FINAL
CLOSURE DECISION DOCUMENT
BUILDING 103-16 CATCHMENT PITS
SWMU B27A

HAWTHORNE ARMY DEPOT
HAWTHORNE, NEVADA

June 2012

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CLOSURE DECISION DOCUMENT SWMU B27A

Hawthorne Army Depot
Hawthorne, Nevada

June 2012

The selected remedy is protective of human health and the environment. It has been shown that a complete pathway to human health and the environment does not exist, and there is no potential for an exposure pathway to be completed in the future.

U.S. Army

20120620
DATE

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Executive Summary

This decision document presents the rationale for the recommended closure of Solid Waste Management Unit (SWMU) B27A, Building 103-16 Catchment Pits, at the Hawthorne Army Depot (HWAD), located in Hawthorne, Nevada. Investigations were performed at the site from 1976 to 2010, including those investigations performed in support of an evaluation in accordance with Nevada Administrative Code (NAC) 445A.22705: *Contamination of soil: Evaluation of Site by Owner or Operator; Review of Evaluation by Division,* and as described in American Society for Testing and Materials (ASTM) Standard E1739-95 – *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM 2002). Based on the site evaluation, corrective action activities were conducted in December 2010. Soil removal actions reduced concentrations of site contaminants to acceptable levels at SWMU B27A.

Site History

SWMU B27A is located in the north magazine area of HWAD, adjacent to Building 103-16 (refer to **Figure 2-2**). The SWMU consists of eight inactive unlined catchment pits (Pit Groups B and C), occupying a total area of approximately 10 acres. Historic aerial photographs were used to identify a suspected former disposal pit (Pit A) that may have been a low lying area. The existing catchment pits are between 3 – 8 feet deep, and are interconnected with a series of steel and clay pipes that appear to have been used for transferring liquids between pits.

Site Conditions

The catchment pits reportedly received wastewater containing explosives and related materials from 1946 to 1975: ammonium picrate, trinitrotoluene (TNT), sodium sulfide, nitric acid, cyclotrimethylenetrinitramine (RDX), and dimethyl hydrazine. The usage of concrete troughs and drain lines likely correlated with usage dates of the pits in which they terminate.

Based on the historical use of the catchment pits, volatile organic compounds (VOCs), explosives (including picric acid), and metals were identified as the target compounds in the soil and groundwater at SWMU B27A. Groundwater is at approximately 95 feet below ground surface (bgs).

Investigations

The investigative history of SWMU B27A began in 1976 with a U.S. Geological Survey (USGS) groundwater investigation. Additional investigations followed in 1977 with an Installation Assessment conducted by the United States Army Environmental Hygiene Agency (USAEHA). Subsequent site inspections, evaluations, and soil investigations were conducted from 1988 to 1998, including a RCRA Facility Assessment (RFA; 1995) and a Remedial Investigation (RI) completed in 1998. In 1999, additional soil samples were collected at SWMU B27A as part of investigations involving SWMU B27B, which overlaps and borders SWMU B27A to the east. The most recent investigations were performed in 2010, and included an investigation of Pit A, Pit Group B, Pit

Group C, concrete troughs, the western drainage ditch, and the installation of five groundwater monitoring wells.

Investigation Results

There were no detections of explosives reported in the investigation of the suspected Pit A and detected metals did not exceed U.S. Environmental Protection Agency (USEPA) Region IX Regional Screening Levels (RSLs). Analytical results from the concrete troughs and drainage ditches were also below RSLs.

There were only two RSL exceedances in groundwater samples collected from five monitoring wells installed at the site. RDX was detected in exceedance of the residential tap water RSL in samples collected from monitoring wells IRPMW75 and IRPMW78. However, these data indicate there is likely no residual source area of RDX in SWMU B27A, and the release that impacted groundwater was relatively minor.

Visible staining was evident in the pit bottoms and on the surrounding berms. Explosives were detected above Tier 1 screening levels (RSLs) in the Pit Groups B and C, and Tier 2 Site-Specific Target Levels (SSTLs) were developed. Arsenic was also detected above the RSL of 1.6 mg/kg in several soil samples; however, all detections were below the HWAD background concentration of 18.1 mg/kg. Therefore, SSTLs were not developed for arsenic. Concentrations of explosives in soil above the SSTLs were generally limited to the upper 5 feet within the Pit Groups B and C, and staining was observed as deep as 51 feet bgs in one of two soil borings installed in the vicinity of Pit C3. One of the two soil boring was completed as a groundwater monitoring well. None of the soil samples collected from the two borings exceeded SSTLs.

Remediation

Following a comparison of the data with the SSTLs, and in coordination with the NDEP, it was determined that soil excavation was the appropriate corrective action at SWMU B27A. In December 2010, a soil removal action was conducted, and 3,608 tons of soil were removed from the catchment pits, associated berms, drainage pipes, and concrete troughs at the site. The Pit Groups B and C were excavated to a maximum depth of 7.5 feet bgs from the pit floors, with the exception of Pit C3, where soil was excavated to a depth of 18 feet bgs. Between March 26 and April 3, 2012, all excavated impacted soil was transported off-site and disposed of as non-hazardous waste.

Remediation Results

Following excavation activities at SWMU B27A, confirmation samples were collected and compared to established SSTLs. Concentrations in residual soil were below the established SSTLs, and the site was backfilled in 2011.

Public Involvement

It is the policy of both the U.S. Department of Defense and the U.S. Army to involve the local community throughout the investigation process at an installation. To initiate this involvement, HWAD has established and maintains a repository library that contains final copies of all past studies and other documents regarding environmental issues at HWAD.

HWAD has solicited community participation through the establishment of a Restoration and Advisory Board (RAB). Because there has been insufficient response, HWAD has not yet formed a RAB. However, HWAD has held open houses to inform the public of on-going environmental issues. HWAD will continue to solicit community involvement and will establish a RAB when there is sufficient community interest.

Conclusions

Corrective action at SWMU B27A has resulted in residual concentrations of explosives at levels below SSTLs based on an Industrial Use scenario. The impact to groundwater is limited and closure of the SWMU is recommended. The five groundwater monitoring wells were added to the Basewide Groundwater Monitoring Program (BGMP) in October 2011.

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ACRONYMS AND ABBREVIATIONS

ACA	Army Contracting Agency
ASTM	American Society for Testing & Materials
ATG	Allied Technology Group, Inc.
BGMP	Basewide Groundwater Monitoring Program
bgs	Below Ground Surface
E&E	Ecology and Environment
GO/CO	Government-Owned/Contractor-Operated
HWAAP	Hawthorne Army Ammunition Plant
HWAD	Hawthorne Army Depot
J	Sample result reported is a quantitative estimate
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilograms
mg/L	Milligrams per Liter
µg/L	Micrograms per Liter
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
Plexus	Plexus Scientific Corporation
RAB	Restoration and Advisory Board
RAI	Resource Applications, Inc.
RBSLs	Risk-Based Screening Levels
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RSLs	Regional Screening Levels
SOC	SOC, LLC
SSI	Site Screening Inspection
SSTLs	Site-Specific Target Levels
SWMU	Solid Waste Management Unit
TNT	Trinitrotoluene
USAEHA	U.S. Army Environmental Hygiene Agency
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOCs	Volatile Organic Compounds

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1.0 INTRODUCTION

1.1 Purpose and Scope

Plexus Scientific Corporation (Plexus) was awarded a performance-based delivery order (Delivery Order 0002) to implement environmental remediation services and the Basewide Groundwater Monitoring Program (BGMP) at the Hawthorne Army Depot (HWAD), in Hawthorne, Nevada. The delivery order was issued by the Army Contracting Agency (ACA) under contract W91ZLK-05-D-0011. This document provides a summary of investigative activities and corrective actions taken at the site to eliminate the risk to human health and the environment under an Industrial Use scenario.

1.2 Overview

Section 1.0 of this document provides an introduction, presents the purpose of the document, discusses the regulatory setting, and summarizes the site evaluation process. Section 2.0 describes the physical setting at HWAD and Solid Waste Management Unit (SWMU) B27A. Section 3.0 provides a summary of investigations at SWMU B27A. Section 4.0 provides a summary of the development of Site-Specific Target Levels (SSTLs) for compounds requiring remedial action at SWMU B27A. Section 5.0 describes the corrective action taken at the site. Section 6.0 provides the conclusions of the report and an assessment required by the Nevada Division of Environmental Protection (NDEP), in accordance with Nevada Administrative Code (NAC) 445A.227. Section 7.0 provides a list of references used in this document.

Figures and tables (with the exception of Tables 2-1 and 4-1) associated with the abovementioned sections are located at the end of this report.

1.3 Regulatory Setting

The U.S. Environmental Protection Agency (USEPA) provides regulatory oversight of contamination assessment and corrective measures at Resource Conservation and Recovery Act (RCRA) SWMUs, under Section 3004(u) of the 1984 Hazardous and Solid Waste Amendments to RCRA. Corrective action for releases of hazardous wastes or constituents is required under 40 CFR Part 264.101 (a), (b), and (c).

Authority and responsibility for the implementation of RCRA has been delegated by USEPA to the State of Nevada, designating the NDEP as the lead regulatory agency for all RCRA corrective actions at HWAD. Sections 445A.226 through 445A.22755 (inclusive) of the NAC are applicable to SWMU B27A.

The HWAD also maintains RCRA Permit No. NEV HW0017, which was last renewed in August 2005; this permit requires corrective actions for any hazardous waste or hazardous constituents released from any SWMUs at the facility.

1.4 Site Evaluation Process

In accordance with NAC 445A.22705: *Contamination of soil: Evaluation of site by owner or*

operator; review of evaluation by Division, a site evaluation was performed at SWMU B27A. NAC 445A.22705 stipulates that site evaluations be performed as described in the American Society for Testing and Materials (ASTM) Standard E1739-95 – *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*. Although ASTM E1739-95 was developed for petroleum sites, the principles and process are applicable to sites and chemicals other than petroleum-based sites.

ASTM E1739-95 provides a stepped approach to evaluating risk at a site and in determining the need for a corrective action. Part of the ASTM process includes reviewing existing investigation documents and determining whether the site has been adequately characterized. If additional investigation is deemed necessary, the additional investigation must be performed prior to recommending a final remedy for the site. However, if adequate data is available, a Tier 1, Tier 2, and Tier 3 evaluation may be performed. A Tier 3 evaluation was not performed for SWMU B27A; therefore, Tier 3 is not addressed in this closure decision document.

1.4.1 Site Characterization

In determining whether the site has been adequately characterized, the following general questions were posed:

- Were the recommended actions provided in previous investigation completed?
- Are there an adequate number of samples to reflect the distribution of contaminants across the site?
- Has the horizontal limit of any impacted soil been delineated?
- Has the vertical limit of impacted soil been delineated?
- Has groundwater been impacted?
- Have the boundaries of the impacted groundwater been delineated?

Existing investigation reports were considered acceptable if issued as final documents.

1.4.2 Tier 1 Evaluation

This evaluation consists of comparing existing site analytical data to Risk-Based Screening Levels (RBSLs). The RBSLs are risk-based values derived from non-site-specific assumptions for direct and indirect exposure pathways. The RBSLs use conservative exposure factors and conservative fate and transport assumptions for potential pathways and property uses (e.g., residential, industrial, etc.). The RBSLs do not represent site-specific conditions.

The RBSLs used in the Tier 1 evaluation for SWMU B27A consist of the USEPA Region IX Regional Screening Levels (RSLs) for Industrial Soil and Residential Tap Water. Site constituents that exceed the RBSLs in the Tier 1 evaluation are considered chemicals of potential concern, and are included in a Tier 2 evaluation, if performed.

