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STATEMENT OF BASIS FOR CORRECTIVE ACTION SOLID WASTE MANAGEMENT UNIT 7
(SWMU7) OLD RIFLE RANGE NSA CRANE IN
9/1/2012
NSA CRANE

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
STATEMENT OF BASIS FOR CORRECTIVE ACTION AT
SOLID WASTE MANAGEMENT UNIT 7 - OLD RIFLE RANGE
NAVAL SUPPORT ACTIVITY CRANE; CRANE, INDIANA
IN5 170 023 498**

This Statement of Basis (SB) was prepared to satisfy the requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action process, which is designed to identify sites that are known to be, or may be, hazardous to human health or the environment and to propose and implement remedies for correcting unacceptable environmental conditions.

PURPOSE OF DOCUMENT

This SB:

- Is a mechanism and basis for gathering public comments for selection of a corrective action to correct unacceptable environmental conditions that exist in groundwater at Solid Waste Management Unit (SWMU) 7.
- Summarizes information that can be found in greater detail in reports documenting the RCRA Facility investigation (RFI) and Corrective Measures Proposal (CMP) Reports and other documents included in the Administrative Record for Naval Support Activity (NSA) Crane.
- Describes groundwater contamination at SWMU 7 and the proposed RCRA Corrective Action and also explains the rationale for selection of this corrective action from among other possible actions.
- Describes all corrective actions evaluated in the process of selecting the proposed corrective action.
- Provides information on how the public can be involved in the corrective action selection process.
- Updates the SWMU 7 boundary.

FACILITY BACKGROUND

This SB applies to SWMU 7, the Old Rifle Range (ORR), located northeast of the Demolition Range in the flat-lying floodplain of Turkey Creek, at NSA Crane (Figure 1). The ORR is listed as SWMU #07/09 in NSA Crane's RCRA hazardous waste management permit, and is commonly referred to as SWMU 7. The original SWMU 7 boundaries were determined based on the area where historical open burning activities were suspected to have occurred. This area also included the current RCRA-permitted

open burning hazardous waste management unit, various closed small arms ranges, and the area covered by the RCRA detection and corrective action monitoring well network. Areas covered by the small arms ranges, which are currently being investigated under the Navy Military Munitions Response Program, are designated as unexploded ordnance (UXO) 7 and generally include much of the area historically designated SWMU 7. The investigations conducted under the Navy Installation Restoration Program have determined that there is no remaining soil contamination that can be attributed to historical open burning activities. Therefore, the boundary of SWMU 7 has been revised to only include the area covered by the RCRA-permitted open burning (OB) unit and the RCRA detection and corrective action monitoring well network. Figures presented later in this SB show the relationship between the former SWMU 7 boundary and the current SWMU 7 boundary. Investigations and corrective action decisions will be documented separately for UXO 7.

NSA Crane covers approximately 100 square miles and is located in a rural, sparsely populated area of south-central Indiana. Most

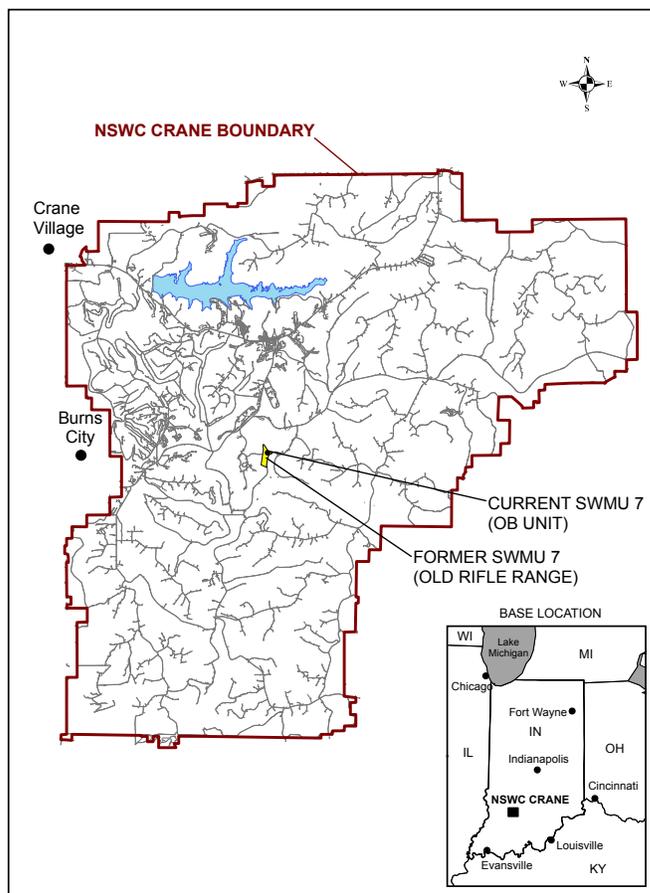


Figure 1: NSA Crane and Old Rifle Range

of NSA Crane is forested, and the surrounding area is wooded or farmed land. NSA Crane manufactures, renovates, and tests equipment, shipboard weapons systems, and ordnance for the United States Navy. More detailed physical and operational descriptions of NSA Crane and SWMU 7 are provided in the RFI Report (Tetra Tech, 2005a), the RFI Report Addendum (Tetra Tech 2005b), and the CMP Report (Tetra Tech, 2006), and are summarized in the following sections of this SB.

LOCATION AND HISTORY OF SWMU 7

SWMU 7, also called the ORR, formerly comprised three main areas, one of which is the actual ORR. These three areas are: (1) an active, OB unit, located in the north-central portion of the former SWMU 7; (2) an abandoned shooting range referred to as the Old Pistol Range (OPR), located at the northern end of the former SWMU 7; and (3) a large area where multiple shooting ranges previously existed, which is also referred to as the ORR. Figure 2 is an aerial photograph that shows the layout of SWMU 7 including the ORR ranges and OPR. The OB unit portion of SWMU 7 is a RCRA permitted facility (permit number IN5170023498) of approximately 1-acre size where bulk yellow D (ammonium picrate), projectiles loaded with yellow D, and materials contaminated by yellow D are burned in containment pans.

ORR

The ORR occupies approximately 20 acres immediately west of NSA Crane Highway 8 in the flat-lying grass-covered area bisected from north to south by a maintained gravel road. Occasionally, material that would normally be treated at the Demolition Range (SWMU 6) is treated at SWMU 7.

