stored at the site for repair or disposal. The storage area was not paved; however it was enclosed by an earthen wall. Transformers were not stored at the site after 1980, and the area was graded and covered with gravel. A summary of the relevant document and action milestones is below.

#### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Screening-level Ecological Risk Assessment Report for Sites 4 and 9	Baker, 2005b	01565

#### Nature and Extent of Potential Contamination

Previous investigations identified PCBs in soil (< 1 mg/kg) and potential migration of PCBs through surface water runoff. No groundwater investigations have been conducted. Potential transport of PCBs through runoff to sediment and surface water downgradient of Site 9 (to the upstream pond by Site 4 and Youth Pond) warrant investigation.

#### Potential Risks

A final human health risk assessment (HHRA) has not been completed at Site 9. A Draft HHRA was included in the *Draft Final No Further Response Action Planned Decision Document Site 9 – Transformer Storage Area* (Baker, 1999c) which was completed based on PCB soil data collected in 1986. No unacceptable human health risks associated with PCBs in soil were identified in the HHRA. However due to concerns related to these results, including the unknown depths of the soil samples, this document and the HHRA was never finalized. A SERA indicated potential unacceptable ecological risk from exposure to PCBs. The SERA recommended that Site 9 continue to Step 3a of an ERA. On-site risks are minimal given poor habitat quality; however, potential risks posed by PCBs migrating downgradient to aquatic and terrestrial receptors warrants further consideration. The SERA also concluded that insufficient data are available at Site 9 to conduct Step 3a of an ERA (Baker, 2005b).

#### Remedial Action(s)

No CERCLA RAs have taken place at Site 9.

#### Activities Completed 2008-2009

A UFP-SAP was submitted to the Partnering Team in March 2009 for review. Comments were resolved and the UFP-SAP went final in October 2009, with fieldwork conducted in November and December 2009. The draft SI report preparation will occur in 2010.

## CERCLA Path Forward

- SI
- EE/CA and NFA DD or RI/FS/PP/ROD

**Schedule 3-3** presents the FY10-11 schedule for Site 9.

### 3.2.5 Site 11— Bone Yard

#### Site Description

The IAS identified Site 11 as an eight acre area located 250 ft south of Antrim Road and the Public Works facility. Documentation in later reports, following the removal of stored material, identified the site being 2.7 acres in size (Baker, 2000b) (**Figure 3-6**). Between 1940 and 1978, Site 11 was used to store containers of waste-oil, tar, asphalt, and other scrap materials. Oil, asphalt, gasoline, as well as scrap metal, old storage and mixing containers (e.g., fuel oil tanks), fence posts, and abandoned cars have been found at Site 11. Various discarded clamshell buckets and other surplus metal objects used in heavy construction were also located throughout the area. Approximately ten 5-gallon containers labeled “paraplastic” (concrete sealant) were also present at one time. South of the entrance, numerous barrels containing petroleum products were discovered, as well as several 500-gallon square tanks containing asphalt or oil used in making asphalt. The site is wooded and slopes slightly east toward Penniman Lake. Two small drainage ditches border the site and flow east toward Penniman Lake. A summary of relevant documents and action milestones is below.

#### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Site Investigation For Sites 1, 10, and 11	Baker, 1994	00140C
SSP Report, Sites 1, 10, and 11	Baker, 1997	00131C
Removal Closeout Report, Site 11 – Bone Yard	Baker, 2000c	01477
RI, Site 11 – Bone Yard	Baker, 2007	02171
EE/CA	CH2M HILL, 2008d	02285
Draft Final Construction Completion Report, Hot Spot Removal Action at Site 11	Shaw, 2009b	(Pending Final Document)
TM – Consensus for NFA in Soil and GW, Site 11 – Bone Yard	CH2M HILL, 2009c	AR No. Pending

#### Nature and Extent of Potential Contamination

The material stored at Site 11 was the source of potential contamination to soil, groundwater, sediment, and surface water. Previous investigations included full suite analysis (VOCs, SVOCs, PCBs, pesticides, explosives, and inorganics) of soil, surface water, sediment, and groundwater. Pesticides (4,4-dichlorodiphenyldichloroethane [DDD] at 37,000 µg/kg and 4,4- DDE at 1,800 µg/kg), PCBs (340 µg/kg), and PAHs (total PAHs > 10,000 µg/kg) were detected in soil in localized areas. VOCs detected in soil were limited

to low concentrations estimated below reporting limits of ethylbenzene, styrene, and xylenes. Only a few VOCs, SVOCs, and pesticides were detected in groundwater at trace concentrations estimated below laboratory reporting limits. Arsenic (21.4 µg/L) was detected in groundwater above the USEPA Maximum Contaminant Level (MCL).

VOCs and SVOCs detected in surface water were low concentrations of common laboratory contaminants (acetone, methylene chloride, toluene, and phthalates). In sediment, trichloroethylene (TCE) (5 J µg/kg) and 1,2-dichloroethene (DCE) (13 J µg/kg) were detected in one sample. PCBs (26 – 15,000 µg/kg) were detected in sediment with the highest concentrations in samples from Penniman Lake.

### Potential Risks

A potential unacceptable cancer risk of  $1.4 \times 10^{-4}$  was calculated for the child resident based on exposure to arsenic based on reasonable maximum exposure (RME) concentrations in groundwater. Non-cancer hazards of 7.2 and 3.1 were identified for the child and adult residents from exposure to arsenic, iron, and manganese at the RME concentrations in groundwater. A cumulative HI of 2.1 was also calculated for the future child resident based on ingestion of soil at RME concentrations. This was primarily due to exposure to iron (HI=1.1) and vanadium (HI=0.26). Under the central tendency exposure (CTE) scenario, non-cancer hazards to the future adult and child residents (1.4 and 4.8, respectively) still indicated potentially acceptable risks. However, the HI (0.98) and cancer risk ( $3.5 \times 10^{-6}$ ) for future child exposure (combined dermal, ingestion, and inhalation) to surface soil was determined to be acceptable.

The SERA through Step 3a concluded that soils pose a potential unacceptable risk to terrestrial receptors primarily as a result of contamination in four areas of the site (labeled as “focus areas” on [Figure 3-6](#)). These four focus areas pose potential unacceptable risk due to elevated concentrations of total PAHs, pesticides (4,4-DDD, 4,4-DDE, 4,4-DDT, dieldrin, and endrin), and inorganics (copper, lead, mercury, selenium, thallium, and zinc) that exceed ecological screening criteria.

### Remedial Action(s)

In 1987, 18 drums were removed from the site for disposal. In 1997, 59 drums, two empty storage tanks, two tar storage boxes and miscellaneous surface debris were removed for offsite disposal (Baker, 2000b). Confirmation soil samples collected from the site demonstrated that contamination remained in the soil. An additional removal action is currently in progress at Site 11. In accordance with the EE/CA (CH2M HILL, 2008d), four focus areas, identified in the SERA, will be excavated to a maximum depth of three feet below ground surface. Following completion of the EE/CA and the removal action workplan, the EPA expressed concern regarding RI surface soil sample location 11SS12 where lead concentrations were detected above the ecological screening criteria of 120 ppm (at 385 ppm). Although the frequency and magnitude of this exceedence, compared to the conservative, literature-based screening value (120 ppm) (not site-specific effects-based values), warranted a conclusion of no unacceptable post-remedial risk for the site, the EPA did not agree and felt more sampling around the sample location was necessary. Therefore, a fifth focus area was added to the removal action around sample location 11SS12.

### Activities Completed 2008-2009

The Site 11 removal action was completed in 2009. A CCR, documenting the hot spot removal action, was submitted for review (Shaw, 2009b). Following completion of the removal action, a TM for team consensus for an NFA decision for Site 11 was signed in September 2009 (CH2M HILL, 2009c). The NFA PP and ROD will follow in 2010, with ROD signature anticipated before the end of FY10.

### CERCLA Path Forward

- NFA PP/ROD

[Schedule 3-4](#) presents the FY10-11 schedule for Site 11.

## 3.2.6 AOC 1—Scrap Metal Dump

### Site Description

AOC 1 was identified as an AOC in 1998, following site visits by the Navy, USEPA, and VDEQ and is divided into a North Area (0.2 acres) and a South Area (0.4 acres). AOC 1 is a former debris disposal area located just west of Chapman Road within two ravines associated with unnamed tributaries to Jones Mill Pond ([Figure 3-7](#)). Wood and metal debris outcrop from the banks of the ravines, with debris being more extensive within the southern ravine. Orange staining in the unnamed tributary that receives runoff from the southern ravine has been identified. Based on an average thickness of debris of 3 ft, the total volume of debris has been estimated to be 3,000 cubic yards (cy). Two cylinders were present along the top of bank along the northern ravine. Markings were distinguishable on both of the cylinders, and included raised lettering around the neck “The Liquid Carbonic Co.” These were later determined to be empty and were removed from the site. A summary of relevant documents and action milestones is presented below.

### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Site Inspection Report, Site 4 and AOC 1	Baker, 2001b	01291

### Nature and Extent of Potential Contamination

The 2001 Site Inspection and field investigation included a geophysical survey and collection of soil, surface water, and sediment samples; no groundwater samples were collected (Baker, 2001b). The geophysical survey concluded debris in the northern area to be about 10 to 12 ft beyond the edge of visible surface debris, and that there is no extensive buried debris in the remaining areas of the site. Total PAHs (~5,000 µg/kg) and arsenic (23.5 mg/kg) were detected in soil, with the highest concentrations in the northern area. Low estimated levels of phthalates were detected in surface water and sediment. Arsenic (7.4 mg/kg) and low estimated levels below reporting limits of ethylbenzene and xylene were also detected in sediment. In addition, a SI field investigation was completed in December 2008 to further determine the nature and extent of contamination at AOC 1. The results of this investigation will be presented in a SI Report.

## Potential Risks

A human health risk screening evaluation indicated total potential unacceptable cancer risk from exposure to PAHs, PCBs, and arsenic and potential unacceptable non-cancer hazards from exposure to iron in soil and surface water. However, individually, chemicals contributing to potential unacceptable cancer risk are within USEPA's acceptable range, and iron (that contributed to the potential unacceptable non-cancer hazard) was within background levels. No groundwater risk exposures or ecological risk evaluations have been performed on terrestrial or aquatic receptors in the drainage ways or Jones Mill Pond.

## Remedial Action(s)

No CERCLA RAs have taken place at AOC 1.

## Activities Completed 2008-2009

SI field activities at AOC 1 were completed in December 2008. The draft SI Report will be submitted in 2010.

## CERCLA Path Forward

- Completion of SI report
- EE/CA and NFA DD or RI/FS/PP/ROD

[Schedule 3-5](#) presents the FY10-11 schedule for AOC 1.

## 3.2.7 AOC 2—Dextrose Dump

### Site Description

AOC 2 was identified during site visits by the Navy, USEPA, and VDEQ in 1998. The area is located in the woods, north of Garrison Road, along the southern perimeter of CAX and contains several rows of concrete foundation piers, which at one time supported a Shipping House at the former Penniman Shell Loading Plant ([Figure 3-8](#)). Most of the Penniman facility was demolished between 1918 and 1925. Grass-covered lanes, which lead to the area, are likely locations of former rail lines that have been removed. Several glass bottles, many of which are labeled dextrose, are present at this AOC. In addition, several partially buried empty drums, unused respirator cartridges, unused military uniforms, and deer carcasses were also noted. A summary of relevant documents and action milestones is below.

### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Field Investigation Report, Site 1 and AOC 2	Baker, 1999b	01217
Field Investigation Report, Site 7 and AOC 2	Baker, 2001c	01348

### Nature and Extent of Potential Contamination

A 1999 investigation consisted of a geophysical survey and soil and groundwater sampling (Baker, 1999b). VOCs, pesticides, and metals were detected in soil. Aluminum, chromium, iron, and manganese were detected in soils at maximum concentrations of 12,500 mg/kg, 43.2 mg/kg, 45,300 mg/kg, and 240 mg/kg, respectively. Concentrations were generally

higher in subsurface samples. Aluminum, arsenic, and manganese were detected in filtered direct push groundwater samples at maximum concentrations of 210 µg/L, 5.5 µg/L, and 317 µg/L. However, the investigation concluded that the low concentrations of detected constituents were not related to site activities.

A 2001 investigation included test pits and hand auger borings to define the extent of buried debris (Baker, 2001c). A large volume of buried drums and respirator filter canisters were encountered. A few of the drums contained a thin layer of tar coating or residue. The remaining drums were empty. The investigation recommended further study and possible waste removal.

### Potential Risks

Select metals (aluminum, chromium, iron, and manganese) were detected in soils at concentrations greater than human health and/or ecological screening values and maximum aluminum, arsenic, and manganese concentrations detected in groundwater exceeded their respective tap water risk-based concentrations (RBCs). However neither an HHRA nor ERA has been conducted at AOC 2.

### Remedial Action(s)

In 1998, Reactives Management, Inc. removed 470 bottles from AOC 2 as part of a routine housekeeping operation and selected 24 bottles for random analysis. Glucose was detected in each bottle at concentrations greater than 2,000 parts per million (ppm), indicating that the bottles contained dextrose, as was suspected.

