Contract No. F41624-01-D8546
Delivery Order No. 0010

CLOSURE REPORT
FOR IRP SITE 12,
FORMER NORTON AIR FORCE BASE,
SAN BERNARDINO, CALIFORNIA

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SAN BERNARDINO, CALIFORNIA

OCTOBER 2004

PREPARED FOR:
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CERTIFICATION

THIS DOCUMENT WAS PREPARED UNDER THE DIRECTION AND SUPERVISION OF A QUALIFIED REGISTERED GEOLOGIST

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APPENDICES

Appendix A Laboratory Analytical Results
Appendix B Photographs

LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEE	Air Force Center For Environmental Excellence
AOC	area of concern
bgs	below ground surface
CDM	Camp, Dresser, and McKee Federal Programs
CoC	chain-of-custody
COPC	contaminant of potential concern
CS	confirmation study
DO	delivery order
DQO	data quality objective
EPA	Environmental Protection Agency
EPC	exposure point concentration
ESI	expanded source investigation
FS	field study
FSP	field sampling plan
GPS	global positioning survey
HI	hazard index
IC	institutional control
ID	identification
IRP	Installation Restoration Program
IWTP	Industrial Waste Treatment Plant
MDL	method detection limit
µg/dL	micrograms per deciliter
mg/kg	milligram per kilogram
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spike duplicate
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PRG	preliminary remediation goal
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RL	reporting limit
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
STLC	soluble threshold limit concentration
SVOC	semivolatile organic compound
TCG	target clean-up goal
TPH	total petroleum hydrocarbons
VOC	volatile organic compound
WP	work plan

1.0 INTRODUCTION

This document presents the closure report for IRP Site 12, at the former Norton Air Force Base (AFB), San Bernardino, California. This report documents the activities performed for removal of contaminated soil and site restoration. The report also presents analytical results from confirmation soil samples collected at Site 12 after soil removal, and offers conclusions with respect to the current environmental condition of Site 12. This document is being prepared by Earth Tech under the direction of the Air Force Center for Environmental Excellence (AFCEE), and under Delivery Order (DO) 0010 as part of the Contract F41624-01-D8546.

1.1 SITE LOCATION AND DESCRIPTION

Site 12 is situated in the south-central portion of the base in an area that has been developed into a golf course and was formerly used as a waste pit (Figure 1). The site has been identified as a waste pit containing chemical and construction debris waste, with reported incineration of the waste within the pit itself (CDM Federal, 2003). It is thought that use of the pit occurred prior to 1959 and the construction of the golf course. Ash material was observed in the vicinity of the suspected waste pit; however, geophysical investigation and soil borings/sampling did not locate pit material (Earth Tech, 2003a).

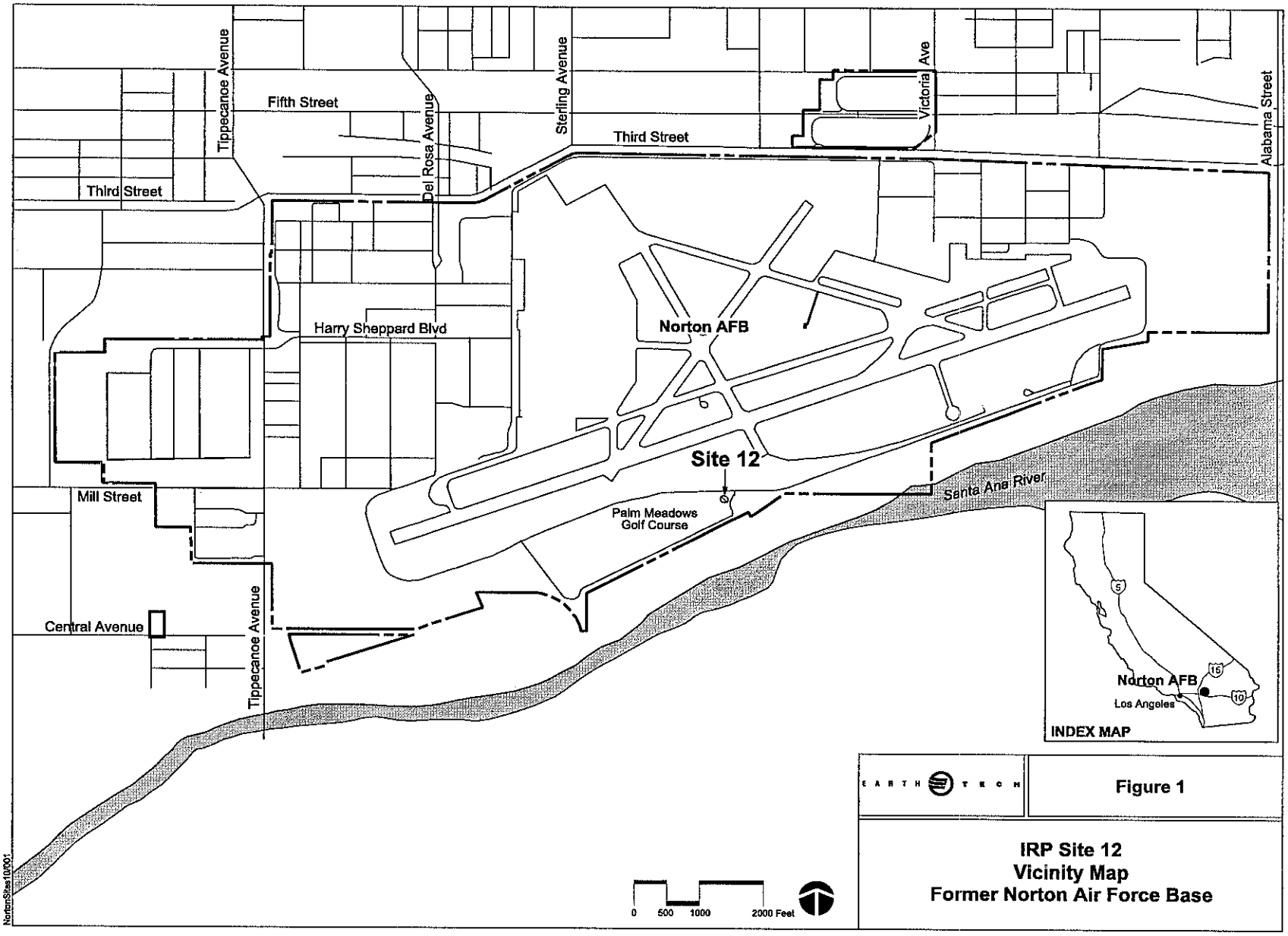
1.2 SITE BACKGROUND

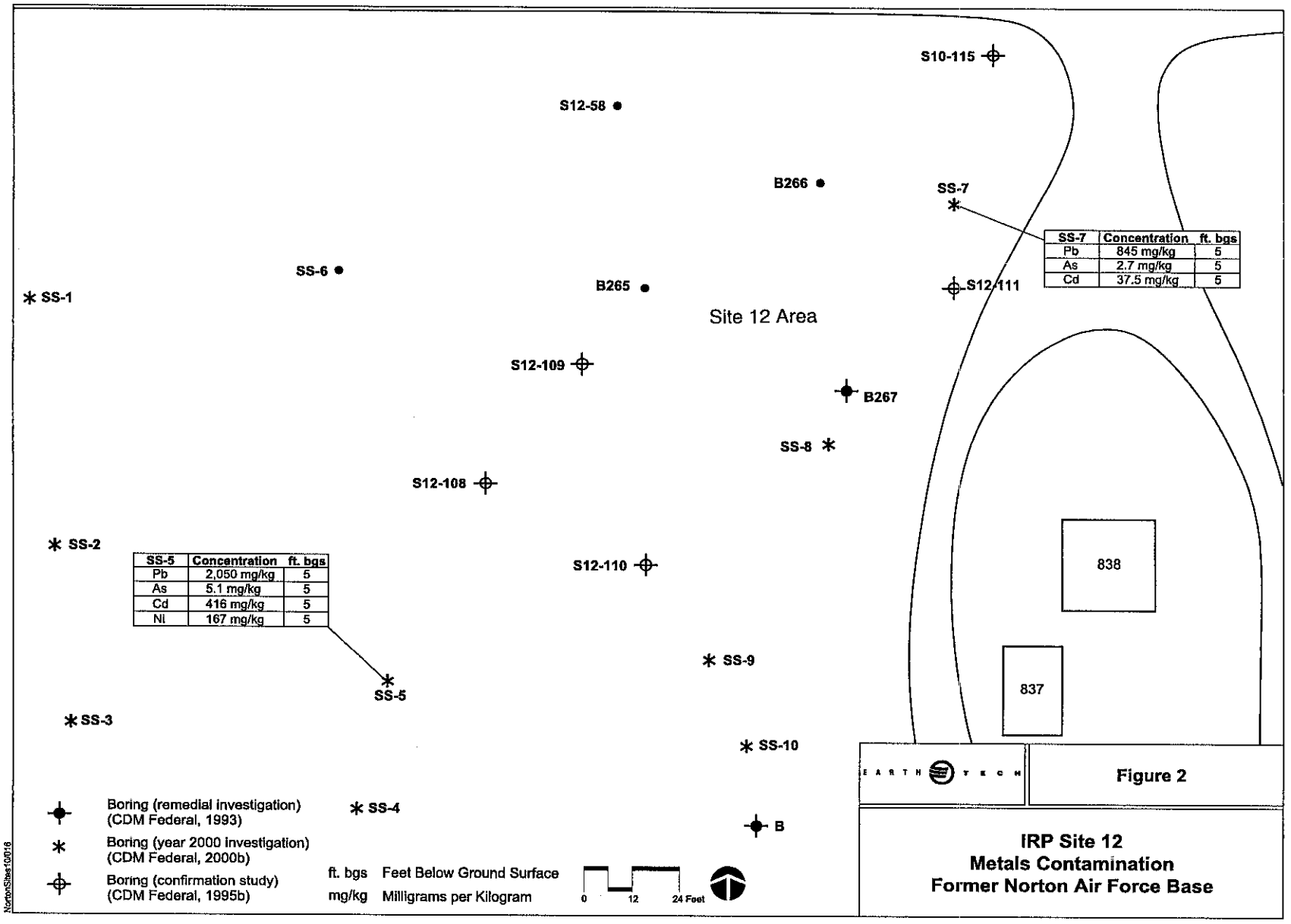
Soil sampling conducted during previous investigations indicated elevated concentrations of the metals arsenic, cadmium, lead, and nickel in two boring locations sampled at 5 feet below ground surface (bgs). Cadmium (maximum of 416 milligrams per kilogram [mg/kg]), lead (maximum of 2,050 mg/kg), and nickel (maximum of 167 mg/kg) concentrations exceeded their respective preliminary remediation goals (PRGs) in one or both of the locations. Arsenic (maximum of 5.1 mg/kg) concentrations exceeded background levels at both locations. These samples were collected from 5 feet bgs (CDM Federal, 2000). These two locations were identified as samples SS-5 and SS-7 (Figure 2). Because of their point-source-like results, these sites were deemed "hot spots."