Operations at the ORR began in the early 1940s and have ranged from use as a firing range for small caliber arms to flashing bulk explosives and pyrotechnics. Around 1984, metal pans were installed at the OB Unit on top of the existing lined pits. In 1997, three concrete-lined burn pads were installed over the pre-existing plastic-lined shallow pits.

HYDROGEOLOGICAL SETTING

The known hydrogeology of the ORR is based on information provided in the Confirmation Work Report of April 1984 for Demolition Area/Old Rifle Range conducted by the United States Army Corps of Engineers (USACE) (Dunbar, 1984) and on subsequent investigations. During well installation by the USACE, groundwater was encountered in fractures in the sandstone at the northern end and in the overburden at the southern end of the ORR. Groundwater at the site is typically found between 10 to 20 feet below ground surface (Tetra Tech, 1999). The uppermost occurrence of groundwater is within the alluvium, which is present over much of the ORR. Groundwater elevations and flow direction within the underlying Big Clifty-Beech Creek aquifer are similar to those in the alluvium. The two units are hydraulically connected

and considered to be one unconfined aquifer in this area (Murphy and Wade, 1988). The occurrence and movement of groundwater is closely tied to the bedrock surface (USACE Waterways Experiment Station [WES], 1991). Groundwater elevations within the site range from approximately 510 to 495 feet above mean sea level (msl), a difference of 15 feet. Flow direction is predominantly toward the east and south although flow reversals do occur underneath SWMU 7. Groundwater flow contours, based on data from 2011 samples taken at the Alluvial aquifer and Upper Big Clifty aquifer wells, are shown on Figures 3 and 4, respectively. Drainage ditches on the east of SWMU 7 drain toward Turkey Creek, which flows southeast to Boggs Creek. Boggs Creek is one of seven primary creeks that carry surface water from the NSA Crane facility and eventually drain into the East Fork of the White River and then to the Wabash River to the southwest. The closest NSA Crane property boundary is approximately 3 miles west of SWMU 7.

ECOLOGICAL SETTING

A biological characterization of NSA Crane, including a listing of plants and animals found at the facility, is presented in the Installation Assessment (U.S. Army, 1978) and the Initial Assessment Study (IAS; NEESA, 1983), and is summarized in subsequent Environmental Monitoring Reports (Halliburton NUS, 1992a, 1992b, 1992c).

SWMU 7 vegetation includes mowed grasslands (open fields), wooded slopes, and riparian wooded vegetation that support a diverse bird population; 35 species were surveyed at SWMU 7 (Tetra Tech, 2005a and 2006). Up to seven macroinvertebrate species have been surveyed at SWMU 7 and up to 12 fish species have been observed at SWMU 7 (Tetra Tech, 2005b and 1999).

INVESTIGATIONS CONDUCTED AT SWMU 7

Various investigations were conducted at SWMU 7 from 1981 to 2005 as part of multi-SWMU investigations. An IAS, which began in April 1981 and concluded in May 1983, detected contamination in select areas of SWMU 7 and recommended further study of the SWMU (Naval Energy and Environmental Support Activity [NEESA], 1983).

Soil

A Current Contamination Conditions Risk Assessment (CCCRA) concluded that the effects of current ORR activities did not adversely impact the ecological population at SWMU 7 (Brown and Root Environmental [B&RE], 1997). The CCCRA concluded that no further action (NFA) was required for 2,4,6-trinitrotoluene (TNT) and that further evaluation was required for polycyclic aromatic hydrocarbons (PAHs) (B&RE, 1997).

An RFI Phase II soil characterization study was performed in 1990 and 1991 to further characterize potential chemical releases to soil. This investigation concluded that NFA was required until OB