### Activities Completed 2008-2009

The AOC SI UFP Quality Assurance Project Plan (QAPP) (CH2M HILL, 2008e), recommended that no additional sampling be completed at AOC 2 because (1) the disposed contents - dextrose bottles, military uniforms, and deer carcasses - are inert and not considered a CERCLA source and (2) where respirator cartridges and 55-gallon drums were identified, previously collected analytical data are adequate to support a qualitative risk screening approach and background comparison in order to determine whether a release has occurred that may pose an unacceptable risk. A draft SI Report will be submitted in 2010, and a housekeeping debris removal effort likely will be the recommended action for the site.

### CERCLA Path Forward

- Completion of SI Report
- Debris Removal/Removal Action
- NFA DD

[Schedule 3-6](#) presents the FY10-11 schedule for AOC 2.

## 3.2.8 AOC 3—CAD 11/12 Pond Bank

### Site Description

AOC 3 consists of an approximately 20 ft by 20 ft by 10 ft high pile of metal banding along the north bank of the upstream pond near Site 4, situated between Buildings CAD 11 and

CAD 12 and west of D Street ([Figure 3-9](#)). This area, which also contains a few empty drums and pieces of charred wood, is adjacent to Site 4 - Medical Supplies Disposal Area. This location was designated as an AOC in 1998 following site visits by Navy, USEPA, and VDEQ. A summary of the relevant document and action milestones is below.

### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Site Inspection Report, Site 4 and AOC 1	Baker, 2001b	01291

### Nature and Extent of Potential Contamination

During the 1999 field investigation of adjacent Site 4, one soil sample and one sediment sample were collected next to the metal banding pile (Baker, 2001b). Iron, chromium, and manganese were detected in surface soils at maximum concentrations of 61,700 mg/kg, 56.6 mg/kg, and 302 mg/kg, respectively. The highest concentration of a PAH in surface soil was fluoranthene, detected at a concentration of 14,000 µg/kg. Further investigation of the site is anticipated in 2009.

### Potential Risks

PAHs and metals were detected in soil and sediment samples above their respective residential RBCs however neither an HHR nor an ERA has been conducted at AOC 3.

### Remedial Actions

No CERCLA RAs have taken place at AOC 3.

### Activities Completed 2007-2008

A UFP-SAP was submitted to the Partnering Team in March 2009 for review. Comments were resolved and the UFP-SAP went final in October 2009, with fieldwork conducted in November and December 2009. The draft SI report preparation will occur in 2010.

### CERCLA Path Forward

- SI
- NFA DD or RI/FS/PP/ROD

[Schedule 3-7](#) presents the FY10-11 schedule for AOC 3.

## 3.2.9 AOC 6—Penniman AOC

### Site Description

AOC 6 consists of five sub-areas related to the former Penniman Shell Loading Plant. The Penniman Shell Loading Plant was an explosives manufacturing facility operated by the DuPont de Nemours Company during World War I on what is now CAX and adjacent properties. This facility operated as a trinitrotoluene (TNT) manufacturing plant beginning in approximately 1916, and subsequently began loading artillery shells for the war effort in

1918. Between 1918 and 1925 this facility was demolished and reverted to farmland. The Navy established CAX on a portion of this property in 1942 (Roy F. Weston, Inc., 1999a).

The five AOC 6 sub-areas ([Figure 3-10](#)) were identified through aerial photographic analysis as follows:

- **Ammonia Settling Pits** - This area consists of earthen ammonia settling pits that were part of a former shell loading area located on CAX. Wastewater from an ammonia finishing building was discharged through these settling pits.
- **TNT Graining House Sump** - This area consists of a concrete-lined, open top pit believed to be the sump pit for the TNT graining house in the former shell loading area.
- **TNT Catch Box Ruins** - This area consists of an earthen, brick-lined depression located immediately adjacent to the TNT graining house in the former shell loading area. This area was used to separate TNT particles from wastewater.
- **Waste Slag Material** - This area consists of waste metallic slag material that is located throughout the shell loading area predominantly along the railroad tracks<sup>2</sup>. The Navy and USEPA are discussing the appropriateness of inclusion of the Waste Slag Material as part of CERCLA and the AOC 6 study area.
- **1918 Drum Storage** - This area was used for the storage of wooden kegs when the shell loading area was active.

A summary of relevant documents and action milestones is below.

#### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Site Inspection Narrative Report, Penniman Shell Loading Plant	Roy F. Weston, Inc., 1999b	00161C
Data Acquisition/Summary Report, Penniman Shell Loading Plant	Roy F. Weston, Inc., 1999a	00162C

#### Nature and Extent of Potential Contamination

A 1999 Site Inspection included the collection of soil, sediment, surface water, and waste samples to assess potential sources of contamination associated with the Penniman Facility and to support HRS evaluations. During this Site Inspection, a total of seven waste source samples were collected among the five areas of AOC 6 as summarized in [Table 3-1](#) (Roy F. Weston, Inc., 1999b).

<sup>2</sup> There are no definitive boundaries to this area, because it consists of widely scattered, uncontained waste slag throughout CAX. The origin of this slag material is unknown; however, it has been speculated that this material may be slag broken out of steam locomotive boilers and dumped along the tracks during the Penniman Shell Loading Plant era (Roy F. Weston, Inc., 1999a).

TABLE 3-1  
1999 Waste Source Sampling at AOC 6  
Results exceeding USEPA Region III RBCs for residential soil

Area	Sample ID	Analytical Results <sup>1</sup>
Ammonia Settling Pits	PEN1-SO-01	Arsenic – 6 mg/kg
TNT Graining House Sump	PEN1-SO-03 PEN1-SO-03A	2,4,6-TNT – 28 mg/kg Arsenic – 15.5 mg/kg Cadmium – 4 mg/kg Lead – 7,580 mg/kg Manganese – 886 mg/kg
TNT Catch Box Ruins	PEN1-SO-04	2,4,6-TNT – 620 mg/kg Arsenic – 11 mg/kg Lead – 813 mg/kg
Waste Slag Material	PEN1-SO-07	Antimony – 4.6 L mg/kg Arsenic – 33.4 mg/kg Chromium – 32.9 mg/kg Lead – 2,600 mg/kg Manganese – 2,070 J mg/kg
1918 Drum Storage Area	PEN1-SO-13 PEN1-SO-14	Arsenic - 4.7 mg/kg (PEN1-SO-13) Arsenic - 5.5 mg/kg (PEN1-SO-14)

Notes:

<sup>1</sup>Analytical results lists all compounds exceeding the USEPA Region III RBCs for Residential Soil in waste samples

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

J = Analyte present. Reported value may or may not be accurate or precise.

mg/kg = milligrams per kilogram

In addition, the slag material found throughout AOC 6 was described as intact, hard, rock-like material. The Site Inspection recommended a sample for toxicity characteristic leaching procedure (TCLP) metals analysis and a soil sample from an area in the overland flow path of surface water runoff associated with this slag material.

### Potential Risks

Select contaminants were detected in soils at concentrations greater than human health risk screening values ([Table 3-1](#)). Waste within the Ammonia Settling Pits and TNT Graining House could be considered to pose human health risks due to the concentrations of arsenic in waste source samples above residential RBCs for soil; these areas were considered potential sources for contaminant transport to Penniman Lake ([Figure 3-10](#)).

Arsenic concentrations in samples collected from the 1918 Drum Storage Area (PEN1-SO-13 and PEN1-SO-14) exceeded the RBC for residential soil ([Table 3-1](#)). As these concentrations were detected between 12 to 24 inches below ground surface (bgs) and within 200 ft of buildings currently occupied by workers, an evaluation of the health risk posed to these workers was recommended.

No additional risk evaluations, including an ERA, have been completed for AOC 6.

### Remedial Action(s)

No CERCLA RAs have taken place at AOC 6.

### Activities Completed 2008-2009

SI field activities at AOC 6 were completed in December 2008. The draft SI Report will be submitted in 2010.

### CERCLA Path Forward

- Completion of SI report
- NFA DD or RI/FS/PP/ROD

[Schedule 3-8](#) presents the FY10-11 schedule for AOC 6.

## 3.2.10 AOC 7—Drum and Can Disposal Area

### Site Description

In April 2004, the Navy identified a potential area of concern north of Building 14 and Site 8 ([Figure 3-11](#)). The potential area of concern consists of several small surface debris disposal areas containing a few 55-gallon drums and numerous cans. One of the areas of note is a pit approximately 30 ft by 20 ft and 8 ft deep that contained 40 to 50 10-gallon rusted cans with labeling containing the word “tetrachloroethene.” A summary of the relevant document and action milestones is below.

### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Completion Letter Report for Housekeeping Actions at CAX Site 1 and AOC 7	Shaw, 2006b	01903

### Nature and Extent of Potential Contamination

The nature and extent of potential contamination at AOC 7 has not yet been determined; this information will be provided in an SI report..

### Potential Risks

An evaluation of site media has not been completed, including risk assessments.

### Remedial Action(s)

In June 2006, Shaw Environmental conducted a housekeeping effort and removed all of the surface debris (drums and cans) (Shaw, 2006b).

### Activities Completed 2008-2009

SI field activities at AOC 7 were completed in December 2008. The draft SI Report will be submitted in 2010.

### CERCLA Path Forward

- Completion of SI report
- NFA DD or RI/FS/PP/ROD

[Schedule 3-9](#) presents the FY10-11 schedule for Site AOC 7.

### 3.2.11 AOC 8—Area South of Site 7

#### Site Description

AOC 8 (formerly referred to as Site 7) is located along the York River on a flat, sparsely vegetated depression, with a berm along the northern perimeter ([Figure 3-12](#)). Gravel and ballast rock can be seen on the ground surface. To the east of the flat area, the land drops off slightly, and in a very small area along the perimeter, buried debris (pipe, metal, and wood) can be seen cropping out from the edge of the slope and along the beach. Test pits conducted in 1999 indicate that the waste post-dates World War I and does not appear to be associated with DuPont Penniman facility waste disposal (Baker, 2001c). Therefore, this area was determined to not be Site 7 and was re-designated as AOC 8. A summary of relevant documents and action milestones is below.

#### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Field Investigation Report, Site 7 and AOC 2	Baker, 2001c	01348

#### Nature and Extent of Potential Contamination

One sediment sample was collected and analyzed for VOCs, SVOCs, pesticides, PCBs, nitramines/nitroaromatics, and metals (Baker, 2001c). Of the detected constituents, only Aroclor-1260 and arsenic exceeded their respective RBCs.

#### Potential Risks

No risk assessments have been conducted.

#### Remedial Actions

No CERCLA RAs have taken place at AOC 8.

#### Activities Completed 2008-2009

SI field activities at AOC 8 were completed in December 2008. The draft SI Report will be submitted in 2010.

#### CERCLA Path Forward

- Completion of SI report
- NFA DD or RI/FS/PP/ROD

[Schedule 3-10](#) presents the FY10-11 schedule for AOC 8.

### 3.2.12 PCB Study Area

#### Site Description

The PCB study area includes the surface water drainage features that feed Outfalls 28 and 29 and that feed the northwest finger of Penniman Lake ([Figure 3-13](#)). Outfall 29 is fed by two grassy drainage channels to the north of Antrim Road. The northwest finger of Penniman

Lake is fed by areas that drain to Outfall 26 (i.e., underground stormwater collection network that originates north of Sanda Avenue), Outfall 27 (i.e., creek to the north of Antrim Road), and the wooded areas that surround this finger of the lake.

The drainage channel that feeds Outfall 28, from the north of Antrim Road, originates south of Building 132. This drainage channel only holds and transports surface water runoff during and immediately following heavy rainfall events. The drainage channels that feed Outfall 29 originate north of Antrim Road: one flows northeast along Antrim Road and the other flows southeast originating just east of Buildings 151. These drainage channels only hold and transport surface water runoff during and immediately following heavy rainfall events.

Surface water runoff enters the northwest finger of Penniman Lake from the heavily wooded slopes along this portion of the lake as well as from Outfalls 26 and 27. Surface water at Outfall 26 originates as stormwater runoff from areas south of Building 10. Stormwater from this area is captured in a drop inlet on the north side of Sanda Avenue. Stormwater that enters this inlet flows within an underground stormwater pipe southeast under Sanda Avenue. On the south side of Sanda Avenue there is another stormwater drop inlet that feeds this underground stormwater network. This inlet captures surface water runoff from grassy drainage channels that run along Sanda Avenue. From this point, stormwater continues underground and is discharged at Outfall 26, which is located on the south side of Antrim Road. Water discharging at Outfall 26 flows via a small creek into the northwest finger of Penniman Lake.

Surface water runoff at Outfall 27 originates as stormwater runoff from areas south of Building 250. Stormwater from this area drains into a creek that ultimately transports water to Outfall 27. The current general use of the area around Building 250 is Public Works equipment storage. The past use of this area is unknown. Water discharging at Outfall 27 flows via a small creek into the northwest finger of Penniman Lake. A summary of relevant documents and action milestones is below.

### Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Pond Study Report	Baker, 2001a	01212
RI, Site 11 – Bone Yard	Baker, 2007	02171

### Nature and Extent of Potential Contamination

Previous investigations regarding the elevated levels of PCBs detected in surface soil within the grassy drainage channel immediately downgradient of Outfall 29 and in shallow sediment within the northwest finger of Penniman Lake are discussed in the 2000 Pond Study (Baker, 2001a) and/or the 2002 CAX Site 11 RI (Baker, 2007).

During the 2000 Pond Study, a total of eight co-located surface water and surface sediment samples from Penniman Lake were analyzed for target compound list (TCL) organics, target analyte list (TAL) inorganics, and explosive compounds. Average concentrations of PCBs detected in Penniman Lake sediments were 0.5 mg/kg with a maximum concentration of 4.7 mg/kg. PCBs were not detected in surface water within Penniman Lake.

During the 2002 RI, a total of 24 surface and subsurface soil, 15 surface and subsurface sediment, 13 surface water, and 8 groundwater samples. Samples were analyzed for TCL organics, TAL inorganics, and explosive compounds, however the majority of these samples were collected to characterize media at CAX Site 11. During upgradient/background sampling associated with this study, elevated levels of PCBs were detected in the grassy drainage channel immediately downgradient of Outfall 29 (total PCB concentration of 7.5 mg/kg) and within the northwest finger of Penniman Lake (total PCB concentration of 15 mg/kg). In addition, Aroclor-1260 was detected in at a concentration of 0.47 J µg/L. No other surface water samples detected PCBs.

### Potential Risks

During the 2000 Pond Study the average PCB concentrations in sediments exceeded the ecological risk screening criteria, but not human health risk screening criteria. One sediment sample, located within the northwest finger of Penniman Lake, was the only location where PCBs concentrations were detected above human health screening criteria (4.7 mg/kg).

During the 2002 RI the one sediment sample, immediately downgradient of Outfall 29, and the one sediment sample within the northwest finger of Penniman Lake were identified with concentrations exceeding human health and ecological risk screening criteria. In addition, detected Aroclor-1260 concentrations in surface water samples were consistent with the human health screening level and below the ecological risk screening level. No other risk assessments have been conducted for this study area.

### Remedial Actions

No CERCLA RAs have taken place in the PCB Study Area.

### Activities Completed 2008-2009

A Draft UFP-SAP was submitted to the Partnering Team for review. At the September 2009 Partnering meeting, the team decided that the PCB study should be incorporated into the Penniman Lake site investigation – a more comprehensive evaluation of CAX's PCB contamination. Therefore, the PCB study will no longer be a separate investigation or section in the SMP.

## 3.2.13 AOC 9 – Penniman Lake

### Site Description

Penniman Lake is a 48-acre surface water body located in the southeastern portion of CAX that was created in 1943 when a portion of King Creek was dammed ([Figure 3-14](#)).

Following completion of the Pond Study, catch-and-release fishing restrictions were recommended for Penniman Lake. Subsequently, fishing restriction (catch-and-release only) signs were posted in August of 2000.

## Documents and Milestones

Document Title /Milestone	Author/Date	AR Document Number
Pond Study Report	Baker , 2001a	01212
RI, Site 11 – Bone Yard	Baker, 2007	02171

### Nature and Extent of Potential Contamination

During the 2000 Pond Study, a total of eight co-located surface water and surface sediment samples from Penniman Lake were analyzed for target compound list (TCL) organics, target analyte list (TAL) inorganics, and explosive compounds. Average concentrations of PCBs detected in Penniman Lake sediments were 0.5 mg/kg with a maximum concentration of 4.7 mg/kg. PCBs were not detected in surface water within Penniman Lake.

During the CAX Site 11 2002 RI, surface water and sediment samples were collected in the drainages north and south of site and within Penniman Lake and analyzed for TCL organics, TAL inorganics, and explosive compounds. These samples were collected to determine what, if any, impact Site 11 had on these areas. During upgradient/background sediment sampling associated with the RI, elevated levels of PCBs were detected immediately downgradient of Outfall 29, in the grassy area of the north drainage channel (total PCB concentration of 7.5 mg/kg) and within the northwest finger of Penniman Lake (total PCB concentration of 15 mg/kg). In addition, Aroclor-1260 was detected in one surface water sample at a concentration of 0.47 J µg/L. No other surface water samples detected PCBs.

### Potential Risks

During the 2000 Pond Study the average PCB concentrations in sediments exceeded the ecological risk screening criteria, but not human health risk screening criteria. One sediment sample, located within the northwest finger of Penniman Lake, was the only location where PCBs concentrations were detected above human health screening criteria (4.7 mg/kg).

During the 2002 Site 11 RI, one sediment sample, immediately downgradient of Outfall 29, and one sediment sample within the northwest finger of Penniman Lake were identified with concentrations exceeding human health and ecological risk screening criteria. In addition, detected Aroclor-1260 concentrations in surface water samples were consistent with the human health screening level and below the ecological risk screening level. No other risk assessments have been conducted for this study area.

### Remedial Actions

No CERCLA RAs have taken place in Penniman Lake.

### Activities Completed 2008-2009

No activities related to the study of Penniman Lake occurred in 2008 or 2009. A UFP-SAP for an SI is anticipated for 2010.

## CERCLA Path Forward

- SI
- EE/CA and DD or RI/FS/PP/ROD

[Schedule 3-11](#) presents the FY10-11 schedule for Penniman Lake.

## 3.3 MRP Sites

Because funding for both the ERP and the MRP is managed by NAVFAC, sites classified as MRP also are included in this SMP. The only MRP site identified at CAX is the other-than-operational Marine Pistol and Rifle Range.

### 3.3.1 Other-than-Operational Marine Pistol and Rifle Range

The other-than-operational Marine Pistol and Rifle Range is approximately 7 acres in the northwest portion of CAX ([Figure 3-15](#)). The range was used between approximately 1939 and the 1970s, exclusively for small-caliber munitions (less than 0.5 caliber rounds). A PA was conducted for the closed Marine Pistol and Rifle Range to identify possible MEC and possible sources of MC-related contamination. Consistent with expected results for a small arms site, the PA did not identify any MEC at the site. However, the PA indicated that potential MC-related contamination may exist at the site associated with bullets and bullet casings potentially present at the site. Indications of expended small caliber ammunition (bullet holes) were found in the old timber targets near the wooden backstop (Malcolm Pirnie, 2006). In 2007, an expanded site inspection (ESI) was conducted to determine whether a release with the potential to adversely affect human health or the environment had occurred at the Marine Pistol and Rifle Range while it was operational. The ESI concluded, based on the conservative risk screening process and the absence of a defined release, that the closed Marine Pistol and Rifle Range pose no unacceptable risk to human health or the environment; therefore, no further investigation or action was recommended for the site (CH2M HILL, 2008f). A summary of relevant documents and action milestones is below.

#### Documents and Milestones

Document Title/ Milestone	Author/Date	AR Document Number
Final PA, WPNSTA Yorktown	Malcolm Pirnie, 2006	01942
Expanded SI Report for the Closed MWR Skeet Range and the Closed Marine Pistol and Rifle Range	CH2M HILL, 2008f	02180

#### Nature and Extent of Potential Contamination

The source of potential contamination is the spent ammunition (specifically lead shot) and clay targets used at the range. A metal detector survey and sieve analysis for lead shot was conducted during the 2007 ESI. In addition, surface and subsurface soil samples were collected during the ESI and analyzed for lead and PAHs. The results indicated exceedances of human and ecological screening values and background levels existed for both zinc and arsenic in surface and subsurface soil.

### Potential Risks

Although future anticipated land use is recreational, based on the conservative risk screening process potential unacceptable human health risks from exposure to soil were considered acceptable for the following reasons: The cumulative carcinogenic risk ( $2.0 \times 10^{-5}$ ) for soil exposure was below the conservative threshold of  $5 \times 10^{-5}$  for UU/UE, therefore potential risk is acceptable for the range and the sporadic distribution of detect concentrations did not indicate a release.

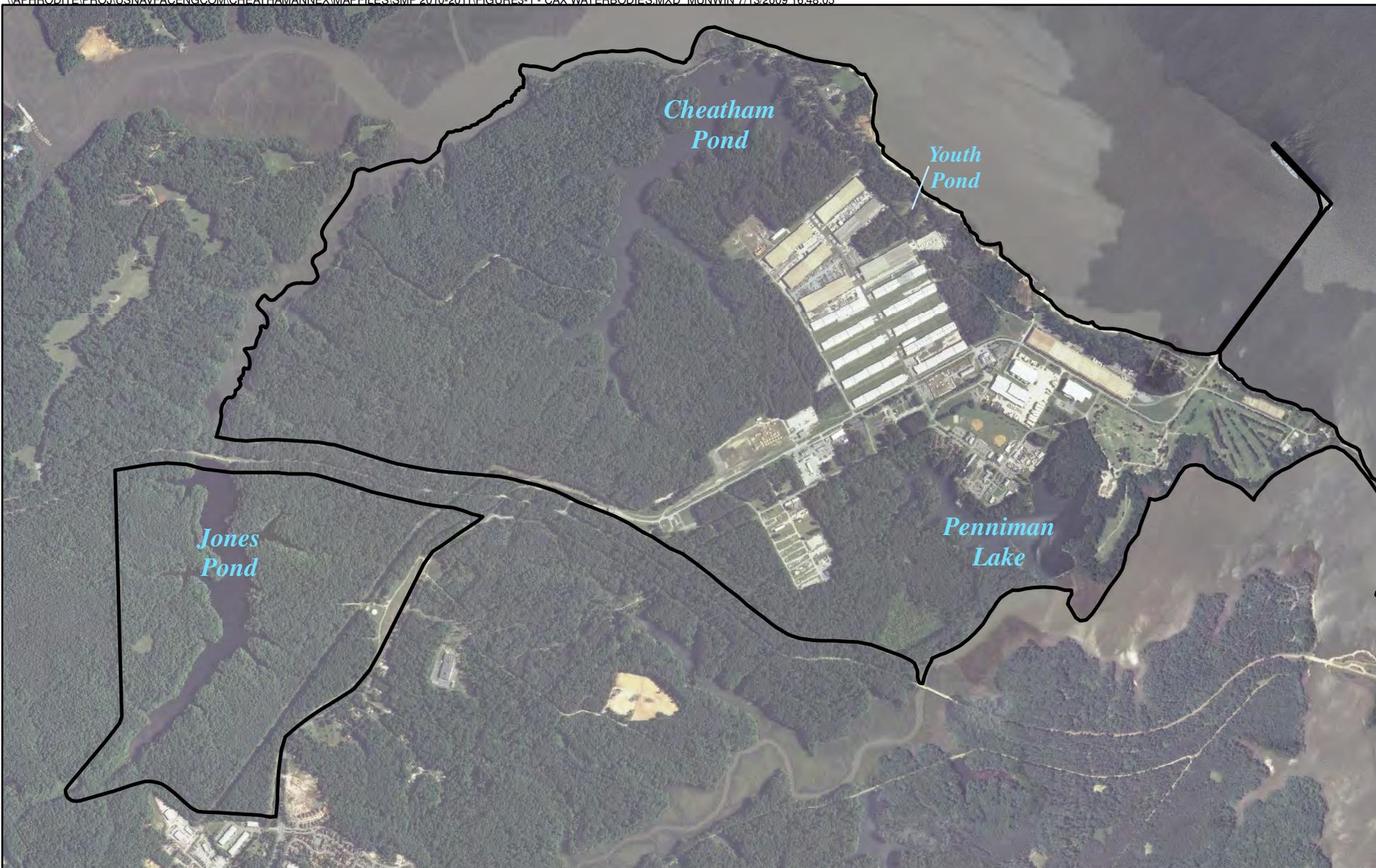
A metal detector survey did not identify any rounds or casings of lead shot which pose a potential unacceptable risk to birds. Additionally, only several occurrences of zinc (seven of 41 surface soil samples and three of 25 subsurface soil samples) exceeded the corresponding ecological screening value. However, the exceedances were for plants, which showed no signs of stress during the sampling event. Using a screening criterion for soil invertebrates, no exceedances resulted. Additionally, the mean concentration of zinc in soil is lower than the ecological screening value, which is a more realistic scenario for receptor populations.

### Remedial Action(s)

No CERCLA RAs were necessary at the other-than-operational Marine Pistol and Rifle Range.

### Activities Complete

CERCLA documentation is complete with signature of the NFA Declaration Signature page included in the ESI (CH2M HILL, 2008f). No other MRP activities are necessary or will occur.