Risk analysis using a residential reuse scenario indicated that human health risks for metals exceeded the acceptable levels at the "hot spots." The combined child/adult soil excess cancer risk was found to be 8.9×10^{-5} for residential exposure. In addition, the child non-cancer Hazard Index (HI) was predicted at 2.8, and the child blood lead level was predicted at 12.8 micrograms per deciliter (ug/dL). These values indicated that further action was necessary (CDM, 2003). While the anticipated use for this site is industrial, the Air Force decided to clean the site to residential/unrestricted levels to allow transfer of the property with no encumbrances. The decision was made to remove the contaminated soil in and around "hot spots," as defined by the Action Memorandum (Earth Tech, 2003b). A work plan and field sampling plan (FSP) was prepared to describe the activities to be performed as well as the analytical data required to determine the final site conditions (Earth Tech, 2003a). The work plan and FSP were approved by the regulatory community, and, subsequently, the soil removal began on March 8, 2004. Final confirmation sampling occurred on April 27, 2004, and site restoration began on June 11, 2004.

1.3 REMEDIAL OBJECTIVES

As presented in the work plan, the objectives of the closure of Site 12 included removal of the soil with metals concentrations exceeding residential PRGs or background concentrations. The field study (FS) (CDM Federal, 2003) indicates that removal of the soil provides long-term effectiveness and permanence by eliminating the contamination from the site and avoids the need for institutional controls (ICs). Thus, this report details the activities undertaken to attain these objectives, and presents the analytical data for determining that this site requires no further remedial actions.


Tippecanoe Avenue
Fifth Street
Del Rosa Avenue
Sterling Avenue
Victoria Ave
Alabama Street
Third Street
Third Street
Harry Sheppard Blvd
Norton AFB
Site 12
Santa Ana River
Palm Meadows
Golf Course
Mill Street
Central Avenue
Tippecanoe Avenue
Norton AFB
Los Angeles
INDEX MAP
0 500 1000 2000 Feet
EARTH TECH
Figure 1
IRP Site 12
Vicinity Map
Former Norton Air Force Base
NortonSites10/001



SS-7	Concentration	ft. bgs
Pb	845 mg/kg	5
As	2.7 mg/kg	5
Cd	37.5 mg/kg	5

SS-5	Concentration	ft. bgs
Pb	2,050 mg/kg	5
As	5.1 mg/kg	5
Cd	416 mg/kg	5
Ni	167 mg/kg	5

2.0 REMEDIAL ACTION IMPLEMENTATION

Site 12 is situated on the eastern edge of the golf course on the former Norton Air Force Base. It consisted of two "hot spots," soil sample locations SS-5 and SS-7, with elevated metal concentrations in the soil. It was used as a waste pit containing chemical and construction debris waste, with reported incineration of the waste in the pit

The remedial action for the site began on March 8, 2004, and consisted of the excavation and removal of soil contaminated with metals The following sections will describe the key activities that were performed during the remedial process. Also, analytical data from confirmation soil samples collected after the soil removal will be presented. Key activities included:

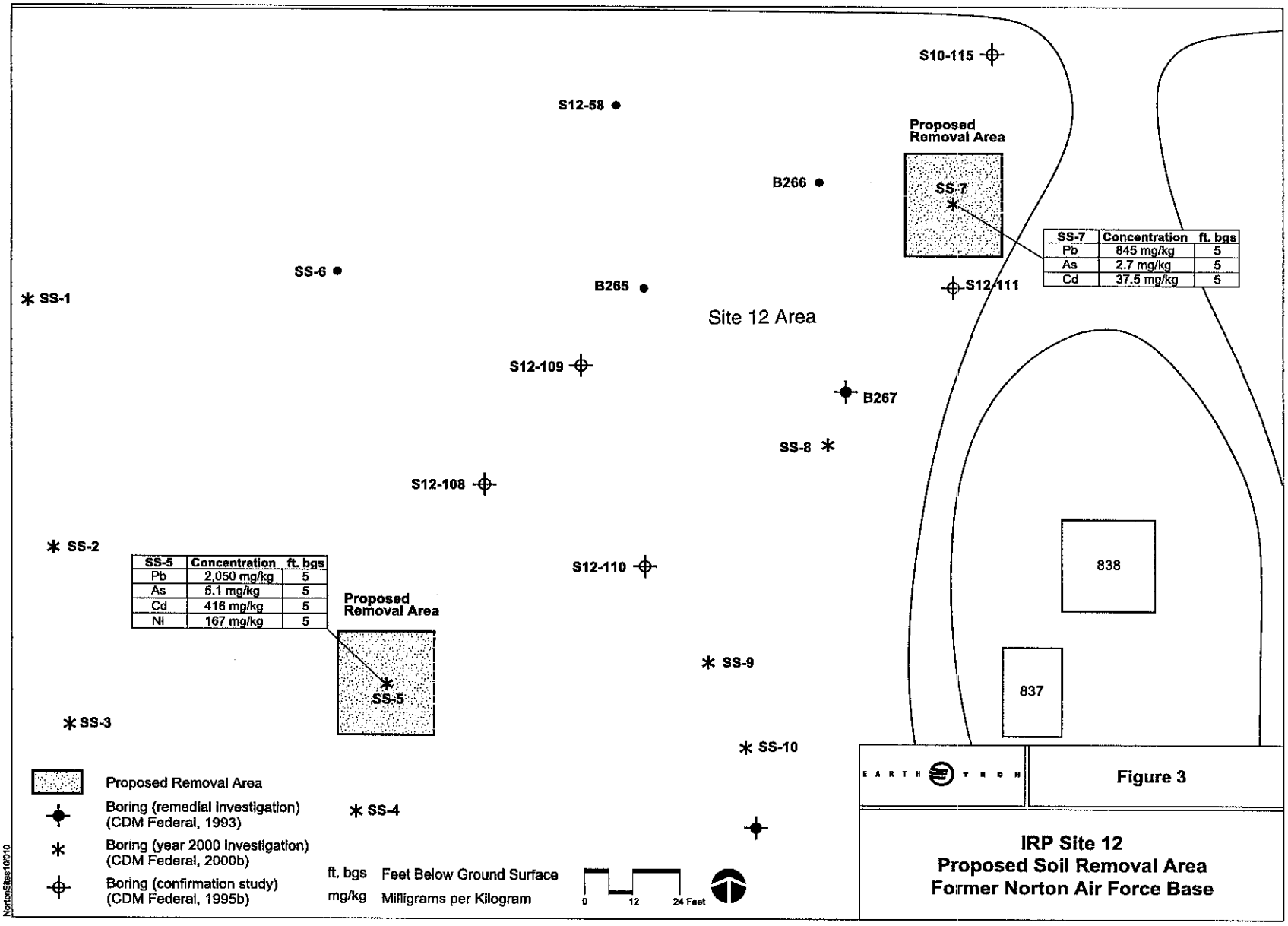
- Locating previously defined contaminated areas
- Providing site control and adequate dust suppression measures
- Removal of surface and shallow subsurface soil, down to 5 feet bgs, within previously defined contaminated areas, and extending the excavation area as necessary
- Locating potential sampling locations within the excavations, collecting confirmation soil samples at each location, and analyzing for metals to verify that contaminated soil has been removed
- Filling in the excavation with clean soil and returning the topography to as close to pre-excavation as possible, and restoring the surface suitable for golf course use
- Disposing of contaminated soil, sampling equipment, and personal protective equipment (PPE) waste in approved disposal facilities.

2.1 AREAS OF CONTAMINATION

Numerous surface and shallow subsurface (5 feet bgs) soil samples were collected prior to excavation The analysis of these samples indicated that two small areas were impacted by nickel, lead, cadmium, and arsenic. Figure 2 displays the locations where metal concentrations exceeded the cleanup goals and Figure 3 shows the areas that were identified for soil removal in the Work Plan and FSP (Earth Tech, 2003a).

Prior to removal of the contaminated soil, the locations of "hot spots," areas of elevated metal concentrations, were identified. Essentially each area was assigned a name based upon the soil sample taken that identified the center of the "hot spot." Soil sample SS-5 is on the southwestern side of Site 12, and Soil Sample SS-7 is in the northeastern area of Site 12. The contractor that conducted characterization sampling constructed a site map based upon measurements relative to existing structures and trees. The structures and trees have remained unchanged, so Earth Tech was able to locate the sampling points and "hot spots" based upon the previous contractor's field map

Once the previous sampling locations were identified, wooden stakes were set at approximately 12.5 feet in each cardinal direction from the centered location. Thus a square was defined with dimensions of 25 feet by 25 feet, in accordance with the work plan It was assumed that this would be sufficient to encompass the soil containing metals contamination.