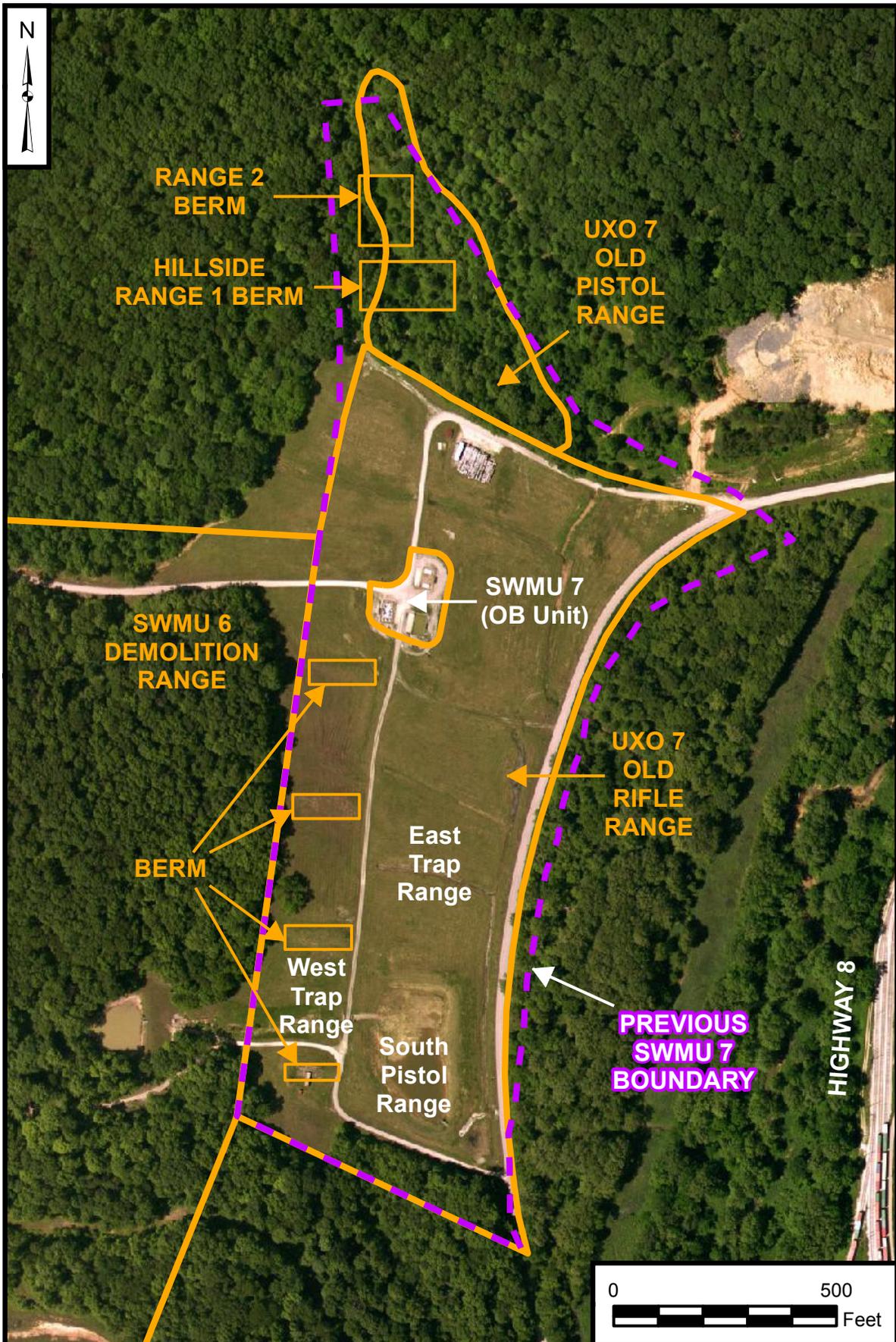
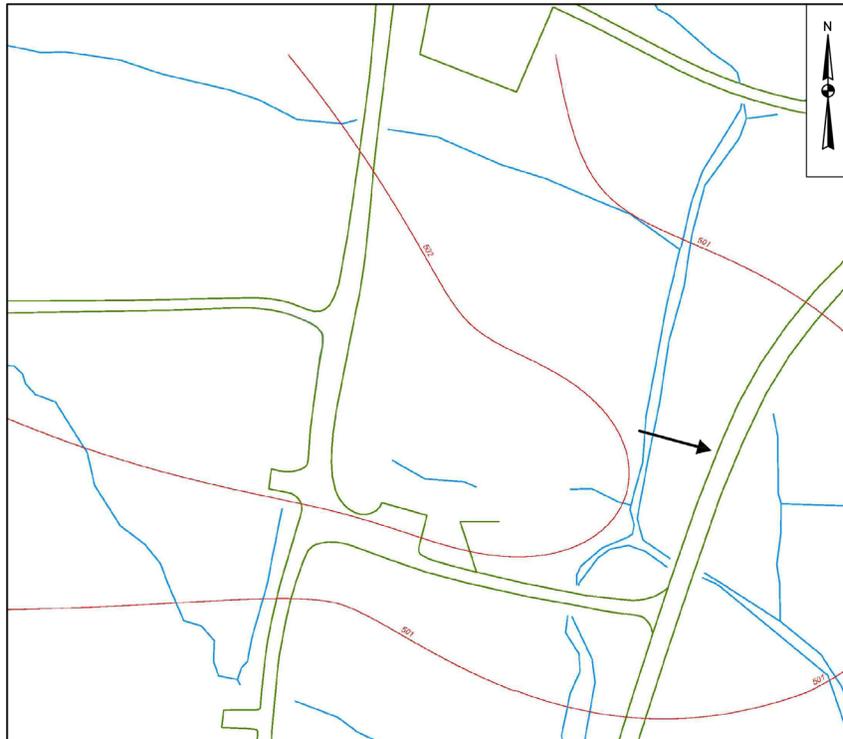


Figure 2: Aerial Photograph of SWMU 7

2nd . Quarter 2011



4th. Quarter 2011



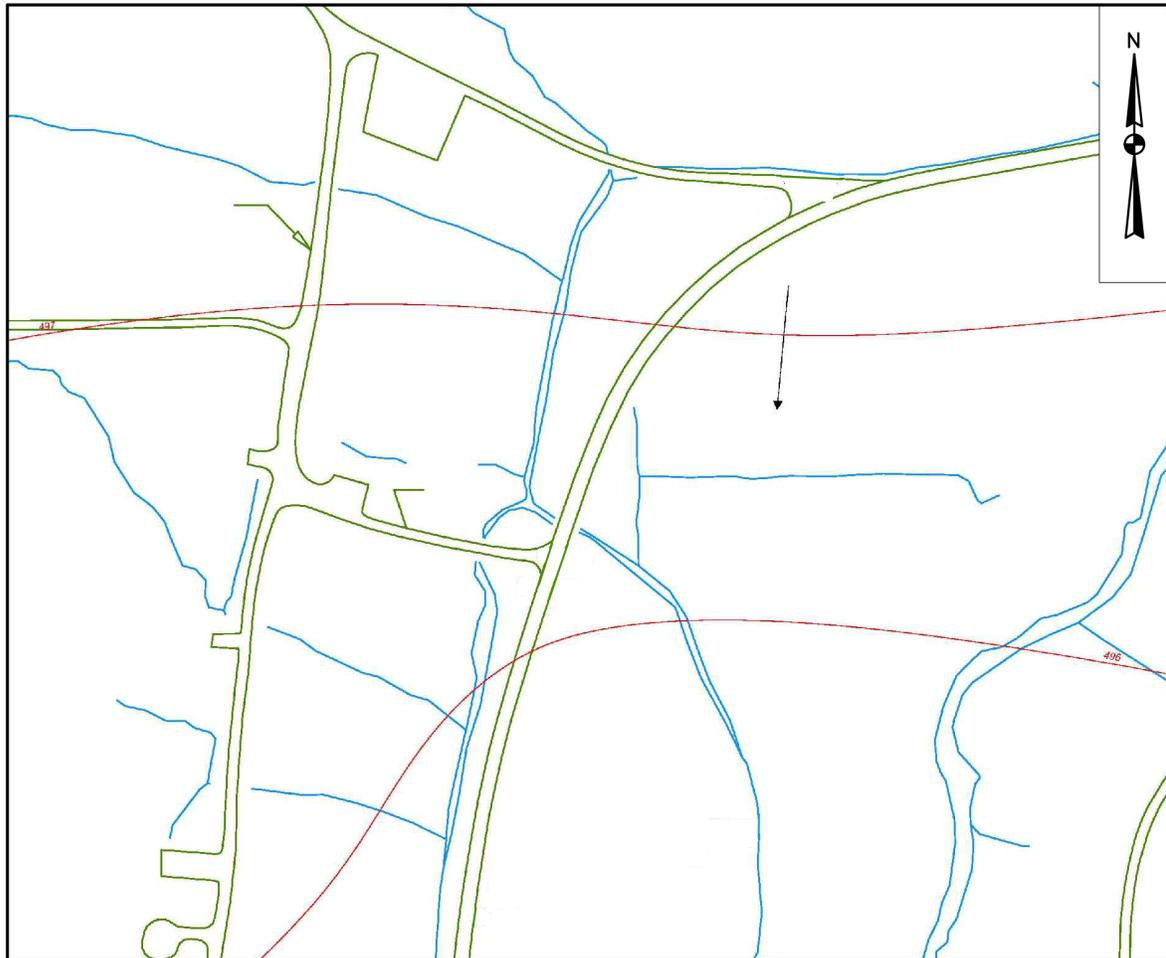
LEGEND:

- GROUNDWATER CONTOUR
- STREAMS
- ROADS
- GROUNDWATER FLOW DIRECTION

NOTE:

AS SHOWN ABOVE, LOCAL GROUNDWATER FLOW OCCASIONALLY REVERSES DIRECTION IN THE ALLUVIAL AQUIFER. HOWEVER, THE PREDOMINATE REGIONAL GROUNDWATER FLOW IS FROM HIGH TOPOGRAPHIC ELEVATIONS WEST OF SWMU 7 TOWARD THE TURKEY CREEK VALLEY ON THE EASTERN SIDE OF SWMU 7. MOST OF THE GROUNDWATER FLOW DISCHARGES TO TURKEY CREEK (SEE FIGURE 7).

Figure 3: Alluvial Aquifer Groundwater Contour



LEGEND:

- GROUNDWATER CONTOUR
- STREAMS
- ROADS
- GROUNDWATER FLOW DIRECTION

NOTE:

AS SHOWN ABOVE, LOCAL GROUNDWATER FLOW IN THE UPPER BIG CLIFTY AQUIFER IS TO THE SOUTH. HOWEVER, THE PREDOMINATE REGIONAL FLOW IS FROM HIGH TOPOGRAPHIC ELEVATIONS WEST OF SWMU 7 TOWARD THE TURKEY CREEK VALLEY ON THE EASTERN SIDE OF SWMU 7. MOST OF THE GROUNDWATER FLOW DISCHARGES TO TURKEY CREEK (SEE FIGURE 7).

Figure 4: Upper Big Clifty Aquifer Groundwater Contours

Unit closure (USACE WES, 1991), which is required for a RCRA-permitted facility.

An RFI Phase III soil characterization study was performed in 2001 to further characterize potential chemical releases to soil at the SWMU. The Phase III RFI concluded that arsenic contamination would be addressed during RCRA closure of the OB unit and that NFA was required for PAH contamination (Tetra Tech, 2005a). A voluntary interim measure (VIM) (Tetra Tech, 2003) was performed at the ORR to remove an area of concern for TNT, eliminating the unacceptable risk for exposure to TNT in soil (Figure 5).

Groundwater

The CCCRA concluded that there were unacceptable human health risks from explosives (dinitrotoluene [DNT], TNT, and cyclotrimethylenetrinitramine [RDX]), a pesticide (heptachlor epoxide), and metals (arsenic, barium, cadmium, lead, manganese, selenium, silver, and zinc) in groundwater if it would be used as a source of drinking water. Analysis for explosives, pesticides, and metals were included as part of the OB Unit RCRA permit groundwater monitoring requirements. Pesticides were not found.

Subsequent investigations identified only arsenic as a chemical of concern (COC) for groundwater (Tetra Tech, 2006).

SUMMARY OF SWMU 7 RISKS

During the course of the RFI and subsequent investigations, ecological and human health risk assessments were performed to characterize the risks posed by site contaminants to ecological receptors and humans exposed to various environmental media. Select chemicals of potential concern (COPCs) and COCs were identified in earlier risk assessments as being responsible for the majority of unacceptable levels to human or ecological receptors but most of the COPCs were subsequently eliminated from concern. Some of the COPCs, COCs, and unacceptable risks were eliminated or reduced to acceptable levels as a result of VIMs. The actions that removed these chemicals from concern are documented in the CMP (Tetra Tech, 2006).

There is no unacceptable risk to ecological receptors at SWMU 7. The COCs that remain are arsenic and TNT in groundwater. These two chemicals are COCs because of a potential for unacceptable human health risk from exposure of future hypothetical residents to groundwater if it would be used as a domestic water supply.

SCOPE OF CORRECTIVE ACTION

Groundwater

The corrective action objectives established in the CMP Report for contaminated groundwater are as follows:

- Prevent human exposure (ingestion and dermal contact) to contaminated groundwater with concentrations greater than the United States Environmental Protection Agency (EPA)-established corrective action objectives.
- Prevent migration of the groundwater contaminant plume.
- Comply with chemical-specific, location-specific, and action-specific applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) criteria.

Based on these objectives, media cleanup standards (MCSs) were developed for the groundwater COCs from the CMP and are shown in Table 1. When concentrations less than or equal to MCSs are achieved, the corrective action process will be considered complete.

CHEMICAL	MCS (ug/L)
Arsenic	10
TNT	18

Contaminant levels less than the MCSs will not pose an unacceptable human health risk. Land use controls (LUCs) will be established to prevent the use of contaminated groundwater and prevent development and use of SWMU 7 for residential purposes.

Soil

The corrective action objectives established in the CMP Report for contaminated soil are as follows:

- Prevent human exposure (ingestion and dermal contact) to lead-contaminated soil with concentrations greater than the EPA-established remediation objectives.
- Comply with chemical-specific, location-specific, and action-specific ARARs and TBC criteria.

Based on these objectives, an MCS for lead (400 mg/kg) was developed. Because the VIMs achieved the MCS for soil, unacceptable risk from exposure to soil was eliminated and corrective action for soil is no longer needed until RCRA unit closure. Therefore, the OB Unit, including any associated TNT contamination, will be characterized and, if necessary, remediated at the time of its closure.

