



**US Army Corps  
of Engineers®**

**July 2010  
FINAL**

---

**ORDNANCE AND EXPLOSIVES (OE) RECURRING  
REVIEW REPORT  
FORMER NEBRASKA ORDNANCE PLANT  
MEAD, NEBRASKA**

---

**Final  
Ordnance and Explosives (OE)  
Recurring Review Report**

for

Former Nebraska Ordnance Plant

FUDS Number: 104443

Mead  
Saunders County, Nebraska

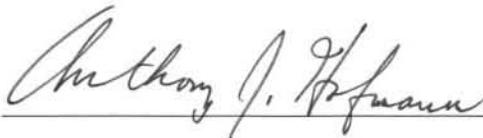
July, 2010

PREPARED BY:

Department of the Army  
U.S. Army Corps of Engineers  
Kansas City District

Approved by:

Date:



---

28 JULY 2010

---

ANTHONY J. HOFMANN  
Colonel, EN  
Commanding

# TABLE OF CONTENTS

---

SECTION 0 EXECUTIVE SUMMARY .....	ES-1
0.1 BACKGROUND .....	ES-1
0.2 REVIEW RESULTS AND CONCLUSIONS .....	ES-1
0.2.1 Culvert Area (Site 5).....	ES-2
0.2.2 Landfill Area, Former Wastewater Treatment Plant (Site 8) .....	ES-2
0.2.3 Potential Landfill Area.....	ES-3
0.3 NEXT OE RECURRING REVIEW .....	ES-3
SECTION 1 INTRODUCTION .....	1-1
1.1 PURPOSE OF THE REPORT .....	1-1
1.2 REPORT ORGANIZATION.....	1-1
SECTION 2 SITE DESCRIPTION .....	2-1
2.1 BACKGROUND INFORMATION .....	2-1
2.2 PHYSICAL CHARACTERISTICS.....	2-1
2.2.1 Physiography and Topography .....	2-2
2.2.2 Geology .....	2-2
2.3 LAND USE.....	2-3
2.4 OE INVESTIGATION HISTORY .....	2-4
2.5 DERP-FUDS PROCESS AT NOP .....	2-4
2.5.1 Bomb Load Lines (Sites 1-4).....	2-4
2.5.2 South Burning Ground (Site 7).....	2-5
2.5.3 Proving Range (Site 9).....	2-5
2.5.4 North Burning Ground (Site 10).....	2-6
2.5.5 Detention Pond (Site 11).....	2-6
2.5.6 Bomb Booster Assembly Area (Site 12).....	2-7
2.5.7 Post-Removal Status .....	2-7
SECTION 3 RECURRING REVIEW PROCESS.....	3-1
3.1 INFORMATION REVIEW .....	3-1
3.1.1 DEMOLITION GROUNDS (SITES 5 AND 6).....	3-1
3.1.2 Landfill Area, Former Wastewater Treatment Plant (Site 8) .....	3-2
3.1.3 Potential Landfill Area.....	3-5
3.2 SITE VISIT.....	3-5
3.2.1 Culvert Area (Site 5).....	3-6
3.2.2 Landfill Area, Former Wastewater Treatment Plant (Site 8).....	3-7
3.2.3 Potential Landfill Area.....	3-7
3.3 STAKEHOLDER AND REGULATOR INPUT .....	3-7
3.3.1 Regulator OE Concerns .....	3-8
3.3.2 Stakeholder OE Concerns .....	3-9
SECTION 4 FINAL SITE ANALYSIS.....	4-1
4.1 CHANGES IN LAND USE, ACCESSIBILITY, TECHNOLOGY .....	4-1
4.2 STATUS OF INSTITUTIONAL CONTROLS .....	4-1
4.3 REVIEW OF POTENTIAL SAFETY HAZARDS .....	4-1
4.3.1 Culvert Area (Site 5).....	4-2
4.3.2 Landfill Area, Former Wastewater Treatment Plant (Site 8) .....	4-2
4.3.3 Potential Landfill Area.....	4-2
4.4 RESPONSE ACTION PROTECTIVENESS.....	4-2
SECTION 5 SITE-SPECIFIC CONCLUSIONS AND RECOMMENDATIONS.....	5-1
5.1 SITE-SPECIFIC CONCLUSIONS.....	5-1
5.1.1 Culvert Area (Site 5).....	5-1
5.1.2 Landfill Area, Former Wastewater Treatment Plant (Site 8) .....	5-2
5.1.3 Potential Landfill Area.....	5-2
5.1.4 Additional OE Response Action.....	5-2
5.2 NEXT OE RECURRING REVIEW .....	5-2
SECTION 6 REFERENCES .....	6-1

# TABLE OF CONTENTS

---

## TABLES

Table 2-1	Chronology of Events
Table 2-2	List of Documents Used for OE Recurring Review

## FIGURES

Figure 1-1	Site Location Map
Figure 2-1	Location of Historical Sites
Figure 2-2	Sites 9, 10 and Potential Landfill Area
Figure 3-1	Site 6 - Turnout Area
Figure 3-2	Site 5 - Culvert Area
Figure 3-3	Site 5 - OE Locations
Figure 3-4	Site 8 - Former Waste Water Treatment Plant, Landfill Area
Figure 3-5	Monitoring Wells Sampled for CWM Compounds
Figure 3-6	Potential Landfill Area-Bomblet Locations

## APPENDICES

Appendix A	Deed Notices
Appendix B	Documentation Relevant to Discovery of Partial Bomblets in 1999
Appendix C	Scrap Ordnance Documentation
Appendix D	Historic CWM Information and Interviews
Appendix E	Stakeholder Meeting Minutes/Correspondence
Appendix F	2007 Site Visit Notes
Appendix G	Photographs
Appendix H	Agency Concerns
Appendix I	Stakeholder Concerns
Appendix J	Report for June 2007 CWM Sampling

## LIST OF ACRONYMS

---

AFB	Air Force Base
ARDC	University of Nebraska Agricultural Research and Development Center
ASR	Archives Search Report
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CENWK	U.S. Army Corps of Engineers Kansas City District
CENWO	U.S. Army Corps of Engineers Omaha District
CWM	Chemical Warfare Materiel
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency, Region VII
FDE	Findings and Determination of Eligibility
FUDS	Formerly Used Defense Site
InPR	Inventory Project Report
LPNNRD	Lower Platte North Natural Resource District
MMRP	Military Munitions Response Program
NDAI	No DoD Action Indicated
NDEQ	Nebraska Department of Environmental Quality
NOP	Nebraska Ordnance Plant
NRD	Natural Resource District
OB/OD	Open Burning/Open Detonation
OE	Ordnance and Explosives
OU	Operable Unit
PA	Preliminary Assessment
RAB	Restoration Advisory Board
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
ROD	Record of Decision
TNT	Trinitrotoluene
UNL	University of Nebraska-Lincoln
USACE	U.S. Army Corps of Engineers
USGS	U.S Geological Survey
USATHAMA	U.S. Army Toxic And Hazardous Materials Agency
UXO	Unexploded Ordnance

### **0.1 BACKGROUND**

An Ordnance and Explosives (OE) Recurring Review was conducted at the former Nebraska Ordnance Plant (NOP) in June 2007. Representatives from U.S. Army Corps of Engineers Kansas City District (CENWK) and Omaha District (CENWO) performed the OE Recurring Review activities. This OE Recurring Review Report evaluates the appropriate site-specific factors that may impact the continued effectiveness of the OE response actions for the former NOP, a Formerly Used Defense Site (FUDS) site located near Mead, Nebraska.

The OE Recurring Review, conducted in June 2007, included a review of existing documentation, identification and review of current and new information, a site visit, and stakeholder meetings. A site visit was conducted to visually confirm the physical condition of the site, and to verify current land use, site accessibility, and other factors affecting public exposure to ordnance risk. Local community members, community leaders, and regulators were interviewed to identify their concerns regarding OE response actions.

Areas of concern, as well as previous response actions, were evaluated during the OE Recurring Review. Response actions are identified in Table 2-1. Areas of concern identified and observed during the OE Recurring Review include:

- Culvert Area (Site 5)
- Landfill Area, Former Wastewater Treatment Plant (Site 8)
- Potential Landfill Area

One removal action has been implemented to date at the former NOP. A Removal Action was conducted in May 1997 at the Culvert Area (Site 5). At Site 5, approximately 6 acres of land were cleared of surface and subsurface OE to a depth of four feet (CMS, 1997). The 6 acres of land were divided into 26 grids 100 feet long by 100 feet wide. A geophysical survey was conducted grid by grid (Figure 3-2) and geophysical anomalies found within the grids were excavated by hand. Thirteen pieces of inert OE were uncovered during the excavations. The inert OE was limited to three of the 26 grids. The inert OE was located in the upper two feet of the site; no anomalies were located from two to four feet in depth. In October 1997, a Statement of Clearance was signed by the U.S. Army Corps of Engineers (USACE), which recommended the cleared parcel on Site 5 be used for any purposes that do not involve intrusive activities below four feet (USACE, 1997).

### **0.2 REVIEW RESULTS AND CONCLUSIONS**

The OE Recurring Review did not reveal any recent or future land use changes at and around the former NOP. No accessibility changes were identified during the OE Recurring Review. No evidence was found that the public has been exposed to any intact live rounds at the former NOP in the past five years.

Fencing (Photo No. 6) and signage (Photo No. 4) are in place at Site 5 (Culvert Area), at Site 8 (Landfill Area, Former Wastewater Treatment Plant), and at the Potential Landfill Area adjacent to Sites 9 and 10. These controls were implemented by the University of Nebraska-Lincoln (UNL) with funding provided by USACE. DoD has not recommended fencing or signage based upon risk at any location at the former NOP.

### **0.2.1 Culvert Area (Site 5)**

At Site 5, the cattle pens in the area serve as a barrier against foot and vehicular traffic from the general public and protect against public entry to the site. UNL does not conduct activities other than feedlot operations and maintenance (including mowing of grass in the feedlots) at this site. In October 1997, a Statement of Clearance was signed by USACE, which recommended the cleared parcel on Site 5 be used for any purposes that do not involve intrusive activities below four feet (USACE, 1997). The Statement of Clearance did not impose any land use restrictions on the parcel.

During the site walk, attendees walked the creek bed adjacent to Site 5. In the bank of the creek two pieces of munitions debris were located. One item was a partial base plate and the other appeared to be a spent grenade fuse. The munitions debris was found outside of the original surface clearance area and was discovered approximately 15-20 feet below the ground surface, protruding from the creek bank, adjacent to Site 5. Due to this finding since the last OE RR, a Site Investigation will be performed to access these new findings.

A review of safety hazards revealed negligible risk and unlikely probability that an OE-related accident would occur under current operating conditions. The May 1997 Removal Action involved clearing approximately six acres of the site of surface and subsurface OE to a depth of four feet. This action remains protective since no land use or accessibility changes were identified during this OE Recurring Review.

### **0.2.2 Landfill Area, Former Wastewater Treatment Plant (Site 8)**

The former Landfill Area at Site 8 is the suspected burial location of CWM, specifically mustard agent. The 1996 Engineering Evaluation/Cost Analysis (EE/CA) stated that insufficient evidence and inaccurate documentation exists regarding the potential CWM burial and classified Site 8 as No DoD Action Indicated (NDAI) for OE. The potential CWM disposal area was not identified during the OE Recurring Review site visit. A security fence was installed around the landfill near the suspected CWM burial location in 1994 (Dames & Moore, 1996b). Also in 1994, a site visit conducted by TCT on behalf of USACE resulted in a former Civilian-in-Charge at NOP pointing out what he remembered as the burial location of the CWM. This location is outside the current fence at Site 8. USACE is currently working with UNL to move the fence to encompass the suspected CWM burial location pointed out by the former Civilian-in-Charge.

Groundwater monitoring wells were installed downgradient of Site 8 in 1992. Samples from these wells have found no detections of thiodiglycol, a degradation product of mustard agent. Sampling of monitoring wells near the landfill was re-initiated in June 2007. These wells were

sampled for three indicator parameters for mustard agent; thiodiglycol, 1,4-oxathiane, and 1,4-dithiane. Results from all wells sampled were non-detect for the three mustard agent indicating parameters.

Results from previous evaluations and studies did not indicate risk. A review of safety hazards revealed negligible risk and unlikely probability that an OE-related accident would occur under current operating conditions.

### **0.2.3 Potential Landfill Area**

During the OE Recurring Review site visit, recent rainfall had elevated the reservoir water level so that the shoreline where empty booster cups, an inert bomb fuse, and other miscellaneous trash were discovered during the 2001 OE Recurring Review site visit could not be evaluated. In 2005 a base plate was found by a UNL representative while conducting Remedial Investigation (RI) activities (Photo No. 1). The finding of munitions debris has been the only OE-related incidence at the Potential Landfill Area since the 2001 OE Recurring Review. Warning signs and a gate at the entrance to the Potential Landfill Area warn of potential hazards in the area. The signs were installed by the UNL with monetary assistance from USACE, but were not recommended by DoD. A review of safety hazards conducted as part of this OE Recurring Review revealed negligible risk and an unlikely probability that an OE-related accident would occur under current operating conditions. A Supplemental Investigation will be performed in the Potential Landfill Area to assess the findings of MEC in 1999 and during the 2001 OE RR site visit.