**Legend**

 Cheatham Annex Boundary



0 1,000 2,000  
 Feet

Figure 3-1  
Location of Major CAX Surface Water Bodies  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

-  Monitoring Wells
-  Unnamed Tributary
-  Wetlands
-  Study Area Boundary
-  Removal Action Area B - 2003
-  Removal Action Area C - 2004
-  Removal Action Area D - 2005
-  Removal Action Area E - 2007

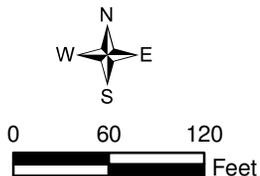


Figure 3-2  
 Site 1 - Landfill Near Incinerator  
 Site Management Plan for FY 2010 to 2011  
 Cheatham Annex  
 Williamsburg, Virginia



**Legend**

-  Study Area Boundary
-  Storm Water Line

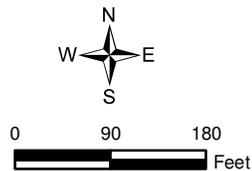


Figure 3-3  
Site 4 - Outdated Medical Supply Disposal Area  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

 Study Area Boundary

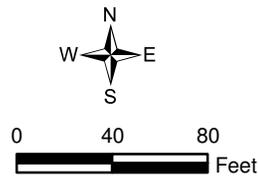


Figure 3-4  
Site 7 - Old DuPont Disposal Area  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**  
Study Area Boundary

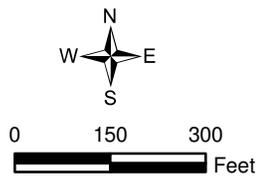
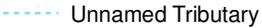
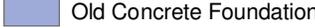


Figure 3-5  
Site 9 - Transformer Storage Area  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

-  Monitoring Well
-  Surface Soil Sampling Location
-  Unnamed Tributary
-  Study Area Boundary
-  Old Concrete Foundation
-  Removal Action Focus Areas

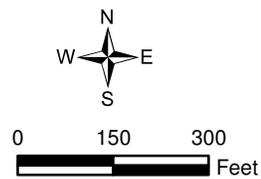


Figure 3-6  
 Site 11 - Bone Yard  
 Site Management Plan for FY 2010-2011  
 Cheatham Annex  
 Williamsburg, Virginia



**Legend**

 Study Area Boundary



0 150 300  
Feet

Figure 3-7  
AOC 1 - Scrap Metal Dump  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

-  Study Area Boundary
-  CAX Boundary / Fenceline

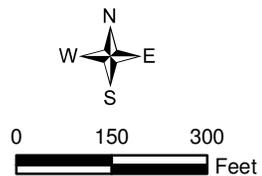


Figure 3-8  
AOC 2 - Dextrose Dump  
Site Management Plan for FY 2010 to 2011  
Cheatham Anex  
Williamsburg, Virginia



**Legend**

 Study Area Boundary

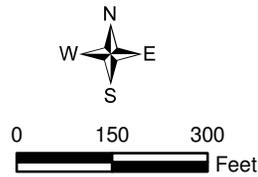


Figure 3-9  
AOC 3 - CAD 11/12 Pond Bank  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

 Approximate Study Area Boundary

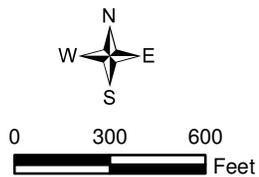


Figure 3-10  
AOC 6 - Penniman AOC  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

- Approximate Location of former Drum Disposal Area
- Approximate Location of former Can Pit
- Study Area Boundary

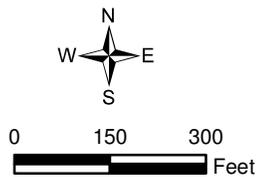


Figure 3-11  
AOC 7 - Drum and Can Disposal Area  
Site Management Plan for FY 2010-2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

 Study Area Boundary

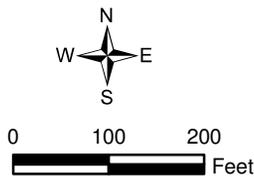
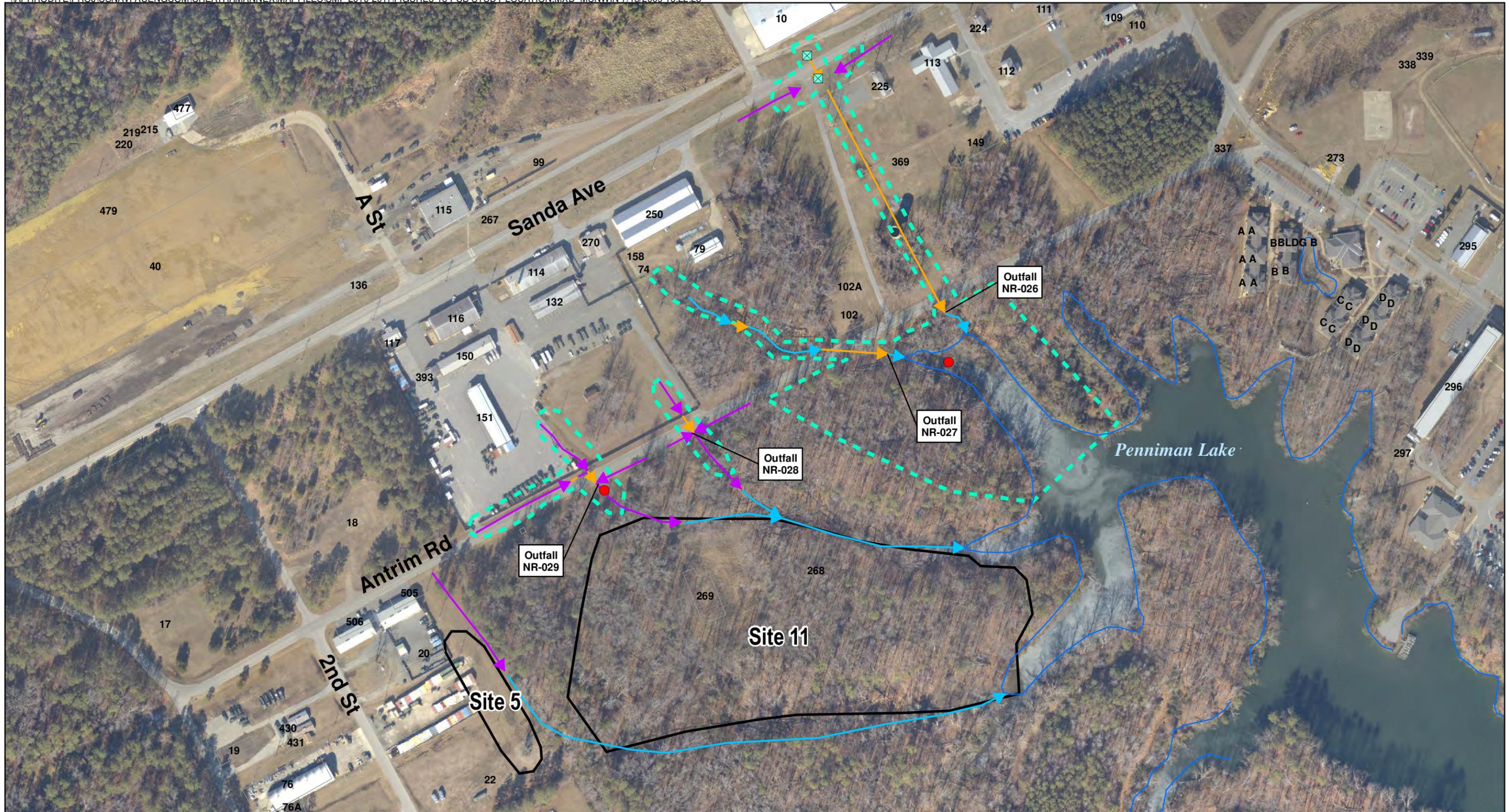


Figure 3-12  
AOC 8 - Area South of Site 7  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

- Locations of Historical PCB Detections Under Investigation
- Study Area Boundary
- Nearby Environmental Restoration Program (ERP) Sites
- X Stormwater Drop Inlets
- Grassy Stormwater Drainage Channels
- Intermittent Creek
- Underground Stormwater Pipe



Figure 3-13  
Polychlorinated Biphenyls (PCB) Site  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**

 Approximate Study Area Boundary

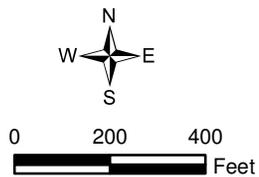


Figure 3-14  
Penniman Lake  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia



**Legend**  
[Yellow Outline] Marine Pistol and Rifle Range

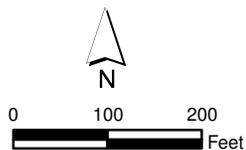
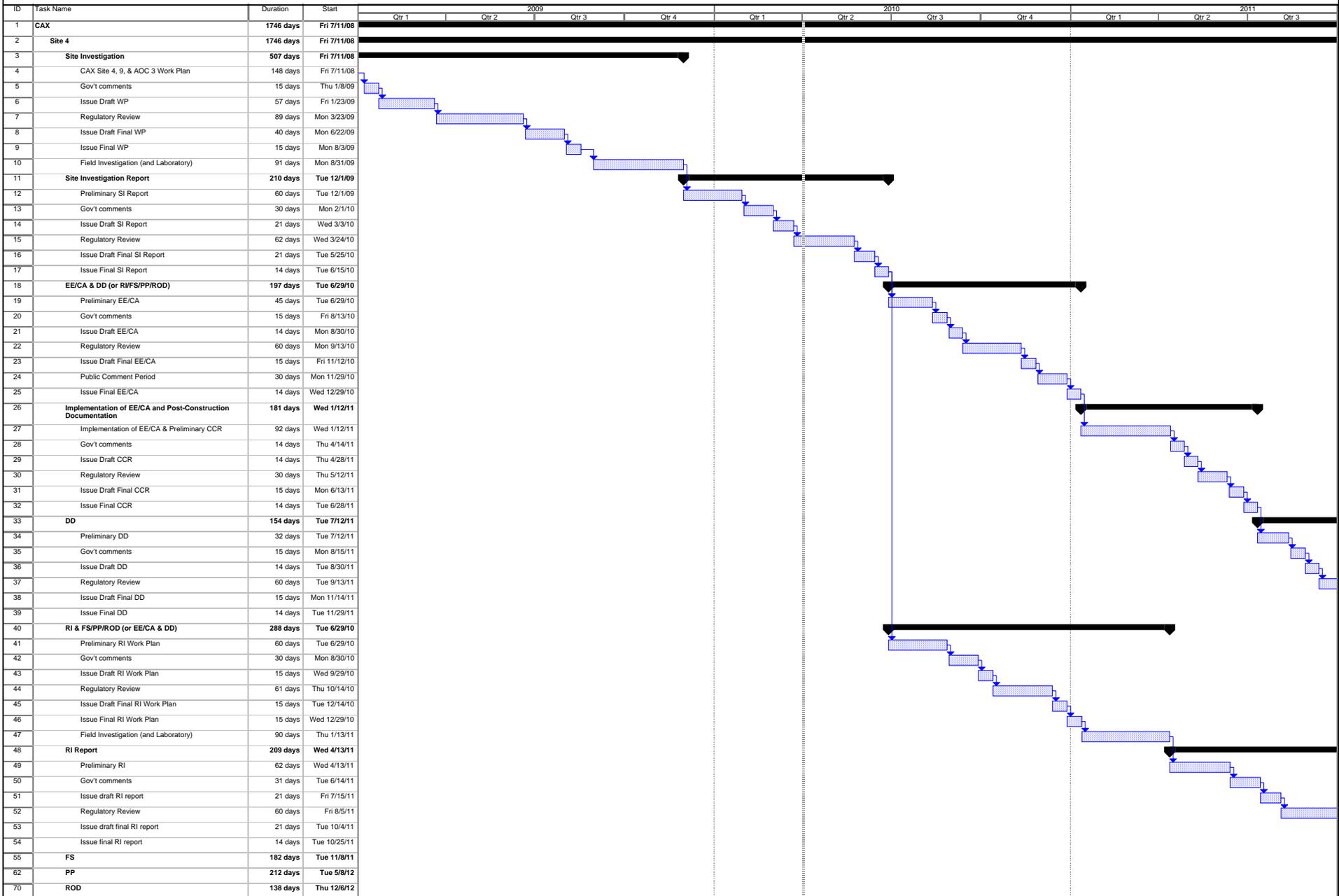


Figure 3-15  
Marine Pistol and Rifle Range  
Site Management Plan for FY 2010 to 2011  
Cheatham Annex  
Williamsburg, Virginia

Schedule 3-1  
Site 4 FY10-FY11 Schedule



Task: [Blue hatched bar] Progress: [Black bar] Summary: [Black bar with arrow] External Tasks: [Grey bar] Deadline: [Green arrow]