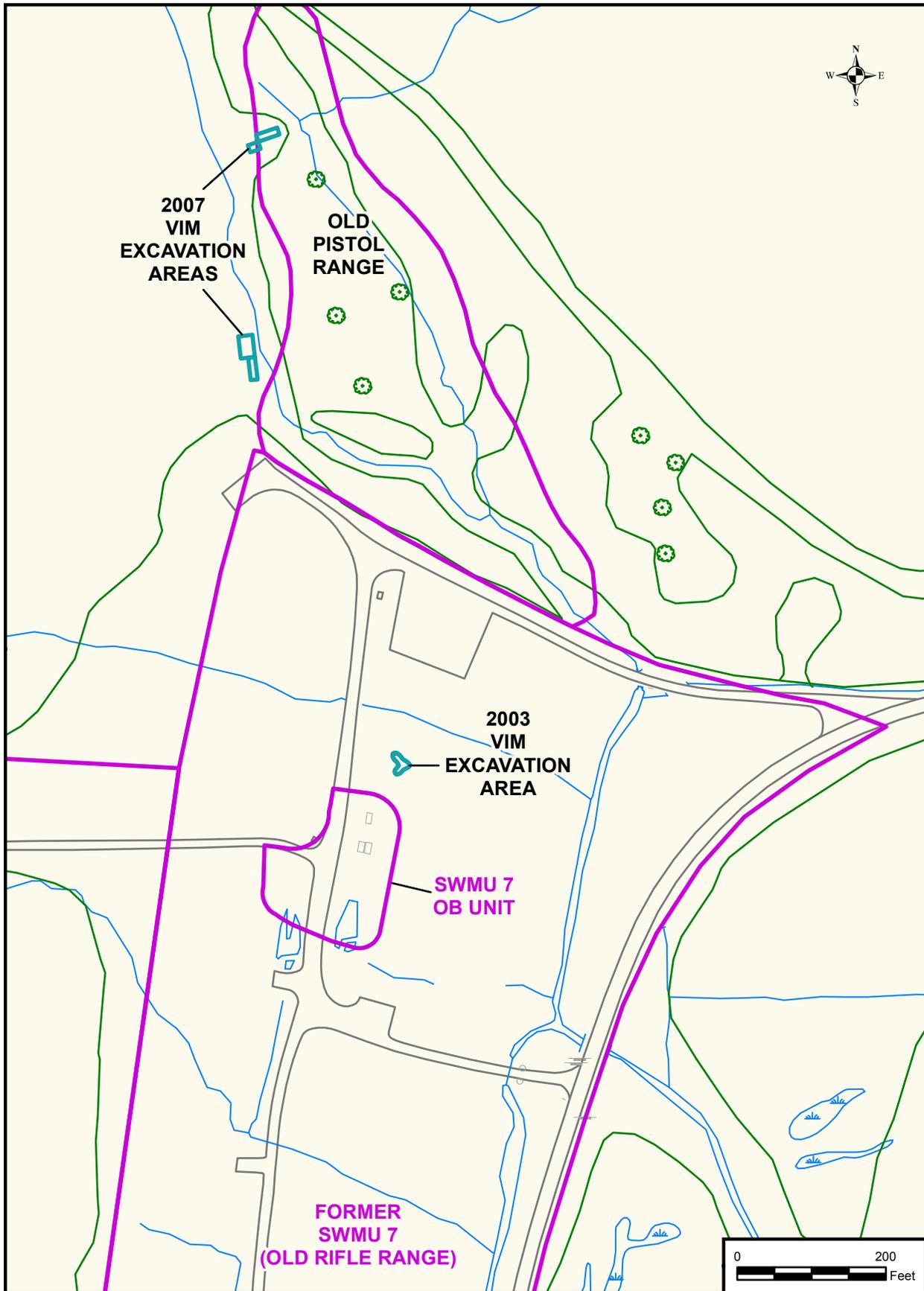


Figure 5: Voluntary Interim Measures

SUMMARY OF CORRECTIVE ACTION ALTERNATIVES

The evaluation of corrective action alternatives began by identifying technologies considered to be practical and cost effective for SWMU 7. Technologies were combined into the corrective action alternatives listed below for particular media and contaminants:

GROUNDWATER

Explosives

Alternative No. GW-1-Exp – No Action. The No Action alternative maintains the site as is and is evaluated to provide a baseline for comparison to other alternatives. Attenuation of groundwater contaminants may occur as the result of naturally occurring processes such as adsorption to soil, biodegradation, and dispersion and dilution caused by groundwater movement, which generally limit or decrease the concentrations of explosives in groundwater over time. However, no monitoring would occur to determine whether natural attenuation is occurring, and no restrictions would be in place to prevent exposure to contaminated groundwater.

Alternative No. GW-2-Exp – Limited Action (Land Use Controls and Long-Term Monitoring). This alternative includes three major components: (1) natural attenuation, (2) LUCs, and (3) long-term monitoring (LTM). Natural attenuation would rely on naturally occurring processes such as biodegradation plus dispersion and dilution through groundwater movement, and adsorption onto soil particles in order to reduce the concentrations of TNT (and other organic explosives). Processes for implementing LUCs to restrict groundwater use would be included in the Corrective Measures Implementation Plan (CMIP) that is under development. As part of the LUCs, annual site inspections would be conducted to verify and enforce the continued application of these controls. Monitoring would consist of regularly collecting groundwater samples and analyzing them for explosives to evaluate the progress of remediation and to verify that the extent of groundwater contamination is not expanding. Monitoring well locations are shown on Figure 6. Preliminary estimates indicate that the remediation timeframe would be somewhat greater than 15 years.

Metals

Alternative No. GW-1-Metal – No Action. The No Action alternative maintains the site as is and is retained to provide a baseline for comparison to other alternatives. Attenuation of groundwater arsenic contamination may occur as the result of naturally occurring processes such as adsorption to soil and dispersion and dilution caused by groundwater movement, which generally limit or decrease the concentrations of arsenic in groundwater over time. However, no monitoring would occur to determine whether natural attenuation is occurring, and no restrictions would be in place to prevent exposure to contaminated groundwater.

Alternative No. GW-2-Metal – Limited Action (Land Use Controls). This alternative has one major component, LUCs. Processes for implementing LUCs to restrict groundwater use would be included in the CMIP. As part of the LUCs, annual site inspections would be conducted to verify and enforce the continued application of these controls. Although Alternative GW-2-Metal does not include LTM for metals, the existing Groundwater Monitoring Program at SWMU 7, which is required by the RCRA Operating Permit for the OB Unit, includes monitoring for metals.

COST EVALUATION

There is no cost associated with Alternatives GW-1-Exp and GW-1-Metal; comparative estimated costs for Alternatives GW-2-Exp and GW-2-Metal are presented in Table 2 in terms of present worth:

TABLE 2. COMPARATIVE COSTS FOR GROUNDWATER ALTERNATIVES

COST ITEM	ALTERNATIVE GW-2-EXP	ALTERNATIVE GW-2-METAL	TOTAL ALTERNATIVE
Present Worth ¹	\$144,000	\$40,000	\$184,000

¹The present value (or worth) of an investment is the total amount that a number of future payments is worth now in today's dollars.

The cost of implementing and maintaining LUCs, and performance of 7-year reviews were included in the cost estimates. Seven-year site reviews would be conducted to verify the long-term reliability and effectiveness of the alternatives and, if deemed necessary, to provide direction for further corrective action. Details of the evaluation process and the factors that were considered are presented in the CMP Report (Tetra Tech, 2006).