### **0.3 NEXT OE RECURRING REVIEW**

This will be the last OE Recurring Review. The OE sites addressed in this document will continue to be evaluated and addressed through the CERCLA process.

## 0.4 RECURRING REVIEW SUMMARY

Site Identification			
Site Name:	Former Nebraska Ordnance Plant (NOP)		
FUDS Number:	B07NE0037		
City:	Mead	County:	Saunders
		State:	Nebraska
Site Status			
Selected Response Action Description:	Removal Action		
Response Action Status:	Under Construction	<input checked="" type="checkbox"/> Complete	
Initiation Date of On-site Field Work for Response Action Implementation:	May-97		
Completion Date for Response Action Implementation:	Jun-97		
Does the site include multiple Sectors/Areas? If yes, list the areas included in this OE Recurring Review	<input checked="" type="checkbox"/> Yes Site 5 (Culvert Area), Site 8 (Landfill Area), Potential Landfill Area	No	Has site been put into reuse? <input checked="" type="checkbox"/> Yes      No
Review Status			
Lead agency:	US Army Corps of Engineers		
Author/District PM Name:	Kristine Stein		
Author/District PM Title:	Project Manager	Author Affiliation:	USACE
Review Period:	Oct-01 to	Oct-06	
Review Number:	2		
Date(s) of site visit:	11-Jun-07		
Triggering Date:	May-97		
Due date for initiation of this Recurring Review:	Oct-06		

### Summary of Findings and Final Site Analysis:

#### Site 5 (Culvert Area)

A review of safety hazards revealed a negligible risk and the unlikely probability that an OE-related accident would occur under current operating conditions. The current response action (clearing of the upper four feet of the site) remains protective, since no land use or accessibility changes were identified in this OE Recurring Review. A Supplemental Investigation will be performed at Site 5 to assess the munitions debris found during the 2007 OE RR site visit protruding from the creek embankment.

#### Site 8 (Landfill Area)

A review of safety hazards revealed a negligible risk and the unlikely probability that an OE-related accident would occur under current operating conditions. Sampling of monitoring wells near the landfill was re-initiated in June 2007. These wells were sampled for three mustard agent degradation products: thiodiglycol; 1, 4-oxathiane; and 1,4-dithiane. Results from all wells sampled were non-detect for each of the three mustard agent degradation products.

#### Potential Landfill

A review of safety hazards conducted as part of this recurring review revealed negligible risk and the unlikely probability that an OE-related accident would occur under current operating conditions. A Supplemental Investigation will be performed to assess the findings of MEC in 1999 and during the 2001 OE RR site visit.

### Conclusions/Recommendations and Follow-Up Actions:

The OE Recurring Review did not reveal any recent or future land use changes at or around the former NOP nor were any accessibility changes identified. No evidence was found that the public has been exposed to any intact live rounds at the former NOP in the past five years. A Supplemental Investigation will be performed at the Culvert Area (Site 5) and Potential Landfill Area to assess MEC findings.

This will be the last OE Recurring Review for the former NOP. The OE sites addressed in this document will continue to be evaluated and addressed through the CERCLA process.

An Ordnance and Explosives (OE) Recurring Review was conducted at the former Nebraska Ordnance Plant (NOP) in June 2007. Representatives from the U.S. Army Corps of Engineers (USACE) Kansas City District (CENWK) and Omaha District (CENWO) performed the OE Recurring Review which included the following activities: document reviews; information evaluations; a site visit; and stakeholder meetings. The purpose of this report is to evaluate information collected during the OE Recurring Review and either substantiate that the original response action is still protective as intended or recommend that a follow-up action is warranted. This was the second OE Recurring Review performed at the site. The first OE Recurring Review was dated December 16, 2002.

### **1.1 PURPOSE OF THE REPORT**

This OE Recurring Review Report evaluates the appropriate site-specific factors that may impact the continued effectiveness of the OE response actions for the former NOP, a Formerly Used Defense Site (FUDS) located near Mead, Nebraska (Figure 1-1). The former NOP is included in the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS), Site Number B07NE0037.

OE recurring reviews are intended to determine whether the OE response actions continue to minimize explosives safety risks and continue to be protective of human health, safety and the environment (USACE, 2006). The information used to evaluate whether the OE response actions are protective include review of existing documentation; identification/review of any new information related to each site, including stakeholder concerns and any incidences of encounters with UXO reported to the local authorities; review of status of current site conditions, including any evidence of munitions debris observed within the site boundaries during the site visit; and a site visit. This review combined with CERCLA response actions, investigations, and evaluations of risk fully assess the protectiveness of site conditions.

Current guidance (USACE, 2006) suggests this review take place every five years, beginning five years following the completion of the response action. Should a problem with a response action be identified or an incident occurs between scheduled recurring reviews, a request for an OE Recurring Review may be submitted to the CENWK office to have the response action reviewed. Stakeholders and regulators are involved in the OE Recurring Review process. Stakeholders include federal, state, and local officials, community organizations, property owners, and others having a personal interest or involvement in the real property which is to undergo an OE Recurring Review.

### **1.2 REPORT ORGANIZATION**

Section 2 of this report provides a site description including chronological history, major events, response actions, and background information. The process by which the OE Recurring Review was conducted and results of the information review and site visit are presented in Section 3. An analysis of current protectiveness of OE response actions at the site is included in Section 4. Section 5 presents conclusions related to OE response actions at the former NOP. Section 6 presents the references cited in this document.

### **2.1 BACKGROUND INFORMATION**

The former NOP is located in Saunders County in eastern Nebraska and covers 17,250 acres (Figure 1-1). The facility is approximately 30 miles west of the city of Omaha and 35 miles northeast of the city of Lincoln, the two largest population centers in the state. The former boundary of the NOP is located one mile south of Mead and five miles east of Wahoo. Saunders County has a population of approximately 18,300 and the largest community and county seat is Wahoo with approximately 3,500 residents.

The former NOP was constructed at the beginning of World War II as a load, assembly, and pack facility for explosive weapons. Owned by the Department of Defense (DoD) and operated by a contractor, NOP consisted of an administration area, bomb load lines, bomb booster assembly plant, ammonium nitrate production plant, burning grounds, proving range, demolition area, landfill, sewage treatment plant, and several acres of storage igloos and magazines. The administration area included analytical laboratories, a laundry, and maintenance shops.

Bombs, projectiles, shells, and mines were produced from 1942 to 1945. With the exception of ammonium nitrate, the materials used to manufacture weapons were fabricated elsewhere and shipped to NOP for assembly. Bombs from 90 pounds to 12,000 pounds were loaded with trinitrotoluene (TNT), amatol (TNT and ammonium nitrate), Tritonal (TNT and aluminum), cyclotrimethylenetrinitramine (RDX), and Composition B (TNT and RDX).

During an interim period from 1945 to 1949, the NOP was decontaminated and used for storage, disposal of bulk explosives and munitions by open burning/open detonation (OB/OD), and for production of ammonium nitrate-grade fertilizer. Decontamination procedures included cleaning, flushing, and sweeping the floors, rafters, pipes, and ventilation systems; flushing drainage ditches; and removing and burning contaminated soil. There were 340,000 pieces of ordnance reportedly destroyed in three detonation pits in the area referred to as the burning grounds although, the exact areas were not reported (ESE, 1983).

Full-scale production was reactivated during the Korean Conflict in the 1950s. Ordnance products included bombs, projectiles, Nike missile warheads, and rocket motors using TNT, Tritonal, and Composition B. The NOP was operational until 1956 when the facility was deactivated. A chronology of historic milestones at the former NOP is presented in Table 2-1.

### **2.2 PHYSICAL CHARACTERISTICS**

The former NOP site is located in the Todd Valley, an abandoned stream terrace of the ancestral Platte River. The Todd Valley is bounded by till uplands to the northeast, the Wahoo Valley to the west and south, and the Platte Valley to the southeast. The thickness of unconsolidated material above bedrock in the Todd Valley at the site ranges from approximately 81 feet to 157 feet. The unconsolidated material consists of topsoil, loess, sand, and gravel. The uppermost bedrock unit is the Omadi Shale in the northwest and the Omadi Sandstone in the southeast portions of the site.

### 2.2.1 Physiography and Topography

The physiography of eastern Saunders County can be divided into three regions: flood plain; terrace plain; and uplands.

The flood plain consists primarily of the flood plains of the Platte River and Wahoo Creek. Elevations range from 1,050 feet (North American Vertical Datum [NAVD] 88) near the Lincoln Water System (LWS) well field in the southeast, to 1,130 feet near Ithaca in the Wahoo Valley, and 1,120 feet near Leshara in the Platte Valley. The topography is flat, sloping four feet per mile in the Platte Valley and six feet per mile in the Wahoo Valley.

The terrace plain is known as the Todd Valley, and is a stream terrace abandoned when the ancestral Platte pirated a tributary of the Elkhorn River. The terrace is generally 50 feet higher in elevation than the Wahoo Creek and Platte River flood plains. Elevations range from 1,220 feet near Colon in the northwest corner of the model area to 1,100 feet in the southeast, with a slope of approximately nine feet per mile.

There are two areas of till uplands in the area: one area is between the Todd Valley and the Platte Valley; and the other is southwest of Wahoo Creek. In contrast to the relatively flat Todd Valley terrace plain, the uplands are hilly with elevations ranging between 50 and 200 feet higher than the Todd Valley.

### 2.2.2 Geology

#### *Bedrock*

The Cretaceous Omadi Formation, approximately equivalent to and often called the Dakota Formation, underlies all but the southeastern portion of Saunders County. The formation consists of sandstone, siltstone, and shale. About half of the unit is poorly cemented sandstone. In general, the uppermost unit in the Omadi is shale in the northwestern portion of the former NOP, and sandstone in the southeastern portion. In southeastern Saunders County, including the area of the LWS Ashland well field, the uppermost bedrock consists of Pennsylvanian limestones and shales.

#### *Till and Fluvio-Glacial Deposits*

Souders (1967) used the configuration of the bedrock surface and data on the ease or difficulty in obtaining water supplies to infer the presence of buried Quaternary channels beneath the till uplands. These sand and gravel channels might possibly correlate to the David City Formation of Nebraskan age, which is a pro-glacial fluvial deposit. The David City Formation is overlain by Nebraskan and Kansan tills composed of a heterogeneous mixture of clay and silt. Souders indicates some sands, silts, and clays in between layers of till, which may correspond to younger fluvio-glacial deposits, possibly of Kansan age.

The ancestral Platte River eroded most of the till; and fluvio-glacial deposits in the Todd Valley were mostly eroded before late Kansan time. Clays, silts, and sands near the margins of the Todd Valley may be remnant Early or Medial-Pleistocene fluvio-glacial deposits.

*Todd Valley Deposits*

During the middle and late Pleistocene, the Todd Valley was filled by coarse alluviation ahead of advancing ice. Deposition was interrupted by erosion during inter-glacial stages. The deposits in the Todd Valley might include Kansan-age sands and gravels of the Grand Island Member, and the Illinoian-age Crete Member, which may be re-worked sediments of the Grand Island Member. Intense erosion preceded the deposition of the finer grained Todd Valley Sand during retreat of the Wisconsinan ice sheet (Reed, 1948).

*Loess*

During Wisconsinan time the Todd Valley and the surrounding uplands were covered by the light brown and light gray mottled Peoria Loess. The loess typically ranges between 10 and 20 feet in thickness in the Todd Valley. The loess is absent in the Platte River Valley and the Wahoo Creek Valley.

*Wahoo Valley Alluvium*

The sediments in the Wahoo Valley are stratigraphically distinct from the Todd Valley sediments and were deposited by Wahoo Creek. The similarity of elevation of the Wahoo and Platte Valleys suggests that the Wahoo Valley may lie in the abandoned channel of the ancestral Platte River.

The sediments in the Wahoo Valley are generally 30 to 80 feet thick. The upper silts and clays in the Wahoo Valley are alluvial overbank fines and are unrelated to the Peoria Loess. They are typically less than 15 feet thick.

*Platte River Alluvial Gravels, Sands and Fines*

Most of the sands and gravels of the Platte River alluvium are probably Wisconsinan or Recent and not correlative to the Todd Valley sediments. However, remnants of older sediments may be present in the Platte Valley. The Platte River alluvium is typically less than 50 feet thick in the western and eastern portions of the valley, but a channel in the bedrock surface up to 100 feet deep is oriented north-south through the center of the valley and the Metropolitan Utilities District (MUD) well field.

The silts and clays overlying the Platte River sands and gravels are alluvial overbank deposits, which are unrelated to the Peoria Loess. The thickness of the overbank fines typically ranges from 0 to 20 feet.

**2.3 LAND USE**

Currently, most of the site is owned by UNL, which operates an agricultural experiment station called the University of Nebraska Agricultural Research and Development Center (ARDC) on the premises. Crop, swine, dairy, and cattle research take place on site. Other portions are owned by the Nebraska National Guard, United States Air Force, and Army Reserves. Some private pasture and crop production also takes place on site, and some private light industry

exists near the northern end of the site. Adjacent land use is primarily agricultural, except for the Village of Mead which is located north of the site.