1.4.3 Tier 2 Evaluation

The Tier 2 evaluation develops SSTLs, which are risk-based remedial action target levels for chemicals of potential concern. In the Tier 2 evaluation, the non-site-specific assumptions used for the RBSLs are replaced with site-specific factors. The values calculated from inputting site-specific factors are the SSTLs. The maximum concentrations of target compounds are then compared to the SSTLs to determine the recommendation for closure.

1.4.4 Conclusions and Recommendations

Conclusions are based on the results of the Tier 1 and Tier 2 evaluations.

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2.0 FACILITY AND SITE DESCRIPTION

2.1 General Facility Location

HWAD is located in Mineral County, Nevada, approximately 140 miles southeast of Reno, Nevada (**Figure 2-1**). The depot covers an area of approximately 150,000 acres and encloses three sides of the town of Hawthorne.

2.2 General Facility Description

HWAD's current mission is to receive issue, store, renovate, inspect, demilitarize, and dispose of conventional ammunition. The depot is a government-owned/contractor-operated (GO/CO) facility that is presently operated by SOC, LLC (SOC).

The installation was originally constructed in 1928 as a U.S. Naval Ammunition Depot. Its original mission was to store, service, and issue ammunition to the Pacific Area. Following World War II, the depot was actively involved in the demolition of various types of allied and enemy ammunition. Its role was also expanded to include receiving, renovating, loading, maintaining, storing, and issuing ammunition, explosives, expendable ordnance items, and/or weapons and technical ordnance materials. It was also used to test weapons and dispose of unserviceable and/or dangerous ammunition and explosives. In 1977, the depot was transferred to the U.S. Army and renamed Hawthorne Army Ammunition Plant (HWAAP).

After the transfer, HWAAP was re-designated as a GO/CO plant in 1980 and operated under the direction of the former Day and Zimmermann/Basil Corporation. Its mission from 1980-1994 included:

- Receive, produce, assemble, load, issue, store, renovate, inspect, test, demilitarize, and dispose of conventional ammunition;
- Operate and/or maintain in operational readiness cast and fuel-air explosive loading plants, rocket assembly plants, and medium/major caliber assembly lines;
- Provide special/experimental high-explosive casting, extruding, and pressing, and fuel air explosive loading and support services to designated research and development activities;
- Provide storage facilities for war reserve ammunition, and maintain designated ammunition in a state of readiness for mobilization, including assembling or otherwise providing base unit materials; and
- Conduct testing of solid propelled munitions, high explosive warheads, mechanical and electronic fuses, cartridge cases, primers, rocket motors, and other ballistic devices (U.S. Army, 2001).

In 1994, HWAAP was renamed the HWAD and was designated as a Tier II (or caretaker) ammunition facility that was used to store war reserve ammunition to be used after the first 30 days (NDEP, 2006; U.S. Army, 2001). HWAD has continued to fulfill its revised mission (shipping,

storage, and recycling of munitions) and operating under the direction of SOC.

HWAD is not on the National Priority List. Studies and investigations have been conducted in coordination with the NDEP. Releases of various hazardous constituents have been located and classified as clean-up sites to be addressed pursuant to applicable clean-up authorities. Remediation efforts have been on-going with the Army Installation Restoration Program since 1974, initially pursuant to the Comprehensive Environmental Response, Compensation and Liability Act. Following issuance of the RCRA Hazardous Waste Storage and Treatment Permit (Permit Number NEV HW0017, Revision 1, August 2005) for HWAD, remediation of all delivery order sites is being conducted pursuant to the Part VI, Corrective Action, of the permit, with regulatory coordination, as appropriate, from the NDEP. Groundwater monitoring is required as a part of corrective action activities at the facility.

2.3 Geology and Hydrology

HWAD is located in west-central Nevada within the Whiskey Flat-Hawthorne sub area of Walker Lake Valley, in the Great Basin section of the Basin and Range physiographic province. Geographically, HWAD is bounded on three sides by mountains: the Wassuk Mountain Range on the west, the Gillis Range on the east, and the Excelsior Mountains on the south. Walker Lake bounds the depot on the north (Ecology and Environment [E&E], 1997).

2.3.1 Soil and Geology

The valley floor, alluvial fans and aprons, and the weathered parent material in the higher elevations are composed of Quaternary and Tertiary unconsolidated sedimentary deposits. The surficial deposits on the installation can be divided into three broad depositional and soil types based on topographic position. The first soil type occupies the mountains/hills, canyons, mountain slopes, and foothills. These deposits are characterized by silty sand, gravel, sand-silt mixtures, silt, and sand and gravel in a clay matrix. Cobbles and boulders are not uncommon. Depth of the overburden is very shallow and interrupted by rock outcrops. The second type consists of deposits forming the alluvial fans and aprons. These deposits are silty sands and gravelly silt-sand mixtures. Fluvial processes have also transported detritus to the lower elevations. The thicknesses of these units are reported to be at least 850 feet in the installation area. Lacustrine deposits, which are predominantly clays deposited from the Pleistocene-Age Lake Lahontan, comprise the final soil type (E&E, 1997).

2.3.2 Surface Waters

The installation occupies the Walker Lake drainage basin. The Wassuk Mountains on the western boundary of the installation are the primary watershed for the installation, with the majority of surface drainage originating there. The installation captures surface water in a series of basins located on major creeks above HWAD for use as drinking water. There are no perennial surface streams on the valley floor. Surface overflow occurs only after a major rainfall or snow melt. After the drainage paths reach the valley floor, the gradient decreases abruptly and the stream becomes

influent. Therefore, surface flow rarely reaches Walker Lake, the only lake on the installation (E&E, 1997).

2.3.3 Groundwater

Depths to the water table increase with distance from Walker Lake and toward the apexes of the alluvial fans. The shallow groundwater regime flows northwest toward Walker Lake at an approximate seepage rate of 1 foot per year (United States Army Environmental Hygiene Agency [USAEHA], 1988). Recharge occurs along the mountain front near the apex of the alluvial fans.

Groundwater is present in several productive zones located at various depths at HWAD. The facility's drinking water is currently obtained from surface catch basins and reservoirs in the Wassuk Mountains, and from several groundwater wells up-gradient and cross-gradient from the SWMU. The town of Hawthorne currently obtains drinking water from groundwater wells in the Whiskey Flats area 12 miles south of town. However, the town formerly used local municipal wells that have not been abandoned. On-site production wells are maintained in a state of readiness to provide water to the firefighting system or to produce water for non-potable use at the facility (USAEHA, 1988). During periods of high water demand, the HWAD production well #11 is used to provide water to blend with water from reservoirs for use as potable water. The depth to groundwater in the vicinity of SWMU B27A is approximately 95 feet below ground surface (bgs).

2.4 General SWMU Description

SWMU B27A is located in the north magazine area of HWAD, adjacent to Building 103-16 (**Figure 2-2**). The SWMU consists of eight inactive unlined catchment pits (**Figure 2-3**):

- Pit Group B (four pits);
- Pit Group C (four pits); and
- One suspected former pit location, Pit A.

The eight catchment pits occupy a total area of approximately 10 acres. The existing catchment pits are between 3 – 8 feet deep, and are interconnected with a series of steel and clay pipes that appear to have been used for transferring liquids between pits. There are two concrete troughs (Concrete Troughs) at SWMU B27A; one trough extends from the north side of Building 103-16 to the east edge of Pit Group B, and the second trough extends from the southwest side of Building 103-16 to the northeastern edge of Pit Group C. Historically there were two drainage ditches at SWMU B27A. One ditch extended southwest of Building 103-16 for approximately 0.5 mile (West Drainage Ditch), and the second ditch was located south of Building 103-16 (East Drainage Ditch). The East Drainage Ditch was investigated and backfilled as part of remediation activities at Building 103-8/10 Oxidation Ditch - SWMU B27B. There is also one drain line (Drain Line) that extends into SWMU B27A from SWMU B27B and ends in Pit Group C.

Table 2-1 shows the period of operation and the source operations for all of the pits within SWMU B27A. Usage of the concrete troughs and drain lines likely correlated with usage dates of the pits in which they terminate. According to the "Final Remedial Investigation Addendum Work Plan for SWMU B27B" (Plexus, 2010a), the East Drainage Ditch and associated Drain Line were likely used for containment and discharge of wastewater from Building 103-8 and 103-10 operations. The West Drainage Ditch appears to have been used for surface water control in the area of Building 103-16.

Table 2-1. SWMU B27A: Period of Operations and Potential Contaminants (E&E, 1995)

Pit or Group of Pits	Period of Use	Explosives and Related Materials Involved
A[a]	*1946-51+(?)*[b]	*Ammonium picrate*
B[c]	*1946-51+*[b] *1962-64* *1968-69* *1974-76*	*Ammonium picrate* *TNT, sodium sulfide* *TNT, RDX, sodium sulfide* *Dimethyl hydrazine, nitric acid*
C	*1955-65* *1974-75*	*Ammonium picrate* *Dimethyl hydrazine, nitric acid*

Table data derived from the written communication of W.K. Glenzer (U.S. Navy, retired, 1976).

[a] *– History of this feature is uncertain. May not have been a planned disposal bed; instead may have been a low-lying area that occasionally received overflow from bed Group B. No evidence of disposal bed features detected as of 1976.*

[b] *– Aerial photographs taken August 16, 1954, show bed still in use, possibly for non-explosive wastes.*

[c] *– These beds apparently also received lavatory wastes from 103-16 building after passage through a septic tank.*

RDX – Cyclotrimethylenetrinitramine

TNT - Trinitrotoluene

3.0 INVESTIGATIVE SITE HISTORY

3.1 Investigations Summary at SWMU B27A

The investigative history of the 103-16 Catchment Pits (SWMU B27A) began in 1976. The following list includes relevant reports associated with investigations at the site:

- 1987 and 1988 - USAEHA. *Final Report Ground-Water Contamination Survey Number 38-26-0850-88, Evaluation of Solid Waste Management Units, Hawthorne Army Ammunition Plant, Hawthorne, Nevada.*
- 1988 - Jacobs Engineering. *RCRA Facility Assessment (RFA), Hawthorne Army Ammunition Plant, TES IV Work Assignment No. 433.*
- 1992 – Resource Applications, Inc. (RAI). *Site Screening Inspection (SSI) for the Hawthorne Army Ammunition Plant, Hawthorne, Nevada. Prepared for the U.S. Army Corps of Engineers Toxic and Hazardous Materials Agency, Falls Church, Virginia. December.*
- 1995 - E&E. *RCRA Facility Assessment Report for 9 Solid Waste Management Units, Hawthorne Army Depot, Hawthorne, Nevada. April.*
- 1998 - Tetra Tech, Inc. *Final Remedial Investigation (RI) Report Solid Waste Management Unit B27a Building 103-16 Catchment Pits, Hawthorne Army Depot, Hawthorne, Nevada. October.*
- 2011 – Plexus. *Final Remedial Investigation and Corrective Action Completion Report, SWMU B27A, Hawthorne Army Depot, Hawthorne, Nevada. July.*

3.1.1 Groundwater Investigations

In 1976 the U.S. Geological Survey (USGS) performed a groundwater investigation at SWMU B27A to determine if contaminants disposed in the SWMU catchments pits had impacted the groundwater. Trinitrotoluene (TNT) was the only explosive detected during the investigation. TNT was detected in three of the seven wells at a maximum concentration of 0.17 micrograms per liter (µg/L), which is well below the RSL of 2.2 µg/L. Nitrate was detected at a maximum concentration of 7.7 milligrams per liter (mg/L), which is below the EPA Primary Maximum Contaminant Level (MCL) for drinking water of 10.0 mg/L.