EVALUATION OF THE PROPOSED CORRECTIVE ACTION AND ALTERNATIVES

CORRECTIVE ACTION EVALUATION CRITERIA

The corrective actions were evaluated using specific criteria set forth by the EPA (U.S. EPA, 1991). Details of these evaluations are provided in the CMP Report (Tetra Tech, 2006).

PROPOSED CORRECTIVE ACTION AND RATIONALE FOR SELECTING THE PROPOSED CORRECTIVE ACTION

Alternatives No. GW-1-Exp and GW-1-Metal – No Action would not be sufficiently protective of human health and the environment because it would not prevent potential future exposure to contaminated groundwater and buried waste. However, the "No Action" alternative is always evaluated during a CMP, as required by EPA, to provide a point of reference for the other alternatives.

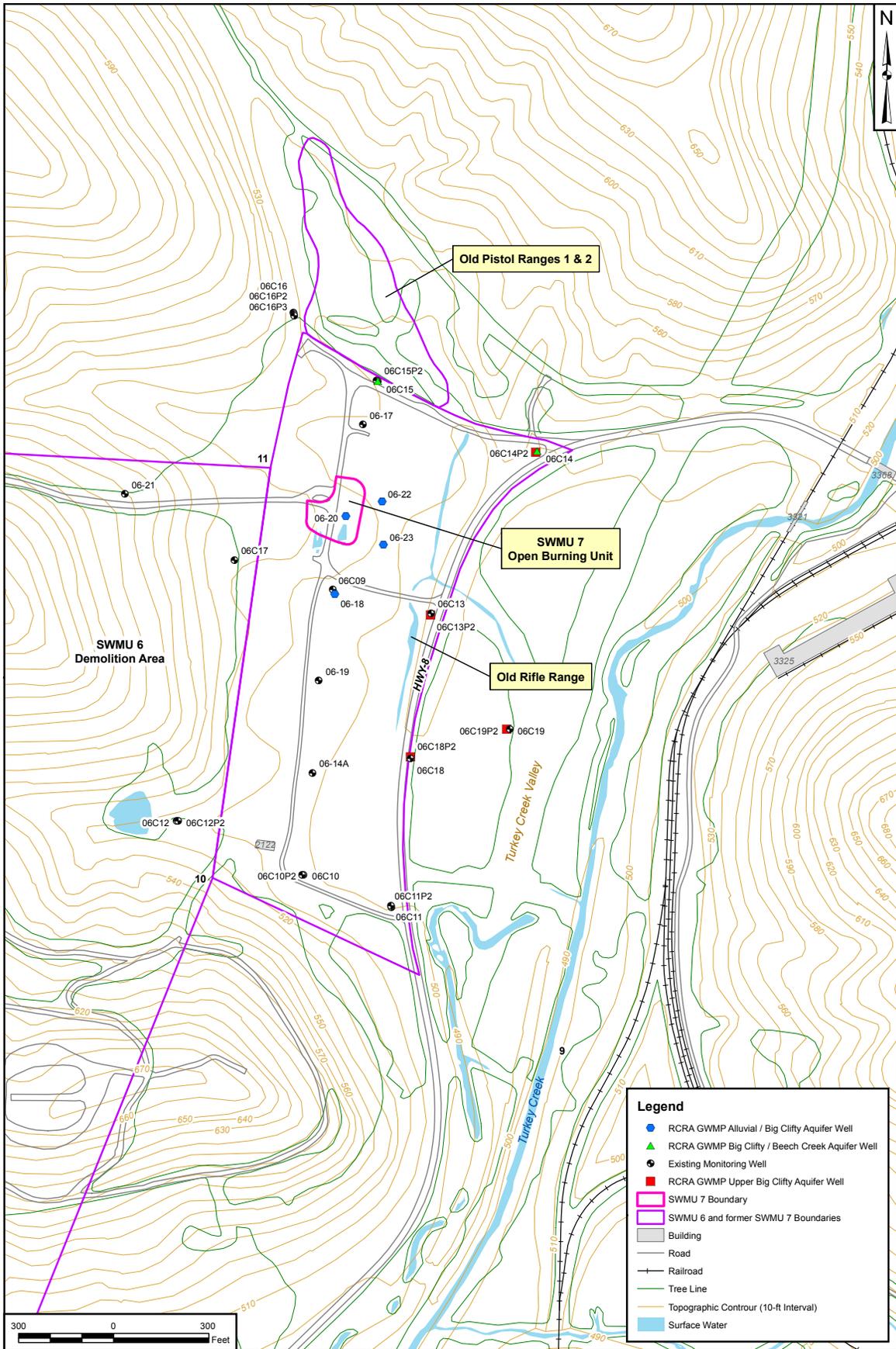


Figure 6: Monitoring Well Locations

Alternative No. GW-2-Exp – Limited Action (LUCs and LTM) would be protective of human health and the environment because it would prevent potential future exposure to elevated TNT concentrations in groundwater and would ensure that TNT concentrations in groundwater continue to decrease and eventually achieve levels that are less than MCSs. There is no single identified TNT contaminant source but controlled access to SWMU 7 would limit any potential for exposure to TNT contamination. As part of the LUCs, annual site inspections and 7-year reviews would be conducted to verify the continued application of these controls.

Alternative No. GW-2-Metal – Limited Action (LUCs) would be protective of human health and the environment because it would prevent potential future exposure to elevated arsenic concentrations in groundwater. There is no single identified arsenic contaminant source but controlled access to SWMU 7 would limit any potential for exposure to arsenic contamination. As part of the LUCs, annual site inspections and 7-year reviews would be conducted to verify the continued application of these controls.

After considering the criteria presented above, the proposed corrective actions are to implement LUCs (Alternatives GW-2-Exp and GW-2-Metal) and monitor TNT concentrations in groundwater (GW-2-Exp). These corrective actions will ensure that controls are in effect to prevent human exposure to site contaminants. With these controls in place, exposure potential is extremely low.