#### **2.4 OE INVESTIGATION HISTORY**

Previous investigations related to OE at the site include an archives search for the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA, now called Army Environmental Center) in 1983; a Preliminary Assessment of Ordnance Contamination (PA) in 1991; an Operable Unit No. 3 (OU3) site visit in 1994; an investigation of the suspected CWM burial at Site 8 in 1994; a geophysical investigation in 1995; an Engineering Evaluation/Cost Analysis (EE/CA) in 1996; a Removal Action for Site 5 in 1997; an OE Recurring Review site visit in 2001; and an OE Recurring Review site visit in 2007. These investigations are identified in Table 2-1.

The former NOP site was listed on the National Priorities List (NPL) under Section 105 of CERCLA on August 30, 1990. In September 1991, USACE, USEPA, and NDEQ entered into an FFA (formerly known as Interagency Agreement (IAG)) under Section 120 of CERCLA to investigate and control environmental contamination at the former NOP site.

#### **2.5 DERP-FUDS PROCESS AT NOP**

In 1991 the PA evaluated the potential sources of explosives contamination and unexploded ordnance (UXO) at 12 suspected sites (Figure 2-1):

- Bomb Load Lines (Sites 1-4)
- Culvert Area (Site 5)
- Turnout Area (Site 6)
- South Burning Ground (Site 7)
- Landfill Area, Former Wastewater Treatment Plant (Site 8)
- Proving Range (Site 9)
- North Burning Ground (Site 10)
- Detention Pond (Site 11)
- Bomb Booster Assembly Area (Site 12)

In subsequent archive search reports, site visits, and investigations (Table 2-2) it was concluded that there was no risk from ordnance and explosives at many of these sites. Therefore, these sites were classified as NDAI and were not reevaluated in the 2008 OE Recurring Review. Each site is, however, detailed in the following sections, with the exception of Site 5, Site 6, and Site 8, which are discussed in Section 3.

##### **2.5.1 Bomb Load Lines (Sites 1-4)**

There was concern that potential OE contamination, associated with high levels of explosives residue, was present in the drain pipes in the wash down areas of the load lines. During operation, wash water was either directed out the door into open concrete trenches that drained toward a settling basin, or directed to a sump. Any explosive residue remaining would likely

have been located in the settling basin or sump area. During the 1992 Operable Unit No. 1 (OU1) Remedial Investigation (RI), USACE collected over 400 soil samples from areas around the load lines (SEC Donohue, 1992). There were indications of soil staining and small pieces of what appeared to be TNT in the surface drainage areas. Soil samples indicated contamination of soil with explosives residue. The soils, basins, and sumps contained within the load lines were investigated under OU1. During the August 1994 site visit for the EE/CA, it was indicated that no further action would be necessary at the bomb load lines since they were currently being investigated for explosive residue under the OU1 RI and Supplemental RI. Explosives contaminated soil in the drain pipes, sumps and adjacent to the load line buildings were remediated under OU1 (OHM, 1998). All of the former production buildings at the load lines were demolished as part of a building demolition and debris removal activity performed by USACE and completed in 1999.

### **2.5.2 South Burning Ground (Site 7)**

This site is located approximately 3,000 feet east of Avenue D and 700 feet west of the former wastewater treatment plant. During the 1991 PA (TCT, 1991), both a visual survey and geophysical survey were completed at this site. There was a concern that potential OE contamination, associated with high levels of explosives residue, was present in this former burning area. During the visual survey several areas were noted to be littered with propellant grains and small (1/4-inch) pieces of what was believed to be TNT. Magnetometer and metal detector results revealed four ferrous contacts and three large areas of ferrous concentration. Hand excavation of the areas of heavy ferrous concentration revealed nails, hinges, and other packing material debris. Sample results from this area indicated residual TNT in the soils. No further OE action was considered for Site 7 due to the fact that this site was investigated further in the OU1 RI due to explosives residue in the soil. In 1997 as part of the OU1 Remedial Action, explosives contaminated soils above action levels were excavated and remediated (OHM, 1998).

### **2.5.3 Proving Range (Site 9)**

Site 9 is approximately four acres in size and is located on property currently owned by the University of Nebraska-Lincoln (UNL) (Figure 2-2). This area was reportedly used by the DoD for Quality Control/Quality Assurance Testing of materials manufactured at the NOP such as caps, fuzes, and boosters. There was no ordnance debris located at this site, however there were several small denuded areas (2 feet x 6 feet) that contained small pieces of what appeared to be bulk explosives.

During the 1994 EE/CA field investigation conducted by Dames & Moore, no evidence of UXO was observed during the visual survey. The geophysical survey identified 128 anomalies. A portion of the Natural Resource District (NRD) Reservoir covered 25 anomalies, but there were a sufficient number of accessible anomalies to provide a statistical representation of the area. The remaining 103 anomalies were located and excavated. The material found was scrap metal, wire and construction debris. No inert OE or UXO were identified from the 103 remaining excavated anomalies. In addition, there is no history of reported incidents or mishaps in this area. The remote locations and the current land use as a wildlife set-aside area further supports the

potential of a person encountering a UXO item resulting in a critical injury is unlikely. The EE/CA recommended no further removal action for ordnance and explosives at Site 9, since the hazard and exposure risk posed by UXO is negligible. In 1997 as part of the OU1 Remedial Action, explosives contaminated soils above action levels were excavated and remediated (OHM, 1998).

#### **2.5.4 North Burning Ground (Site 10)**

Site 10 is approximately five acres in size and is contiguous with Site 9 (Figure 2-2). It is currently owned by UNL. This area contained cages that were used to burn the empty cardboard TNT containers. The area was never used to burn any explosives residues. The land is currently being utilized as a wildlife set-aside area. The vegetation is tall grasses and weeds. During the 1994 EE/CA field investigation conducted by Dames & Moore, the visual survey revealed only one piece of inert OE (spent booster cup). Numerous pieces of metallic debris were located.

During the same field investigation, a geophysical survey was conducted at two areas believed to be burn pads. The survey identified 130 possible anomaly locations. At three of these locations the magnetometer could not detect any ferrous anomaly, so these areas were not excavated. Of the remaining 127 anomalies located and excavated, only two were identified as inert OE.

Soil samples were collected from various locations around Site 10 during the 1991 PA. Samples from Site 10 revealed that levels of explosive constituents (TNT concentrations ranged from 0.25 to 0.49 mg/kg) were not indicative of an explosive hazard.

UNL has placed a deed notice on the property that they currently own which includes Site 10. The deed notice can be found in Appendix A. The deed notice for Site 10 describes the laboratory chemical disposal by UNL and the military munitions and munitions' constituent disposal by DoD. The notice places the following restrictions on the land: *(1) The property may not be used in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of any response actions that have been or may be performed; (2) The use of the property for other than wildlife habitat except for maintenance of the remedy and further cleanup and stewardship activities; (3) The ground water may not be used for human consumption unless it has been treated before use to standards acceptable to EPA and NDEQ; (4) The landowner may enforce the requirements of the Consent Decree against any subsequent owner or transferee of the property; and (5) EPA is a third party beneficiary with authority to enforce the requirement here within.*

In addition, there is no history of reported incidents or mishaps at Site 10. The remote location and the current and imminent land use as a wildlife set-aside area further supports the potential of a person encountering a UXO item is remote. NDAI was determined for Site 10.

#### **2.5.5 Detention Pond (Site 11)**

Reviews of historical maps, drawings, and documents could not confirm this pond was ever constructed. During the 1991 PA, this pond only appeared on one drawing (Figure 2-1) and its

existence could not be confirmed. It is believed that the pond was planned but never constructed. This site is considered no further action for OE.

### **2.5.6 Bomb Booster Assembly Area (Site 12)**

This site is located in the northwest portion of the former NOP (Figure 2-1). The buildings had been used to manufacture fireworks. The buildings are reportedly contaminated with black powder from the fireworks operations. There is no documentation to indicate that the buildings are contaminated with explosives residue from past NOP operations. Public access to this private property is restricted via “No Trespassing” signage around the property. During the 1994 EE/CA surface field investigation, conducted by Dames & Moore, two samples were taken at this site for explosives: one from the inlet pipe located in a sump; and one from a sewer line that was uncovered to a depth of 3.5 feet at the northern end of the building. Sampling results from the two locations (both non-detect for explosives) did not warrant further action with regard to OE removal. The EE/CA recommended no further action because risk to public safety and the environment is negligible at this location. During the OU3 RI (Woodward-Clyde, 1997), soil samples were collected around the Tetryl Pelleting Building for explosives. Tetryl (maximum concentration detected was 0.000093 mg/kg) and HMX (maximum concentration detected was 0.47 mg/kg) were the only two explosives compounds detected. Both below the screening level and therefore, did not warrant any further action.

### **2.5.7 Post-Removal Status**

In April 1999 during OU3 RI activities, two partially-expended incendiary bomblets, considered to be munitions debris, were found near the Potential Landfill Area along the western shore of the NRD Reservoir. At the time of the discovery, the reservoir was being lowered to accommodate OU3 RI fieldwork (URS, 2000). The locations where the partial bomblets were found are identified on Figure 3-6. The 774<sup>th</sup> Ordnance Company (EOD) from Ft. Riley, Kansas destroyed the partial bomblets. The Explosive Ordnance Incident Report filed by the 774<sup>th</sup> EOD Company, in response to the finding, is included in Appendix B.

The OU3 Feasibility Study Report notes that the U.S. Environmental Protection Agency, Region VII (EPA) and the Nebraska Department of Environmental Quality (NDEQ) suggested a deed notice and fencing near the NRD Reservoir due to uncertainties associated with OE (URS, 2000). Based upon the findings in the 1996 EE/CA and the type of OE debris discovered following the EE/CA, USACE does not concur with the recommendation (Dames and Moore, 1996b).

The June 2006 Phase I Interim Remedial Investigation Report (University of Nebraska) notes the finding of ordnance scrap near the NRD Reservoir in 2005 (MACTEC, 2006). The Field Investigation Daily Report prepared for EPA documenting this occurrence is found in Appendix C.

The scope of the OE Recurring Review is dependent upon the response action objectives and the specific response actions implemented. The review evaluates appropriate site-specific factors that may impact the continued effectiveness of the response action. These factors include changes in physical conditions at the site, changes in public accessibility and land use, and the applicability of new technology for addressing a previous technical impracticability determination. The review addresses the following:

1. Is the response action functioning as intended?
2. Are any of the assumptions used at the time of the response action selection still valid?
3. Does new information indicate that the previously selected response is no longer protective of human health, safety, and the environment, considering the best available technology?

The OE Recurring Review, conducted in June 2007, included a review of existing documentation, identification and review of current and new information, a site visit, and stakeholder meetings.

### **3.1 INFORMATION REVIEW**

The project team reviewed existing documentation related to the 12 sites identified in the PA where potential ordnance contamination was a concern at the former NOP. Through this review, the team determined the actions completed at the site, where OE items are suspected or were located; what assumptions regarding land use and site accessibility were made for selection of the response action; and whether new information or technologies exist that warrant reconsideration of prior decisions. The OE-related documents that were assessed during this review are identified in Table 2-2.

Based on this information review the following three sites have been retained and will be the subject of this OE Recurring Review: (1) Demolition Grounds (Sites 5 and Site 6); (2) former Landfill Area, former Wastewater Treatment Plant (Site 8); and (3) Potential Landfill Area. These sites were evaluated because recent issues or actions involve these sites. There were no elevated risks reported at these sites since the last OE Recurring Review.

#### **3.1.1 Demolition Grounds (Sites 5 and 6)**

The Culvert Area (Site 5) and Turnout Area (Site 6) make up the area known as the Demolition Grounds. The Turnout Area (Site 6) is located in the southwest corner of the former NOP. During the 1991 PA, aerial photography indicated five possible craters (Figure 3-1) in this area. A complete magnetometer and metal detector survey (TCT, 1991) was conducted for each crater and any ferrous contacts were investigated by hand excavation. One contact in crater 3 turned out to be a M51 Series Point Detonating Artillery Fuse. No other UXO or ordnance debris was located during the survey. The ARDC headquarters facility was constructed in close proximity to the assumed location of Site 6. No OE was discovered during previous investigations or during the large excavations for the new facility. The craters were also investigated during the Operable Unit No. 3 (OU3) RI. Geophysical was conducted to try to identify any anomalies to focus soil sampling locations. Soil samples for explosives were collected and none were found at concentrations that warranted any further action.

The Culvert Area (Site 5) is approximately six acres in size and is located on property currently owned by UNL, which operates a cattle feedlot on the site (Figure 3-2). The cattle pens, fencing, and gates serve as a barrier against foot and vehicular traffic from the general public. Signage is used to restrict access and any new UNL personnel are made aware of the history of OE at this site.

Prior to the 1997 Removal Action, the area contained three partially-buried sections of corrugated steel culvert pipe, approximately 48 inches in diameter. A small depression, approximately 10-20 feet in diameter by 1-2 feet deep, is located in the area of the buried pipe. This depression (Figure 3-2) is thought to be the location of a former OB/OD site (CMS, 1997). The PA describes this location as a demolition area for tetryl boosters (TCT, 1991).