Plexus installed four monitoring wells (IRPMW75, IRMMW76, IRPMW77, and IRPMW78) at SWMU B27A in December 2010, and the fifth monitoring well (IRPMW79) was installed in January 2011. The four monitoring wells were installed to evaluate potential groundwater impact due to historical activities within B27A. The fifth monitoring well was installed during a second mobilization in January 2011 to determine if ammonium picrate-impacted soil in the Pit C3 area also impacted groundwater in the immediate vicinity of the pit (Plexus, 2011). The location of these five groundwater monitoring wells at SWMU B27A are shown in **Figure 3-1**.

There were only two RSL exceedances in the groundwater samples collected from monitoring wells

IRPMW75, IRMMW76, IRPMW77, IRPMW78, and IRPMW79. Cyclotrimethylenetrinitramine (RDX) was detected in exceedance of the RSL of 0.61 µg/L in samples collected from IRPMW75 (2.1 µg/L) and IRPMW78 (0.78 J µg/L). The analytical results are located in **Table 3-1,** and results are also shown in **Figure 3-1**.

3.1.2 Soil Investigations

In 1977, an Installation Assessment was conducted by USAEHA, which included a record search and on-site visit (E&E, 1995). Subsequent site inspections, evaluations, and investigations were conducted by Jacobs Engineering (1988), the Army (USAEHA, 1988), RAI (1992), and E&E (1995). These investigations visually identified TNT (red staining) and ammonium picrate (yellow staining) in the catchment pits of Groups B and C. In addition, soil samples collected from the Pit Groups B and C, the east drainage ditch, and west drainage ditch revealed the presence of explosive residues (TNT and RDX). The highest concentrations of both compounds were recorded in soil samples collected at depths less than 5 feet bgs (E&E, 1995). The only soil sample collected that exceeded RSLs for explosives was collected from 0.5 feet bgs at location HA08 in Pit C1 of Pit Group C, which contained 700 milligrams per kilogram (mg/kg) of TNT. The USEPA Region IX RSLs for TNT is 79 mg/kg. Several soil samples exceeded the arsenic RSL, but these values were below the previously established maximum background concentration of 18.1 mg/kg for arsenic at HWAD.

Additional soil samples have also been collected within SWMU B27A as part of investigations involving SWMU B27B (Allied Technology Group, Inc. [ATG], 1999), which overlaps and borders SWMU B27A to the east. These samples were collected adjacent or within the features designated "East Drainage Ditch" and "Drain Line from Building 103-10" in the 1998 RI (Tetra Tech, 1998). During the investigation of adjacent SWMU B27B, samples were collected from a total of 17 locations within SWMU B27A and analyzed for a combination of Explosives, RCRA 8 Metals, volatile organic compounds (VOCs), chromium, lead, and/or mercury. All constituents were either not detected or were detected below their established HWAD background concentrations (Tetra Tech, 1997).

In 2010, two separate additional soil investigations were performed at SWMU B27A. The first soil investigation was performed in July 2010, and focused on the suspected Pit A area (**Figure 3-2**). Soil samples were collected from a total of seven test pits and analyzed for Explosives (including ammonium picrate) and RCRA 8 Metals. All constituents were either not detected or were detected below their established HWAD background concentrations (Plexus, 2011).

The second investigation was performed in November 2010 and focused on areas identified as Pit Group B, Pit Group C, the concrete troughs, and the western drainage ditch (**Figure 3-2**). Soil samples collected from the concrete troughs (six locations) and the western drainage ditch (three locations) were analyzed for Explosives (including ammonium picrate) and RCRA 8 Metals. All constituents were either not detected or were detected below their established HWAD background concentrations (Plexus, 2011).

Visible staining was evident in pit bottoms and surrounding berms. Concentrations of the explosives ammonium picrate (maximum of 17,000 mg/kg in the floor of Pit B1 at 0.5 feet bgs) and TNT (maximum of 1,900 mg/kg in the floor of Pit B3 at 0.5 feet bgs) exceeded RSLs in several Pit B and Pit C soil sample locations. All metals were either not detected or were detected below their established HWAD background concentrations in Pit Group B and Pit Group C (Plexus, 2011). Concentrations of explosives in soil above RSLs were generally limited to the upper 5 feet.

Deeper stained soil was uncovered during remedial activities, which lead to an additional investigation of Pit C3 after soil removal was completed. Two soil borings (SB-01 and SB-03) were installed; one in the center of the pit (SB-01), and one down-gradient from the impacted area (SB-03) to depths of 62 and 109 feet, respectively. Soil staining was observed at a maximum depth of 51 feet bgs in SB-01. SB-03 was completed as a monitoring well (IRPMW79) to determine the impact to groundwater. Two soil samples collected from SB-01 and one collected from SB-03 were submitted for laboratory analysis, and none of the three soil samples exceeded RSLs.

A summary of analysis results for explosives detected above RSLs in the pits is located in **Table 3-2**.

3.2 Summary of Investigation Conclusions

Soil: The field and laboratory analytical results from the field investigation indicated that soil in the Pit Group B and Pit Group C contained concentrations of two explosives that exceed their RSLs: ammonium picrate and TNT.

Groundwater: Based on the 2011 sample results, it appeared the groundwater at SWMU B27A had been well characterized. The detection of RDX at down-gradient well IRPMW78 slightly exceeded the RSL, but the up-gradient data at the site suggested there was minimal residual source remaining. Additional investigations or remedial actions related to groundwater were not warranted at SWMU B27A. The five groundwater monitoring wells were added to the BGMP in October 2011.

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4.0 SELECTION OF SITE-SPECIFIC CLEAN-UP GOALS

Consistent with the requirements of NAC 445A.22705, an evaluation of SWMU B27A was performed using the risk-based corrective action approach outlined in ASTM Standard E1739-95 – *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*. This section provides a summary of the selection of site-specific clean-up goals. In a Letter Work Plan submitted to NDEP in December 2010 (Plexus, 2010b), a Tier I evaluation (including the development of a conceptual site model) was completed for SWMU B27A, and Tier II SSTLs were established for the site.

The final selection of a clean-up goal was based on a comparison of the SSTL for an appropriate target cancer risk factor (Construction Worker scenario with a target risk level of $1x10^{-6}$) and the non-cancer SSTL. The lower, more conservative value of the two was selected as the final SSTL for use as the cleanup goal for future corrective actions and site closure. The cancer-based SSTL was utilized for RDX as the final clean-up goal, and the non-cancer SSTL was used for TNT since the cancer-based Construction Worker scenario ($1x10^{-6}$) exceeds the non-cancer SSTL. The non-cancer SSTL was also utilized for ammonium picrate due to the lack of a cancer-based SSTL. The final soil clean-up goals for the selected analytes at SWMU B27A are protective of human health and the environment, and are summarized in **Table 4-1** below.

Table 4-1. Selected Final Site-Specific Target Levels (SSTLs) / Clean-up Goals

Target Compound	Final SSTL/ Clean-up Goal (mg/kg)
RDX	363
Ammonium Picrate/Picric Acid (2,4-dinitrophenol surrogate)	916
2,4,6 TNT	272

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5.0 CORRECTIVE ACTIONS

Following a review of the data collected during the November 2010 investigation activities, and in coordination with the NDEP, it was determined soil removal was the appropriate corrective action at SWMU B27A. In addition to developing SSTLs and selecting a corrective action, the December 2010 Letter Work Plan (Plexus, 2010b) discussed planned excavation and confirmation sampling. Target compounds above SSTLs would be excavated and confirmation samples would be compared to SSTLs to determine the final extents of the planned excavations. It was also determined that pit-related piping would be removed during excavation activities. The soil removal is detailed in the *Final Remedial Investigation and Corrective Action Completion Report, SWMU B27A* (Plexus, 2011).

Corrective action began in December 2010. Excavation activities included inspecting the pit berm walls and floors for visible staining, removing the stained soil, and removing the soil located in the areas where investigation sample results exceeded SSTLs. The depths of the excavations were determined by the depth of the known impacted areas and the presence of visibly stained soil. In some cases the concentrations were not above SSTLs, but due to the scheduling restrictions at the site due to on-going demilitarization activities at Building 103-16, a determination was made to excavate all yellow-stained soil in the Pit Group B and Pit Group C areas.

Excavations within the Pit Groups B and C extended to a maximum depth of 7.5 feet below the original pit floors, generally corresponding with the results of the November 2010 soil investigations. An exception was Pit C3. Although exceedances of SSTLs at Pit C3 were detected at a maximum depth of 2.5 feet bgs during the November 2010 investigation, the extent of yellow staining was observed to be more widespread following the initial 0.5-foot vertical removal. Soil excavation eventually extended to a maximum depth of 18 feet below the original pit floor surface (approximately 24 feet below the top of the berm) in one area near the center of Pit C3.

Confirmation samples were collected from each excavation and submitted for laboratory analysis, and all final extent analytical results were below SSTLs. As previously discussed in Sections 3.1.1 and 3.1.2, an additional investigation was conducted at Pit C3 following corrective action activities. Staining was observed within two soil borings at a maximum of 51 feet bgs, and concentrations of target compounds in soil samples collected from these borings were below SSTLs.

Approximately 10,400 cubic yards of soil were backfilled into the pit area at SWMU B27A between December 27, 2010 and January 8, 2011. To account for future settlement and promote drainage away from the area, excavations were crowned a minimum of 1 foot above surrounding grade. The extent of the SWMU B27A excavations and the locations of confirmation samples are shown in **Figure 5-1.** Laboratory analytical results for the final extent of excavations are summarized in **Table 5-1**. Site restoration photo documentation is provided in **Appendix A**.

All excavated soil was stockpiled for waste characterization. Disposal of the impacted soil, totaling 3,608 tons, began on March 26 and was completed on April 3, 2012. The soil was

disposed of off-site as a non-hazardous waste. Soil disposal activities are detailed in the *Letter Report – Soil Disposal Activities at SWMU B27A* (Plexus, 2012).

6.0 CONCLUSIONS

Corrective actions have removed soil containing explosives posing a risk to human health and the environment. Concentrations of constituents remaining at SWMU B27A are below SSTLs. Groundwater impact has been shown to be minimal and there is not a complete pathway for exposure. SWMU B27A is recommended for closure, with a restriction that the site only be used for industrial purposes. This restricted use should be added to the master plan for HWAD.

In accordance with NAC 445A.227, the following factors (items a. – k.) were evaluated to determine whether further corrective actions are required or may be terminated:

a. The depth of any groundwater: 95 feet bgs.

b. The distance to irrigation wells or wells for drinking water: Water supply well #11, utilized as a potable water source during periods of high demand, is located approximately 2.8 miles cross-gradient and to the southwest of SWMU B27A. The non-potable supply wells #7 and #8 are located 1 mile to the northeast and 1.8 miles to the southwest of the site, respectively. Both are cross-gradient of SWMU B27A.

c. The type of soil that is contaminated: Fine to medium sand, silty sands.

d. The annual precipitation: 4.6 inches (evapotranspiration potential is 45 inches per year).

e. The type of waste or substance that was released: Wastewater contaminated with explosives and related materials.

f. The extent of the contamination:

   Soil: Following the 2010 soil removal activities, no target compounds remain on-site above their respective SSTL. The only target compound remaining above RSLs after the soil removal action is TNT, which was detected at a concentration of 91 mg/kg in a sample collected from 0.75 feet bgs in the east berm of Pit C1. This TNT concentration exceeds the RSL of 79 mg/kg, but is below the SSTL of 272 mg/kg selected for the site. Confirmation sampling has verified that all other target compounds at SWMU B27A are below EPA Region IX RSLs.