The proposed corrective actions were selected for the following reasons:

- The identified human health risks for exposure to TNT and arsenic in groundwater can be controlled under the proposed corrective action.
- Unacceptable risks were identified only for hypothetical future residents of SWMU 7; however, residential land use at SWMU 7 is unlikely in the near future and can be controlled with LUCs. Therefore, the estimated unacceptable risks do not require additional immediate action.
- Alternatives GW-2-Exp and GW-2-Metal are cost-effective means of protecting human health and the environment. Under GW-2-Exp, additional data will be collected routinely to assess future site conditions, to assess the effectiveness of natural attenuation, and to verify that the implemented corrective actions are protective of human health and the environment. Although GW-2-Metal does not require LTM, the NSA Crane on-going groundwater monitoring program includes arsenic and thus will also provide future indications of the extent of arsenic contamination in groundwater. A cost comparison is presented in Table 2. This comparison does not include LTM for arsenic in groundwater.

- Alternative GW-2-Exp would provide a warning of potential migration of groundwater contaminated with TNT through LTM.

The proposed corrective actions would require long-term LUCs, which would be similar to current LUCs at other environmental sites at NSA Crane. If, at any time, it is determined that LUCs are not sufficient to effectively protect human health and the environment, another corrective action for SWMU 7 will be considered. Seven-year reviews would be conducted to verify the long-term reliability and effectiveness of the proposed corrective action and to provide direction for further corrective action, if deemed necessary.

The CMIP will include details of annual LUC implementation and maintenance actions and 7-year reviews of the effectiveness of the corrective action.

LAND USE CONTROL OBJECTIVES

As part of Alternatives GW-2-Exp and GW-2-Metal, it will be necessary to protect human health by implementing LUCs. The LUC objectives for SWMU 7 are as follows:

- Prevent access to and/or use of groundwater contaminated with TNT and arsenic within the SWMU 7 groundwater LUC boundary 1 (Figure 7) until MCSs (cleanup goals) are achieved throughout that area.
- Maintain the integrity of any current or future corrective action system, including monitoring system components (e.g., monitoring wells).

Use of the site for other purposes (such as industrial) may be acceptable and are not prohibited. However, any future industrial development that could increase the exposure of sensitive receptors such as residents would require coordination with EPA Region 5.

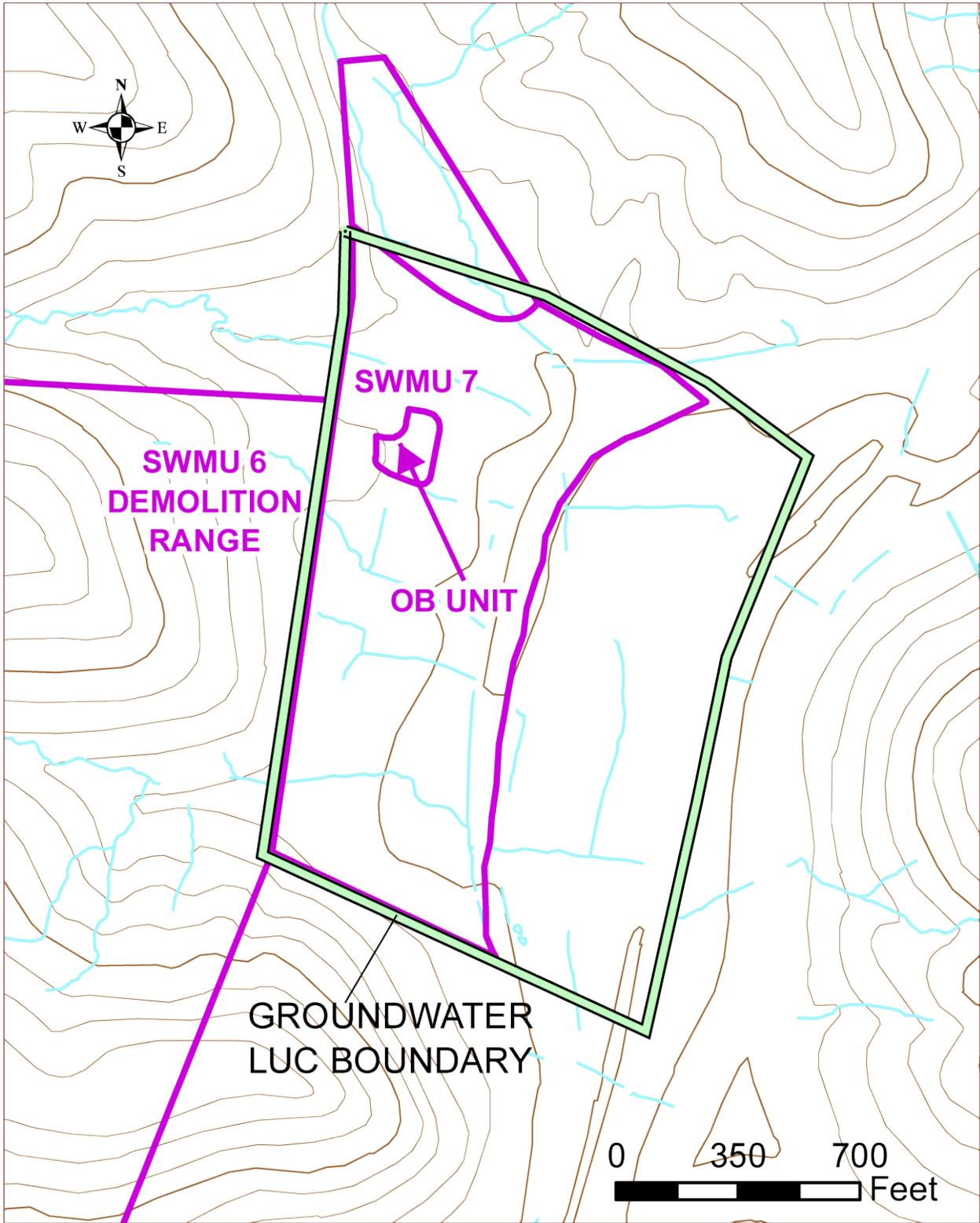


Figure 7: Groundwater Land Use Control Boundary

PUBLIC PARTICIPATION

IMPORTANCE OF PUBLIC COMMENT

The “public” includes the general public, the owner or operator of NSA Crane, and other parties (for example, public interest groups and regulatory agencies). Because of a slight potential for exposure of the public to SWMU 7 contaminants, the public may have an interest in understanding the environmental conditions at SWMU 7 and the relationship of the proposed or alternate corrective actions to resolving the environmentally unacceptable conditions. EPA may modify the proposed corrective actions or select another corrective action based on new information or public comment. The public can be involved in the corrective action selection process by reviewing the documents contained in the administrative record file and submitting comments to the EPA during the public comment period.