In 1994 Dames & Moore conducted an EE/CA field investigation which consisted of surface clearance activities and collection of geophysical data (Dames & Moore, 1996b). Surface clearance was conducted in three 100-foot x 100-foot grids over an area of 0.7 acres using a Schonstedt GA-72C ferrous metal locator (Figure 3-3). Following surface clearance a geophysical survey was conducted using a Geonics EM-31 electromagnetic ground conductivity meter and a Geonics EM-61 time-domain metal detector. A total of 107 anomalies were recorded for Site 5. Seventy-nine of the 107 anomalies were excavated. Of the remaining 28 locations, the magnetometer could not detect any anomaly. Since no metallic signals were recorded, these 28 locations were not excavated. Of the 79 excavated anomalies, 33 contained inert OE and one was treated as UXO. The types of inert OE located consisted of M48-series fuses, ballistic windshields, pull tabs, starter screens, booster cups, and pull rings. One of the M48 series fuses had a very slight possibility of containing a small detonator in the nose element and was, therefore, treated as UXO.

Following the 1996 EE/CA, a Removal Action was conducted in May 1997 at Site 5. Approximately six acres of land were cleared of surface and subsurface OE to a depth of four feet (CMS, 1997). The six acres of land were divided into 26 grids 100 feet long by 100 feet wide. A geophysical survey was conducted grid by grid (Figure 3-3) and geophysical anomalies found within the grids were excavated by hand. Thirteen pieces of inert OE were uncovered during the excavations. The inert OE was limited to three of the 26 grids and was located in the upper two feet of the site. No anomalies were located from two to four feet in depth. The Final Removal Report was completed in June 1997 by CMS Environmental, Inc. In October 1997, a Statement of Clearance was signed by USACE, which recommended the cleared six-acre parcel be used for any purposes that do not involve intrusive activities below four feet (USACE, 1997).

### **3.1.2 Landfill Area, Former Wastewater Treatment Plant (Site 8)**

Site 8 includes a former landfill and wastewater treatment plant (Figure 3-4). The landfill was in use during operations at the former NOP. Use of the landfill, by the UNL, continued following the closing of the NOP. UNL waste may have included chemical, low-level radiological, and biological wastes. UNL wastes may have been disposed in the landfill, or immediately adjacent to the landfill in "Burial Site D", which has since been excavated and disposed off site as part of an Administrative Order between the UNL and EPA. Operations at the landfill have ceased, the landfill is capped with a soil and clay cover, and was officially closed on May 1, 1993.

There have been reports concerning the disposal of mustard agent within the confines of the landfill in this area. Based on interviews (Appendix D) with a former United States Air Force officer working at Offutt Air Force Base in 1960, the suspected mustard agent was likely contained in a Chemical Agent Identification Set (CAIS), also known as a War Gas Identification Set, an item used to train military personnel safely to identify, handle, and decontaminate chemical agents. CAIS consisted of small quantities of various chemical agents in glass vials and bottles that were packed in metal shipping containers or wooden boxes. CAIS K941 (toxic gas set M-1) and CAIS K942 (toxic gas set M-2/E11) contained small bottles of undiluted (neat) chemical agent (mustard agent). CAIS K941 contained 24 glass bottles, each with approximately 3.5 ounces of undiluted mustard agent. CAIS K942 contained 28 glass bottles, each with approximately 3.8 ounces of undiluted mustard agent. CAIS were either disposed of individually or in their original metal or wooden storage and shipping containers called PIGS. Typically, CAIS vials were broken before disposal and decontaminant was used to neutralize any chemical agent present.

Based on available documentation (Appendix D), there are indications that CAIS items were moved from Offutt Air Force Base in 1960 to an unknown burial location for disposal. It is believed that these CAIS items could potentially have been buried at the former NOP. Based on interviews with both Offutt Air Force Base and former NOP personnel, USACE believes the most plausible series of events is described below:

- In 1960, a number of CAIS PIGS were discovered leaking at Offutt Air Force Base. Base Disaster Control personnel responded to the incident and verified the leaking substance was mustard agent. These containers were wrapped in plastic and placed in sealed 55-gallon drums to prevent further leaking. The barrels may have been temporarily buried at Offutt before being transported for reburial to an unspecified site, possibly NOP. Base personnel, when interviewed and shown pictures of typical CAIS sets (Appendix D), identified the containers as CAIS items.
- Also in 1960, former NOP employees were present when military personnel arrived at a disposal area adjacent to the landfill with drums purportedly containing the PIGS with leaking mustard agent. The description of the drums appears to match that reported in the Offutt incident.
- In 1994, USACE took measures to further reduce the potential for exposure to Chemical Warfare Materiel (CWM), the CAIS, and military munitions by paying UNL to install a barbed wire fence with warning signs around the landfill and potential disposal area (Dames & Moore, 1996a). The fence was installed as a precautionary measure at the request of UNL, due to concerns from the suspected burial of CWM (mustard agent). Also in 1994, a site visit was conducted by TCT on behalf of USACE. Some of the attendees included USACE representatives, ARDC representatives, and a former Civilian-in-Charge at NOP during the time of the suspected burial. This site visit gave the former Civilian-in-Charge at NOP an opportunity to point out the location he identifies as the suspected burial location. The location described was 50 feet north of the existing fence and approximately 20 to 25 feet below ground surface (bgs).

- Additionally, from 1994 to 2000, USACE performed groundwater monitoring at the former Landfill Area for thiodiglycol. In 2007 groundwater monitoring wells (Figure 3-5) downgradient of Site 8 were sampled for thiodiglycol, 1,4-oxathiane, and 1,4-dithiane, all mustard agent degradation products.

In 1995, the USACE Military Munitions Center of Expertise conducted a site wide assessment of military munitions and CWM at the former NOP, publishing an EE/CA in 1996 (Dames & Moore, 1996b). The report recommended “no further action” related to mustard agent at the former Landfill Area for the following reasons:

- The specific burial location is not known.
- Any potential burial location would now be at a depth of greater than 20 feet due to additional waste being put on top of the disposal area. If mustard agent were present in the landfill, exposure to humans under current or reasonable conditions in the future would be remote. Mustard agent has low volatility in the atmosphere and does not readily dissolve in water, so its chance of migration through groundwater or air from a buried location is very low.
- There was no mustard agent degradation product thiodiglycol present in groundwater near the landfill.
- Intrusive investigations into landfills are normally inadvisable and not typically productive because other waste material is present.

Groundwater monitoring wells (Figure 3-5) located downgradient of the suspected burial location were sampled for thiodiglycol, an indicator of CWM (mustard agent), from 1994 to 2000. In June 2007, USACE resumed sampling of monitoring wells in the vicinity of the suspected burial for thiodiglycol, 1,4-dithiane, and 1,4-oxathiane. The June 2007 sampling event results indicated that mustard agent degradation products are not present in groundwater therefore, no further sampling for these degradation products will be conducted.

Since the 2002 OE Recurring Review, several stakeholders notified USACE of information they collected in an effort to substantiate the burial of CWM at this site. Much of this information was previously evaluated by USACE during previous OE evaluations and as part of the EE/CA. Historic CWM information is provided in Appendix D. The approximate location of the buried CWM is presented on Figure 3-5. An evaluation of historic interviews with former NOP and site personnel provide information regarding the suspected CWM burial. These interviews are also included in Appendix D. The EE/CA stated that there has not been sufficient evidence or accurate documentation to suspect that mustard agent was disposed of in the landfill to warrant further investigation and classified Site 8 as No DoD Action Indicated (NDAI) for OE. To address the concerns raised by stake holders and to be conservative USACE, is proceeding under the assumption that CWM was buried in the former Landfill Area, despite the assertion in the EE/CA .

UNL has placed a deed notice on the area that includes Site 8 (Appendix A). The deed notice for Site 8 describes that both the UNL and DoD used the area as a solid waste disposal area. Use of

the landfill is restricted under the terms of the Nebraska Administrative Code, Title 132, Integrated Solid Waste Management Regulations. The deed notice states, *“The post-closure use of the property must not disturb the integrity of the either the containment system or any monitoring system unless the Director of NDEQ determines the proposed use (a) will not increase the potential threat to human health or the environment, or (b) is necessary to reduce the threat to human health or environment.”* The deed notice also states that: (a) the property may not be used in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of any response actions that have been or may be performed; (b) the groundwater may not be used for human consumption unless it has been treated before use to standards acceptable to EPA and the Nebraska Health and Human Services System; (c) the landowner may enforce the requirements of the Consent Decree against any subsequent owner or transferee of the property; and (d) EPA is a third-party beneficiary with authority to enforce the requirements of the Consent Decree.

### **3.1.3 Potential Landfill Area**

The Potential Landfill Area is bordered by the NRD Reservoir to the east, Site 10 (North Burning Ground) to the west, Site 9 (Proving Range) to the south, and cropland to the north (Figure 3-6). A gate controls the main access to Sites 9, 10, and the Potential Landfill Area and UNL does not allow access to these areas.

A geophysical investigation within the entire boundary of the Potential Landfill Area was conducted between April and May 1999 as part of the OU3 RI (URS, 2000) to determine anomalies and select locations for intrusive activities. The investigation consisted of both an electromagnetic survey and ground penetrating radar geophysical survey. The results of these surveys indicated the likely presence of buried waste materials. Also in 1999, during the OU3 RI field activities, two fragments of incendiary bomblets were found along the western shore of the NRD Reservoir (Figure 3-4) when the reservoir was lowered to accommodate fieldwork (URS, 2000). The partial bomblets were subsequently destroyed in accordance with UXO policy and procedures (URS, 2000). Documentation of the finding and destruction of the partial bomblets is included in Appendix B. A photo of a partial bomblet discovered in 1999 is included in Appendix G (Photo No. 8). No other OE was discovered during the investigation.

During the OU3 RI, 39 test pits were excavated in the area of the Potential Landfill Area (URS, 2000). The tests pits were excavated with waste generally being found within four feet of the ground surface, although some waste was located at greater depths. The waste uncovered in the test pits was indicative of a construction and debris landfill. Some OE scrap, such as bomb plates, was also discovered in the test pits.

## **3.2 SITE VISIT**

The project team conducted a site visit in June 2007 to visually confirm the physical condition of the site, and to verify current land use, site accessibility, and other factors affecting public exposure to ordnance risk. An open meeting was held on March 5, 2007, with the local community members, community leaders, and regulators to solicit their comments and identify their concerns regarding OE response actions at the site. Meeting minutes from the March 2007

meeting, summaries of discussions with stakeholders, and other community correspondence are presented in Appendix E. A summary of the site visit activities is presented in Appendix F.

The site visit was conducted to evaluate information in the following areas:

- development at the site
- recreation activities
- changes in land use
- changes in accessibility

Reports of OE incidents were accessed by contacting the Saunders County Sheriff Department and asking the main landowner of OE sites if they have had any specific ordnance related incidents in the last five years (see Appendix I).

It was anticipated that any new information, not currently in the Administrative Record that was necessary to support the findings of the review, would be discovered during the site visit and stakeholder meeting. A USACE OE Safety Specialist developed an OE health and safety plan and directed the site visit. Areas of concern observed by project team members and EPA representatives include:

- Culvert Area (Site 5) (Part of the Demolition Grounds)
- Landfill Area, Former Wastewater Treatment Plant (Site 8)
- Potential Landfill Area

These locations are identified on Figure 2-1. Observations made during the site visit are included in Appendix F. Photographs taken during the site visit are included in Appendix G. Site 6 (Turnout Area) was also included in the site visit, due to its convenient accessibility and proximity to the ARDC building. There are no new concerns or risks associated with Site 6 to warrant further evaluation. USACE considers the NDAI classification for Site 6, determined in the EE/CA, to be appropriate.

### **3.2.1 Culvert Area (Site 5)**

During the site visit, the Culvert Area was inspected to review the status of the site with regard to the 1997 Removal Action. At Site 5, the cattle pens, fencing, and gates serve as a barrier against foot and vehicular traffic from the general public. There is no fencing surrounding the location where the 1997 Removal Action took place (see Photo No. 5 in Appendix G); however access is restricted by barbed wire fencing and cattle pen gates. UNL posted signs on trees in the area to warn of the potential for UXO (see Photo No. 4 in Appendix G); however there was evidence that some signage may have fallen off sign posts and trees in the area. Signage installed by UNL was not implemented or recommended by USACE. The feedlots in Site 5 are occasionally mowed by UNL personnel, but no other activities are performed in the area.

During the site visit, attendees walked the creek bed adjacent to Site 5. The creek bed is located approximately 15-20 feet below ground level of the site (see Photo No. 5 in Appendix G). Two

pieces of munitions debris were visibly protruding from the creek embankment. One item appeared to be a portion of a base plate and the other item appeared to be a spent grenade fuse. The location of these items in the creek bank was noted as being west of the pond and south of Monitoring Well 10B. No other OE incidences have been reported in this area since the 1997 Removal Action was completed.