SS-7	Concentration	ft. bgs
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SS-5	Concentration	ft. bgs
Pb	2,050 mg/kg	5
As	5.1 mg/kg	5
Cd	416 mg/kg	5
Ni	167 mg/kg	5

2.2 REMOVAL OF SOIL

2.2.1 Removal and Confirmation Sampling

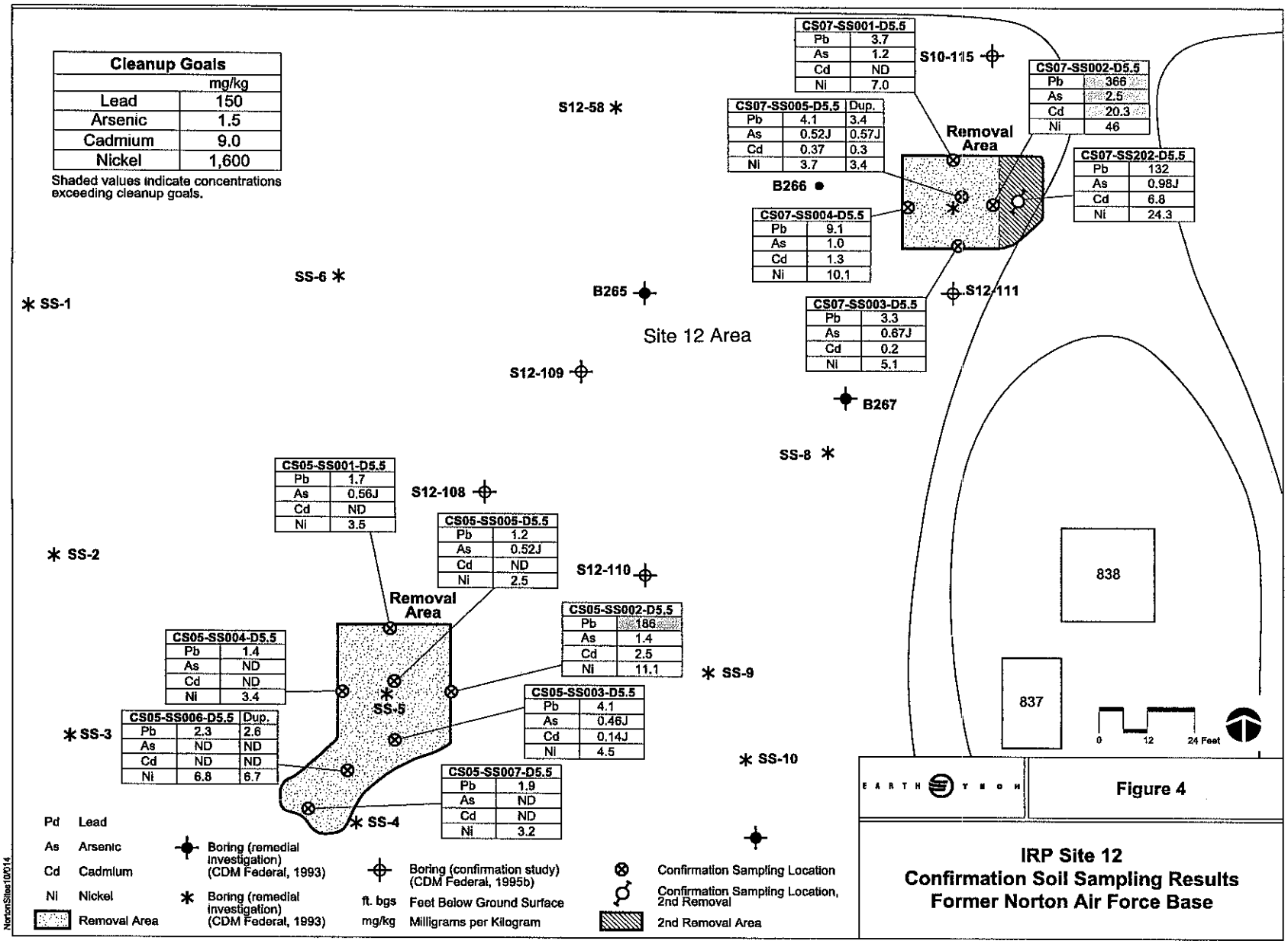
SS-5 The previous sampling location identified as SS-5 was used as a centering point for identifying the potentially contaminated soil area. Soil was removed from the area around and including point SS-5. The excavation at SS-5 was approximately 25 feet by 25 feet square by 5.5 feet deep. However, upon completion of soil removal, it was noticed that a bowl-shaped ash layer was present at approximately 3-4 feet bgs along the south wall of the excavation. It was concluded that this was likely part of the burn pit mentioned in previous studies Therefore, additional soil was removed in an attempt to follow the layer and remove it from the subsurface As Figure 4 shows, the south wall extended southwesterly for approximately 25 feet and the depth varied from 5.5 feet to 6.5 feet bgs Excavation was halted when it visually appeared that the ash layer had been completely removed The final shape of the excavation is shown in Figure 4. Photos have also been included in Appendix B

After removal of soil at SS-5 was complete, seven confirmation samples were collected at the bottom of the excavation. This was two more than originally planned since the size of the excavation was increased. Four of the sampling locations were centrally located at the intersection of the excavation floor and wall. One of the locations was placed in the center of the square excavation and approximated at the original characterization sample SS-5. The other two samples were collected along the center floor of the extended excavation as shown in Figure 4. Confirmation samples were collected on March 11 and 16, 2004. Analytical results are discussed in Section 2.2.1.1.

SS-7 The previous sampling location identified as SS-7 was used as a centering point for identifying the potentially contaminated soil area. Soil was removed from the area around and including point SS-7 The excavation at SS-7 was approximately 25 feet by 25 feet square by 5 5 feet deep and is depicted in Figure 4. A photographic record has been provided in Appendix B

After removal of soil at SS-7 was complete, five confirmation samples were collected at the bottom of the excavation in accordance with the work plan. Four of the sampling locations were centrally located at the intersection of the excavation floor and wall. One of the locations was placed in the center of the square excavation and approximated the original characterization sample SS-7. Analytical results from the confirmation samples (as discussed in Section 2.2.1.1) indicated that one sample, CS07-SS002-D5.5, contained a lead concentration of 366 mg/kg, which exceeds the cleanup goal. Thus additional soil was removed in an easterly direction from the east wall. Immediately following the start of the new excavation, it was noticed by field personnel that a bowl-shaped ash layer was present at approximately 3.5 to 4.5 feet bgs along the east wall of the excavation As Figure 4 shows, the eastern wall was extended easterly for approximately 10 feet with the depth variable from 5 5 feet to 6.5 feet bgs. Excavation was halted when it visually appeared that the ash layer had been completely removed Upon completion of the excavation, a final confirmation sample was collected just to the east and adjacent to CS07-SS002-D5.5. Analytical results from this soil sample indicated that lead concentration had been reduced to well below the cleanup goal.

Soil samples were collected using sterile disposable plastic shovels The soil was scooped into a sterile disposable plastic bowl, thoroughly mixed, and then poured into a sterile glass jar. Each jar was labeled with the sample identification number, placed in a plastic bag, then placed into an ice-filled cooler for shipment to the laboratory. A chain-of-custody (CoC) form was properly filled out and accompanied each cooler to the laboratory. Sample identification numbers were assigned sequentially based on the site and number designation of the area being sampled


Cleanup Goals
mg/kg
Lead 150
Arsenic 1.5
Cadmium 9.0
Nickel 1,600
Shaded values indicate concentrations exceeding cleanup goals.
CS07-SS001-D5.5
Pb 3.7
As 1.2
Cd ND
Ni 7.0
S10-115
CS07-SS002-D5.5
Pb 366
As 2.5
Cd 20.3
Ni 46
S12-58
CS07-SS005-D5.5 Dup.
Pb 4.1 3.4
As 0.52J 0.57J
Cd 0.37 0.3
Ni 3.7 3.4
Removal Area
CS07-SS202-D5.5
Pb 132
As 0.98J
Cd 6.8
Ni 24.3
B266
CS07-SS004-D5.5
Pb 9.1
As 1.0
Cd 1.3
Ni 10.1
SS-6
B265
S12-111
SS-1
CS07-SS003-D5.5
Pb 3.3
As 0.67J
Cd 0.2
Ni 5.1
Site 12 Area
S12-109
B267
SS-8
CS05-SS001-D5.5
Pb 1.7
As 0.56J
Cd ND
Ni 3.5
S12-108
CS05-SS005-D5.5
Pb 1.2
As 0.52J
Cd ND
Ni 2.5
SS-2
S12-110
Removal Area
CS05-SS002-D5.5
Pb 186
As 1.4
Cd 2.5
Ni 11.1
CS05-SS004-D5.5
Pb 1.4
As ND
Cd ND
Ni 3.4
SS-9
838
SS-5
CS05-SS003-D5.5
Pb 4.1
As 0.46J
Cd 0.14J
Ni 4.5
CS05-SS006-D5.5 Dup.
Pb 2.3 2.6
As ND ND
Cd ND ND
Ni 6.8 6.7
SS-3
837
0 12 24 Feet
SS-10
CS05-SS007-D5.5
Pb 1.9
As ND
Cd ND
Ni 3.2
SS-4
Pd Lead
As Arsenic
Cd Cadmium
Ni Nickel
Removal Area
Boring (remedial investigation) (CDM Federal, 1993)
Boring (remedial investigation) (CDM Federal, 1993)
Boring (confirmation study) (CDM Federal, 1995b)
ft. bgs Feet Below Ground Surface
mg/kg Milligrams per Kilogram
Confirmation Sampling Location
Confirmation Sampling Location, 2nd Removal
2nd Removal Area
EARTH TECH
Figure 4
IRP Site 12
Confirmation Soil Sampling Results
Former Norton Air Force Base
NortonSites10/01/4

2.2.1.1 Analytical Results

SS-5 There were eight confirmation samples, including one duplicate, collected in the area around SS-5 Sample CS05-SS002-D5.5 contained the greatest concentration of lead at a maximum of 186 mg/kg, arsenic at a maximum concentration of 1 4 mg/kg, cadmium at a maximum concentration of 2.5 mg/kg, and nickel at a maximum concentration of 11.1 mg/kg. Only lead marginally exceeded the cleanup goal of 150 mg/kg. Figure 4 shows the sampling locations and associated analytical results

SS-7 There were six confirmation samples collected, including one duplicate, in the area around SS-7 after the excavation was initially completed Sample CS07-SS002-D5.5 contained the maximum concentrations for each of the contaminants of concern. Lead, arsenic, cadmium, and nickel were each detected at concentrations of 366 mg/kg, 2.5 mg/kg, 20 3 mg/kg, and 46 mg/kg, respectively The lead, arsenic, and cadmium concentrations all exceeded the cleanup goals Thus additional soil was removed as described in Section 2.2.1. At completion of the second removal, a final confirmation sample was collected slightly east of CS07-SS002-D5.5 on the floor of the excavation. Analytical results indicate that none of the contaminants of concern has concentrations exceeding their respective cleanup goals.