   Groundwater: In January 2011 the five new monitoring wells at SWMU B27A were gauged and sampled. During this sampling event RDX was the only compound detected in exceedance of the RSL:

   - RDX was detected in exceedance of the residential tap water RSL in one of the three wells located down-gradient of SWMU B27A; and
   - RDX was detected at a concentration approximately twice the residential tap water RSL in one well located slightly up-gradient of SWMU B27A.

There are no on-going releases to groundwater. The release that impacted groundwater was relatively minor. The newly installed network of wells is adequate for long-term monitoring of groundwater impact related to historical releases at SWMU B27A. The existing wells have been added to the BGMP.

g. The present and future use for the land: Industrial (present and future). Significant changes in land use (e.g., residential use) in the future may require a reassessment of the results.

h. The preferred routes of migration: Contamination pathways identified include ingestion of soil, dermal contact with soil, and inhalation of soil dust.

i. The location of structures or impediments: Building 103-16, a former ordnance wash-out building, lies immediately to the east of the catchment pits, followed by a gravel parking area, paved and dirt roads, and railroad tracks. A dirt road borders the former pits areas to the west.

j. Potential fire, vapor, or explosion: None.

k. Other factors: The SWMU B27A catchment pits have been backfilled to approximately 12 inches above surrounding grade and contoured to allow for surface water run-off.

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FIGURES

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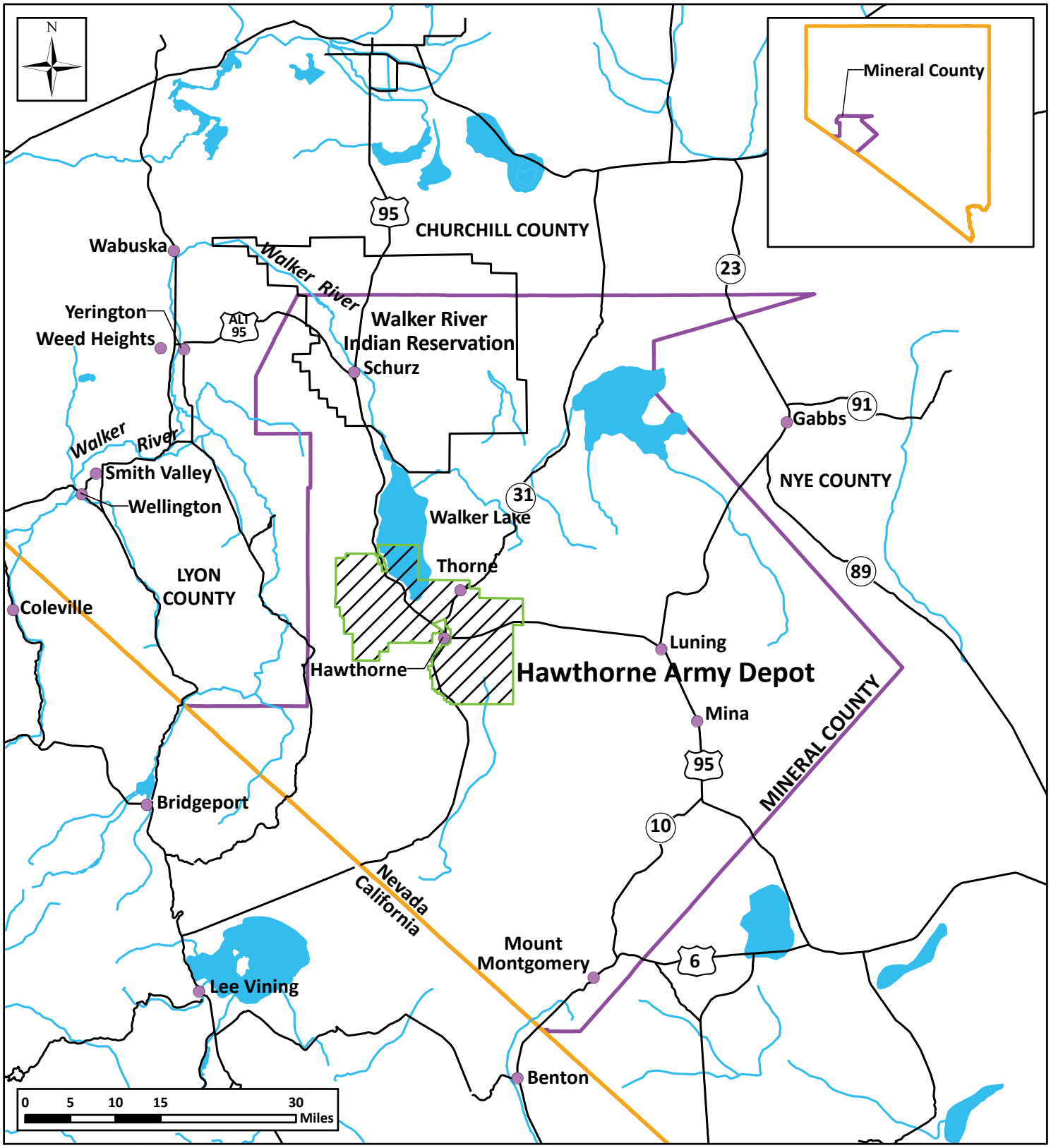

Map Key:

- State Boundary
- County Boundary
- Hawthorne Army Depot
- Walker River Indian Reservation
- Cities
- Major Highways
- Surface Water Body

Hawthorne Army Depot Location Map

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Figure 2-1

Hawthorne Army Depot Hawthorne, Nevada

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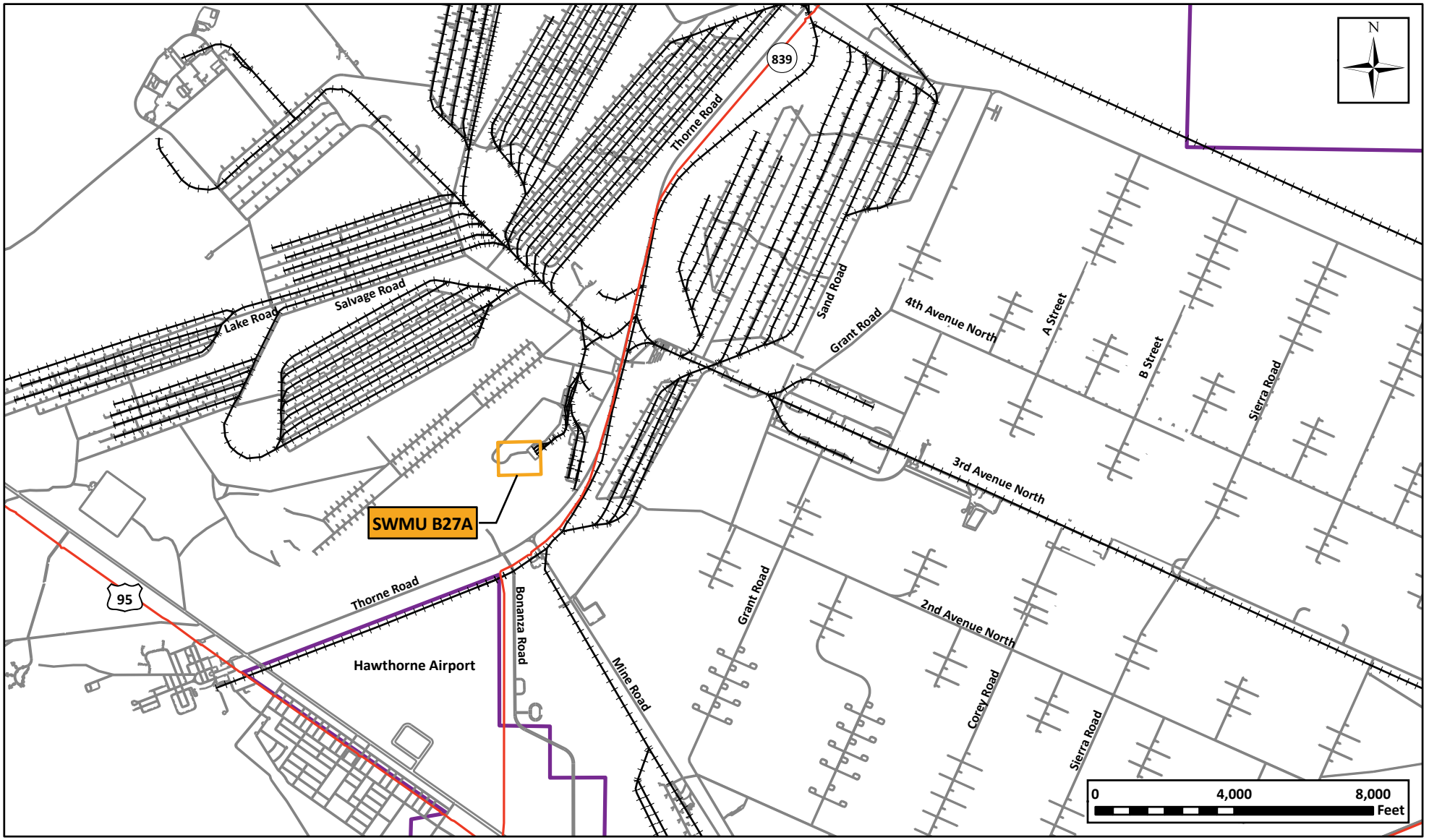

Map Key:

- Roads
- Rails
- Highways
- SWMU Boundary
- HWAD Boundary

Soild Waste Management Unit (SWMU) Location Map

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Figure 2-2

Hawthorne Army Depot
Hawthorne, Nevada

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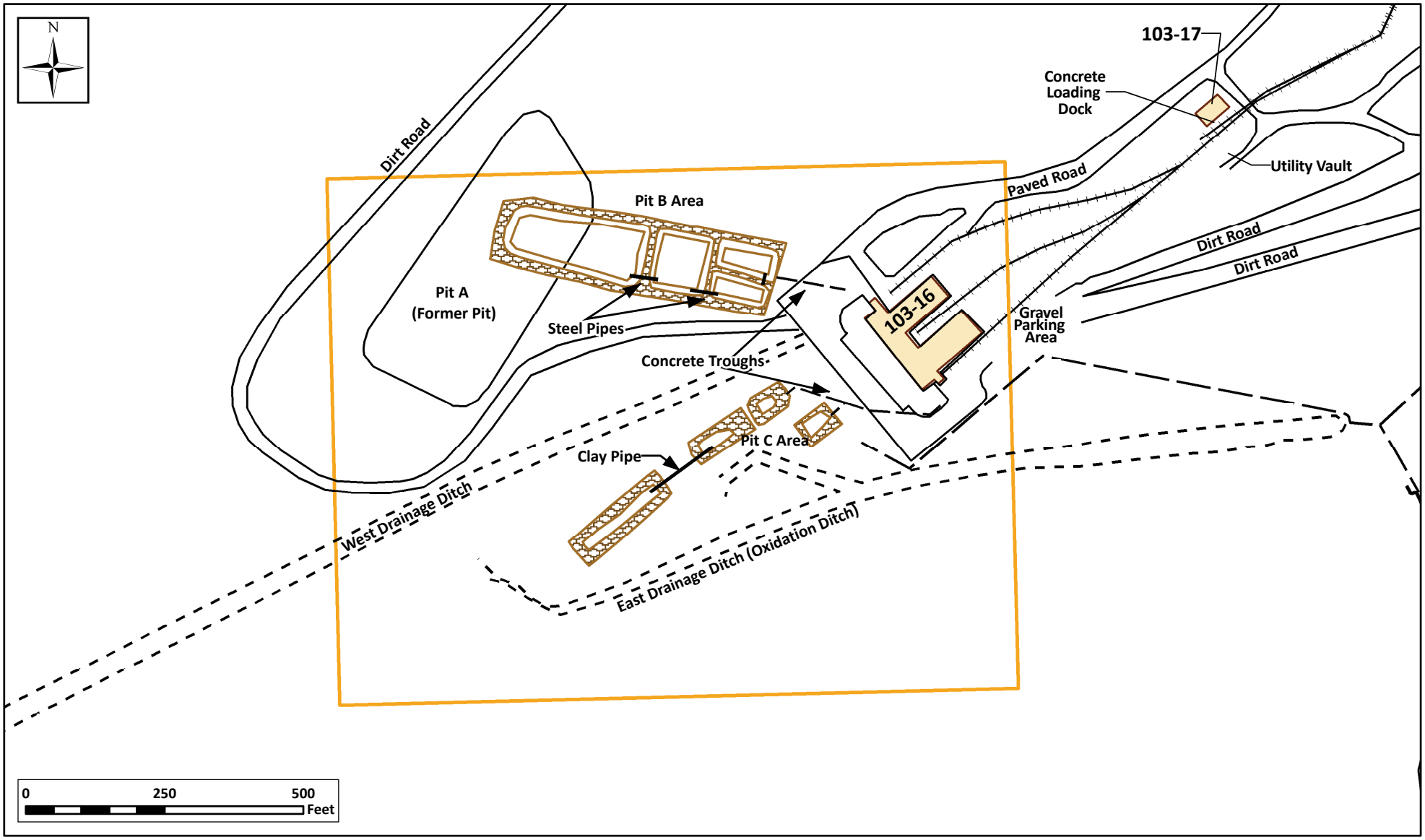