The site visit determined that there were no land use or accessibility changes at the site however, munitions debris was found outside of the original surface clearance area and was discovered approximately 15-20 feet below the level of ground surface, protruding from the creek bank, adjacent to Site 5. Access is restricted to UNL personnel and is controlled by gates and signage restricting any recreational activities.

### **3.2.2 Landfill Area, Former Wastewater Treatment Plant (Site 8)**

Site 8 was included in the site visit due to the suspected burial of CWM in the former Landfill Area. However, the CWM disposal area was not identified during the site visit. Fencing to restrict public access was intact (see Photo No. 6); however there was indication that signage in the area was aged and not functioning as intended. The former Landfill Area is shown on Photo No. 7 of Appendix G.

The site visit determined that there were no new developments at the site and no changes in land use or accessibility were noted. Access to Site 8 is restricted to UNL personnel. Deed notices and Title 132 of the Nebraska Administrative Code control the development and management of this site.

### **3.2.3 Potential Landfill Area**

The Potential Landfill Area was included in the site visit to evaluate the area where partially expended bomblets were discovered in 1999 during OU3 RI activities. During the site visit, the water level in the reservoir was high due to recent heavy rains and the shoreline was not exposed (see Photo Nos. 9, 10, and 11 in Appendix G). Access to this area is controlled by a locked gate; however, indications of recent entry by the public were noted during the site visit and signage in the area was aged and not functioning as intended.

The site visit determined that there were no new developments at the site and no changes in land use were noted. Access to the Potential Landfill Area are restricted to UNL personnel and is controlled by gates and signage restricting any recreational activities.

## **3.3 STAKEHOLDER AND REGULATOR INPUT**

Stakeholders and regulators were notified of the OE Recurring Review in December 2006. A public notice was published in local newspapers and letters were mailed to stakeholders to inform them of the project and encourage them to attend the open meeting on March 5, 2007. The 2001 Final OE Recurring Review Plan was updated during the 2007 OE Recurring Review process. This plan was followed during the 2007 review and was presented to the regulators and stakeholders during the OE Recurring Review process. Stakeholders were provided with a copy

of the plan during the interviews and the open meeting. The following section presents regulator and stakeholder concerns identified during the OE Recurring Review.

### 3.3.1 Regulator OE Concerns

Comments on the 2002 OE Recurring Review Report were provided to USACE by NDEQ and EPA in March 2007. Due to the fact that these comments were submitted in conjunction with the execution of the 2007 OE Recurring Review, these comments and USACE's responses are presented as regulatory concerns in Appendix H of this report.

EPA questioned whether Site 5 (Culvert Area) had been completely cleared in the 1997 Removal Action, believing the potential exists for more shallow OE hazards to be present. During the June 2007 site visit, EPA noted a spent grenade fuse and a portion of a base plate embedded in the bank of the creek adjacent to Site 5. This munitions debris was located approximately 15-20 feet below the surface of Site 5. The EE/CA recommended surface clearance and subsurface clearance at Site 5 to a depth of one foot. This recommendation was based on land use. A six-acre portion of the site was cleared to four feet during the 1997 Removal Action. An evaluation of complete clearance at Site 5 was conducted during the EE/CA and found that technology limitations exist in detecting potential OE to 10 feet below the ground surface. Associated costs for complete clearance at Site 5 were also found to be prohibitive. The clearance area was determined based upon a review of aerial photography, historical records of land use, and current land use.

The former Landfill Area (Site 8) is a concern of EPA because it is the suspected CWM burial area. Historic information reviewed by USACE and provided by the public is included in Appendix D. USACE took measures to reduce the potential for exposure to the suspected burial area by assisting UNL to erect a barbed wire fence and post warning signs around the landfill and suspected burial area. UNL has also placed a deed notice on the Landfill Area which identifies the site as a solid waste disposal area, used by both UNL and DoD.

Additionally, from 1994 to 2000 and in 2007, USACE performed groundwater sampling in the vicinity of the suspected burial for thiodiglycol, a mustard agent degradation product. USACE has also monitored wells downgradient of the suspected burial location and there have been no detections of mustard agent degradation products in groundwater, to date. In June 2007 USACE resumed sampling for mustard agent degradation products, including 1,4-oxathiane, 1,4-dithiane, and thiodiglycol. Results were non-detect for these analytes.

EPA also expressed concern regarding the 1999 discovery of two partially expended bomblets (munitions debris) on the shore of the NRD Reservoir, adjacent to the Potential Landfill Area. This occurred when the reservoir was lowered to accommodate fieldwork for the OU3 RI. EPA also noted the 2005 discovery of a base plate from a general purpose shell near the reservoir during investigative activities (see Photo No. 1 in Appendix G). Additionally, EPA discovered shell casings during the June 2007 site visit, which raised concerns about uncontrolled public access to the area.

### 3.3.2 Stakeholder OE Concerns

#### Community Member Concerns

On March 5, 2007, an OE Recurring Review public meeting was held to hear stakeholder and public concerns regarding OE response actions. The transcript of the meeting is included in Appendix E. Two questions asked by community members were deferred by USACE until further research could be completed and a proper response provided.

The first deferred stakeholder question posed during the meeting asked what geophysical investigations have been completed to locate [the suspected] mustard [agent that was documented as being] sent to the NOP for disposal. Upon further review of information, no geophysical investigations have been conducted to locate the suspected burial area. USACE does not believe that a geophysical investigation would detect such a burial based on its proximity to the existing landfill.

Current geophysical methods do not allow for determination between buried cars, metal debris, and 55-gallon drums. Disruption of landfills is not technically advisable or practical. No detections of mustard agent degradation products have been found in groundwater near the suspected burial location, to date. The accounts of this burial indicate that any mustard agent buried was secured in plastic, in a 55-gallon drum, and at a depth of more than 20 feet below the current ground surface. Therefore, in this instance, USACE believes that users of the site would be protected from any exposure to the suspected mustard agent. If future uses of the suspected burial site change to include excavation or disturbance of the landfill, proper notification and precautions will be taken or recommended, since the management and disturbance of landfills is regulated under Title 132 of the Nebraska Administrative Code.

The second deferred stakeholder question posed during the meeting asked if a complete screening or searching of the NRD Reservoir occurred with respect to ordnance and explosives. Upon further review of information, a complete screening of the reservoir has not been completed for the specific purpose of evaluating OE. USACE does not believe this screening is warranted based on current land use and conditions at the site. However, during the OU3 RI the NRD Reservoir was lowered over 100 feet so that the far eastern boundaries of the Proving Range and Potential Landfill Area would be exposed further. It was during this time that the two incendiary bomblets were discovered along the shoreline adjacent to the Potential Landfill Area. A geophysical investigation occurred at the Potential Landfill Area in April-May 1999. This investigation consisted of both an electromagnetic survey and ground penetrating radar geophysical survey. The results of these surveys indicated the likely presence of buried waste materials. Thirty nine tests pits were excavated with waste generally being found within four feet below ground surface, although some waste was located at greater depths. The waste uncovered in the test pits was indicative of a construction and debris landfill.

During the OU3 RI, surface water, sediment, and fish tissue sampling occurred in the NRD Reservoir. Five sediment samples were collected from the bottom of the reservoir and no incidence of OE was recorded during this investigation. The only OE discovered in this area were the partial bomblets (munitions debris) discovered adjacent to the Potential Landfill Area.

One community member raised concerns about the NRD Reservoir area and any possibility of the existence of explosives and/or mustard agent. The community member expressed concern that sampling under the lake bed deposits has not been conducted despite the presence of munitions debris found on the shore of the reservoir. Additionally, a concern was raised that USACE has inadequately addressed the burial of mustard agent. USACE, at the request of EPA and the community, resumed sampling monitoring wells near the suspected CWM burial area for three mustard agent degradation products. In 2007 these wells were non-detect for mustard agent degradation products. Since the area in question is a landfill, USACE does not believe it would be safe to excavate and, therefore, no excavation will occur in an effort to locate the suspected burial site. The management and disturbance of landfills is regulated by Title 132, Integrated Solid Waste Management Regulations, of the Nebraska Administrative Code. Also, the presence of munitions debris was considered in the risk analysis of the NRD Reservoir in the OU3 Baseline Risk Assessment.

The Restoration Advisory Board (RAB) Community Co-Chairperson provided a letter, dated April 6, 2007, with comments and questions to be considered as USACE proceeds through the OE Recurring Review process. This letter is presented in Appendix I. Appendix I also includes a May 10, 2007 letter from USACE addressing the public's comments. These comments are supplemental to comments and questions posed at the March 5, 2007, public meeting.

#### Comment 1

“The NRD Reservoir should be drained to do full investigation of the entire area beneath the reservoir. As EPA noted in the 1990s, potential contamination beneath the reservoir is a concern. Indeed, information from local residents indicates that there is a great deal of junk under the reservoir. In addition, because partially expended bomblets were found on the shoreline in 1999, it is certainly possible that there are more ordnance, explosives, and other materials of concern farther into the reservoir. As-built maps on file at the Lower Platte North Natural Resources District indicate that the reservoir (Clear Creek Structure 22-A) is approximately 1,400 feet wide at its widest. Therefore, the lowering of the reservoir 25 feet in 1999 which revealed the bomblets is clearly not sufficient to assure that all materials of concern have been identified. In addition, merely testing sediment as the Corps claims to have done is obviously not an adequate substitute for full investigation of the materials under the reservoir.”

#### Comment 2

“The Corps’ evaluation of the landfill area and other areas of the site regarding mustard gas and nerve gas burial is wholly inadequate. Local residents with firsthand knowledge have provided information that mustard gas was indeed buried at the site in the 1950s and/or 1960s. In addition, other local residents with firsthand knowledge have provided information that a yellow-greenish gas was emitted in the 1970s during a digging operation at the site. Public records document this information. However, regardless of existing documentation, the Corps should investigate in response to information provided by local residents. It is completely unacceptable for the Corps to fail to investigate these incidents thoroughly and to fail to assure that all risks are removed. As EPA has noted, it is inappropriate for the Corps to rely upon testing for

thiodiglycol in monitoring wells as an indicator as to whether or not mustard gas is present at the site. Furthermore, it is unacceptable for the Corps to ignore and/or dismiss information as not being credible or reliable from local residents, who have done their duty to report what they know, particularly when the Corps has encouraged local residents to come forward with information. Moreover, it is the Corps' responsibility to prove through credible investigation and other supporting information that this site no longer has hazardous substances that pose a risk to health and the environment; it is **not** the local residents' responsibility to prove that risks exist."

Comment 3

"The Feasibility Study for OU3 is inadequate. It doesn't address ordnance contamination and risks, much less the very significant risks associated with mustard and nerve gas."

Comment 4

"The most current regulatory guidance regarding assessing risk should be used to evaluate all risks associated with the site."

**University of Nebraska-Lincoln Concerns**

UNL is a landowner of portions of the former NOP. A conference call was held with UNL to discuss concerns about OE at the former NOP. Their concerns are documented in Appendix I. UNL expressed concern that there are a few areas, which they own, that have not been cleared of ordnance. UNL expressed concern about specific areas where they have imposed their own restrictions on land use, including Site 5 (Culvert Area), Site 9 (Proving Range), and former Landfill Areas. UNL stated that these areas are being used for agricultural research purposes. Irrigation capacity, wells, and buildings have been added to the site and UNL has plans for a new dairy and swine facility. UNL reported that they are not aware of any changes in current or future land use on their property or on adjacent properties.

Under an Administrative Order of Consent with EPA, UNL was required to conduct removal actions at areas near the North Burning Ground area, and south of the former Landfill Area, and to perform a Remedial Investigation/Feasibility Study to include the former Landfill Area. In spring 2007, as part of that Administrative Order, UNL excavated trenches in the former Landfill Area (Site 8). UXO expertise will be required to oversee this work. UNL expressed disappointment that they had to hire UXO support for recent investigation activities, since USACE was unable to provide UXO support. At the time of the interview, UNL is concerned USACE will deny UXO support again if requested for trench excavation activities in the spring of 2007.

Additionally, UNL raised concerns about site accessibility, since the former NOP property is accessible to the public by state highways and county roads. UNL stated that they currently restrict access to the former Landfill Area (Site 8), North Burning Ground, and Proving Range, and are attempting to further restrict access.

UNL stated that Site 5 is currently being used as a feedlot with access restricted by signage. New personnel are instructed on the history of OE at the site. No expansion or construction is planned at Site 5. Currently, UNL only allows its personnel to conduct mowing activities at the site.

The Saunders County Sheriff's Department was contacted (Appendix I) during this OE Recurring Review. Personnel in the Records Department had no recollection of any reports having been filed in the last five years related to UXO at the former NOP.

No other stakeholders communicated OE-related concerns during the OE Recurring Review process.

This section presents an analysis of the current protectiveness of OE response actions, based upon information gathered during the OE Recurring Review. The analysis addresses changes in land use, accessibility, and technology that may affect the site; the status of institutional controls; and the protectiveness of response actions previously implemented at the site.

#### **4.1 CHANGES IN LAND USE, ACCESSIBILITY, TECHNOLOGY**

Stakeholders contacted during the OE Recurring Review did not reveal any recent or future land-use changes associated with the former NOP. No land-use changes were identified at the former NOP within the last five years; and there was no evidence or information indicating that land-use changes had occurred on property adjacent to the former NOP.