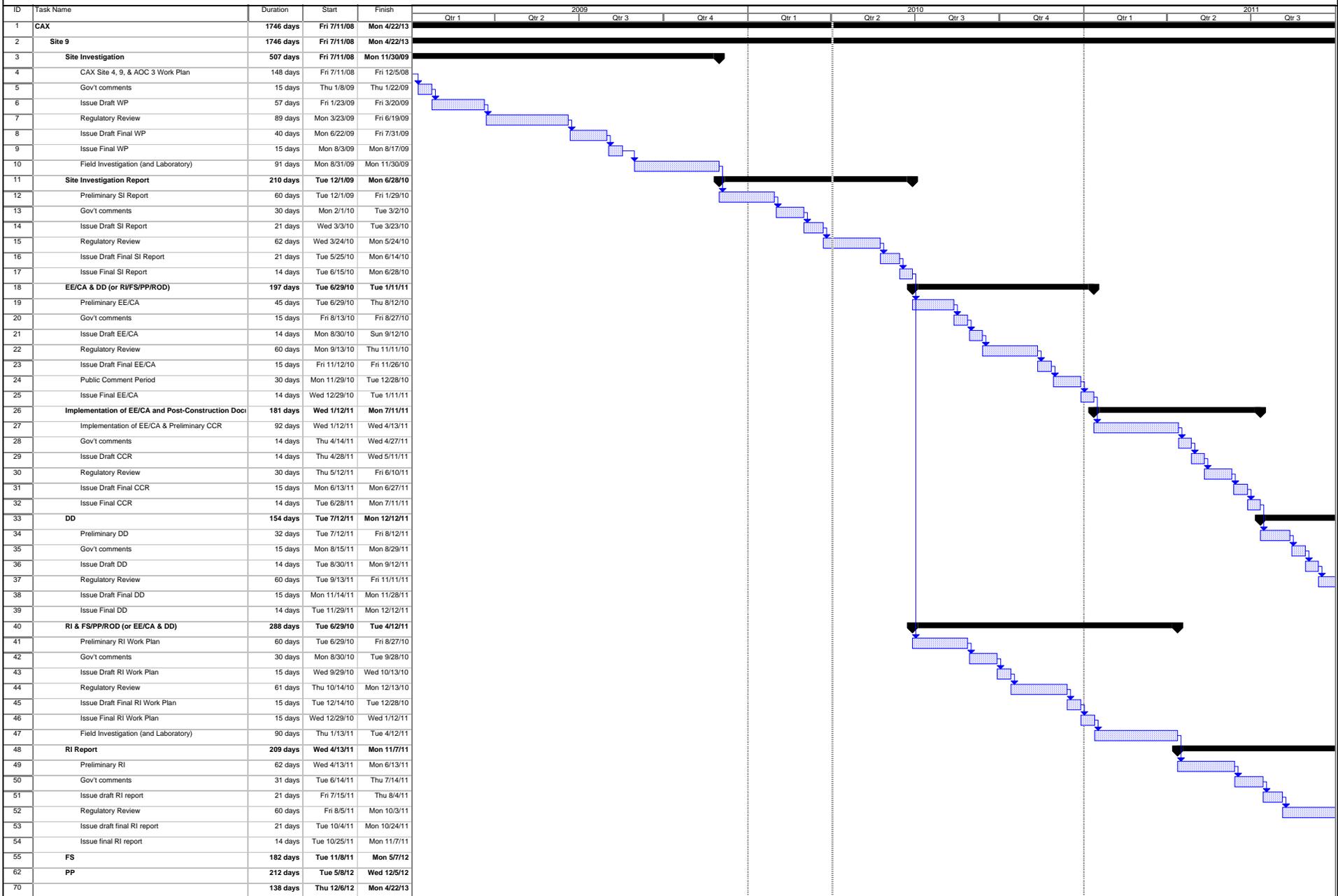
Split: [Blue dashed line] Milestone: [Black diamond] Project Summary: [Black bar with arrow] External Milestone: [Black diamond]

Schedule 3-2  
Site 7 FY10-FY11 Schedule

ID	Task Name	Duration	Start	Finish	2009				2010				2011			
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	
1	<b>CAX</b>	<b>2114 days</b>	<b>Mon 11/12/07</b>	<b>Mon 9/9/13</b>												
2	<b>Site 7</b>	<b>2114 days</b>	<b>Mon 11/12/07</b>	<b>Mon 9/9/13</b>												
3	<b>Removal Action</b>	<b>473 days</b>	<b>Mon 11/12/07</b>	<b>Thu 3/12/09</b>												
4	RA WP	166 days	Mon 11/12/07	Fri 5/9/08												
5	Removal Action	105 days	Thu 2/21/08	Wed 6/4/08												
6	CCR	281 days	Thu 6/5/08	Thu 3/12/09												
7	<b>Site Investigation</b>	<b>457 days</b>	<b>Fri 1/2/09</b>	<b>Sun 4/4/10</b>												
8	CAX Site 7 WP	214 days	Fri 1/2/09	Mon 8/3/09												
9	Gov't Comments	30 days	Tue 8/4/09	Wed 9/2/09												
10	Issue Draft WP	30 days	Thu 9/3/09	Fri 10/2/09												
11	Regulatory Review	60 days	Mon 10/5/09	Fri 12/4/09												
12	Issue Draft Final WP	14 days	Mon 12/7/09	Sun 12/20/09												
13	Issue Final WP	15 days	Mon 12/21/09	Mon 1/4/10												
14	Field Investigation (and Laboratory)	90 days	Tue 1/5/10	Sun 4/4/10												
15	<b>Site Investigation Report</b>	<b>211 days</b>	<b>Mon 4/5/10</b>	<b>Mon 11/1/10</b>												
16	Preliminary SI Report	60 days	Mon 4/5/10	Thu 6/3/10												
17	Gov't Comments	32 days	Fri 6/4/10	Mon 7/5/10												
18	Issue Draft SI Report	21 days	Tue 7/6/10	Mon 7/26/10												
19	Regulatory Review	60 days	Tue 7/27/10	Fri 9/24/10												
20	Issue Draft Final SI Report	22 days	Mon 9/27/10	Mon 10/18/10												
21	Issue Final SI Report	14 days	Tue 10/19/10	Mon 11/1/10												
22	<b>DD Signature Page for SI (or RI/FS/PP/ROD)</b>	<b>10 days</b>	<b>Tue 11/9/10</b>	<b>Thu 11/18/10</b>												
23	Issue DD for Signature	10 days	Tue 11/9/10	Thu 11/18/10												
24	<b>RI &amp; FS/PP/ROD (if needed)</b>	<b>284 days</b>	<b>Tue 11/2/10</b>	<b>Fri 8/12/11</b>												
25	Preliminary RI Work Plan	60 days	Tue 11/2/10	Fri 12/31/10												
26	Gov't Comments	30 days	Mon 1/3/11	Tue 2/1/11												
27	Issue Draft RI Work Plan	14 days	Wed 2/2/11	Tue 2/15/11												
28	Regulatory Review	62 days	Wed 2/16/11	Mon 4/18/11												
29	Issue Draft Final RI Work Plan	14 days	Tue 4/19/11	Mon 5/2/11												
30	Issue Final RI Work Plan	14 days	Tue 5/3/11	Mon 5/16/11												
31	Field Investigation (and Laboratory)	88 days	Tue 5/17/11	Fri 8/12/11												
32	<b>RI Report</b>	<b>227 days</b>	<b>Mon 8/15/11</b>	<b>Wed 3/28/12</b>												
33	Preliminary RI	60 days	Mon 8/15/11	Thu 10/13/11												
34	Gov't Comments	32 days	Fri 10/14/11	Mon 11/14/11												
35	Issue Draft RI Report	21 days	Tue 11/15/11	Mon 12/5/11												
36	Regulatory Review	60 days	Tue 12/6/11	Fri 2/3/12												
37	Issue Draft Final RI Report	22 days	Mon 2/6/12	Mon 2/27/12												
38	Issue Final RI Report	30 days	Tue 2/28/12	Wed 3/28/12												
39	<b>FS</b>	<b>180 days</b>	<b>Thu 3/29/12</b>	<b>Mon 9/24/12</b>												
46	<b>PP</b>	<b>213 days</b>	<b>Tue 9/25/12</b>	<b>Thu 4/25/13</b>												
54	<b>ROD</b>	<b>137 days</b>	<b>Fri 4/26/13</b>	<b>Mon 9/9/13</b>												

Task Progress Summary External Tasks Deadline 
  
 Split Milestone Project Summary External Milestone

Schedule 3-3  
Site 9 FY10-FY11 Schedule



Task Progress Summary External Tasks Deadline Split Milestone Project Summary External Milestone

Schedule 3-4  
Site 11 FY10-FY11 Schedule

ID	Task Name	Duration	Start	Finish	2009				2010				2011			
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	
1	<b>CAX</b>	<b>1046 days</b>	<b>Fri 2/15/08</b>	<b>Mon 12/27/10</b>												
2	<b>Site 11</b>	<b>1046 days</b>	<b>Fri 2/15/08</b>	<b>Mon 12/27/10</b>												
3	<b>EE/CA</b>	<b>284 days</b>	<b>Fri 2/15/08</b>	<b>Mon 11/24/08</b>												
4	Preliminary EE/CA	32 days	Fri 2/15/08	Mon 3/17/08												
5	Gov't Comments	14 days	Tue 3/18/08	Mon 3/31/08												
6	Issue Draft EE/CA	9 days	Tue 4/1/08	Wed 4/9/08												
7	Regulatory Review	64 days	Thu 4/10/08	Thu 6/12/08												
8	Issue Draft Final EE/CA	117 days	Fri 6/13/08	Tue 10/7/08												
9	Public Comment Period	30 days	Thu 10/16/08	Fri 11/14/08												
10	Issue Final EE/CA	8 days	Mon 11/17/08	Mon 11/24/08												
11	<b>Implementation of EE/CA and Post-Construction Doc</b>	<b>304 days</b>	<b>Mon 12/15/08</b>	<b>Wed 10/14/09</b>												
12	<b>Removal Action</b>	<b>187 days</b>	<b>Mon 12/15/08</b>	<b>Fri 6/19/09</b>												
13	Removal Action Work Plan	60 days	Mon 12/15/08	Thu 2/12/09												
14	Removal Action	90 days	Sun 3/22/09	Fri 6/19/09												
15	Preliminary CCR	60 days	Fri 5/22/09	Mon 7/20/09												
16	Gov't Comments	14 days	Tue 7/21/09	Mon 8/3/09												
17	Issue Draft CCR	14 days	Tue 8/4/09	Mon 8/17/09												
18	Regulatory Review	30 days	Tue 8/18/09	Wed 9/16/09												
19	Issue Draft Final CCR	14 days	Thu 9/17/09	Wed 9/30/09												
20	Issue Final CCR	14 days	Thu 10/1/09	Wed 10/14/09												
21	<b>TM for Post-Construction Risk Evaluation for all Medi</b>	<b>161 days</b>	<b>Mon 6/15/09</b>	<b>Mon 11/23/09</b>												
22	Preliminary TM	40 days	Mon 6/15/09	Fri 7/24/09												
23	Gov't Comments	30 days	Mon 7/27/09	Tue 8/25/09												
24	Issue Draft TM	28 days	Wed 8/26/09	Tue 9/22/09												
25	Regulatory Review	30 days	Wed 9/23/09	Thu 10/22/09												
26	Issue Draft Final TM	14 days	Fri 10/23/09	Fri 11/6/09												
27	Issue Final TM	15 days	Mon 11/9/09	Mon 11/23/09												
28	<b>PP</b>	<b>276 days</b>	<b>Mon 11/9/09</b>	<b>Wed 8/11/10</b>												
29	Preliminary PP	30 days	Mon 11/9/09	Tue 12/8/09												
30	Gov't Comments	30 days	Wed 12/9/09	Thu 1/7/10												
31	Issue Draft PP	30 days	Mon 3/15/10	Tue 4/13/10												
32	Regulatory / Legal Review	62 days	Wed 4/14/10	Mon 6/14/10												
33	Draft Final PP	14 days	Tue 6/15/10	Mon 6/28/10												
34	Public Comment Period	30 days	Tue 6/29/10	Wed 7/28/10												
35	Issue Final PP	14 days	Thu 7/29/10	Wed 8/11/10												
36	<b>ROD</b>	<b>138 days</b>	<b>Thu 8/12/10</b>	<b>Mon 12/27/10</b>												
37	Preliminary ROD	30 days	Thu 8/12/10	Fri 9/10/10												
38	Gov't Comments	15 days	Mon 9/13/10	Mon 9/27/10												
39	Issue Draft ROD	14 days	Tue 9/28/10	Mon 10/11/10												
40	Regulatory / Legal Review	60 days	Tue 10/12/10	Fri 12/10/10												
41	Issue ROD for Signature	15 days	Mon 12/13/10	Mon 12/27/10												