EPA is soliciting input from the community on the selected proposed corrective actions for SWMU 7. Comments on this SB (proposed corrective action) will be taken for 30 days. The beginning and end of the 30-day comment period will be posted on the NSA Crane website (<http://go.usa.gov/vox>). Members of the public may submit written comments to the EPA regarding the proposed corrective actions. Comments may either be submitted by e-mail to Thomas.Brent@navy.mil or by mail to the following:

Peter Ramanauskas
United States Environmental Protection Agency – Region 5
77 West Jackson Boulevard (LU-9J)
Chicago, IL 60604
ramanauskas.peter@epa.gov

Written comments concerning this proposal should include the name and address of the writer and the supporting relevant facts upon which the comments are based. Written comments received will be summarized, and responses will be provided to all persons on the facility mailing list. Written comments should be submitted via e-mail or postmarked by the end of the comment period.

A copy of this SB, which is part of the NSA Crane Administrative Record, and other documents in the administrative record are available at the following locations:

LOCATION	HOURS OF OPERATION
United States Environmental Protection Agency - Region 5 77 West Jackson Boulevard 7 th Floor File Room Chicago, IL 60604	8:00am to 4:00pm Monday through Friday (excluding federal holiday) By appointment: (312) 886-6173
Bedford Public Library 1323 K Street Bedford, IN 47421	9:00am to 8:00pm Monday through Friday 9:00am to 5:00pm Friday and Saturday 1:00pm to 5:00pm Sunday (812) 275-4471

Anyone interested in reviewing the RFI Report, CMP Report, or report summaries, and the justification for the proposed corrective action (recorded in this SB), may view these documents at the EPA office listed above or on compact disk at the Bedford Public Library.

In addition, text-only versions of the SB and summaries of the RFI and CMP Reports are available at, <http://go.usa.gov/vox>.

ACRONYMS

µg/L - micrograms per liter

ARAR - Applicable or relevant and appropriate requirement

B&RE - Brown and Root Environmental

CAAA - Crane Army Ammunitions Activity

CCCRA - Current Contamination Conditions Risk Assessment

CMIP - Corrective Measures Implementation Plan

CMP - Corrective Measures Proposal

COC - Chemical of concern

COPC - Chemical of Potential Concern

DNT - Dinitrotoluene

EPA - United States Environmental Protection Agency

IAS - Initial Assessment Study

LTM – Long-term monitoring

LUC - Land use control

MCS - Media cleanup standard

mg/kg - milligram per kilogram

msl - mean sea level

NEESA - Naval Energy and Environmental Support Activity

NFA - No further action
NSA - Naval Support Activity
OB - Open Burning
OPR - Old Pistol Range
ORR - Old Rifle Range
PAH - Polycyclic aromatic hydrocarbon
RCRA - Resource Conservation and Recovery Act
RDX - Cyclotrimethylenetrinitramine
RFI - RCRA Facility Investigation
SB - Statement of Basis
SWMU - Solid Waste Management Unit
TBC - To be considered
TNT - 2,4,6-Trinitrotoluene
UXO – Unexploded Ordnance
USACE - United States Army Corps of Engineers
VIM – Voluntary Interim Measure
WES - Waterways Experiment Station

REFERENCES

- B&RE (Brown and Root Environmental), 1997. Current Contamination Conditions Risk Assessment. SWMU #03/10 (Ammunition Burning Ground), SWMU #07/ 09 (Old Rifle Range), SWMU #06/09 (Demolition Range).
- Dunbar, Joseph B., 1984. Definition of Contaminated Ground-Water Plumes at Selected Waste Disposal Sites, Naval Weapons Support Center, Crane, Indiana. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.
- Halliburton NUS, 1992a. Final Environmental Monitoring Report, Naval Weapons Support Center Crane, Indiana, Halliburton NUS.
- Halliburton NUS, 1992b. RFI Phase I, Environmental Monitoring Report, SWMUs 15/06, 14/10, 16/16, NorthDiv, CTO 15.
- Halliburton NUS, 1992c. RFI Phase I, Environmental Monitoring Report, SWMUs 19/00, 08/17, 12/14, 13/14, Navy Northern Division, CTO 15.
- Murphy, W.L., and Wade, R., 1988, Final Report, RCRA Facility Investigation, Phase II Groundwater Release Assessment, SWMU 06/09 Demolition Area and Phase III Release Characterization, SWMU 07/09 Old Rifle Range, Naval Surface Warfare Center, Crane, Indiana. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.
- NEESA (Naval Energy and Environmental Support Activity), 1983. Initial Assessment Study of Naval Weapons Support Center, Crane, Indiana. NEESA 13- 003.
- Tetra Tech, 1999. Current Contamination Conditions Risk Assessment. SWMU #03/10 (Ammunition Burning Ground), SWMU #07/ 09 (Old Rifle Range), SWMU #06/09 (Demolition Range).
- Tetra Tech, 2003. Voluntary Interim Measure Letter Report for TNT Contamination Removal at Solid Waste Management Unit 7 (Old Rifle Range). Naval Surface Warfare Center, Crane Division, Crane, Indiana.
- Tetra Tech, 2005a. Phase III Soils RCRA Facility Investigation, Solid Waste Management Unit 7 (Old Rifle Range), Naval Surface Warfare Center, Crane Division, Crane, Indiana.
- Tetra Tech, 2005b. Phase III Soils RCRA Facility Investigation, Solid Waste Management Unit 7 Addendum for X-Ray Fluorescence Field Measurement and Soil Sampling for Select Metals at the Old Pistol Range, Naval Surface Warfare Center, Crane Division, Crane, Indiana.
- Tetra Tech, 2006. Resource Conservation and Recovery Act Corrective Measures Proposal Report for SWMU 7 - Old Rifle Range/Old Pistol Range. Naval Surface Warfare Center. Crane, Indiana.
- U.S. Army, 1978. Installation Assessment of the NSWC Crane, Record of Evaluation Report No. 117, Aberdeen Proving Ground, Maryland.
- U.S. EPA, 1991. Guidance on RCRA Corrective Action Decision Documents: The Statement of Basis Final Decision and Response to Comments, OSWER Direction 9902.6, Office of Waste Programs Enforcement, U.S. Environmental Protection Agency, Wash. D.C.
- USACE WES (United States Army Corps of Engineer Waterways Experiment Station), 1991. Draft RFI Phase II, Soils. Old Rifle Range Report for: SWMU 07/09. Naval Weapons Support Center, Crane, Indiana. United States Army Corps of Engineer; Waterways Experiment Station, Vicksburg, Mississippi.