Areas on the site that have historically been controlled by gates and/or fencing, explosives hazards warning signs and/or no trespassing signs continue to be controlled in the same manner. No changes in accessibility to the former NOP were identified during this OE Recurring Review with the exception of the NRD Reservoir area. Evidence of trespassing (shot gun shells) was observed along the western shoreline of the NRD Reservoir.

#### **4.2 STATUS OF INSTITUTIONAL CONTROLS**

Institutional controls have been implemented to manage residual OE risks. Fencing has been constructed and signage has been posted at various locations at the former NOP with funding provided by USACE. However, no institutional controls were recommended by DoD based upon risks identified at any location at the former NOP. At the time of this OE Recurring Review, fencing and signage installed at Site 5 (Culvert Area), at Site 8 (former Landfill Area, former Wastewater Treatment Plant), and at the Potential Landfill Area adjacent to Sites 9 and 10, were aged and not functioning as intended. The few existing signs that are functional warn of potential UXO in those areas. Additional institutional controls include deed notices imposed by UNL for Sites 8 and 10 (Appendix A). The deed notice for Site 8 states that both UNL and DoD used the area as a solid waste disposal area, and that it must be managed in accordance with Title 132 of the Nebraska Administrative Code.

In 2007 questions were raised regarding the location of fencing at the former Landfill Area (Site 8). In a trip report written by a USACE contractor, the former Civilian-in-Charge of the NOP in 1994 pointed out the location of the suspected CWM burial and that the location of the landfill fence in 1994 did not contain the designated location. Based on this information and community concerns USACE coordinated with UNL to move the fencing 50 feet north to encompass the specified area. Signage at the former Landfill Area (Site 8) was upgraded in August 2007 by USACE.

#### **4.3 REVIEW OF POTENTIAL SAFETY HAZARDS**

Potential safety hazards were reviewed for Sites 5 and 8, and the Potential Landfill Area. A summary of this review is presented below.

**4.3.1 Culvert Area (Site 5)**

The hazard severity at Site 5 is negligible for OE and the accident probability was determined to be unlikely since current feedlot operations are not expected to change. These conclusions are based on information summarized in Section 3.2.1.

Should UNL excavate below four feet in the area, the hazard severity would be marginal. A remote possibility exists that OE would be encountered during those excavations. However, USACE will evaluate their ability to assist UNL with UXO avoidance or, if necessary, removal.

Munitions debris found during the site walk does not present an elevated safety hazard, since it was found protruding from the creek embankment approximately 15-20 feet below the ground level of the site. Additionally, the area is secured with cattle pens, fencing, and signage. The hazard severity ranking for Site 5, established in the EE/CA, will not change based on these findings.

**4.3.2 Landfill Area, Former Wastewater Treatment Plant (Site 8)**

The hazard severity at Site 8 is negligible for OE and the accident probability was determined to be unlikely since no activities are currently conducted in the area. These conclusions are based on information summarized in Section 3.2.2.

Should any investigations be conducted in the former Landfill Area, the hazard severity is expected to be marginal and the accident probability is expected to be seldom, or a remote possibility exists that OE would be encountered during any such investigations.

**4.3.3 Potential Landfill Area**

The hazard severity at the Potential Landfill Area has not been previously assessed as this area has not been specifically investigated for OE in the past.

If surface activities were to be conducted at the Potential Landfill Area, the hazard severity and accident probability would have to be assessed.

**4.4 RESPONSE ACTION PROTECTIVENESS**

The only OE removal action that has been implemented, to date, at the former NOP is the surface and subsurface clearance of Site 5, conducted in 1997 and described in Section 3.1.1.

The response action appears to be functioning as intended. The only new OE-related discovery was where munitions debris was protruding from the creek embankment on the west side of Site 5. The creek bed is approximately 15-20 feet below the ground level on the west side of Site 5. No land use changes were identified during this review. The Statement of Clearance recommended a portion of Site 5 be used for any purposes that do not involve intrusive activities below four feet (USACE, 1997). It does not prevent UNL from using that area of the site.

The recommendations identified in the July 1996 Action Memorandum (see Table 2-1) were based on Site 5 data from previous actions, sampling results, surface and subsurface field investigations and an assessment of potential hazards and exposure risks to OE at Site 5 (Dames & Moore, 1996a). Since no new data has been identified for Site 5 during this OE Recurring Review in relation to the surface clearance, the assumptions stated in the July 1996 Action Memorandum are still valid.

No new information was discovered during the OE Recurring Review that would indicate the previously selected response is no longer protective for Site 5. No evidence was found that the public has been exposed to any intact live rounds at the former NOP in the past 40 years. At the time of this OE Recurring Review, the current response action at Site 5 was determined to be protective of human health, safety, and the environment.

This will be the final OE Recurring Review for the former NOP. The OE sites will be addressed through the CERCLA process starting in 2009.

## **SECTION 5      SITE-SPECIFIC CONCLUSIONS AND RECOMMENDATIONS**

---

The purpose of this OE Recurring Review is to determine whether: (1) the OE response action is functioning as intended; (2) the assumptions used at the time of the response action are still valid; and (3) new information exists that would indicate that the previously-selected response no longer minimizes explosives safety risks or is no longer protective of human health, safety, and the environment, considering the best available technology.

One removal action was conducted in 1997 at Site 5 (Culvert Area). The protectiveness of the Site 5 removal action was analyzed as part of this OE Recurring Review and is discussed in Section 4.4 of this report. Site-specific conclusions are presented below.

During the OE Recurring Review site visit, the only OE-related discovery was where munitions debris was protruding from the creek embankment on the west side of Site 5. The creek bed is approximately 15-20 feet below ground surface on the west side of Site 5. No land use or accessibility changes were identified during the review. No evidence was found that the public had been exposed to any unexploded ordnance based on communications (Appendix I) with the Saunders County Sheriff's Department. USACE will be evaluating future military munitions risks under the CERCLA process, to ensure that any risks will continue to be addressed in decision documents and five-year reviews.

### **5.1      SITE-SPECIFIC CONCLUSIONS**

The following sites were identified during the OE Recurring Review as possessing the most potential for residual OE:

- Culvert Area (Site 5)
- Landfill Area (Site 8)
- Potential Landfill Area

#### **5.1.1 Culvert Area (Site 5)**

A review of safety hazards revealed negligible risk and unlikely probability that an OE-related accident would occur under current operating conditions.

Existing fencing at Site 5 is used to control the movement of livestock and signs warn of potential UXO in the area. Any new personnel are made aware of the history of OE at this site. Although the feedlot fencing is not specifically intended to keep personnel and the public out of the Culvert Area, it is adequately protective for that purpose. No expansion or construction activities are planned at Site 5. Activities performed by the property owner in the area do allow for foot and vehicle (mowing) traffic.

The response action at Site 5 was evaluated to determine if it was still functioning as intended. Since no OE-related discoveries at Site 5 were identified in the last five years with regard to the surface clearance area, it was determined that the response action is functioning as originally intended. No land-use changes were identified during this review. The munitions debris found

## **SECTION 5      SITE-SPECIFIC CONCLUSIONS AND RECOMMENDATIONS**

---

during the OE Recurring Review 2007 site visit was outside the surface clearance area and was discovered approximately 15-20 feet below the level of ground surface, protruding from the creek embankment, adjacent to Site 5. Based on this new information a Supplemental Investigation will be performed at the Culvert Area to assess the findings from the 2007 site visit.

### **5.1.2 Landfill Area, Former Wastewater Treatment Plant (Site 8)**

In 1994 a fence was installed around the former Landfill Area in the suspected CWM burial area, at the request of UNL. A portion of the fence, originally installed in 1994, was moved to extend an additional 50 feet to the north to encompass the area the Civilian in Charge denoted as the suspected burial location of the CWM.

A review of safety hazards conducted as part of this OE Recurring Review revealed negligible risk and the unlikely probability that an OE-related accident would occur under current operating conditions. Results from previous evaluations and studies did not indicate risks at Site 8 and the EE/CA established an NDAI classification for OE at Site 8. During this OE Recurring Review, no new information regarding the presence of CWM at Site 8 was discovered and no land use or accessibility changes were identified for this site. Site 8 does not pose a threat to the public and does not warrant further investigation for OE.

### **5.1.3 Potential Landfill Area**

During the June 2007 OE Recurring Review site visit, the water level at the reservoir was high and the shoreline examined during the previous OE Recurring Review (October 2001) was not visible. Munitions debris discovered on the shore of the NRD Reservoir in the Potential Landfill Area during OU3 RI activities and during the 2001 site visit was not visible during the June 2007 site visit. These items are not a risk to the public since the UNL does not allow access to the area and there is no public access since it is surrounded by private property. However, evidence of trespassing was observed. A Supplemental Investigation will be performed in the Potential Landfill Area to assess the findings of MEC in 1999 and during the 2001 OE RR site visit.

### **5.1.4 Additional OE Response Action**

No additional response actions are needed at this time. Additional response actions will be considered based on the results of the Supplemental Investigation at the Culvert Area (Site 5) and Potential Landfill Area.

## **5.2      NEXT OE RECURRING REVIEW**

This will be the last OE Recurring Review conducted at the former NOP. USACE will be evaluating future military munitions risks under the CERCLA process to ensure that any risks will continue to be addressed in decision documents and five-year reviews.

- CMS Environmental, Inc. (CMS). 1997. Final Removal Report, Former Nebraska Ordnance Plant, Nebraska. June.
- Dames & Moore, Inc. 1996a. Action Memorandum, Former Nebraska Ordnance Plant. Final. July.
- Dames & Moore, Inc. 1996b. Engineering Evaluation/Cost Analysis, Former Nebraska Ordnance Plant. Final. February.
- Environmental Science and Engineering, Inc. (ESE). 1983. Archive Search Report of the Former Nebraska Ordnance Plant, Saunders County Nebraska. July.
- MACTEC. 2006. Phase I Interim Remedial Investigation Report and Phase II Sampling and Analysis Plan, Former Nebraska Ordnance Plant, Operable Unit 5, University of Nebraska Agricultural Research and Development Center. June.
- OHM Remediation Services Corporation (OHM). 1998. Final Remedial Action Report for the Former Nebraska Ordnance Plant, OU1 in Mead, Nebraska. September.
- Reed, E.C. 1948. Stratigraphy and Geomorphology of the Pleistocene of Nebraska. Geological Society of America Bulletin, v.59, no. 6, pp. 613-616.
- SEC Donohue. 1992. Supplemental RI/FS for the Former Nebraska Ordnance Plant, Operable Unit 1, in Mead, Nebraska. September.
- Souders, V.L. 1967. Availability of Water in Easter Saunders County, Nebraska. Hydrogeologic Investigations Atlas HA-266, Department of the Interior, U.S. Geological Survey, Washington, D.C.
- TCT-St. Louis (TCT). 1991. Preliminary Assessment of Ordnance Contamination at the Former Nebraska Ordnance Plant, Mead, Nebraska. Final. April.
- TCT-St. Louis (TCT). 1993. Supplementary Archives Search Report at the Former Nebraska Ordnance Plant, Mead, Nebraska. Final. November.
- URS Corporation (URS). 2000. Remedial Investigation Addendum Report, Operable Unit No. 3, Former Nebraska Ordnance Plant, Mead, Nebraska. February.
- U.S. Army Corps of Engineers (USACE). 1997. Statement of Clearance, Former Nebraska Ordnance Plant, Mead, Nebraska. October.
- U.S. Army Corps of Engineers (USACE). 2006. Military Munitions Response Process. Engineer Pamphlet EP 1110-1-18. April.
- U.S. Environmental Protection Agency (USEPA). 2005. Handbook on the Management of Munitions Response Actions. Interim Final. EPA 505-B-01-001. May.