Task Progress Summary External Tasks Deadline

Split Milestone Project Summary External Milestone

Schedule 3-5  
AOC 1 FY10-FY11 Schedule

ID	Task Name	Duration	Start	Finish	2009				2010				2011				
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3		
1	CAX	1874 days	Tue 7/10/07	Mon 10/15/12													
2	AOC 1	1874 days	Tue 7/10/07	Mon 10/15/12													
3	Site Investigation	533 days	Tue 7/10/07	Wed 2/11/09													
4	Various AOC Work Plan	45 days	Tue 7/10/07	Mon 9/10/07													
5	Gov't comments	110 days	Tue 9/11/07	Wed 1/30/08													
6	Issue Draft WP	29 days	Thu 1/31/08	Thu 2/28/08													
7	Regulatory Review	169 days	Fri 2/29/08	Fri 8/15/08													
8	Issue Draft Final WP	24 days	Mon 8/18/08	Wed 9/10/08													
9	Issue Final WP	34 days	Thu 9/11/08	Tue 10/14/08													
10	Field Investigation (and Laboratory)	120 days	Wed 10/15/08	Wed 2/11/09													
11	Site Investigation Report	312 days	Thu 2/12/09	Mon 12/21/09													
12	Preliminary SI Report	173 days	Thu 2/12/09	Mon 8/3/09													
13	Gov't comments	30 days	Tue 8/4/09	Wed 9/2/09													
14	Issue Draft SI Report	14 days	Thu 9/3/09	Wed 9/16/09													
15	Regulatory Review	60 days	Thu 9/17/09	Mon 11/16/09													
16	Issue Draft Final SI Report	21 days	Tue 11/17/09	Mon 12/7/09													
17	Issue Final SI Report	14 days	Tue 12/8/09	Mon 12/21/09													
18	EE/CA and/or DD (or R/FS/PP/ROD)	193 days	Tue 12/22/09	Fri 7/2/10													
19	Preliminary EE/CA	45 days	Tue 12/22/09	Thu 2/4/10													
20	Gov't comments	14 days	Fri 2/5/10	Thu 2/18/10													
21	Issue Draft EE/CA	14 days	Fri 2/19/10	Thu 3/4/10													
22	Regulatory Review	60 days	Fri 3/5/10	Mon 5/3/10													
23	Issue Draft Final EE/CA	15 days	Tue 5/4/10	Tue 5/18/10													
24	Public Comment Period	30 days	Wed 5/19/10	Thu 6/17/10													
25	Issue Final EE/CA	15 days	Fri 6/18/10	Fri 7/2/10													
26	Implementation of EE/CA and Post-Construction Documentation	179 days	Mon 7/5/10	Thu 12/30/10													
27	Implementation of EE/CA & Preliminary CCR	89 days	Mon 7/5/10	Fri 10/1/10													
28	Gov't comments	15 days	Mon 10/4/10	Mon 10/18/10													
29	Issue Draft CCR	14 days	Tue 10/19/10	Mon 11/1/10													
30	Regulatory Review	30 days	Tue 11/2/10	Wed 12/1/10													
31	Issue Draft Final CCR	15 days	Thu 12/2/10	Thu 12/16/10													
32	Issue Final CCR	14 days	Fri 12/17/10	Thu 12/30/10													
33	DD	151 days	Fri 12/31/10	Mon 5/30/11													
34	Preliminary DD	32 days	Fri 12/31/10	Mon 1/31/11													
35	Gov't comments	14 days	Tue 2/1/11	Mon 2/14/11													
36	Issue Draft DD	14 days	Tue 2/15/11	Mon 2/28/11													
37	Regulatory Review	60 days	Tue 3/1/11	Fri 4/29/11													
38	Issue Draft Final DD	15 days	Mon 5/2/11	Mon 5/16/11													
39	Issue Final DD	14 days	Tue 5/17/11	Mon 5/30/11													
40	RI & FS/PP/ROD (or Housekeeping Removal Action & DD)	287 days	Tue 12/22/09	Mon 10/4/10													
41	Preliminary RI Work Plan	60 days	Tue 12/22/09	Fri 2/19/10													
42	Gov't comments	30 days	Mon 2/22/10	Tue 3/23/10													
43	Issue Draft RI Work Plan	14 days	Wed 3/24/10	Tue 4/6/10													
44	Regulatory Review	62 days	Wed 4/7/10	Mon 6/7/10													
45	Issue Draft Final RI Work Plan	14 days	Tue 6/8/10	Mon 6/21/10													
46	Issue Final RI Work Plan	14 days	Tue 6/22/10	Mon 7/5/10													
47	Field Investigation (and Laboratory)	91 days	Tue 7/6/10	Mon 10/4/10													
48	RI Report	210 days	Tue 10/5/10	Mon 5/2/11													
49	Preliminary RI	60 days	Tue 10/5/10	Fri 12/3/10													
50	Gov't comments	30 days	Mon 12/6/10	Tue 1/4/11													
51	Issue draft RI report	21 days	Wed 1/5/11	Tue 1/25/11													
52	Regulatory Review	62 days	Wed 1/26/11	Mon 3/28/11													
53	Issue draft final RI report	21 days	Tue 3/29/11	Mon 4/18/11													
54	Issue final RI report	14 days	Tue 4/19/11	Mon 5/2/11													
55	FS	182 days	Tue 5/3/11	Mon 10/31/11													
56	Preliminary FS	45 days	Tue 5/3/11	Thu 6/16/11													
57	Gov't comments	32 days	Fri 6/17/11	Mon 7/18/11													
58	Issue draft FS	14 days	Tue 7/19/11	Mon 8/1/11													
59	Regulatory Review	60 days	Tue 8/2/11	Fri 9/30/11													
60	Issue draft final FS	15 days	Mon 10/3/11	Mon 10/17/11													
61	Issue final FS	14 days	Tue 10/18/11	Mon 10/31/11													
62	PP	212 days	Tue 11/1/11	Wed 5/30/12													
70	ROD	138 days	Thu 5/31/12	Mon 10/15/12													

Task Split Progress Milestone Summary Project Summary External Tasks External Milestone Deadline

Schedule 3-6  
AOC 2 FY10-FY11 Schedule

ID	Task Name	Duration	Start	Finish	2009				2010				2011			
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	
1	CAX	1888 days	Tue 7/10/07	Mon 10/29/12												
2	AOC 2	1888 days	Tue 7/10/07	Mon 10/29/12												
3	Site Investigation	533 days	Tue 7/10/07	Wed 2/1/09												
4	Various AOC Work Plan	45 days	Tue 7/10/07	Mon 9/10/07												
5	Gov't comments	110 days	Tue 9/11/07	Wed 1/30/08												
6	Issue Draft WP	29 days	Thu 1/31/08	Thu 2/28/08												
7	Regulatory Review	169 days	Fri 2/29/08	Fri 8/15/08												
8	Issue Draft Final WP	24 days	Mon 8/18/08	Wed 9/10/08												
9	Issue Final WP	34 days	Thu 9/11/08	Tue 10/14/08												
10	Field Investigation (and Laboratory)	120 days	Wed 10/15/08	Wed 2/11/09												
11	Site Investigation Report	312 days	Thu 2/12/09	Mon 12/21/09												
12	Preliminary SI Report	173 days	Thu 2/12/09	Mon 8/3/09												
13	Gov't comments	30 days	Tue 8/4/09	Wed 9/2/09												
14	Issue Draft SI Report	14 days	Thu 9/3/09	Wed 9/16/09												
15	Regulatory Review	60 days	Thu 9/17/09	Mon 11/16/09												
16	Issue Draft Final SI Report	21 days	Tue 11/17/09	Mon 12/7/09												
17	Issue Final SI Report	14 days	Tue 12/8/09	Mon 12/21/09												
18	Implementation of Housekeeping Removal Action and Post-Construction Documentation (or RIFS/PP/ROD)	183 days	Mon 1/4/10	Mon 7/5/10												
19	Implementation of Removal Action & Preliminary CCR	89 days	Mon 1/4/10	Fri 4/2/10												
20	Gov't comments	15 days	Mon 4/5/10	Mon 4/19/10												
21	Issue Draft CCR	14 days	Tue 4/20/10	Mon 5/3/10												
22	Regulatory Review	32 days	Tue 5/4/10	Fri 6/4/10												
23	Issue Draft Final CCR	15 days	Mon 6/7/10	Mon 6/21/10												
24	Issue Final CCR	14 days	Tue 6/22/10	Mon 7/5/10												
25	DD	147 days	Tue 7/6/10	Mon 11/29/10												
26	Preliminary DD	30 days	Tue 7/6/10	Wed 8/4/10												
27	Gov't comments	14 days	Thu 8/5/10	Wed 8/18/10												
28	Issue Draft DD	14 days	Thu 8/19/10	Wed 9/1/10												
29	Regulatory Review	61 days	Thu 9/2/10	Mon 11/1/10												
30	Issue Draft Final DD	14 days	Tue 11/2/10	Mon 11/15/10												
31	Issue Final DD	14 days	Tue 11/16/10	Mon 11/29/10												
32	RI & FS/PP/ROD (or Housekeeping Removal Action & DD)	288 days	Mon 1/4/10	Mon 10/18/10												
33	Preliminary RI Work Plan	60 days	Mon 1/4/10	Thu 3/4/10												
34	Gov't comments	32 days	Fri 3/5/10	Mon 4/5/10												
35	Issue Draft RI Work Plan	14 days	Tue 4/6/10	Mon 4/19/10												
36	Regulatory Review	60 days	Tue 4/20/10	Fri 6/18/10												
37	Issue Draft Final RI Work Plan	15 days	Mon 6/21/10	Mon 7/5/10												
38	Issue Final RI Work Plan	14 days	Tue 7/6/10	Mon 7/19/10												
39	Field Investigation (and Laboratory)	91 days	Tue 7/20/10	Mon 10/18/10												
40	RI Report	210 days	Tue 10/19/10	Mon 5/16/11												
41	Preliminary RI	60 days	Tue 10/19/10	Fri 12/17/10												
42	Gov't comments	30 days	Mon 12/20/10	Tue 1/18/11												
43	Issue draft RI report	21 days	Wed 1/19/11	Tue 2/8/11												
44	Regulatory Review	62 days	Wed 2/9/11	Mon 4/11/11												
45	Issue draft final RI report	21 days	Tue 4/12/11	Mon 5/2/11												
46	Issue final RI report	14 days	Tue 5/3/11	Mon 5/16/11												
47	FS	182 days	Tue 5/17/11	Mon 11/14/11												
48	Preliminary FS	45 days	Tue 5/17/11	Thu 6/30/11												
49	Gov't comments	32 days	Fri 7/1/11	Mon 8/1/11												
50	Issue draft FS	14 days	Tue 8/2/11	Mon 8/15/11												
51	Regulatory Review	60 days	Tue 8/16/11	Fri 10/14/11												
52	Issue draft final FS	15 days	Mon 10/17/11	Mon 10/31/11												
53	Issue final FS	14 days	Tue 11/1/11	Mon 11/14/11												
54	PP	212 days	Tue 11/15/11	Wed 6/13/12												
62	ROD	138 days	Thu 6/14/12	Mon 10/29/12												

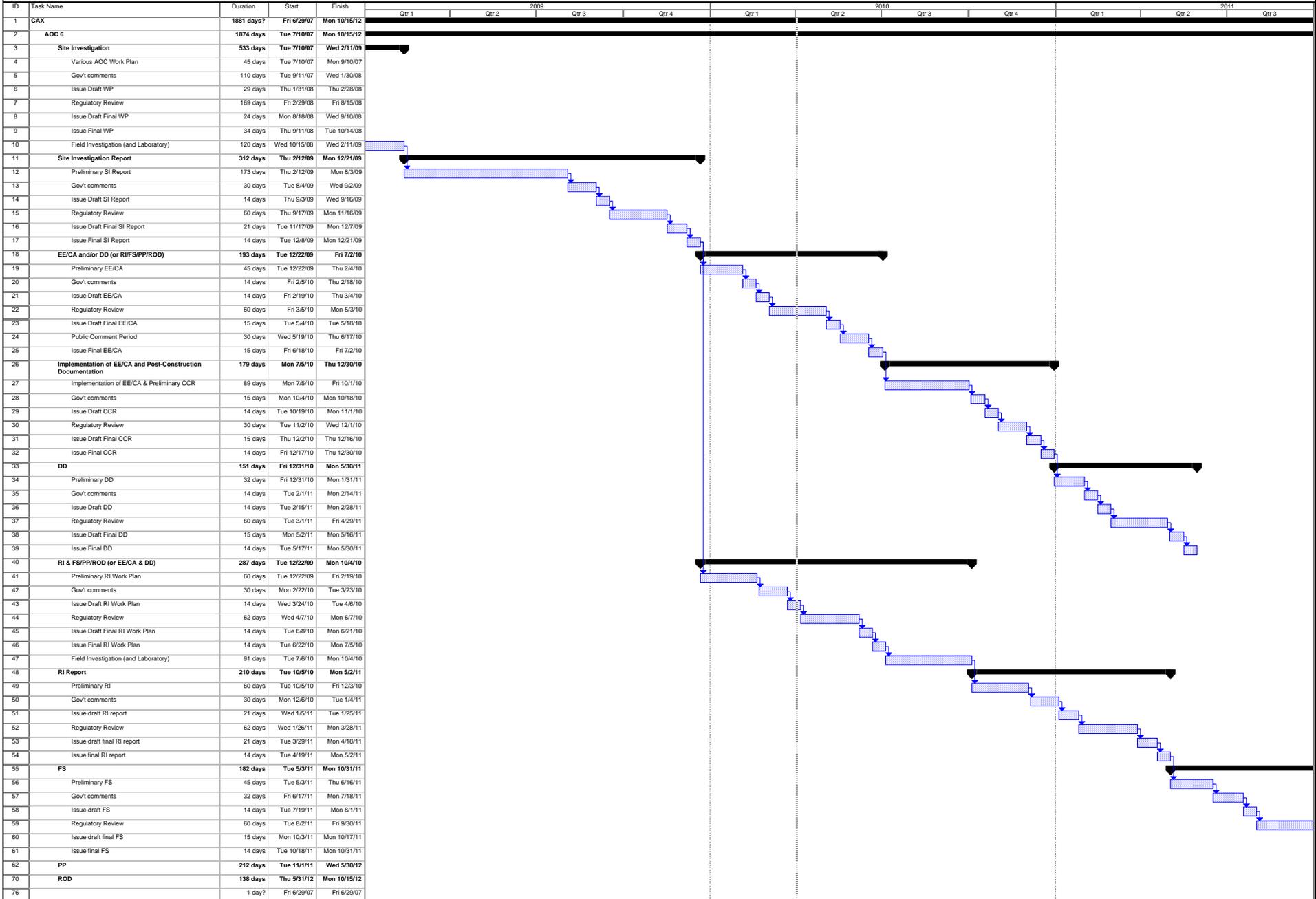
Task Progress Summary External Tasks Deadline Split Milestone Project Summary External Milestone