Table 1 lists the sample identification numbers and analytical results for each of the confirmation samples collected after the soil was removed. Actual laboratory reports are included in Appendix A.

Table 1. Analytical Results from Confirmation Soil Samples

Sample ID	Sample Date	Nickel (mg/kg)	Lead (mg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)
SS-5					
12-CS05-SS001-D5.5	3/11/2004	3.5	1.7	0.56B	ND
12-CS05-SS002-D5.5	3/11/2004	11.1	186	1.4	2.5
12-CS05-SS003-D5.5	3/11/2004	4.5	4 1	0 46B	0.17B
12-CS05-SS004-D5 5	3/11/2004	3.4	1.4	ND	ND
12-CS05-SS005-D5 5	3/11/2004	2.5	1.2	ND	ND
12-CS05-SS006-D5.5	3/16/2004	6.8	2.3	ND	ND
12-CS05-SS106-D5.5 (DUP)	3/16/2004	6.7	2.6	ND	ND
12-CS05-SS007-D5 5	3/16/2004	3.2	1.9	ND	ND
SS-7					
12-CS07-SS001-D5.5	3/11/2004	7	3.7	1.2	ND
12-CS07-SS002-D5.5 (Removed)	3/11/2004	46	366	2.5	20.3
12-CS07-SS202-D5.5	4/27/2004	24.3	132	0.98	6.8
12-CS07-SS003-D5.5	3/11/2004	5.1	3.3	0.67B	0.2
12-CS07-SS004-D5 5	3/11/2004	10.1	9.1	1.0	1.3
12-CS07-SS005-D5.5	3/11/2004	3.7	4.1	0.52B	0.37
12-CS07-SS105-D5.5 (DUP)	3/11/2004	3.4	3.4	0.57B	0.3

Note: Shaded values indicate those concentrations that exceed clean up goals
DUP = duplicate sample
B = estimated value
mg/kg = milligram per kilogram
ND = not detected

Table 2 shows the target cleanup goals for Site 12.

Table 2. Contaminants of Concern and Target Cleanup Goals

Contaminant of Potential Concern	Cleanup Goal (mg/kg)	Rationale
Lead	150	California Modified Residential PRGs
Nickel	1600	U.S. EPA Region 9 Residential PRGs
Arsenic	1.5*	Background at Norton
Cadmium	9.0	California Modified Residential PRGs

Note: * Based on background levels of arsenic at Norton AFB.
EPA = Environmental Protection Agency
mg/kg = milligrams per kilogram
PRG = preliminary remediation goal

2.3 QUALITY CONTROL/QUALITY ASSURANCE

Quality assurance/quality control (QA/QC) reviews of the laboratory analytical data discussed above were performed as specified in the QA/QC section of the work plan (Earth Tech, 2003a). The laboratory data were reviewed by the Earth Tech QA/QC manager to ensure compliance with the QA/QC specifications. The data were reviewed for conformance procedures, effort levels, acceptance limits, and any corrective actions required. These procedures were followed to ensure that the data quality objectives (DQOs) as detailed in the work plan (Earth Tech, 2003a) were met. The data collected during the field investigation are being used to document the soil conditions at Site 12 now that the remedial activities have been completed.

Based on the results of the validation, none of the samples was classified as unusable. The samples identified as 12-CS05-SS006-D5.5 and 12-CS07-SS005-D5.5 and their duplicates were analyzed for arsenic, nickel, lead, and cadmium, and the results were in good agreement.

No ambient or equipment rinsate samples were collected since the sampling equipment consisting of plastic scoops and plastic bags were disposed after each soil sample was collected.

Field activities and other pertinent information were documented in a waterproof, permanently bound field logbook with consecutively numbered pages. Information was entered with waterproof black ink, and signed by the person recording the information. Recorded information in the logbook includes the following, where appropriate:

- Names of each person on the field team along with a field title.
- Weather conditions and other environmental conditions
- General description of daily field activities and associated times of occurrence
- Estimates of quantity of soil removed
- Date of entry, collection location, time, and identification for all samples collected.

All samples had sample identification labels attached immediately after the sample had been collected. Each label displayed the pertinent information about the sample, including the identification number, the date and time of collection, identification of the sample collector, the sample matrix, preservatives used, and the required analyses.

CoC procedures were used to document and identify each sample, its handling, and possession, including the time from collection through the arrival at the laboratory for analysis. The CoC forms clearly identified the project name, the samplers or sample collectors, the sample ID, date and time of collection, the matrix, numbers and types of containers, and the analyses required. In addition, each CoC provided sufficient signature spaces to properly account for each transfer point and the person responsible. A laboratory signature space was provided to show acceptance of the samples by the laboratory. After the samples and CoCs were placed in ice-filled coolers, custody seals consisting of strips of adhesive paper were used to demonstrate that the samples had not been tampered with.

2.4 WASTE MANAGEMENT

Management of waste soil produced during the removal activities was performed in accordance with regulatory requirements. The amount of waste generated and handled was minimized during all phases of the work performed All waste soil was transported off site within 45 days of removal. For Site 12, approximately 560 cubic yards of soil was removed from the two excavations; however, soil from each excavation was segregated into separate piles for the purpose of waste profiling

After the removal of soil was complete, profile samples were collected from each of the soil piles. Soil from at least six separate locations on each pile was collected in a plastic bag and thoroughly mixed. A sample jar was then filled with the mixed soil. This was designated the profile for that particular soil pile. Since there were two soil piles, a total of two profile samples were collected. Profile samples were analyzed for oil and grease, perchlorate, metals, hexavalent chromium, total petroleum hydrocarbons, and volatile organic compounds (VOCs).

Analytical results indicated that the sample collected from the SS-7 soil pile had a soluble threshold limit concentration (STLC) of 7.3 milligrams per liter (mg/L) (l) for lead, thus exceeding the regulatory limit of 5 mg/L. The soil from this pile was transported under hazardous waste manifests to Chemical Waste Management in Kettleman City, California, where it was properly disposed

Analytical results from the sample collected from the SS-5 soil pile did not indicate any chemicals exceeding their respective regulatory disposal limits, thus the soil from this pile was taken to a local landfill where it was used as daily cover material.

All other wastes, including disposable sampling equipment and PPE items, were bagged and properly disposed.

2.5 SITE RESTORATION

Site restoration occurred following excavation, removal of waste soil, and confirmation sampling Clean backfill was used to return the excavations to grade. Since the site was mostly sand before the excavation, little compaction was needed. The clean backfill was leveled to as close to the original topography as possible The underground sprinkler system was restored and the soil hydroseeded. The backfilling and site restoration commenced on June 21 and was completed on August 9, 2004.

3.0 REMEDIAL ACTION PERFORMANCE

The following sections summarize and discuss the effectiveness of the remedial actions performed at Site 12 They provide data regarding the soil removal action and confirmation sampling results, and an evaluation of achievement of the cleanup objectives as well as compliance with regulatory requirements.

3.1 SOIL REMOVAL RESULTS

The two excavations at Site 12 yielded approximately 560 cubic yards or 840 tons of waste soil. The soil was profiled and disposed at appropriate landfills Figure 4 shows the configuration of the two excavations. The final dimensions of the excavations varied from the original proposal in that additional soil was removed as a result of either contaminant of concern concentrations exceeding cleanup goals, or finding buried ash material during the excavation process The first removal area, identified as SS-5, was extended to the south-southwest past its original southern boundary approximately 25 feet. The extension was based on visually discovering a thin bowl-shaped ash layer below the ground surface. It was concluded that this was likely a remnant of the burn pit discussed in previous documents (CDM, 2003). The total depth of removal throughout the excavation varied from approximately 5.5 feet bgs to 6.5 feet bgs. No ash material appeared to remain either in the walls or the floor of this excavation.

The second removal area, identified as SS-7, was initially excavated to a depth of 5 5 to 6 feet bgs, and its shape was approximately square with sides of 25 feet in length After confirmation sample analytical results were reviewed, it was decided to remove more soil based on a relatively high concentration of lead found in one sample. The excavation was extended to the east approximately 10 feet from the original east wall. Immediately following the start of the second removal, a thin bowl-shaped ash layer was observed. Soil removal continued until the ash layer was no longer visible The total depth of this excavation varied from approximately 5.5 to 6.5 feet bgs.

It is likely that the metals contamination found in the two areas SS-5 and SS-7 is a direct result of the burned waste found in the excavations Based on the results, as the ash and other burned material was removed, metals contamination was reduced to levels at or below residential PRGs or background levels.