Map Key:

- SWMU Boundary
- Building
- Misc. Features
- Berm
- Pit
- Rail
- Drainage Ditch

SWMU B27A
Pre-Excavation Site Layout

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Figure 2-3

Hawthorne Army Depot
Hawthorne, Nevada

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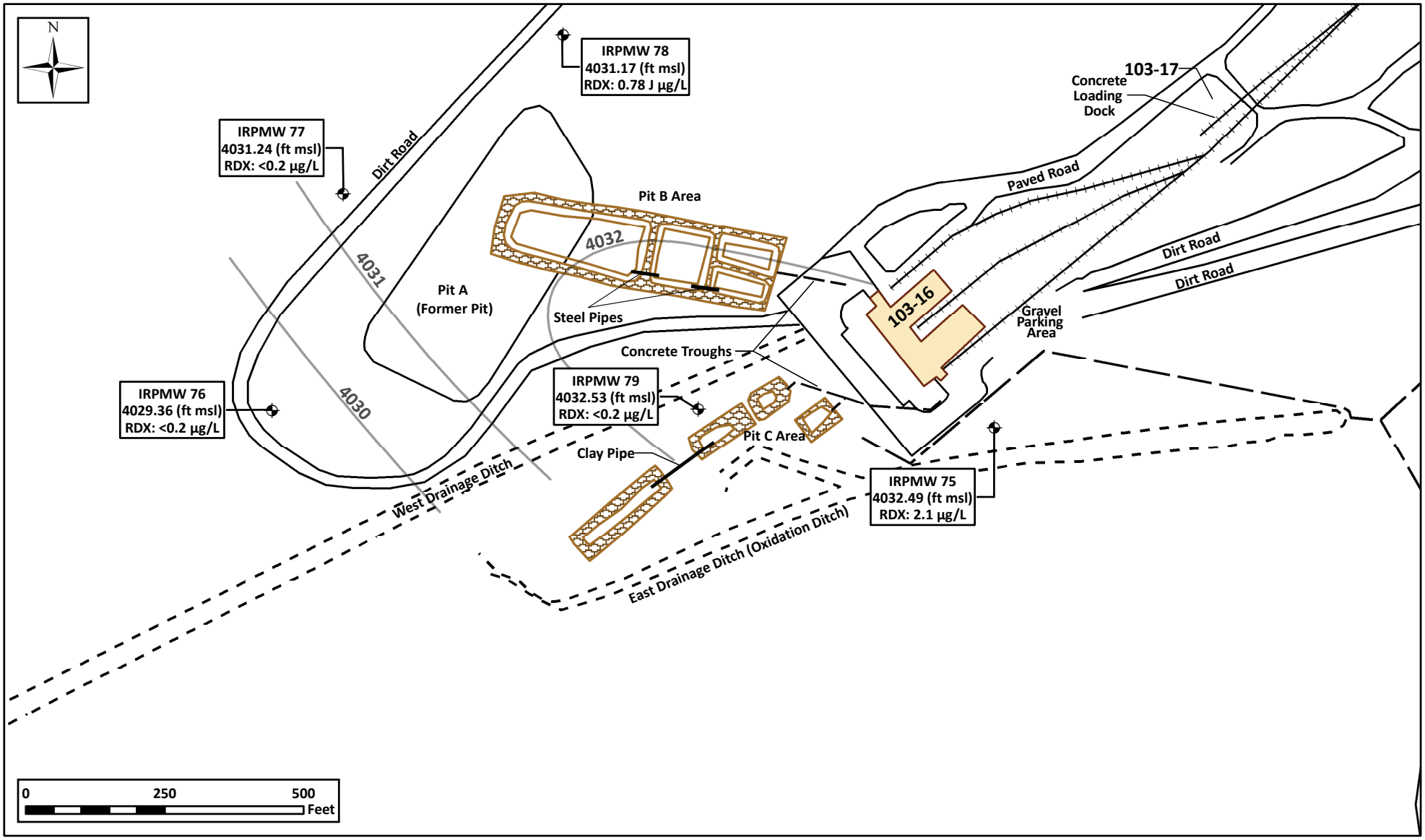

Map Key:

- SWMU boundary
- Building
- Misc. Features
- Berm
- Pit
- Rail
- Drainage Ditch
- Groundwater Contours (ft msl)
- Groundwater Monitoring Well

Example Sample Identification:

Well ID
Groundwater Elevation
RDX: Concentration

SWMU B27A
Groundwater Monitoring Well Locations, Groundwater Elevations, and Sample Results, January 9th, 2011

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Figure 3-1

Hawthorne Army Depot
Hawthorne, Nevada

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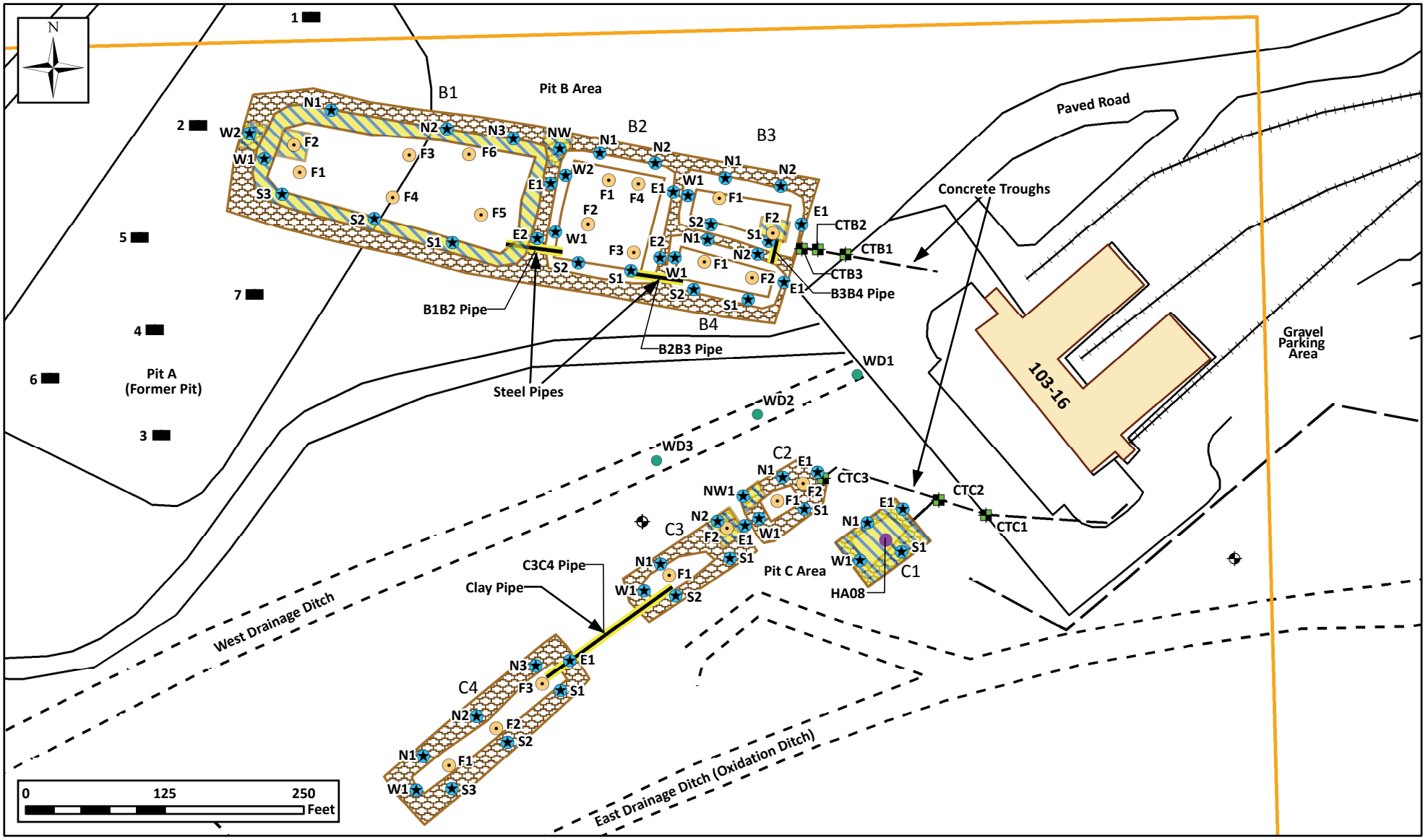

Map Key:

- Groundwater Monitoring Well
- Historical Soil Sample Location
- Concrete Trough Soil Sample Location
- Pit Floor Sample
- Berm Sample
- Drainage Ditch Sample
- Pit A Investigation Test Pit
- Concrete Trough
- Drainage Ditch
- Existing Sanitary Sewer Line
- Pipes - To Be Removed
- Rail
- Proposed Excavation Areas (Areas with Surface Staining and/or Sample(s) Above Cleanup Goals)
- SWMU Boundary
- Building

SWMU B27A
July and November 2010 Investigation Sample Locations & Proposed Excavation Areas