Schedule 3-7  
AOC 3 FY10-FY11 Schedule

ID	Task Name	Duration	Start	Finish	2009				2010				2011			
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	
1	CAX	1746 days	Fri 7/11/08	Mon 4/22/13												
2	AOC 3	1746 days	Fri 7/11/08	Mon 4/22/13												
3	Site Investigation	507 days	Fri 7/11/08	Mon 11/30/09												
4	CAX Site 4, 9, & AOC 3 Work Plan	148 days	Fri 7/11/08	Fri 12/5/08												
5	Gov't comments	15 days	Thu 1/8/09	Thu 1/22/09												
6	Issue Draft WP	57 days	Fri 1/23/09	Fri 3/20/09												
7	Regulatory Review	89 days	Mon 3/23/09	Fri 6/19/09												
8	Issue Draft Final WP	40 days	Mon 6/22/09	Fri 7/31/09												
9	Issue Final WP	15 days	Mon 8/3/09	Mon 8/17/09												
10	Field Investigation (and Laboratory)	91 days	Mon 8/31/09	Mon 11/30/09												
11	Site Investigation Report	210 days	Tue 12/1/09	Mon 6/28/10												
12	Preliminary SI Report	60 days	Tue 12/1/09	Fri 1/23/10												
13	Gov't comments	30 days	Mon 2/1/10	Tue 3/2/10												
14	Issue Draft SI Report	21 days	Wed 3/3/10	Tue 3/23/10												
15	Regulatory Review	62 days	Wed 3/24/10	Mon 5/24/10												
16	Issue Draft Final SI Report	21 days	Tue 5/25/10	Mon 6/14/10												
17	Issue Final SI Report	14 days	Tue 6/15/10	Mon 6/28/10												
18	EE/CA & DD (or RI/FS/PP/ROD)	197 days	Tue 6/29/10	Tue 1/11/11												
19	Preliminary EE/CA	45 days	Tue 6/29/10	Thu 8/12/10												
20	Gov't comments	15 days	Fri 8/13/10	Fri 8/27/10												
21	Issue Draft EE/CA	14 days	Mon 8/30/10	Sun 9/12/10												
22	Regulatory Review	60 days	Mon 9/13/10	Thu 11/11/10												
23	Issue Draft Final EE/CA	15 days	Fri 11/12/10	Fri 11/26/10												
24	Public Comment Period	30 days	Mon 11/29/10	Tue 12/28/10												
25	Issue Final EE/CA	14 days	Wed 12/29/10	Tue 1/11/11												
26	Implementation of EE/CA and Post-Construction Doci	181 days	Wed 1/12/11	Mon 7/11/11												
27	Implementation of EE/CA & Preliminary CCR	92 days	Wed 1/12/11	Wed 4/13/11												
28	Gov't comments	14 days	Thu 4/14/11	Wed 4/27/11												
29	Issue Draft CCR	14 days	Thu 4/28/11	Wed 5/11/11												
30	Regulatory Review	30 days	Thu 5/12/11	Fri 6/10/11												
31	Issue Draft Final CCR	15 days	Mon 6/13/11	Mon 6/27/11												
32	Issue Final CCR	14 days	Tue 6/28/11	Mon 7/11/11												
33	DD	154 days	Tue 7/12/11	Mon 12/12/11												
34	Preliminary DD	32 days	Tue 7/12/11	Fri 8/12/11												
35	Gov't comments	15 days	Mon 8/15/11	Mon 8/29/11												
36	Issue Draft DD	14 days	Tue 8/30/11	Mon 9/12/11												
37	Regulatory Review	60 days	Tue 9/13/11	Fri 11/11/11												
38	Issue Draft Final DD	15 days	Mon 11/14/11	Mon 11/28/11												
39	Issue Final DD	14 days	Tue 11/29/11	Mon 12/12/11												
40	RI & FS/PP/ROD (or EE/CA & DD)	288 days	Tue 6/29/10	Tue 4/12/11												
41	Preliminary RI Work Plan	60 days	Tue 6/29/10	Fri 8/27/10												
42	Gov't comments	30 days	Mon 8/30/10	Tue 9/28/10												
43	Issue Draft RI Work Plan	15 days	Wed 9/29/10	Wed 10/13/10												
44	Regulatory Review	61 days	Thu 10/14/10	Mon 12/13/10												
45	Issue Draft Final RI Work Plan	15 days	Tue 12/14/10	Tue 12/28/10												
46	Issue Final RI Work Plan	15 days	Wed 12/29/10	Wed 1/12/11												
47	Field Investigation (and Laboratory)	90 days	Thu 1/13/11	Tue 4/12/11												
48	RI Report	209 days	Wed 4/13/11	Mon 11/7/11												
49	Preliminary RI	62 days	Wed 4/13/11	Mon 6/13/11												
50	Gov't comments	31 days	Tue 6/14/11	Thu 7/14/11												
51	Issue draft RI report	21 days	Fri 7/15/11	Thu 8/4/11												
52	Regulatory Review	60 days	Fri 8/5/11	Mon 10/3/11												
53	Issue draft final RI report	21 days	Tue 10/4/11	Mon 10/24/11												
54	Issue final RI report	14 days	Tue 10/25/11	Mon 11/7/11												
55	FS	182 days	Tue 11/8/11	Mon 5/7/12												
62	PP	212 days	Tue 5/8/12	Wed 12/5/12												
70	ROD	138 days	Thu 12/6/12	Mon 4/22/13												

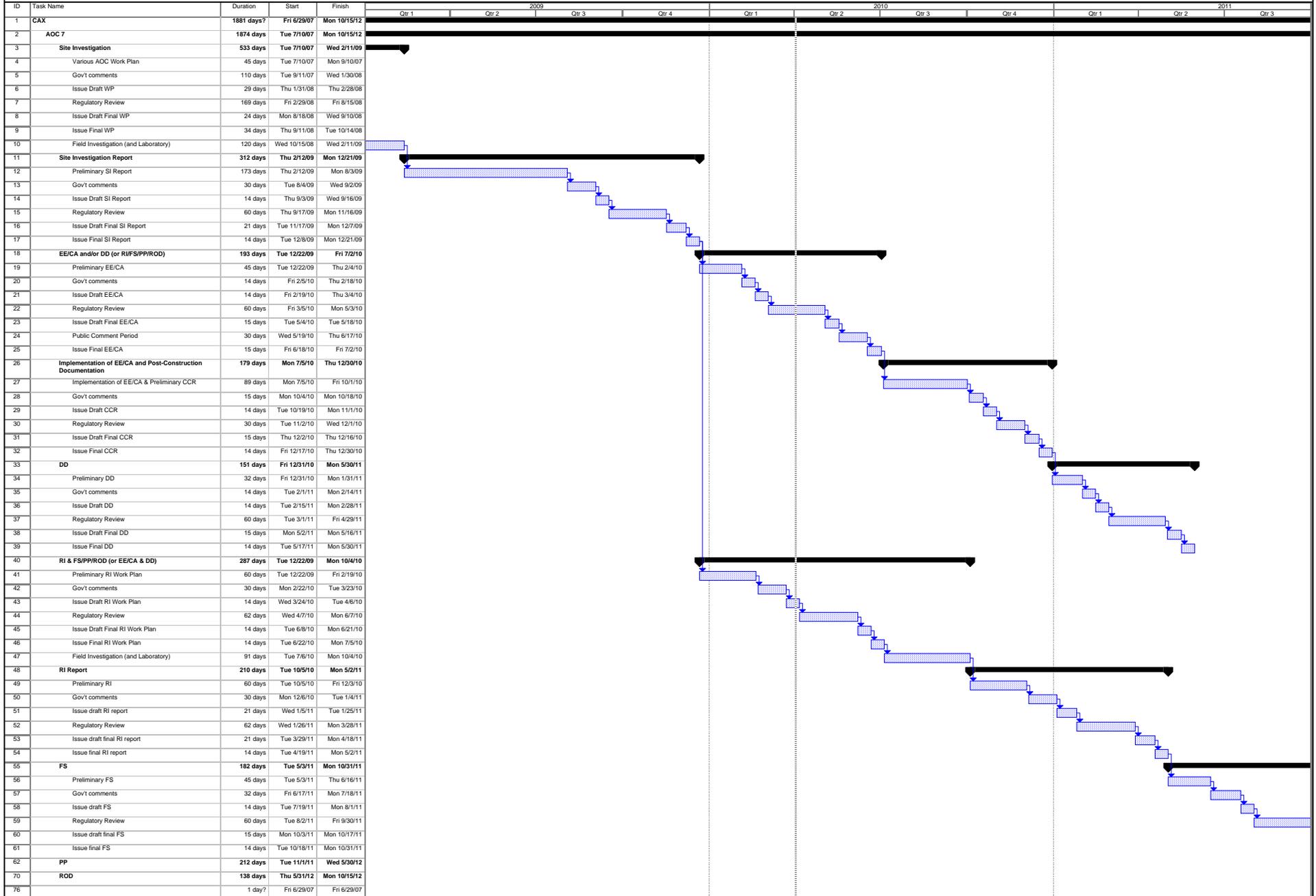
Task Progress Summary External Tasks Deadline Split Milestone Project Summary External Milestone

Schedule 3-8  
AOC 6 FY10-FY11 Schedule



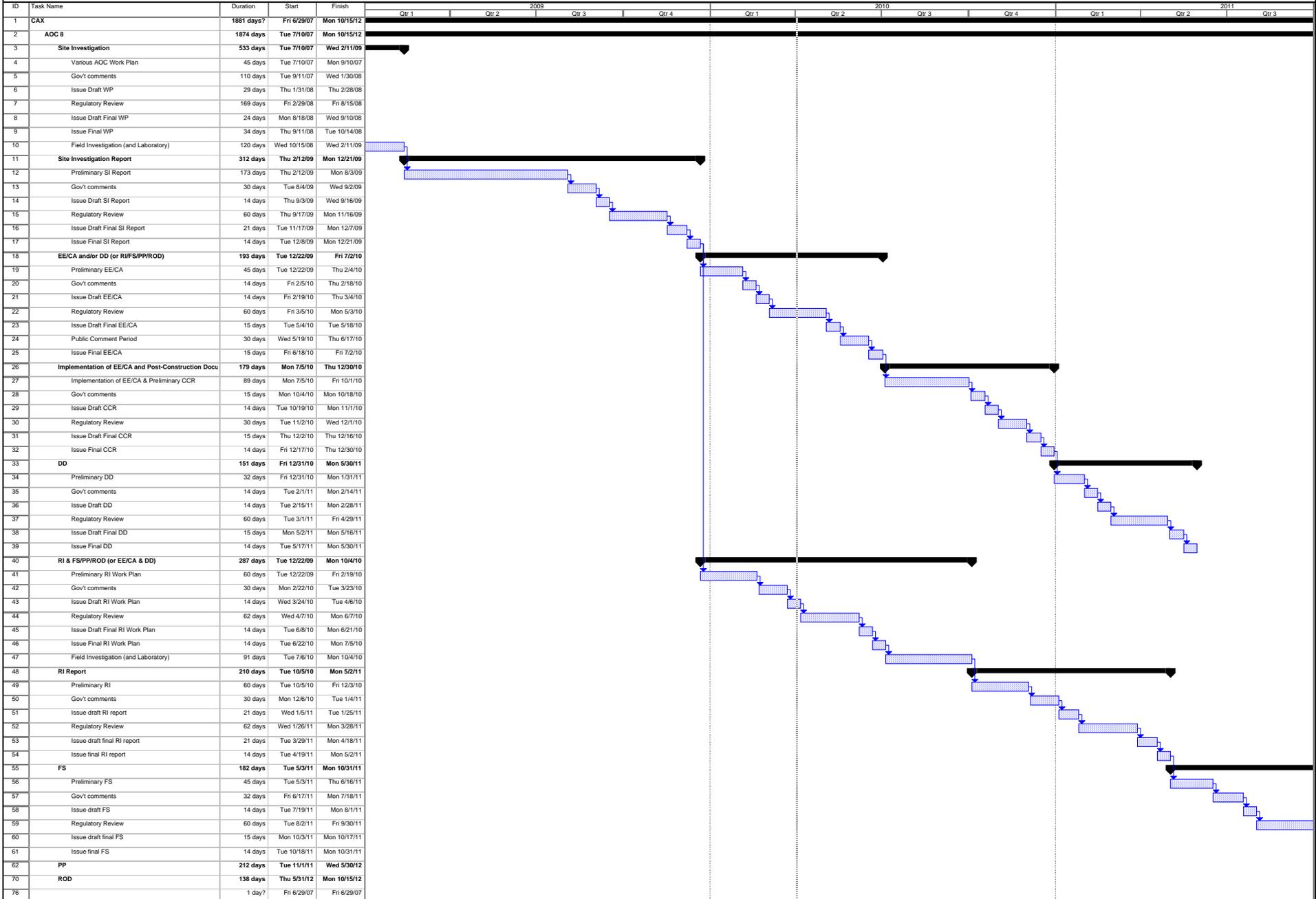
Task Split Progress Milestone Summary Project Summary External Tasks External Milestone Deadline