3.1.1 Confirmation Sampling Results

SS-5 A total of eight confirmation soil samples, including one duplicate, were collected from the bottom of the excavation around SS-5 when soil removal was completed. A total of four samples, including one duplicate, were collected along the center of each wall where the floor and the wall of the excavation intersects. A total of 3 samples were collected from the excavation floor. Of the contaminants of concern for this area, only the metal lead was detected in one sample (CS05-SS002-D5.5) at a concentration of 186 mg/kg, thus slightly exceeding the cleanup goal of 150 mg/kg (see Figure 4). This sample was collected at the intersection of the eastern wall and floor of the excavation. The eastern extent of the excavation was determined by the absence of any observable ash or burn material, and the presence of apparently clean native material. The slightly elevated concentration of lead in this sample may be a result of remnant amounts of ash or burn material that was removed west of this location. No other contaminants of concern had concentrations exceeding cleanup goals.

SS-7 A total of six confirmations soil samples, including one duplicate, were collected from the bottom of the excavation around SS-7 when soil removal was completed A total of five samples, including one duplicate, were collected along the center of each wall where the floor and the wall of the excavation

intersects One sample was collected from the center of the excavation floor. The sample collected from the east wall/floor intersection (CS07-SS002-D5.5) had detections of lead at 366 mg/kg, arsenic at 2.5 mg/kg, and cadmium at 20.3 mg/kg, all exceeding their cleanup goals of 150 mg/kg, 1.7 mg/kg, and 9.0 mg/kg, respectively Additional soil was removed from the east wall and floor, with the excavation ultimately extending approximately 10 feet further east It was noted that a thin bowl-shaped ash layer became visible as soon as addition excavation activities were commenced Excavation continued until the ash layer was apparently eliminated from the subsurface. A final confirmation sample was collected slightly east of CS07-SS002-D5.5 and analyzed for the contaminants of concern. None of the contaminants of concern was detected at concentrations that exceed cleanup goals

3.2 REMEDIAL ACTION EFFECTIVENESS

The purpose of this removal action was to remove soil in order to reduce concentrations of the metals lead, arsenic, cadmium, and nickel to levels at or below established cleanup goals, or in this instance, residential PRGs or established background values Based upon the historical investigations and data from the this remedial action, it appears that the metals contamination found at Site 12 was a direct result of disposal and burning of various materials in one or more shallow pits This remedial action was successful in locating the burn material and removing it to the extent that only native, uncontaminated soil remains.

The use of analytical data from confirmation samples is a definitive way to measure the effectiveness of the removal action. For Site 12, confirmation soil sample data at area SS-7 clearly show that soil removal has reduced the concentrations of all contaminants of concern to below their respective cleanup goals. Confirmation soil sample data at area SS-5 also show that soil removal has reduced the concentrations of all but one of the contaminants of concern to below their respective cleanup goals. The one exception is lead found in one sample at a concentration slightly exceeding the California modified residential PRG.

It is anticipated that this site and surrounding area will be developed commercially in the near future, hence any future residential use is unlikely. Additionally, the single remaining lead contamination that slightly exceeds the cleanup goal is currently beneath 5-6 feet of clean backfill, and thus will not contribute a risk in either a residential or commercial reuse scenario. Based on these conclusions, it is recommended that Site 12 be closed and no further action taken

4.0 REFERENCES

Air Force Center For Environmental Excellence, 2001 *Guidance For Contract Deliverables: Quality Assurance Project Plan*, Version 3 1, August.

CDM Federal Programs Corporation, 2000. *IRP Sites 10 and 12, Additional Soil Characterization in Support of the Basewide Feasibility Study, Former Norton AFB, San Bernardino, California*. November

_____, 2003 *Final Basewide Feasibility Study for Former Norton Air Force Base, San Bernardino, California*. March.

Earth Tech Inc., 2001. *Final Sampling and Analysis Plan for Basewide Groundwater Monitoring Program and Water Supply Contingency Policy Groundwater Sampling Program, Norton Air Force Base*. May

_____, 2003a. *Non-Time Critical Removal Action Work Plan and Field Sampling Plan IRP Sites 10 and 12, Norton Air Force Base, California*. August.

_____, 2003b. *Final Action Memorandum for IRP Sites 10 and 12 Former Norton Air Force Base, San Bernardino, California*. November.

U.S. Environmental Protection Agency (EPA), 2000. *Preliminary Remediation Goals*. November.

APPENDIX A

LABORATORY ANALYTICAL RESULTS

SITE 12
Excavation at SS-5

	Base		NORTN			NORTN			NORTN			NORTN			NORTN			NORTN			NORTN			NORTN		
	Site		12			12			12			12			12			12			12			12		
	Point		12-CS05			12-CS05			12-CS05			12-CS05			12-CS05			12-CS05			12-CS05			12-CS05		
	Sampling Date		3/11/2004 11:20			3/11/2004 11:25			3/11/2004 11:30			3/11/2004 11:35			3/11/2004 11:40			3/16/2004 13:15			3/16/2004 13:15			3/16/2004 13:25		
	Sample Depth		5.5			5.5			5.5			5.5			5.5			5.5			5.5			5.5		
	Field Sample		12-CS05-SS001-D5.5			12-CS05-SS002-D5.5			12-CS05-SS003-D5.5			12-CS05-SS004-D5.5			12-CS05-SS005-D5.5			12-CS05-SS006-D5.5			12-CS05-SS106-D5.5			12-CS05-SS007-D5.5		
	Lab Sample		G4C130164-001			G4C130164-002			G4C130164-003			G4C130164-004			G4C130164-005			G4C180324-001			G4C180324-003			G4C180324-002		
Analyte	Method	Unit	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]
antimony	SW6010B	mg/kg	ND		[1.0, 1]	**34.8**		[1.1, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND B		[1.0, 1]	ND		[1.0, 1]
arsenic	SW6010B	mg/kg	ND B		[1.0, 1]	**1.4**		[1.1, 1]	ND B		[1.0, 1]	ND		[1.0, 1]	ND B		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]
barium	SW6010B	mg/kg	**20.7**		[1.0, 1]	**54.2**		[1.1, 1]	**25.3**		[1.0, 1]	**25.0**		[1.0, 1]	**16.5**		[1.0, 1]	**46.4**		[1.0, 1]	**47.4**		[1.0, 1]	**32.0**		[1.0, 1]
beryllium	SW6010B	mg/kg	ND B		[0.20, 1]	**0.26**		[0.22, 1]	ND B		[0.21, 1]	ND B		[0.21, 1]	ND B		[0.21, 1]	ND B		[0.21, 1]	ND B		[0.21, 1]	ND B		[0.20, 1]
cadmium	SW6010B	mg/kg	ND		[0.20, 1]	**2.5**		[0.22, 1]	ND B		[0.21, 1]	ND		[0.21, 1]	ND		[0.21, 1]	ND		[0.21, 1]	ND		[0.21, 1]	ND		[0.20, 1]
chromium,	SW6010B	mg/kg	**6.9 J**		[0.51, 1]	**38.7 J**		[0.56, 1]	**7.9 J**		[0.51, 1]	**5.8 J**		[0.52, 1]	**5.2 J**		[0.51, 1]	**12.2 J**		[0.52, 1]	**12.7 J**		[0.52, 1]	**5.6 J**		[0.51, 1]
cobalt	SW6010B	mg/kg	**2.8**		[1.0, 1]	**5.3**		[1.1, 1]	**2.8**		[1.0, 1]	**2.1**		[1.0, 1]	**1.8**		[1.0, 1]	**4.5**		[1.0, 1]	**4.5**		[1.0, 1]	**2.5**		[1.0, 1]
copper	SW6010B	mg/kg	**3.9**		[1.0, 1]	**44.1**		[1.1, 1]	**6.4**		[1.0, 1]	**3.4**		[1.0, 1]	**18.1**		[1.0, 1]	**7.6**		[1.0, 1]	**7.3**		[1.0, 1]	**4.4**		[1.0, 1]
lead	SW6010B	mg/kg	**1.7**		[0.31, 1]	**186**		[0.34, 1]	**4.1**		[0.31, 1]	**1.4**		[0.31, 1]	**1.2**		[0.31, 1]	**2.3**		[0.31, 1]	**2.6**		[0.31, 1]	**1.9**		[0.31, 1]
molybdenu	SW6010B	mg/kg	ND B		[2.0, 1]	ND B		[2.2, 1]	ND B		[2.1, 1]	ND B		[2.1, 1]	ND B		[2.1, 1]	ND B		[2.1, 1]	ND B		[2.1, 1]	ND B		[2.0, 1]
nickel	SW6010B	mg/kg	**3.5**		[1.0, 1]	**11.1**		[1.1, 1]	**4.5**		[1.0, 1]	**3.4**		[1.0, 1]	**2.5**		[1.0, 1]	**6.8**		[1.0, 1]	**6.7**		[1.0, 1]	**3.2**		[1.0, 1]
selenium	SW6010B	mg/kg	ND		[0.51, 1]	ND		[0.56, 1]	ND		[0.51, 1]	ND		[0.52, 1]	ND		[0.51, 1]	ND		[0.52, 1]	ND		[0.52, 1]	ND		[0.51, 1]
silver	SW6010B	mg/kg	ND		[0.51, 1]	**1.0**		[0.56, 1]	ND		[0.51, 1]	ND		[0.52, 1]	ND		[0.51, 1]	ND		[0.52, 1]	ND		[0.52, 1]	ND		[0.51, 1]
thallium	SW6010B	mg/kg	ND		[1.0, 1]	ND		[1.1, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]
vanadium	SW6010B	mg/kg	**16.0**		[1.0, 1]	**23.4**		[1.1, 1]	**17.3**		[1.0, 1]	**12.2**		[1.0, 1]	**12.4**		[1.0, 1]	**24.9**		[1.0, 1]	**26.1**		[1.0, 1]	**14.6**		[1.0, 1]
zinc	SW6010B	mg/kg	**16.4**		[0.51, 1]	**94.3**		[1.1, 1]	**27.6**		[1.0, 1]	**15.4**		[1.0, 1]	**12.3**		[1.0, 1]	**30.8 J**		[1.0, 1]	**32.2 J**		[1.0, 1]	**19.7 J**		[1.0, 1]
mercury	SW7471A	mg/kg	ND B		[0.041, 1]	**0.081**		[0.045, 1]	**0.60**		[0.041, 1]	ND		[0.042, 1]	ND		[0.041, 1]	ND B		[0.042, 1]	ND B		[0.042, 1]	ND		[0.041, 1]