Figure 3-2

Hawthorne Army Depot
Hawthorne, Nevada

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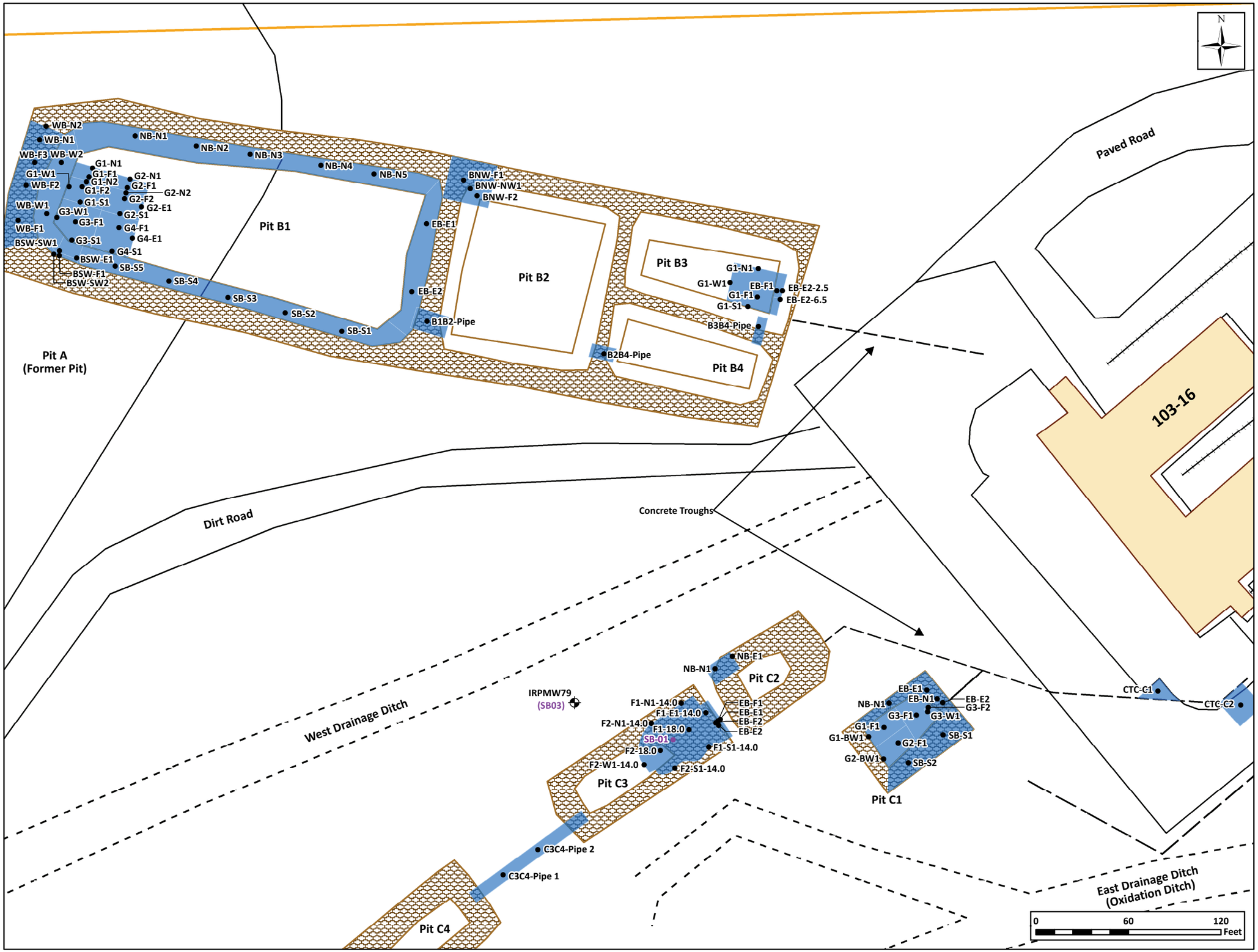

Map Key:

- Location of Excavation
- Confirmation Sample
- Soil Boring
- Groundwater Monitoring Well
- Berm
- Pit
- Rail
- SWMU Boundary
- Building

SWMU B27A
Excavation and Confirmation Sample Locations

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Figure 5-1

Hawthorne Army Depot
Hawthorne, Nevada

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TABLES

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Table 3-1
Summary of Analytes Detected During January 2011 Groundwater Sampling at SWMU B27A

Sample Name	Depth to Groundwater feet BTOC	TOC Elev feet msl	Groundwater Elevation feet msl	Explosives			Metals				VOCs		VOCs					General Chemistry	
				2-Amino-4,6-dinitrotoluene ug/L	HMX ug/L	RDX ug/L	Arsenic ug/L	Barium ug/L	Chromium ug/L	Selenium ug/L	1,2-Dichloroethane ug/L	Chloroform ug/L	cis-1,2-Dichloroethene ug/L	Tetrachloroethene ug/L	Toluene ug/L	Trichloroethene ug/L	Trihalomethanes, Total ug/L	Nitrate as N mg/L	Nitrite as N mg/L
Action Level				**73[b]**	**1,800[b]**	**0.61[b]**	**10[a]**	**2,000[a]**	**100[a]**	**50[a]**	**5[a]**	**80[a]**	**70[a]**	**5[a]**	**1,000[a]**	**5[a]**		**10[a]**	**1.0[a]**
IRPMW75-010911	104.89	4137.38	4032.49	0.2 U	**0.19 J**	**2.1**	**4.5 J**	**25**	**24**	22 U	1 U	1 U	1 U	**1.5**	**0.54 J**	**1.6**	1 U	**0.41 J**	0.5 U
IRPMW76-010911	101.64	4131.00	4029.36	0.2 U	0.41 U	0.2 U	25 U	**27**	**1.9 J**	22 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**0.4 J**	0.5 U
IRPMW77-010911	98.78	4130.02	4031.24	0.2 U	0.41 U	0.2 U	25 U	**37**	**7.6 J**	22 U	1 U	**0.16 J**	1 U	**1.8**	1 U	**1.5**	**0.16 J**	**0.85**	0.5 U
IRPMW78-010911	99.99	4131.16	4031.17	**0.16 J**	0.47 U	**0.78 J**	25 U	**34**	**3.1 J**	**9.9 J**	**0.44 J**	**0.18 J**	**0.35 J**	**0.94 J**	1 U	**1.3**	**0.18 J**	**4.8 J**	**0.32 J**
IRPMW79-010911	103.46	4135.99	4032.53	0.2 U	0.4 U	0.2 U	**7.8 J**	**33**	**3.4 J**	**7.1 J**	1 U	1 U	1 U	**0.29 J**	1 U	**0.88 J**	1 U	**0.28 J**	0.5 U

Notes:
BTOC - below top of casing
msl - mean sea level
ug/L - micrograms per liter
RSL - Regional Screening Level (Tapwater)
a= MCL, EPA primary maximum contaminant level for drinking water.
b= RSL, EPA Regional Screening Levels for tap water.
J - Detected result is estimated.
U - Undetected at the limit of detection
Bold - Detected result
Highlighted - Result exceeds RSL or MCL

Table 3-2
Summary of Analytes Detected During November 2010 Investigation at SWMU B27A