## TABLES

---

**TABLE 2-1  
CHRONOLOGY OF EVENTS  
FORMER NEBRASKA ORDNANCE PLANT, MEAD, NEBRASKA**

Date	Activity
December 1941	NOP construction contracts are awarded.
1942	DoD acquires 6,984 ha, 176 parcels of land for NOP operations.
October 1942	First bomb load line is operational.
March 1943	Ammonium nitrate plant is operational for DoD purposes.
May 1943	Ammonium nitrate production terminated and placed on standby; production area decontaminated .
August 1945	Bomb load lines close.
October 1945	NOP final decontamination and shut-down.
1945-1949	Ammonium nitrate plant is re-activated for emergency fertilizer production; NOP is used for storage of large quantities of explosives.
1946	340,000 pieces of ordnance, including M102, M104, M115 boosters, fuses, and detonators, destroyed at three unknown pit locations. Debagging of 105-mm propelling charges (100-1200 280-mm Nike war heads).
1951-1953	Full-scale production reactivated at NOP during the Korean Conflict.
February 1952	NOP reactivates with National Gypsum.
1956	NOP is deactivated.
1959	Contamination survey conducted by the U.S. Army Ordnance Ammunition Command.
1959	NOP declared excess to Army needs, except for 4.8 ha in Nike Missile area and 862 ha to Offutt AFB for Nike S-1 Missile site.
1960	389 ha are reassigned to U.S. Army Reserves.
1962	University of Nebraska purchases 3,590 ha via quitclaim deed. 2,125 ha purchased by private interests.
1964	USAir Force excesses 484 ha and reassigns to the U.S. Army for Mead Army National Guard Facility (in 1969).
1964	University of Nebraska purchases 259 ha via quitclaim deed.
1964	118.5 ha sold to private interests via quitclaim deeds.
July 1983	USATHAMA Archives Search Report (ASR), 43 references, no site visit, geophysics, or aerial photographic interpretation.
1989	Findings and Determination of Eligibility determined that NOP was formerly used by DoD. Fireworks production by Apollo Fireworks and Omaha Pyrotechnics ceases at Site 12.
April 1991	Preliminary Assessment Report completed by USACE as an independent review of ASR, 30 references.
November 1993	Supplementary Archives Search Report completed by USACE, 128 references.
March 1994	Inventory Project Report is prepared for the former NOP. Investigation of the suspected CWM burial area in landfill area at Site 8.
February 1996	EE/CA recommends removal action for Site 5, and recommends no further action for Sites 1-4, Site 6, Site 8, Site 9, Site 10, Site 12, and the Laundry Facility, 32 references.
July 1996	Action Memorandum recommended surface and subsurface clearance activities for OE, based on land use at Site 5 (Culvert Area).
June 1997	Site 5 (Culvert Area) Removal Action.
April 1999	Partially expended bomblets are discovered on the shoreline of the NRD Reservoir in the Potential Landfill Area during supplemental RI work.
October 2001	(First) OE Recurring Review site visit, document review, stakeholder interviews.
December 2001	(First) OE Recurring Review Report submitted.
June 2006	Phase I Interim RI Report, UNL.
June 2007	(Second) OE Recurring Review site visit, document review, stakeholder interviews.

1 hectare (ha) = 2.47105 acres

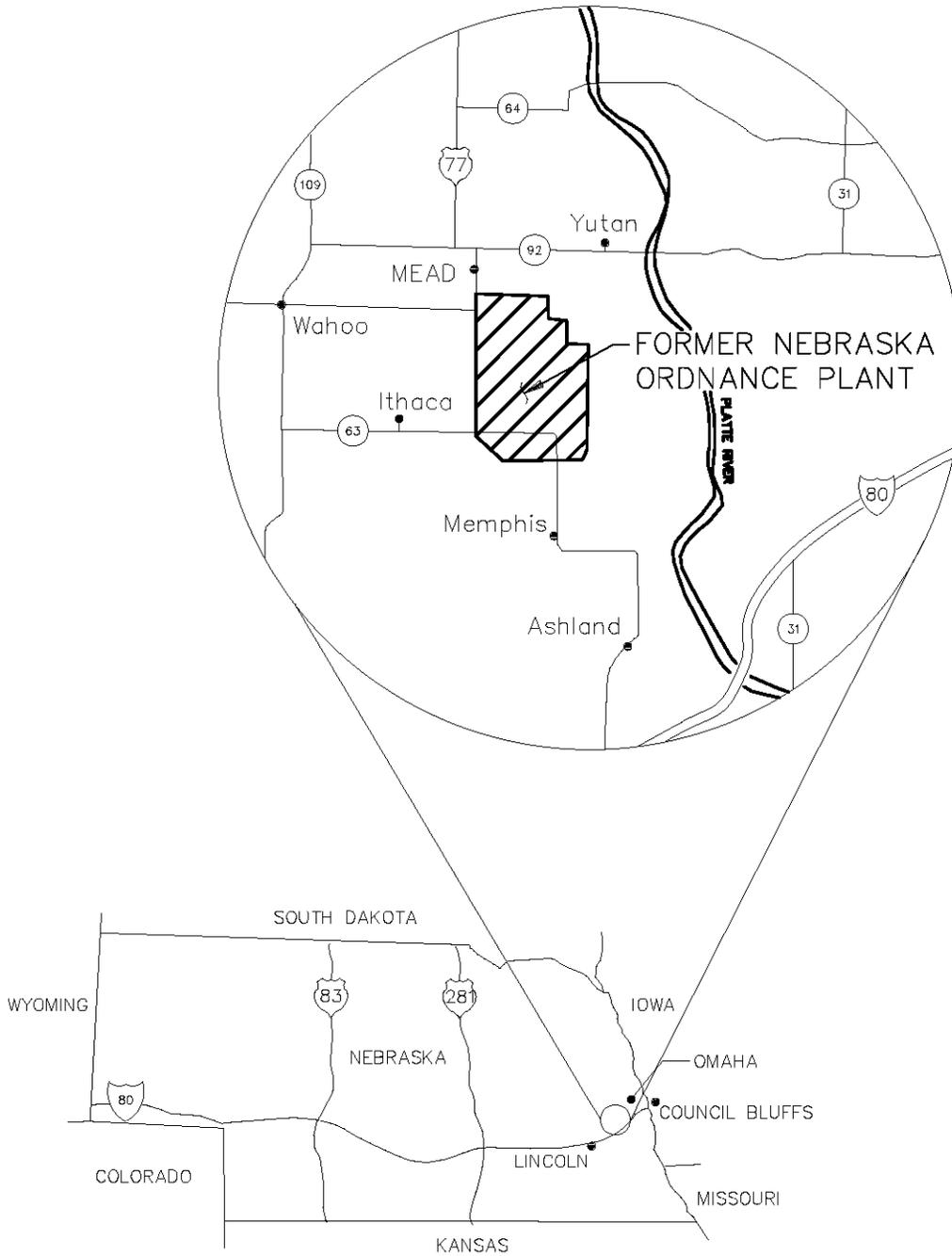
**TABLE 2-2**  
**LIST OF DOCUMENTS USED FOR OE RECURRING REVIEW**  
**FORMER NEBRASKA ORDNANCE PLANT, MEAD, NEBRASKA**

Title	Author	Date
Report on Decontamination and Shut-Down of NOP	Nebraska Defense Corporation	Oct-45
Topographic Map, Mead Quad	USGS	Jun-69
Topographic Map, Wahoo East Quad	USGS	Jun-69
Archives Search Report	Environmental Science and Engineering, Inc.	Jul-83
Aerial Photographic Analysis of NOP	EPA, Region VII	Jul-87
Draft Work Plan for Preliminary Assessment of Ordnance Contamination	TCT-St. Louis	Jul-90
NOP Survey Data	File	Jan-91
Final Preliminary Assessment of Ordnance Contamination	TCT-St. Louis	Apr-91
Mead Quad Topographic Map, Explosives Contaminated Soils Markup	USACE	Apr-91
NRD Dam 22-A	Soil Conservation Service	Jul-92
Supplementary Archives Search Report	TCT-St. Louis	Dec-93
Memo, Construction of 2 Lakes Near Mead	Saunders County	Feb-94
NOP OU3 Site Visit	CENWK	Aug-94
OE Waste Information from Dames & Moore	CENWK	Nov-94
Geophysical Investigation Report	Dames & Moore, Inc.	Jan-95
Work Plan OE Waste Survey for RI	UXB, International	Feb-95
Executive Summary NOP Geophysical Data	Sanford Cohen & Associates	Mar-95
Final EE/CA	Dames & Moore, Inc.	Feb-96
Final Remedial Investigation Phase I Preliminary Data Package, OU-3	Woodward-Clyde	Feb-96
Action Memorandum	Dames & Moore, Inc.	Jul-96
InPR, B07NE003700, Mar-94, Revised	CENWK	Nov-96
Remedial Investigation Report OU3	Woodward-Clyde	May-97
Final Removal Report	CMS Environmental, Inc.	Jun-97
Statement of Clearance Former NOP Mead, Nebraska	CEHNC	Sep-97
Final Remedial Action Report for OU1	OHM Remediation Services Corporation	Sep-98
Explosive Ordnance Incident Report	774 <sup>th</sup> EOD	Apr-99
Remedial Investigation Addendum Report OU3	URS Corporation	Feb-00
Phase I Interim Remedial Investigation Report	MACTEC for UNL	Jun-06
General Correspondence	Various	Various

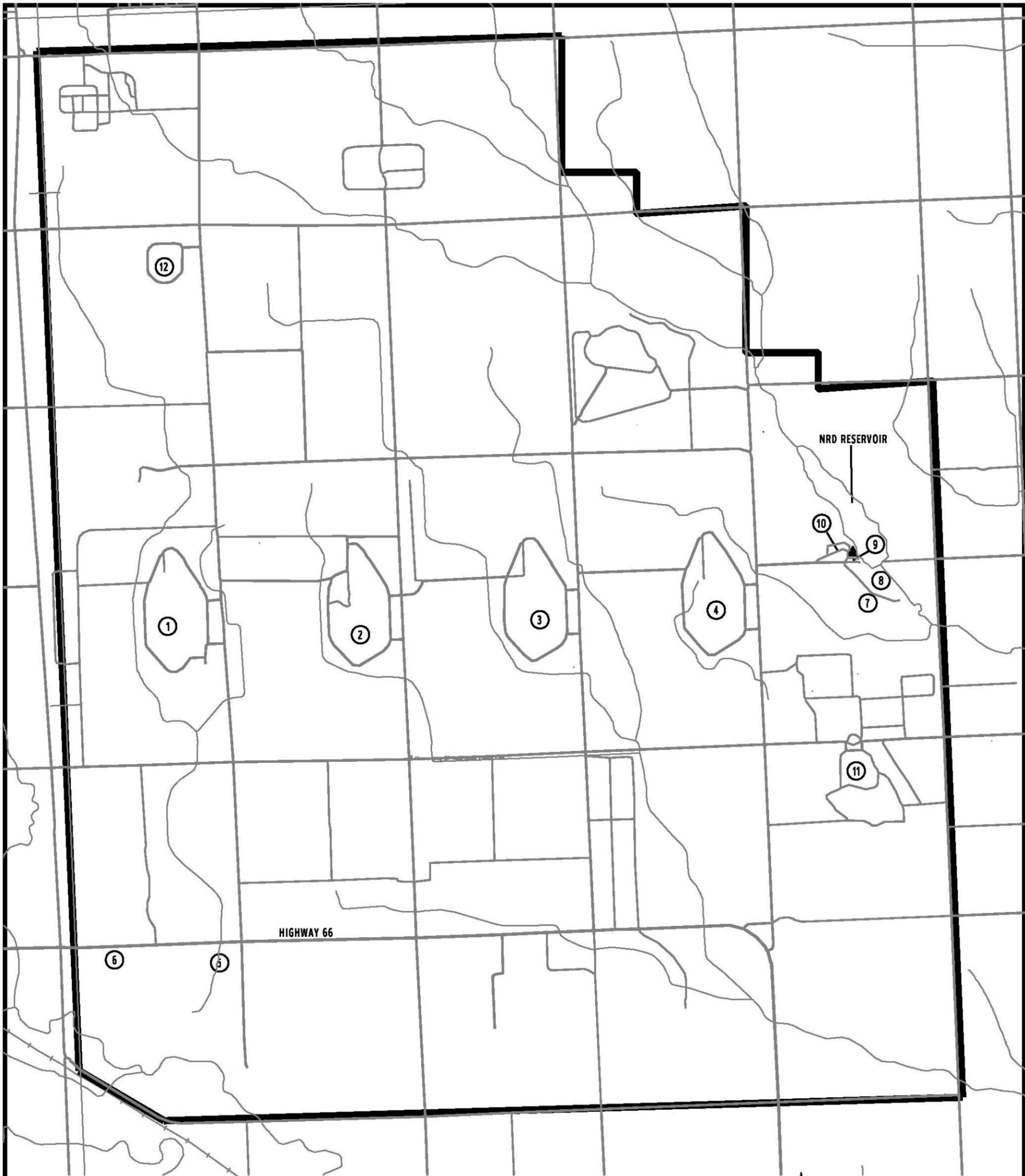
## FIGURES

---

December 9, 2009 12:56:11 pm (OVF)  
 I:\16530276 Mead NOP Tech Support (Omaha Contract)\OE RR\Draft Final Report\Drawings\Fig 1-1.dwg



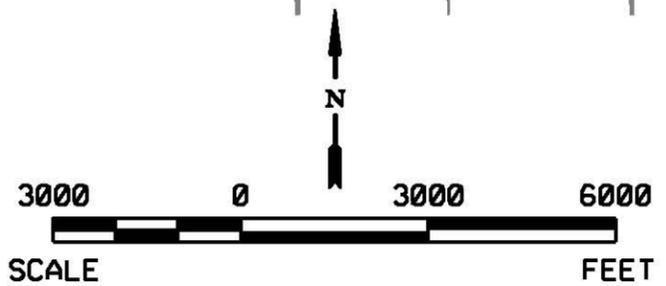
<b>URS</b> 6300 College Boulevard, Suite 200 Overland Park, Kansas 66210		U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI	
Designed by: <b>L.A.T.</b>	 U.S. Army Corps of Engineers	OE RECURRING REVIEW FORMER NEBRASKA ORDNANCE PLANT—MEAD, NE	
Drawn by: <b>A.P.Z.</b>		<b>SITE LOCATION MAP</b>	
Checked by: <b>D.C.C.</b>			
Submitted by: <b>L.A.T.</b>	Date: DECEMBER, 2009	1-1	
	Dwg. No.: 1-1		