Site 12
Excavation at SS-7

	Base		NORTN			NORTN			NORTN			NORTN			NORTN			NORTN			NORTN		
	Site		12			12			12			12			12			12			12		
	Point		12-CS07			12-CS07			12-CS07			12-CS07			12-CS07			12-CS07 (Duplicate)			12-CS07		
	Sampling Date		3/11/2004 10:35			3/11/2004 10:45			3/11/2004 10:50			3/11/2004 10:55			3/11/2004 11:05			3/11/2004 11:05			4/27/2004 13:45		
	Sample Depth		5.5			5.5			5.5			5.5			5.5			5.5			5.5 (2nd Removal)		
	Field Sample		12-CS07-SS001-D5.5			12-CS07-SS002-D5.5			12-CS07-SS003-D5.5			12-CS07-SS004-D5.5			12-CS07-SS005-D5.5			12-CS07-SS105-D5.5			12-CS07-SS202-D5.5		
	Lab Sample		G4C130164-006			G4C130164-007			G4C130164-008			G4C130164-009			G4C130164-010			G4C130164-011			G4D290222-001		
Analyte	Method	Unit	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]	Result	QA	[RL, DF]
antimony	SW6010B	mg/kg	ND		[1.1, 1]	3.2		[1.1, 1]	ND		[1.0, 1]	ND B		[1.0, 1]	ND		[1.0, 1]	ND B		[1.0, 1]	ND B		[1.0, 1]
arsenic	SW6010B	mg/kg	1.2		[1.1, 1]	2.5		[1.1, 1]	ND B		[1.0, 1]	1.0		[1.0, 1]	ND B		[1.0, 1]	ND B		[1.0, 1]	ND B		[1.0, 1]
barium	SW6010B	mg/kg	57.3		[1.1, 1]	135		[1.1, 1]	33.0		[1.0, 1]	58.0		[1.0, 1]	19.5		[1.0, 1]	18.4		[1.0, 1]	68.5		[1.0, 1]
beryllium	SW6010B	mg/kg	0.31		[0.22, 1]	0.31		[0.21, 1]	0.20		[0.20, 1]	0.28		[0.21, 1]	ND B		[0.20, 1]	ND B		[0.20, 1]	ND B		[0.20, 1]
cadmium	SW6010B	mg/kg	ND		[0.22, 1]	20.3		[0.21, 1]	0.20		[0.20, 1]	1.3		[0.21, 1]	0.37		[0.20, 1]	0.30		[0.20, 1]	6.8		[0.20, 1]
chromium,	SW6010B	mg/kg	13.1 J		[0.54, 1]	61.9 J		[0.53, 1]	10.9 J		[0.51, 1]	14.0 J		[0.51, 1]	6.4 J		[0.51, 1]	5.2 J		[0.51, 1]	30.2		[0.51, 1]
cobalt	SW6010B	mg/kg	4.9		[1.1, 1]	10.5		[1.1, 1]	3.6		[1.0, 1]	5.1		[1.0, 1]	2.4		[1.0, 1]	2.3		[1.0, 1]	11.5		[1.0, 1]
copper	SW6010B	mg/kg	8.4		[1.1, 1]	249		[1.1, 1]	6.7		[1.0, 1]	15.4		[1.0, 1]	5.9		[1.0, 1]	4.7		[1.0, 1]	74.6		[1.0, 1]
lead	SW6010B	mg/kg	3.7		[0.33, 1]	366		[0.32, 1]	3.3		[0.30, 1]	9.1		[0.31, 1]	4.1		[0.30, 1]	3.4		[0.30, 1]	132		[0.31, 1]
molybdenu	SW6010B	mg/kg	ND B		[2.2, 1]	2.9		[2.1, 1]	ND B		[2.0, 1]	ND B		[2.1, 1]	ND B		[2.0, 1]	ND B		[2.0, 1]	2.0		[2.0, 1]
nickel	SW6010B	mg/kg	7.0		[1.1, 1]	46.0		[1.1, 1]	5.1		[1.0, 1]	10.1		[1.0, 1]	3.7		[1.0, 1]	3.4		[1.0, 1]	24.3		[1.0, 1]
selenium	SW6010B	mg/kg	ND		[0.54, 1]	ND		[0.53, 1]	ND		[0.51, 1]	ND		[0.51, 1]	ND		[0.51, 1]	ND		[0.51, 1]	ND B		[0.51, 1]
silver	SW6010B	mg/kg	ND		[0.54, 1]	3.8		[0.53, 1]	ND		[0.51, 1]	ND B		[0.51, 1]	ND		[0.51, 1]	ND		[0.51, 1]	1.3		[0.51, 1]
thallium	SW6010B	mg/kg	ND		[1.1, 1]	ND		[1.1, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]	ND		[1.0, 1]
vanadium	SW6010B	mg/kg	27.3		[1.1, 1]	25.6		[1.1, 1]	26.1		[1.0, 1]	28.1		[1.0, 1]	18.1		[1.0, 1]	14.2		[1.0, 1]	28.1		[1.0, 1]
zinc	SW6010B	mg/kg	41.3		[1.1, 1]	611		[1.1, 1]	29.4		[1.0, 1]	66.3		[1.0, 1]	27.7		[1.0, 1]	25.3		[1.0, 1]	198 J		[0.51, 1]
mercury	SW7471A	mg/kg	ND B		[0.043, 1]	0.87		[0.042, 1]	ND		[0.041, 1]	ND B		[0.041, 1]	ND		[0.041, 1]	ND B		[0.040, 1]	NA		NA