Schedule 3-9  
AOC 7 FY10-FY11 Schedule



Task Split Progress Milestone Summary Project Summary External Tasks External Milestone Deadline

Schedule 3-10  
AOC 8 FY10-FY11 Schedule



Task Split Progress Milestone Summary Project Summary External Tasks External Milestone Deadline

Schedule 3-11  
AOC 9 FY10-FY11 Schedule

ID	Task Name	Duration	Start	Finish	2010				2011				2012				2	
					Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2
1	<b>CAX</b>	<b>1030 days</b>	<b>Mon 2/1/10</b>	<b>Mon 11/26/12</b>														
2	<b>AOC 9</b>	<b>1030 days</b>	<b>Mon 2/1/10</b>	<b>Mon 11/26/12</b>														
3	<b>Remedial Investigation</b>	<b>288 days</b>	<b>Mon 2/1/10</b>	<b>Mon 11/15/10</b>														
4	Preliminary RI Work Plan	60 days	Mon 2/1/10	Thu 4/1/10														
5	Gov't comments	32 days	Fri 4/2/10	Mon 5/3/10														
6	Issue Draft RI Work Plan	14 days	Tue 5/4/10	Mon 5/17/10														
7	Regulatory Review	60 days	Tue 5/18/10	Fri 7/16/10														
8	Issue Draft Final RI Work Plan	15 days	Mon 7/19/10	Mon 8/2/10														
9	Issue Final RI Work Plan	14 days	Tue 8/3/10	Mon 8/16/10														
10	Field Investigation (and Laboratory)	91 days	Tue 8/17/10	Mon 11/15/10														
11	<b>RI Report</b>	<b>210 days</b>	<b>Tue 11/16/10</b>	<b>Mon 6/13/11</b>														
12	Preliminary RI	60 days	Tue 11/16/10	Fri 1/14/11														
13	Gov't comments	30 days	Mon 1/17/11	Tue 2/15/11														
14	Issue draft RI report	21 days	Wed 2/16/11	Tue 3/8/11														
15	Regulatory Review	62 days	Wed 3/9/11	Mon 5/9/11														
16	Issue draft final RI report	21 days	Tue 5/10/11	Mon 5/30/11														
17	Issue final RI report	14 days	Tue 5/31/11	Mon 6/13/11														
18	<b>FS</b>	<b>182 days</b>	<b>Tue 6/14/11</b>	<b>Mon 12/12/11</b>														
19	Preliminary FS	45 days	Tue 6/14/11	Thu 7/28/11														
20	Gov't comments	32 days	Fri 7/29/11	Mon 8/29/11														
21	Issue draft FS	14 days	Tue 8/30/11	Mon 9/12/11														
22	Regulatory Review	60 days	Tue 9/13/11	Fri 11/11/11														
23	Issue draft final FS	15 days	Mon 11/14/11	Mon 11/28/11														
24	Issue final FS	14 days	Tue 11/29/11	Mon 12/12/11														
25	<b>PP</b>	<b>212 days</b>	<b>Tue 12/13/11</b>	<b>Wed 7/11/12</b>														
33	<b>ROD</b>	<b>138 days</b>	<b>Thu 7/12/12</b>	<b>Mon 11/26/12</b>														

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

## SECTION 4

# References

---

- Baker Environmental, Inc. (Baker). 1994. *Site Investigation Report, Sites 1, 10, and 11, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. November. (Admin Record (AR) No.: 00140C).
- Baker. 1997. *Site Screening Process Report, Sites 1, 10, and 11*. September. (AR No.: 00131C).
- Baker. 1999a. *Action Memorandum, Site 1 – Landfill Near Incinerator, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. August. (AR No.: 00176C).
- Baker. 1999b. *Final Field Investigation Report, Site 1 and AOC 2 Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. September. (AR No.: 01217).
- Baker. 1999c. *Draft Final No Further Response Action Planned Decision Document Site 9 – Transformer Storage Area, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. December. (AR No.: 01223).
- Baker. 2000a. *Construction Close-Out Report, Site 1 Time Critical Removal Action, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 00214C).
- Baker. 2000b. *Focused Feasibility Study, Site 1 – Landfill Near Incinerator, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. November. (AR No.: 01124)
- Baker. 2000c. *Removal Closeout Report, Site 11 – Bone Yard, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. April. (AR No.: 01477).
- Baker. 2001a. *Final Pond Study Report, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. August. (AR No.: 01212).
- Baker. 2001b. *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. May. (AR No.: 01291).
- Baker. 2001c. *Final Field Investigation Report, Site 7 and AOC 2, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. March. (AR No.: 01348).
- Baker. 2002. *Trenching Letter Report, Site 1, Site 4, and AOC 2, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 01234).
- Baker. 2003a. *Final No Further Response Action Planned Decision Document for Sites 2, 3, 5, 6, 8, and 10. Naval Weapons Station Yorktown, Cheatham Annex Site*. September. (AR No.: 01373).
- Baker. 2003b. *Engineering Evaluation/Cost Analysis for Contaminated Soil, Site 1 – Landfill Near Incinerator*. June. (AR No.: 01563).
- Baker. 2004a. *Final No Further Response Action Planned Decision Document for Site 12, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. March. (AR No.: 01428).

- Baker. 2004b. *Round One Remedial Investigation Report for Site 1 – Landfill Near Incinerator, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. February. (AR No.: 01475).
- Baker. 2004c. *Trenching and Limited Investigation Report, Site 7N, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 01479).
- Baker. 2004d. *Action Memorandum Time-Critical Removal Action, Site 7N – Old DuPont Disposal Area, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 01592).
- Baker. 2005a. *Screening Level Ecological Risk Assessment and Step 3A Refinement Report, Site 1 – Landfill Near Incinerator, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. April. (AR No.: 01669).
- Baker 2005b. *Screening-level Ecological Risk Assessment Report for Sites 4 and 9, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 01565).
- Baker. 2006. *Technical Memorandum, Pre-Removal Characterization of Sediments, Site 1 – Landfill Near Incinerator, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. December. (AR No.: 02014).
- Baker. 2007. *Remedial Investigation, Site 11 – Bone Yard, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. April. (AR No.: 02171).
- Bhate Associates (Bhate). 2005. *Final Explosives Safety Submission, Shoreline Stabilization/Geotextile Tube Installation at IR Site 7 – Old DuPont Disposal Area, Naval Weapons Station Yorktown, Cheatham Annex, Yorktown, Virginia*. December. (AR No.: 01865).
- Bhate. 2007a. *Project Completion Report, Site 1 – Landfill Near Incinerator and Site 7 – Old DuPont Disposal Area, Naval Weapons Station Yorktown Cheatham Annex, Yorktown, Virginia*. December. (AR Nos.: 02195, 02196, 02197, and 02198).
- Bhate. 2007b. *Final UXO Remediation After Action Report, Shoreline Stabilization/Geotextile Tube Installation at IR Site 7– Old DuPont Disposal Area, Naval Weapons Station Yorktown Cheatham Annex, Yorktown, Virginia*. April. (AR No.: to be added to AR).
- Brockman, A. R., D. L. Nelms, G. E. Harlow, Jr., and J. J. Gildea. 1997. *Geohydrology of the Shallow Aquifer System. Naval Weapons Station Yorktown, Yorktown, Virginia*. Prepared in cooperation with the Naval Weapons Station Yorktown Base Civil Engineer, Environmental Directorate. USGS Water Resources Investigation Report 97-4188.
- C. C. Johnson & Associates, Inc. and CH2M Hill. 1984. *Initial Assessment Study of Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division*. February. (AR No.: 00247).
- CH2M HILL. 2008a. *Final CAX Site 1 Groundwater Data Review and Risk Management Consideration Technical Memorandum, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. February. (AR No.: 02199).
- CH2M HILL. 2008b. *Technical Memorandum, Documentation for NFA Regarding Site Waste, Soils, and Sediment, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. May. (AR No.: 02215).

- CH2M HILL. 2008c. *Proposed Plan, Site 1 – Landfill Near Incinerator, Naval Weapons Station Yorktown, Cheatham Annex, Williamsburg, Virginia*. January. (AR No. Pending).
- CH2M HILL. 2008d. *Engineering Evaluation/Cost Analysis, Site 11 – Bone Yard, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. November. (AR No.: 02285).
- CH2M HILL. 2008e. *UFP-SAP for Various CAX AOCs*. October. (AR No. Pending).
- CH2M HILL. 2008f. *Expanded Site Inspection Report for the Closed MWR Skeet Range and the Closed Marine Pistol and Rifle Range, Naval Weapons Station Yorktown and Cheatham Annex, Williamsburg, Virginia*. March. (AR No.: 02180).
- CH2M HILL. 2009a. *Final Community Involvement Plan, Naval Weapons Station Yorktown and Cheatham Annex*. August. (AR No. Pending).
- CH2M HILL. 2009b. *Final Record of Decision, Operable Unit 1, Site 1: Landfill Near Incinerator, Naval Weapons Station Yorktown, Cheatham Annex, Williamsburg, Virginia*. September. (AR No. Pending)
- CH2M HILL. 2009c. *Final Technical Memorandum, Consensus for No Further Action in Soil and Groundwater, Site 11 – Bone Yard, Naval Weapons Station Yorktown, Cheatham Annex, Williamsburg, Virginia*. September. (AR. No. Pending)
- Dames & Moore. 1986. *Confirmation Study Step 1A (Verification), Round One, Naval Supply Center, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 00256).
- Dames & Moore. 1988. *Confirmation Study Step 1A (Verification), Round Two, Naval Supply Center, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 00259).
- Dames & Moore. 1991. *Final Remedial Investigation Interim Report, Fleet and Industrial Supply Center (Norfolk), Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. February. (AR No.: 00812).
- Malcolm Pirnie. 2006. *Final Preliminary Assessment, Naval Weapons Station Yorktown – Cheatham Annex, Virginia*. April. (AR No.: 01942).
- Naval Facilities Engineering Command (NAVFAC). 2003. *Memorandum: Yorktown, Cheatham Annex Site-1 Physical Changes Due To Hurricane Isabel*. (AR No.: 01380).
- Roy F. Weston, Inc. 1999a. *Data Acquisition/Summary Report, Penniman Shell Loading Plant, Williamsburg, Virginia*. October. (AR No.: 00162C).
- Roy F. Weston, Inc. 1999b. *Final Site Inspection Narrative Report Penniman Shell Loading Plant, Williamsburg, Virginia*. August. (AR No.: 00161C).
- Shaw Environmental and Infrastructure (Shaw). 2006b. *Completion Letter Report for Housekeeping Actions at CAX Site 1 and AOC 7. Cheatham Annex, Williamsburg, Virginia*. June. (AR No.: 01903).
- Shaw. 2006a. *Closeout Report, Site 1 – Landfill Near Incinerator, Southeast Wooded Area, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. August. (AR No.: 01922).

Shaw. 2008a. *Final Construction Completion Report, Removal Action E, Hot Spot Removal and Pond Recovery at Site 1, Cheatham Annex, Naval Weapons Station, Williamsburg, Virginia*. July. (AR No.: 02279).

Shaw. 2009a. *Final Construction Completion Report: Soil and Debris Removal at Site 7, Cheatham Annex, Naval Weapons Station, Williamsburg, Virginia*. September. (AR No. Pending).

Shaw. 2009b. *Draft Final Construction Completion Report, Hot Spot Removal Action at Site 11, Cheatham Annex, Yorktown Naval Weapons Station, Williamsburg, Virginia*. August. (AR No. Pending).

Speiran and Hughes. 2001. *Hydrology and Water Quality of the Shallow Aquifer System, Yorktown Battlefield, Colonial National Historical Park at Yorktown, Virginia*. September.

United States Environmental Protection Agency (USEPA). 2005. *Federal Facility Agreement for Naval Weapons Station Yorktown Cheatham Annex*. March.