Sample Name	Explosives												Metals							
	1,3,5-Trinitrobenzene mg/kg	2,4,6-Trinitrotoluene mg/kg	2,4-Dinitrotoluene mg/kg	2-Amino-4,6-dinitrotoluene mg/kg	2-Nitrotoluene mg/kg	3-Nitrotoluene mg/kg	4-Amino-2,6-dinitrotoluene mg/kg	Ammonium Picrate mg/kg	HMX mg/kg	Nitroglycerin mg/kg	Picric acid mg/kg	RDX mg/kg	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg	Silver mg/kg
RSL	**27,000**	**79**	**5.5**	**2,000**	**13**	**62**	**1,900**	**1,200**	**49,000**	**62**		**24**	**1.6**	**190,000**	**800**		**800**	**43**	**5,100**	**5,100**
B27ACTB1-111710-B-2.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	0.26 U	**0.08 J**	4.9 U	0.24 U	0.25 U	**4.5**	**66**	**0.66**	**7.6**	**14**	**0.018 J**	2.7 U	1.3 U
B27ACTB2-111710-B-2.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.25 U	0.27 U	**0.36**	5.1 U	0.25 U	**0.099 J**	**6.7**	**100**	**1**	**6.4**	**13**	**0.043**	3.1 U	1.5 U
B27ACTB3-111810-B-2.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.47 U	0.23 U	0.25 U	0.23 U	4.8 U	0.23 U	0.24 U	**7.2**	**100**	**0.16 J**	**5.1**	**9.2**	**0.0099 J**	**1.1 J**	1.5 U
B27ACTC1-111710-B-2.6	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.25 U	0.27 U	0.25 U	5.1 U	0.25 U	**0.84**	**17**	**310**	**0.21 J**	**11**	**16**	**0.029 J**	3.4 U	1.7 U
B27ACTC2-111710-B-2.8	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	0.26 U	**0.87**	4.9 U	0.24 U J	**4.4 J**	**3.7**	**71**	**0.31 J**	**5.3**	**9.7**	**0.016 J**	2.8 U	1.4 U
B27ACTC2-111710-B-2.8-Z	0.24 U	0.24 U	0.24 U	**0.071 J**	0.24 U	0.48 U	**0.088 J**	0.26 U	**0.91**	4.9 U	0.24 U	**9.7**	**3.9**	**75**	**0.39 J**	**5.1**	**8.2**	0.033 U	2.7 U	1.4 U
B27ACTC3-111710-B-2.8	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.47 U	0.24 U	0.25 U	0.24 U	4.8 U	0.24 U	0.25 U	**5.6**	**97**	**0.058 J**	**5.2**	**8**	**0.008 J**	2.9 U	1.5 U
B27APB1BERMN1-111210-A-0.5	24 U	24 U	24 U	24 U	24 U	47 U	24 U	**1000**	24 U	480 U	**960**	25 U	**13**	**230 J**	**2**	**19**	**41**	**0.043**	2.7 U	1.3 U
B27APB1BERMN2-111310-A-0.5	24 U	24 U	24 U	24 U	24 U	48 U	24 U	**2400**	24 U	490 U	**2200**	25 U	**8.2**	**97**	**0.51**	**5.8**	**15**	**0.058**	2.8 U	1.4 U
B27APB1BERMN2-111810-B-2.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.46 U	0.23 U	**11**	0.23 U	4.7 U	**11**	0.24 U	**11**	**100**	**0.1 J**	**4.1 J+**	**7.4**	**0.022 J**	2.8 U	1.4 U
B27APB1BERMN3-111310-A-0.5	50 U	50 U	50 U	50 U	50 U	100 U	50 U	**3100**	50 U	1000 U	**2900**	52 U	**9**	**190**	**11**	**80**	**300**	**0.65**	**0.98 J**	1.3 U
B27APB1BERMS1-111210-A-0.5	24 U	24 U	24 U	24 U	24 U	48 U	24 U	26 U	24 U	490 U	24 U	25 U	**8.4**	**140 J**	**0.47**	**7.2**	**27**	**0.057**	2.7 U	**0.23 J**
B27APB1BERMS1-111810-B-2.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	**12**	0.24 U	4.9 U	**12**	0.25 U	**7.1**	**81**	**0.26 J**	**8.3 J+**	**17**	**0.069**	**1.1 J**	1.3 U
B27APB1BERMS2-111210-A-0.5	24 U	24 U	24 U	24 U	24 U	47 U	24 U	**1300**	24 U	480 U	**1200**	25 U	**12**	**190 J**	**1.7**	**21**	**81**	**0.47**	2.8 U	**0.26 J**
B27APB1BERMS2-111810-B-2.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.25 U	0.27 U	0.25 U	5.1 U	0.25 U	0.26 U	**9.9**	**130**	**0.15 J**	**7.9 J+**	**12**	**0.063**	**1.3 J**	1.5 U
B27APB1BERMS3-111210-A-0.5	250 U	250 U	250 U	250 U	250 U	490 U	250 U	**12000**	250 U	5000 U	**11000**	260 U	**5.8**	**110**	**1.6**	**22**	**65**	**0.24**	**0.81 J**	**0.18 J**
B27APB1BERMW2-111210-A-0.5	120 U	120 U	120 U	120 U	120 U	240 U	120 U	**4300**	120 U	2500 U	**4000**	120 U	**4.1**	**42 J**	**0.057 J**	**3.4 J**	**5.9**	**0.014 J**	3.1 U	1.6 U
B27APB1BERMW2-111210-A-0.5-Z	23 U	23 U	23 U	23 U	23 U	46 U	23 U	**2400**	23 U	470 U	**2200**	24 U	**4.3**	**47 J**	**0.12 J**	**6.5**	**13**	**0.022**	2.7 U	1.3 U
B27APB1F1-111410-A-0.5	0.24 UJ	0.24 UJ	0.24 UJ	0.24 UJ	0.24 UJ	0.48 UJ	0.24 UJ	0.26 UJ	0.24 UJ	4.9 UJ	0.24 UJ	0.25 UJ	NA	NA	NA	NA	NA	NA	NA	NA
B27APB1F2-111410-A-0.5	250 U	250 U	250 U	250 U	250 U	490 U	250 U	**17000**	250 U	5000 U	**16000**	260 U	**8.7**	**140**	**8.9 J-**	**89 J**	**300 J**	**0.52 J-**	2.9 U	1.4 U
B27APB1F2-111410-A-0.5-Z	240 U	240 U	240 U	240 U	240 U	490 U	240 U	**15000**	240 U	5000 U	**14000**	250 U	**8.1**	**130**	**10 J-**	**140**	**660**	**0.65 J-**	3.1 U	1.5 U
B27APB1F4-111510-A-0.5	0.24 U	0.24 U	0.24 U	**0.081 J**	0.24 U	0.48 U	**0.069 J**	0.26 U	0.24 U	4.9 U	0.24 U	0.25 U	**13**	**140**	**1.5**	**26 J+**	**45**	**0.054**	2.6 U	1.3 U
B27APB1F5-111510-A-0.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.25 U	0.27 U	0.25 U	5.0 U	0.25 U	0.26 U	**11**	**210**	**0.55**	**14 J+**	**27**	**0.021 J**	3.1 U	1.6 U
B27APB2BERMNW-111210-A-0.5	49 U	49 U	49 U	49 U	49 U	97 U	49 U	**3000**	49 U	990 U	**2800**	50 U	**12**	**190 J**	**2**	**7.3**	**24**	**0.051**	2.8 U	**0.38 J**
B27APB2BERMW1-111210-A-0.5	0.23 UJ	0.23 UJ	0.23 UJ	0.23 UJ	**0.29 J**	**0.46 J**	**0.2 J**	**0.057 J**	0.23 UJ	4.8 UJ	**0.053 J**	0.24 UJ	NA	NA	NA	NA	NA	NA	NA	NA
B27APB2F2-111710-A-0.5	0.23 U	0.23 U	0.23 U	**0.37**	0.23 U	0.46 U	**0.83**	0.25 U	0.23 U	4.7 U	0.23 U	0.24 U	NA	NA	NA	NA	NA	NA	NA	NA
B27APB2F4-111710-B-2.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.47 U	0.24 U	0.25 U	0.24 U	4.8 U	0.24 U	0.25 U	NA	NA	NA	NA	NA	NA	NA	NA
B27APB3BERME1-111310-A-0.5	0.23 U	0.23 U	0.23 U	**1.4**	0.23 U	0.46 U	**1.5 J**	0.25 U	**0.92**	4.8 U	0.23 U	**4**	**9.6**	**140**	**0.66**	**6.3**	**13**	**0.0092 J**	2.8 U	1.4 U
B27APB3BERME1-111310-A-0.5-Z	0.23 U	**3.2**	0.23 U	**1.8**	0.23 U	0.47 U	**1.3**	0.25 U	**0.12 J**	4.8 U	0.23 U	**4.1**	**11**	**140**	**0.58**	**7.5**	**18**	**0.011 J**	2.7 U	1.4 U
B27APB3F1-111610-A-0.5	0.23 U	**1.9**	0.23 U	**2.2**	0.23 U	0.47 U	**1.7**	0.25 U	**2.4**	4.8 U	0.23 U	**0.93**	**2.7**	**57**	**3.1 J-**	**52**	**24**	**0.035**	2.9 U	1.5 U
B27APB3F2-111610-A-0.5	120 U	**1900**	120 U	**31 J**	120 U	240 U	120 U	130 U	120 U	2500 U	120 U	120 U	**3.3**	**68**	**8.4 J-**	**26**	**60**	**0.029 J**	3 U	1.5 U
B27APB3F2-111610-B-2.5	6.1 U	**89**	6.1 U	**2.8 J**	6.1 U	12 U	6.1 U	6.6 U	6.1 U	120 U	6.1 U	6.4 U	**1.7 J**	**40**	**1.3 J-**	**11**	**9.7**	**0.032**	2.9 U	1.5 U
B27APB3F2-111610-B-5.0	12 U	**400 J**	12 U	**5.4 J**	12 U	24 U	12 U	13 U	12 U	250 U	12 U	13 U	**4.7**	**65**	**1.2**	**9.2**	**15**	**0.01 J**	3.2 U	1.6 U
B27APB3F2-111810-B-7.5	**2.6 J**	**110**	**0.6 J**	**3.2 J**	0.23 U	0.47 U	0.23 U	0.25 U	**0.42**	4.8 U	0.23 U	**1.3**	**6.2**	**77**	**0.83**	**8.2**	**10**	**0.0087 J**	2.9 U	1.4 U
B27APB4BERMN1-111310-A-0.5	0.24 UJ	0.24 UJ	0.24 UJ	0.24 UJ	0.24 UJ	0.49 UJ	0.24 UJ	0.26 UJ	**0.12 J**	5.0 UJ	0.24 UJ	**0.75 J**	NA	NA	NA	NA	NA	NA	NA	NA
B27APB4BERMS1-111310-A-0.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	0.26 U	**1**	4.9 U	0.24 U	**2.6**	**8**	**250**	**3.5**	**17**	**62**	**0.047**	**0.96 J**	1.5 U
B27APB4BERMS2-111310-A-0.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.47 U	0.23 U	0.25 U	0.23 U	4.7 U	0.23 U	0.24 U	**6.1**	**95**	**0.16 J**	**3.8**	**7.4**	**0.0074 J**	2.9 U	1.5 U
B27APB4F2-111610-B-2.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.46 U	**0.093 J**	0.25 U	**0.23**	4.7 U	0.23 U	0.24 U	**2.2 J**	**68**	**0.31 J**	**7.3**	**9.9**	**0.044**	2.7 U	1.4 U
B27APC1BERMN1-111310-A-0.5	48 U	48 U	48 U	48 U	48 U	95 U	48 U	**2700 J**	48 U	970 U	**2500 J**	50 U	**6.7**	**140**	**0.11 J**	**7.3**	**12**	**0.088**	**0.96 J**	**0.28 J**
B27APC1BERMS1-111310-A-0.5	50 U	50 U	50 U	50 U	50 U	99 U	50 U	**2800**	50 U	1000 U	**2600**	51 U	**10**	**110**	**0.058 J**	**5.7**	**9.7**	**0.022**	**1.3 J**	1.6 U
B27APC2BERMNW-111310-A-0.5	230 U	230 U	230 U	230 U	230 U	450 U	230 U	**8100 J**	230 U	4600 U	**7600 J**	240 U	**8.5**	**140**	**0.15 J**	**6.1**	**11**	**0.016 J**	**1.1 J**	1.6 U
B27APC2BERMW1-111310-A-0.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	0.26 U	0.24 U	4.9 U	0.24 U	0.25 U	**7.4**	**120**	**0.13 J**	**4.5**	**11**	**0.023**	**1 J**	1.4 U
B27APC2F2-111610-A-0.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.46 U	0.23 U	0.25 U	**0.099 J**	**4.7**	0.23 U	0.24 U	**5**	**120**	**0.59 J**	**4.9 J+**	**19**	**0.037 J**	3.7 U	**0.27 J**
B27APC3BERME1-111310-A-0.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.46 U	0.23 U	0.25 U	0.23 U	4.7 U	0.23 U	0.24 U	**8.2**	**120**	**0.13 J**	**5**	**9.8**	**0.013 J**	**1 J**	1.5 U
B27APC3BERME1-111810-B-2.5	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.46 U	0.23 U	0.25 U	0.23 U	4.7 U	0.23 U	0.24 U	**7**	**110**	**0.16 J**	**5.3 J+**	**9.3**	**0.014 J**	**1.2 J**	1.4 U
B27APC3BERMN2-111310-A-0.5	120 U	120 U	120 U	120 U	120 U	250 U	120 U	**4600**	120 U	2500 U	**4300**	130 U	**6.7**	**86**	**0.11 J**	**4.5**	**7.1**	**0.018**	2.7 U	1.3 U
B27APC3F1-111510-B-2.5	0.23 U	**0.069 J**	0.23 U	0.23 U	0.23 U	0.47 U	0.23 U	0.25 U	0.23 U	4.8 U	0.23 U	0.24 U	**6.2**	**51**	**0.061 J-**	**5.7**	**6.3**	0.036 U	2.9 U	1.5 U
B27APC3F1-111510-B-5.0	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.47 U	0.24 U	0.25 U	0.24 U	4.8 U	0.24 U	0.25 U	**3.1**	**51**	**0.063 J**	**3.7 J+**	**4.6**	0.031 U	2.8 U	1.4 U
B27APC3F2-111510-A-0.5	62 U	62 U	62 U	62 U	62 U	120 U	62 U	**1300**	62 U	1300 U	**1200**	64 U	**5.5**	**98**	**0.39 J-**	**4.5**	**9.5**	**0.021 J**	2.8 U	1.4 U
B27APC3F2-111510-A-0.5-Z	120 U	120 U	120 U	120 U	120 U	240 U	120 U	**1400**	120 U	2500 U	**1300**	130 U	**5.9**	**120**	**0.42 J-**	**5.2**	**10**	**0.020 J**	3 U	1.5 U
B27APC3F2-111510-B-2.5	6.2 U	6.2 U	6.2 U	6.2 U	6.2 U	12 U	6.2 U	**89**	6.2 U	130 U	**83**	6.4 U	**8.2**	**72**	**0.12 J-**	**5.7**	**7.7**	**0.0063 J**	2.8 U	1.4 U
B27APC4F3-111410-A-0.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.49 U	0.25 U	0.26 U	0.25 U	5.0 U	0.25 U	0.25 U	**4.4**	**100**	**0.11 J**	**3.9 J+**	**14**	**0.062**	3.1 U	**0.18 J**
B27APC4F3-111410-B-2.5	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ	0.5 UJ	0.25 UJ	0.27 UJ	0.25 UJ	5.1 UJ	0.25 UJ	0.26 UJ	NA	NA	NA	NA	NA	NA	NA	NA
B27AWD1-111710-B-2.5[a]	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.49 U	0.24 U	0.26 U	0.24 U	5.0 U	0.24 U	0.25 U	**8.1**	**190**	**6.8**	**43 J+**	**60**	**0.25**	3.7 U	1.9 U
B27AWD1-111710-B-2.5[a]	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.46 U	0.23 U	0.25 U	0.23 U	4.7 U	0.23 U	0.24 U	**3.2**	**110**	**1.7**	**15 J+**	**24**	**0.23**	3.3 U	1.6 U
B27AWD2-111710-A-0.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	0.26 U	0.24 U	4.9 U	0.24 U	0.25 U	**10**	**220**	**3.9**	**39 J+**	**58**	**0.2**	3.5 U	**0.23 J**
B27AWD2-111710-B-2.5	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.48 U	0.24 U	0.26 U	0.24 U	4.9 U	0.24 U	0.25 U	**3.4**	**95**	**0.8**	**31 J+**	**14**	**0.099**	3 U	1.5 U
B27AWD3-111710-A-0.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.49 U	0.25 U	0.26 U	0.25 U	5.0 U	0.25 U	0.25 U	**4.1**	**130**	**2.7**	**40 J+**	**32**	**0.79**	3.2 U	1.6 U
B27AWD3-111710-B-2.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.25 U	0.27 U	0.25 U	5.1 U	0.25 U	0.26 U	**3.9**	**110**	**4**	**45 J+**	**37**	**0.25**	2.7 U	1.4 U
B27A-SB01-40-42-010411	NA	0.23 U	NA	NA	NA	NA	NA	**420**	NA	NA	NA	0.24 U	NA	NA	NA	NA	NA	NA	NA	NA
B27A-SB01-60-62-010411	NA	0.24 U	NA	NA	NA	NA	NA	0.26 U	NA	NA	NA	0.25 U	NA	NA	NA	NA	NA	NA	NA	NA
B27A-SB03-100-102-010511	NA	0.23 U	NA	NA	NA	NA	NA	0.25 U	NA	NA	NA	0.24 U	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

[a] - The 0.5 foot sample from WD1 was mislabeled 2.5 in the field, resulting in two samples labeled 2.5. Neither sample had any elevated concentrations of explosives or metals so no additional research was performed.

mg/kg - milligrams per kilogram

RSL - Regional Screening Level

NA - Not Analysed

J - Detected result is estimated.