APPENDIX B

PHOTOGRAPHS

Photo 1. Site 12, Area SS-5 Initial Excavation

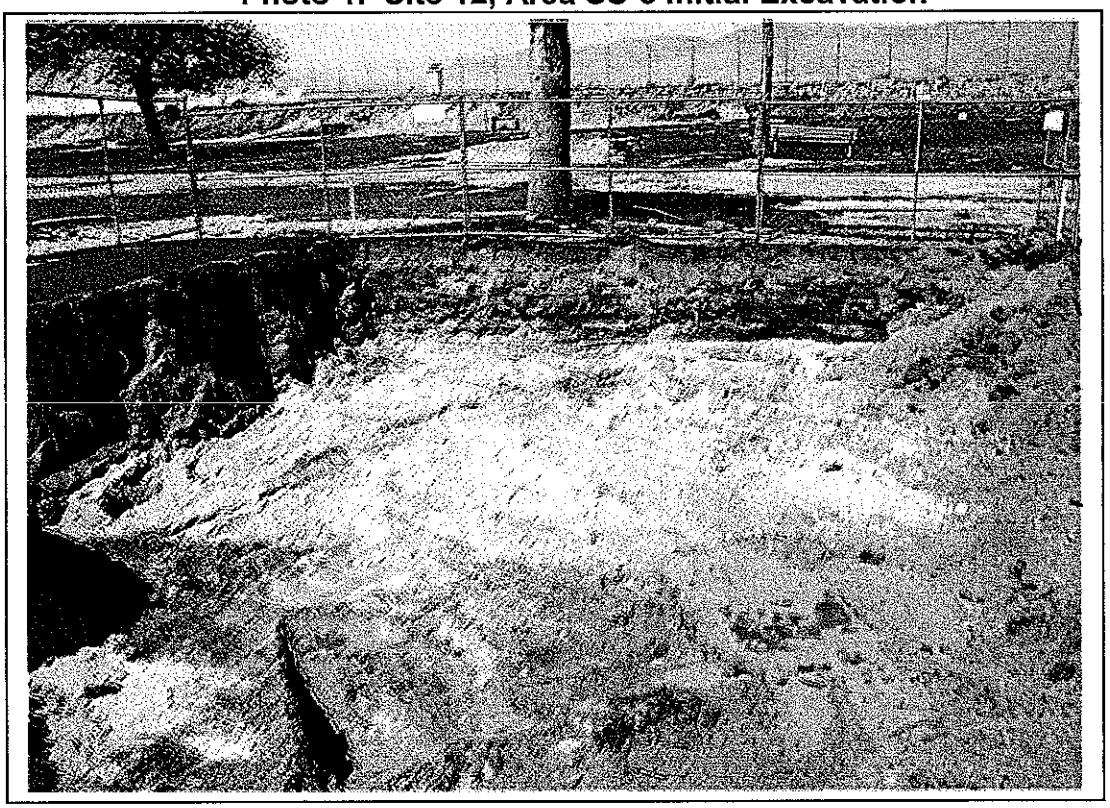


Photo 2. Site 12, Area SS-5 South Extension

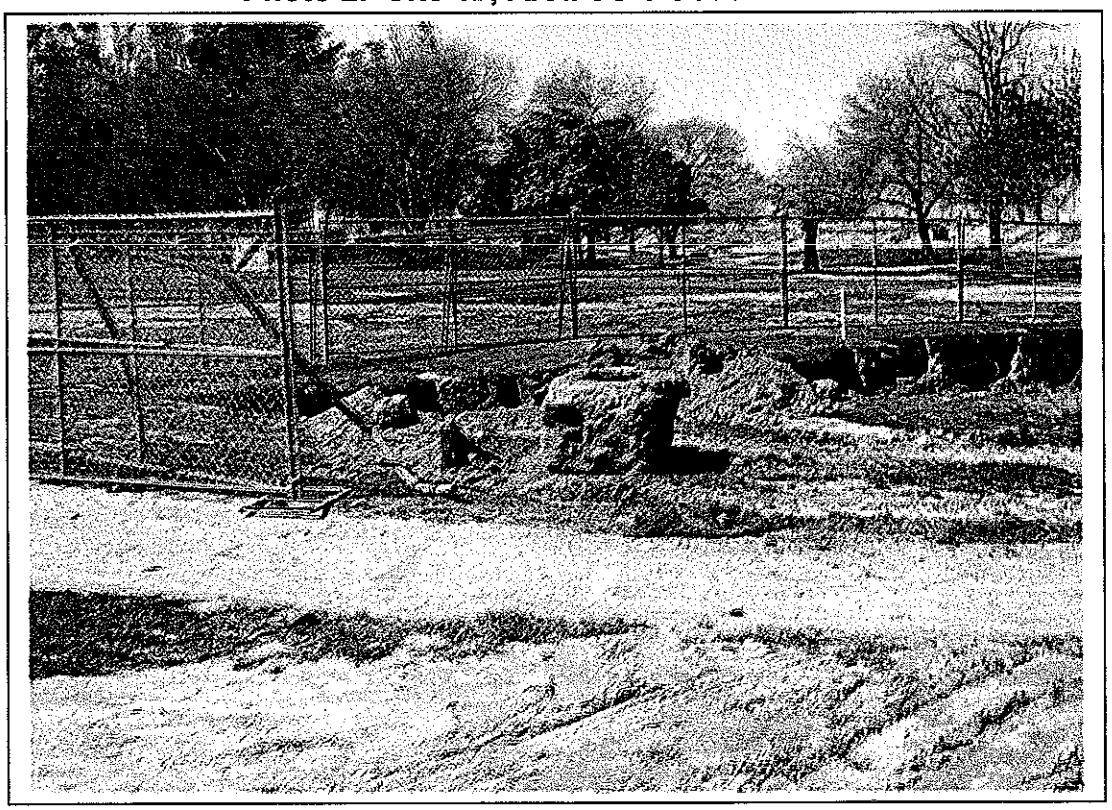


Photo 3. Site 12, Area SS-5, Ash Layer

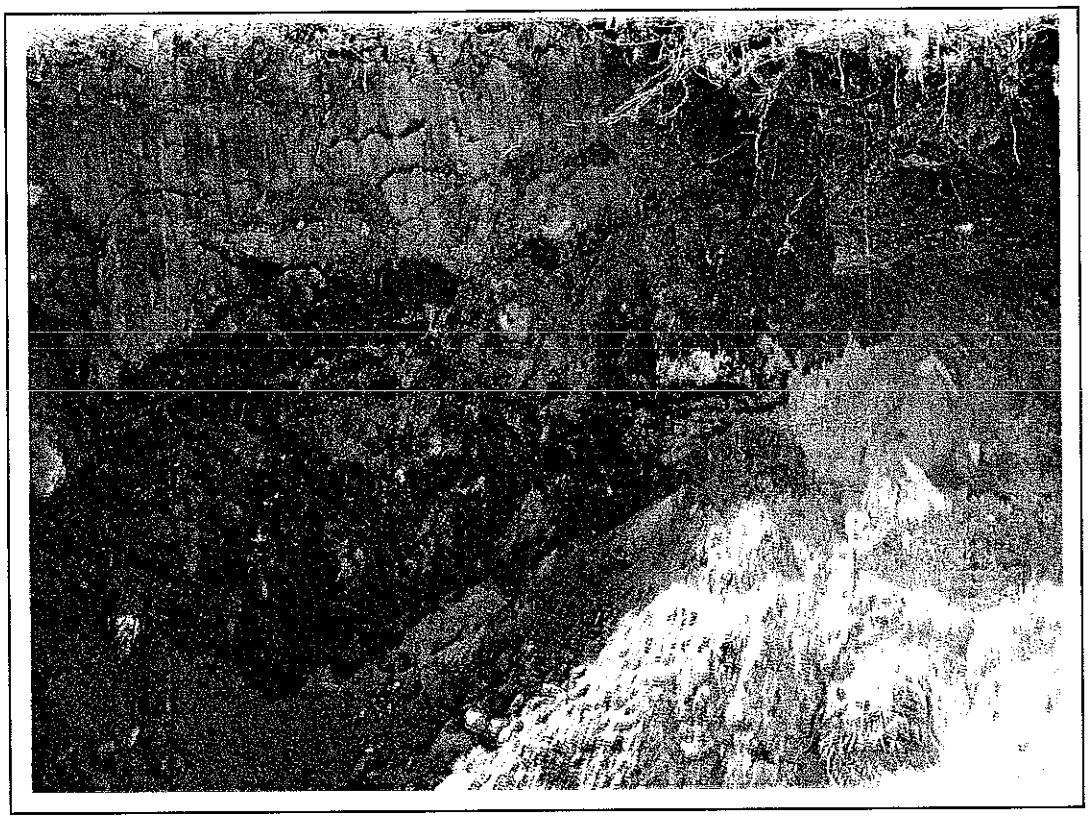


Photo 4. Site 12, Area SS-5

Photo 5. Site 12, Area SS-5

Photo 6. Site 12, Area SS-5 Southwesterly Extension