**LEGEND:**

- ① Load Line 1
- ② Load Line 2
- ③ Load Line 3
- ④ Load Line 4
- ⑤ Culvert Area
- ⑥ Turnout Area
- ⑦ South Burning Ground
- ⑧ Landfill Area - Former Wastewater Treatment Plant
- ⑨ Proving Range
- ⑩ North Burning Ground
- ⑪ Detention Pond
- ⑫ Bomb Booster Assembly Area
- ▲ Potential Landfill Area (location where incendiary bomblets found)

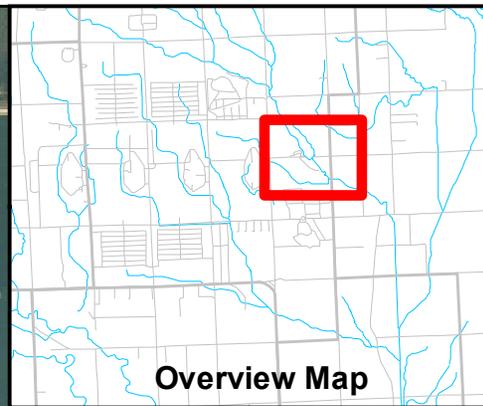
— Former NOP Boundary



Revisions			
Symbol	Descriptions	Date	Approved

<p><b>URS</b> 8300 College Boulevard, Suite 200 Overland Park, Kansas 66210</p>	<p><b>U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI</b></p>
<p>Designed by: <b>L.A.T.</b></p>	 <b>U.S. Army Corps of Engineers</b>
<p>Drawn by: <b>A.P.Z.</b></p>	
<p>Checked by: <b>D.C.C.</b></p>	<p>OE RECURRING REVIEW FORMER NEBRASKA ORDNANCE PLANT - MEAD, NE</p>
<p>Submitted by: <b>L.A.T.</b></p>	<p><b>LOCATION OF HISTORICAL SITES</b></p>
<p>Scale: 1/4" = 3,000 FT</p>	<p>Date: <b>DECEMBER 2009</b></p>
<p>Sheet number: <b>2-1</b></p>	<p>Dep. No.: <b>2-1</b></p>

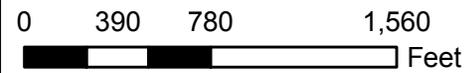
07 DEC 2009 11:54 AM I:\430276\DE RR\DRAWING\FINAL REPORT\DRAWINGS\FIGURE 2-1.dgn



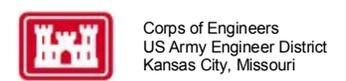
**Overview Map**

**Legend**

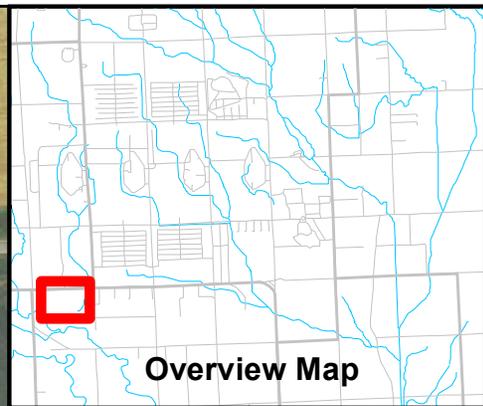
- Monitoring Well Cluster
- White lines indicate approximate site boundaries.



1 inch = 800 feet



CLIENT: U.S. ARMY CORPS OF ENGINEERS		
SITE: FORMER NEBRASKA ORDNANCE PLANT MEAD, NEBRASKA		
PROJECT: OE RECURRING REVIEW		
TITLE: SITES 9, 10 AND POTENTIAL LANDFILL AREA		
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 2-2



Overview Map

**Legend**

 Detonation Crater



1 inch = 400 feet

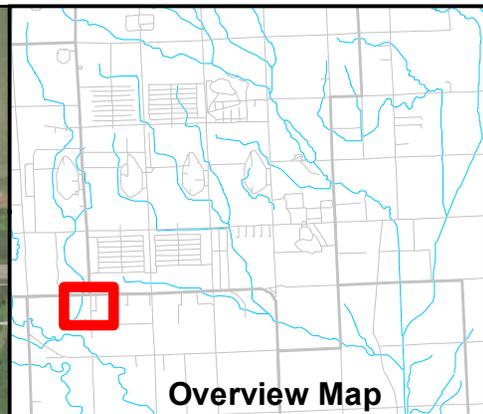


Corps of Engineers  
US Army Engineer District  
Kansas City, Missouri



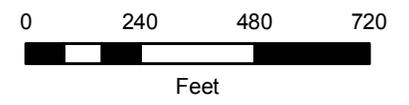
8300 College Blvd. Suite 200  
Overland Park, KS 66210

CLIENT: U.S. ARMY CORPS OF ENGINEERS		
SITE: FORMER NEBRASKA ORDNANCE PLANT MEAD, NEBRASKA		
PROJECT: OE RECURRING REVIEW		
TITLE: SITE 6 - TURNOUT AREA		
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 3-1



**Legend**

\* OE Sites



1 inch = 400 feet

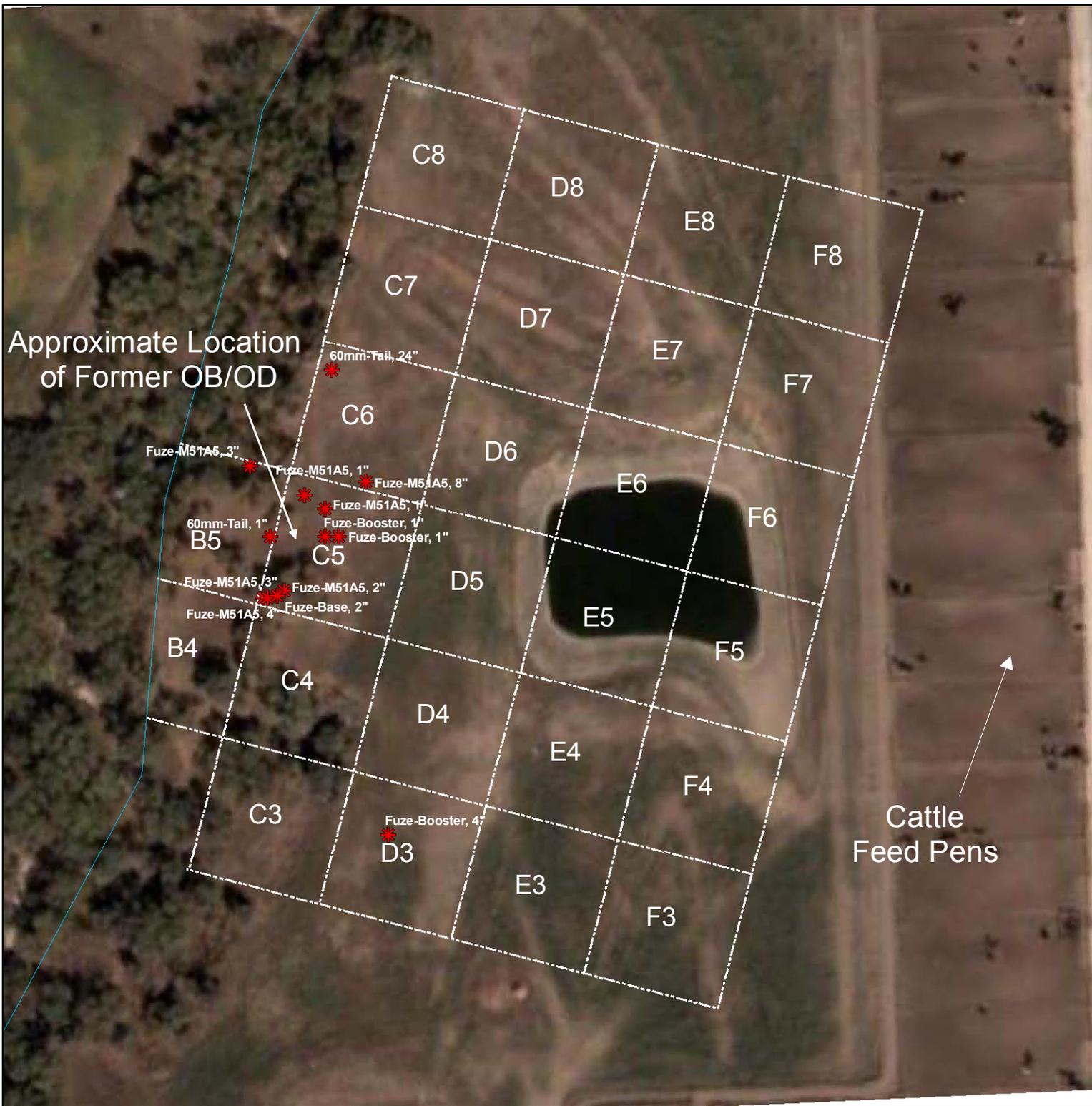


Corps of Engineers  
US Army Engineer District  
Kansas City, Missouri



8300 College Blvd. Suite 200  
Overland Park, KS 66210

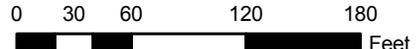
CLIENT: U.S. ARMY CORPS OF ENGINEERS		
SITE: FORMER NEBRASKA ORDNANCE PLANT MEAD, NEBRASKA		
PROJECT: OE RECURRING REVIEW		
TITLE: SITE 5 - CULVERT AREA		
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 3-2



Overview Map

**Legend**

- \* OE Sites
- 100ft\_grid
- Streams



1 inch = 100 feet

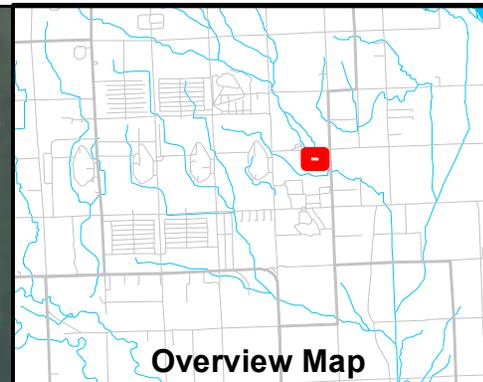


Corps of Engineers  
US Army Engineer District  
Kansas City, Missouri



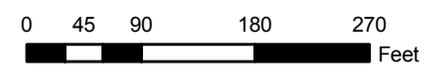
8300 College Blvd., Suite 200  
Overland Park, KS 66210

CLIENT: U.S. ARMY CORPS OF ENGINEERS		
SITE: FORMER NEBRASKA ORDNANCE PLANT MEAD, NEBRASKA		
PROJECT: OE RECURRING REVIEW		
TITLE: SITE 5 - OE LOCATIONS		
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 3-3



**Legend**

- Landfill Signs
- ✕✕ Fence
- Landfill Area Boundary
- Monitoring Well



1 inch = 151 feet

Corps of Engineers  
US Army Engineer District  
Kansas City, Missouri

**URS** 8300 College Blvd. Suite 200  
Overland Park, KS 66210

CLIENT: U.S. ARMY CORPS OF ENGINEERS

SITE: FORMER NEBRASKA ORDNANCE PLANT  
MEAD, NEBRASKA

PROJECT: OE RECURRING REVIEW

TITLE: SITE 8 - FORMER WASTEWATER  
TREATMENT PLANT, LANDFILL AREA

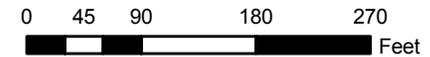
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
-----------------	-------------------	--------------------

PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 3-4
-------------------------	-----------------------	-------------------



**Legend**

-  Landfill Area Boundary
-  Monitoring Well



1 inch = 150 feet

 Corps of Engineers  
US Army Engineer District  
Kansas City, Missouri

**URS** 8300 College Blvd. Suite 200  
Overland Park, KS 66210

CLIENT: U.S. ARMY CORPS OF ENGINEERS		
SITE: FORMER NEBRASKA ORDNANCE PLANT MEAD, NEBRASKA		
PROJECT: OE RECURRING REVIEW		
TITLE: MONITORING WELLS SAMPLED FOR CWM COMPOUNDS		
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 3-5



**Legend**

- ⊕ Monitoring Well
  - + Approximate Locations of Partial Bomblets that were found in 1999 (OU3 RI)
- White lines indicate approximate site boundaries.



1 inch = 200 feet



Corps of Engineers  
US Army Engineer District  
Kansas City, Missouri



8300 College Blvd. Suite 200  
Overland Park, KS 66210

CLIENT: U.S. ARMY CORPS OF ENGINEERS		
SITE: FORMER NEBRASKA ORDNANCE PLANT MEAD, NEBRASKA		
PROJECT: OE RECURRING REVIEW		
TITLE: POTENTIAL LANDFILL AREA - BOMBLET LOCATIONS		
DRAWN BY IJP	CHECKED BY MML	APPROVED BY LAT
PROJECT No. 16530276	DATE DECEMBER 2009	FIGURE NO. 3-6