U - Undetected at the limit of detection

UJ - Undetected result is estimated.

Bold - Detected result

Highlighted - Result exceeds RSL

Table 5-1
Summary of Laboratory Analytical Results for the Final Extent of Excavation Activities at SWMU B27A

Sample Name		2,4,6-Trinitrotoluene mg/kg	Ammonium Picrate mg/kg	RDX mg/kg
	SSTL	272	916	363
B27A-CTC-C1-0.5	1/7/2011	**0.76**	0.26 U	**7.6**
B27A-CTC-C2-1.0	1/7/2011	**0.22 J**	0.25 U	**4.9**
B27A-B1-BSW-E1-0.75	12/4/2010	0.24 U	**1.9**	0.25 U
B27A-B1-BSW-F1-1.5	12/4/2010	0.24 U	**0.43**	0.25 U
B27A-B1-BSW-SW1-2.5	12/4/2010	0.23 U	0.25 U	0.24 U
B27A-B1-BSW-SW1-2.5Z	12/4/2010	0.25 U	0.26 U	0.25 U
B27A-B1-BSW-SW2-1.0	12/4/2010	0.23 UJ	**1.4 J**	0.24 UJ
B27A-B1-EB-E1-0.75	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-EB-E2-0.75	12/5/2010	0.23 U	0.25 U	0.24 U
B27A-B1-G1-F1-0.75	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-G1-F2-1.5	12/5/2010	0.24 U	**1.5**	0.25 U
B27A-B1-G1-N1-0.25	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-G1-N2-0.75	12/5/2010	0.23 U	0.25 U	0.24 U
B27A-B1-G1-S1-0.75	12/5/2010	0.24 U	**1.5**	**0.14 J**
B27A-B1-G1-W1-0.75	12/5/2010	0.24 U	**8.4**	0.25 U
B27A-B1-G2-E1-0.75	12/5/2010	0.22 U	**62**	0.23 U
B27A-B1-G2-F1-0.75	12/5/2010	0.23 U	0.25 U	**0.16 J**
B27A-B1-G2-F2-1.5	12/5/2010	0.25 U	**2.8**	0.26 U
B27A-B1-G2-N1-0.25	12/5/2010	0.24 U	**17**	0.25 U
B27A-B1-G2-N2-0.75	12/5/2010	0.25 U	**0.53**	0.26 U
B27A-B1-G2-S1-0.75	12/5/2010	0.23 U	**2**	0.24 U
B27A-B1-G3-F1-0.75	12/5/2010	0.25 U	0.27 U	**0.29**
B27A-B1-G3-S1-0.25	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-G3-W1-0.25	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-G4-E1-0.25	12/5/2010	0.24 U	**23**	**0.28**
B27A-B1-G4-F1-0.75	12/5/2010	0.24 U	**1.1**	**0.27**
B27A-B1-G4-S1-0.25	12/5/2010	0.25 U	0.27 U	0.26 U
B27A-B1-NB-N1-0.75	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-NB-N2-0.75	12/5/2010	0.25 U	0.26 U	0.25 U
B27A-B1-NB-N3-0.75	12/5/2010	0.23 U	0.25 U	0.24 U
B27A-B1-NB-N4-0.75	12/5/2010	0.24 U	**5.9**	0.25 U
B27A-B1-NB-N5-0.75	12/5/2010	0.23 U	**3.8**	0.24 U
B27A-B1-SB-51-0.75[a]	12/4/2010	0.23 U	**4.1 J**	0.24 U
B27A-B1-SB-52-0.75[a]	12/4/2010	0.23 U	**0.66 J**	0.24 U
B27A-B1-SB-53-0.75[a]	12/4/2010	0.23 U	**6.8**	**1.3**
B27A-B1-SB-54-0.75[a]	12/4/2010	0.24 U	0.26 U	**0.098 J**
B27A-B1-SB-55-0.75[a]	12/4/2010	2.3 U	**53**	2.4 U
B27A-B1-WB-F1-0.75	12/5/2010	0.23 U	0.25 U	0.24 U
B27A-B1-WB-F2-0.75	12/5/2010	0.23 U	**5.2**	0.24 U
B27A-B1-WB-F3-0.75	12/5/2010	0.24 U	0.26 U	0.25 U
B27A-B1-WB-N1-0.25	12/5/2010	0.24 U	**170**	0.25 U
B27A-B1-WB-N1-0.25-Z	12/5/2010	0.23 U	**150**	0.24 U
B27A-B1-WB-N2-0.5	12/13/2010	0.23 U	**2.6**	0.24 U
B27A-B1-WB-W1-0.75	12/4/2010	0.23 U	**34**	0.24 U
B27A-B1-WB-W1-0.75Z	12/4/2010	0.24 U	**45**	0.25 U
B27A-B1-WB-W2-0.75	12/4/2010	0.23 U	0.25 U	0.24 U
B27A-B2-BNW-F1-0.75	12/3/2010	0.25 U	0.27 U	0.26 U
B27A-B2-BNW-F2-0.75	12/3/2010	0.25 U	0.27 U	0.26 U
B27A-B2-BNW-NW1-0.75	12/3/2010	0.23 U	0.25 U	0.24 U
B27A-B3-EB-E2-2.5	12/5/2010	0.24 U	0.26 U	**0.31**
B27A-B3-EB-E2-6.5	12/5/2010	**0.23 J**	0.26 U	**0.99**
B27A-B3-EB-F1-5.0	12/5/2010	0.23 U	0.24 U	**0.56**
B27A-B3-G1-F1-5.0	12/4/2010	**3.3**	0.26 U	**3**
B27A-B3-G1-N1-1.0	12/4/2010	**1.8**	0.26 U	**1.2**

Table 5-1

Summary of Laboratory Analytical Results for the Final Extent of Excavation Activities at SWMU B27A

Sample Name		2,4,6-Trinitrotoluene mg/kg	Ammonium Picrate mg/kg	RDX mg/kg
	SSTL	272	916	363
B27A-B3-G1-S1-2.5	12/4/2010	0.25 U	0.26 U	**5.2**
B27A-B3-G1-W1-0.5	12/4/2010	0.24 U	0.26 U	**0.35**
B27A-C1-EB-E1-0.75	12/2/2010	**91**	0.26 U	**7.7**
B27A-C1-EB-E1-1.5	12/5/2010	**8.9**	**6.5**	**1.7**
B27A-C1-EB-E2-2.0	12/2/2010	**41**	0.26 U	**22**
B27A-C1-EB-N1-1.25	12/2/2010	**1.4**	0.25 U	**3**
B27A-C1-G1-F1-1.5	12/1/2010	**0.72**	0.26 U	**1.3**
B27A-C1-G1-W1-0.75	12/1/2010	**16 J**	0.27 U	**1.9 J**
B27A-C1-G2-F1-1.5	12/1/2010	**0.078 J**	0.26 U	--
B27A-C1-G2-W1-1.0	12/1/2010	0.24 U	0.26 U	**1.2**
B27A-C1-G3-F1-1.5	12/1/2010	**2.1**	0.26 U	**0.52**
B27A-C1-G3-F2-2.0	12/2/2010	**2**	0.27 U	**4**
B27A-C1-G3-W1-1.75	12/1/2010	0.24 U	0.26 U	**1.6**
B27A-C1-NB-N1-0.75	12/2/2010	**27**	0.27 U	**6.4**
B27A-C1-SB-S1-0.75	12/2/2010	**6.4**	0.27 U	**13**
B27A-C1-SB-S2-0.75	12/2/2010	**0.41**	0.27 U	**6.5**
B27A-C2-NB-E1-0.75	12/3/2010	0.23 U	0.25 U	0.24 U
B27A-C2-NB-N1-0.5	12/3/2010	0.24 U	0.26 U	0.25 U
B27A-C3-EB-E1-1.5	12/3/2010	0.24 U	0.26 U	0.25 U
B27A-C3-EB-E2-5.0	12/3/2010	0.24 U	0.26 U	0.25 U
B27A-C3-EB-F1-3.0	12/3/2010	0.23 U	0.25 U	0.24 U
B27A-C3-EB-F2-6.5	12/3/2010	0.23 U	0.24 U	0.23 U
B27A-C3-F1-18.0	12/13/2010	0.24 U	**280**	0.25 U
B27A-C3-F1-E1-14.0	12/16/2010	0.24 U	0.26 U	0.25 U
B27A-C3-F1-N1-14.0	12/16/2010	0.25 U	**260**	0.26 U
B27A-C3-F1-S1-14.0	12/17/2010	0.25 U	**250**	2.5 U
B27A-C3-F2-18.0	12/17/2010	0.25 U	**600**	0.25 U
B27A-C3-F2-N1-14.0	12/17/2010	0.24 U	**170**	0.25 U
B27A-C3-F2-S1-14.0	12/17/2010	0.24 U	**400**	0.25 U
B27A-C3-F2-W1-14.0	12/17/2010	0.24 U	0.25 U	0.25 U
B27A-B1B2-PIPE-1.5	12/4/2010	0.24 U	**73**	0.25 U
B27A-B1B2-PIPE-2.5	12/5/2010	0.23 U	0.25 U	0.24 U
B27A-B2B4-PIPE-2.5	12/10/2010	**0.11 J**	0.25 U	0.25 U
B27A-B3B4-PIPE-1.5	12/4/2010	0.24 U	0.25 U	**0.13 J**
B27A-C3C4-PIPE1-2.0	12/10/2010	0.23 U	0.25 U	0.24 U
B27A-C3C4-PIPE2-2.0	12/10/2010	0.24 U	0.26 U	0.25 U

Notes:

[a] - The portion of the sample IDs labeled as 51, 52, 53, 54, and 55 were assigned incorrectly by the laboratory. The correct sample IDs should be S1, S2, S3, S4, and S5, respectively.

mg/kg - milligrams per kilogram

SSTL - Site Specific Target Level

J - Detected result is estimated.

U - Undetected at the limit of detection

Bold - Detected result

Highlighted - Result exceeds SSTL

APPENDIX A
Photo Documentation

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November 2010 sampling location B1-S3, located on the southwestern corner of Pit B1

November 2010 sampling location B1-W1, located on western side of Pit B1

November 2010 sampling location C1-N1, located on the north side of Pit C-1

November 2010 sampling location CTC1, collected next to the concrete trough extending from Bldg. 103-16 to the C Pits


Explosives staining observed during
December 2010 excavation of Pit C3


Explosives staining observed during
December 2010 excavation of Pit C3

December 2010 excavation of Pit C3, facing south

December 2010 removal of pipe connecting Pits B2 and B4

December 2010 trench dug beneath pipe connecting Pits B3 and B4, facing west


January 2011 - Final restoration and backfill of B Pits, facing northwest

January 2011 - Final restoration and backfill of C Pits, facing west.