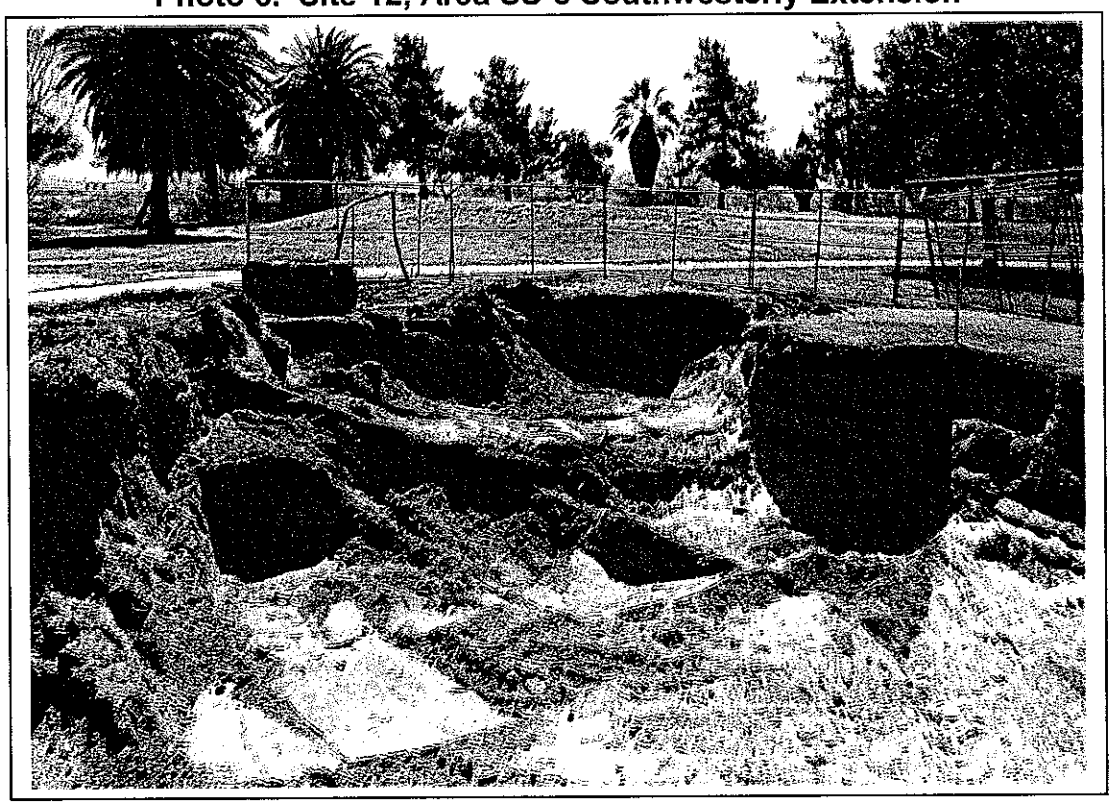


Photo 7. Site 12, Area SS-7

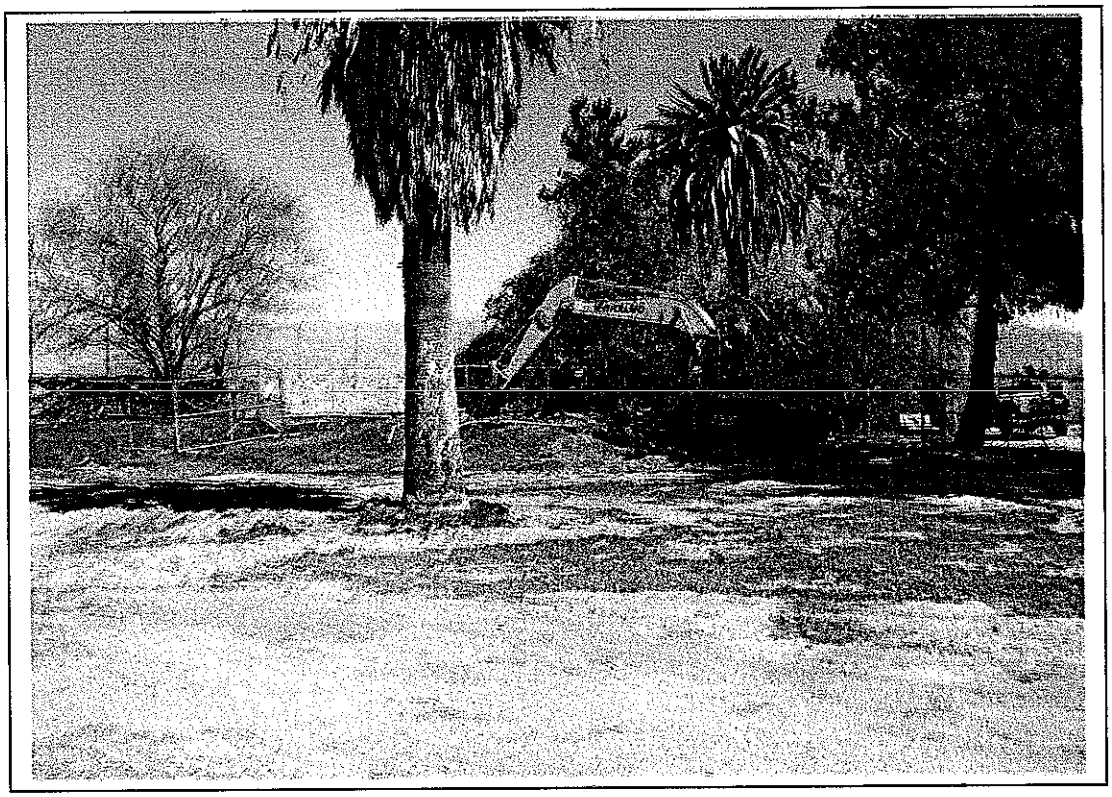


Photo 8. Site 12, Area SS-7 Initial Excavation

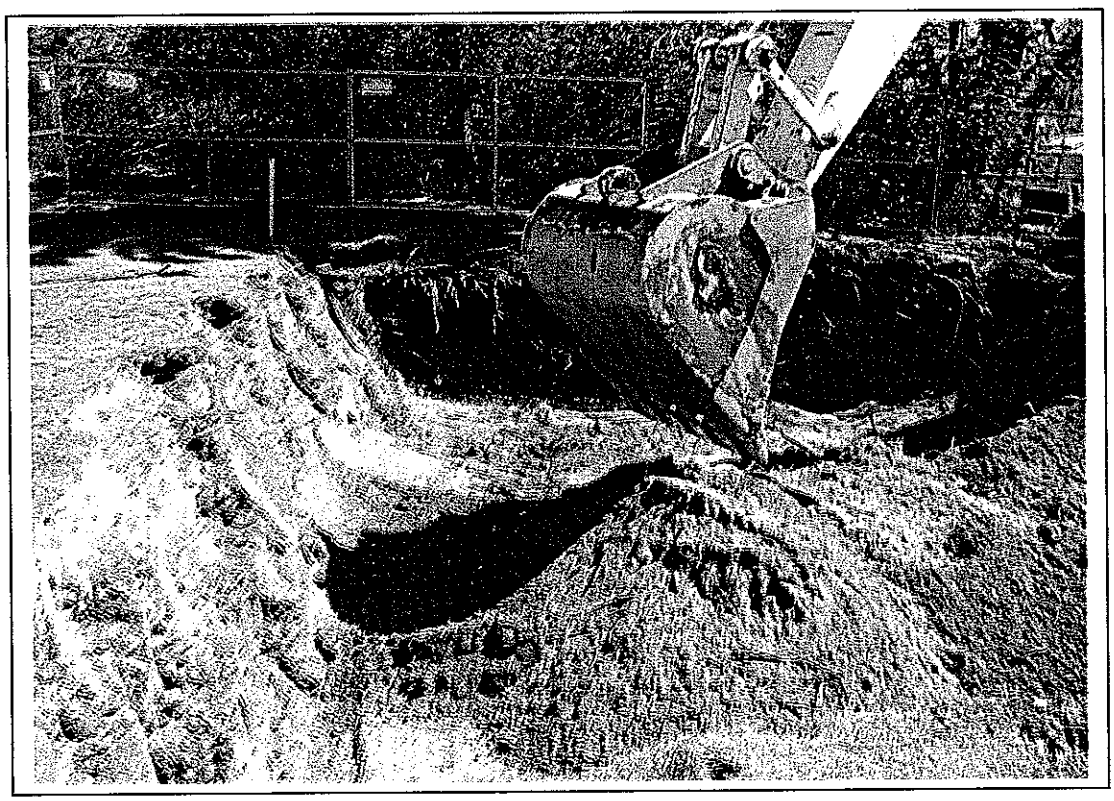


Photo 9. Site 12, Area SS-7 Thin Ash Layer

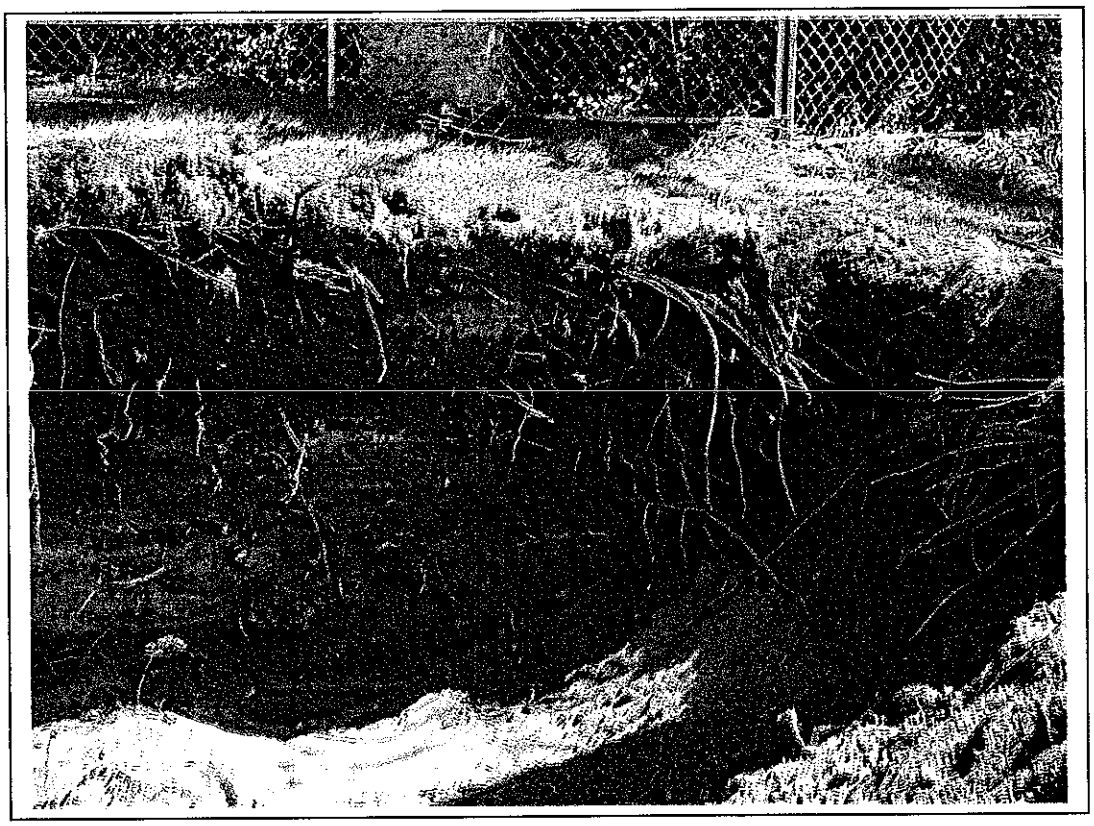
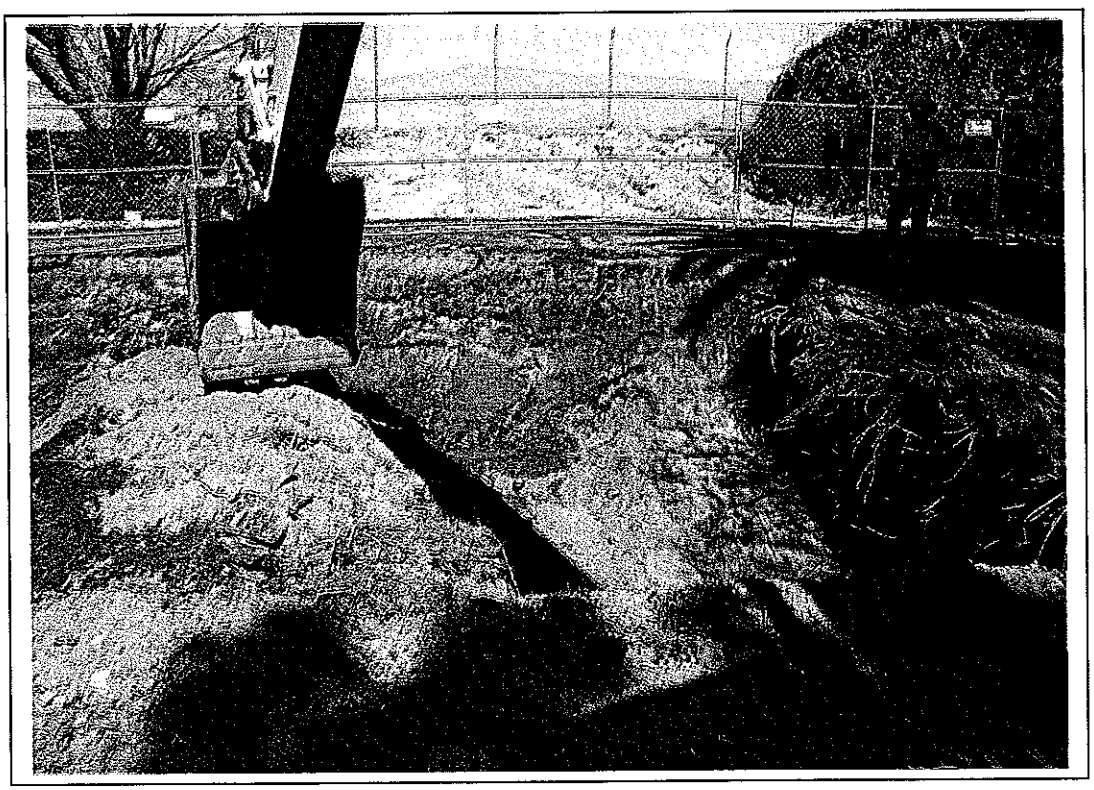



Photo 10. Site 12, Area SS-7 Eastern Extension