FINAL
TOURTELOT PROJECT SITE ORDNANCE AND EXPLOSIVES REMEDIAL DESIGN DOCUMENT

Tourtelot Remediation
Benicia, California

Prepared for:

Granite Management
by
Earth Tech, Inc.

Lead Agency:

California Environmental Protection Agency

Department of Toxic Substances Control

Sacramento, California

February 2002

LIMITATIONS

The information presented in this Ordnance and Explosives Remedial Design Document has been provided in accordance with the principles and practices generally employed in the environmental consulting profession.

The scope of work set forth in this document has been based on data obtained from documentation of previous investigations. Data obtained from future regulatory consultation and field activities (including geophysical mapping and OE investigation) may modify the information and scope of work presented in this work plan.

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ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
ASR	Archives Search Report
BAAQMD	Bay Area Air Quality Management District
BATF	Bureau of Alcohol, Tobacco, and Firearms
bgs	below ground surface
BIP	blow in place
CAAQS	California Ambient Air Quality Standards
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSP	California State Plane
°	degrees
DAQ	Data Acquisition
DC	direct current
DDESB	Department of Defense Explosives Safety Board
DFW	Definable Features of Work
DGPS	Differential Global Positioning System
DID	Data Item Description
DNT	dinitrotoluene
DOD	Department of Defense
DOT	Department of Transportation
DTSC	Department of Toxic Substances Control
EE/CA	engineering evaluation/cost analysis
EIR	Environmental Impact Report
EM	electromagnetic
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESS	Explosive Safety Submission
FS	Feasibility Study
GIS	Geographic Information System
GPS	Global Positioning System
Granite	Granite Management Corporation
GTM	Geophysical Technical Manager
H&SC	Health and Safety Code
HDPE	high-density polyethylene
HE	high explosive
HSO	Health and Safety Officer
Hz	Hertz
mg/m^3	milligrams per cubic meter
mm	millimeter
MOA	Memorandum of Agreement
MPA	man-portable adjunct

mph	miles per hour
MPM	Most Probable Munition
MSA	minimum separation area
MSAP	Minimum Separation Area Notification and Implementation Plan
MSD	minimum separation distance
MSL	mean sea level
MTADS	Multi-sensor Towed-Array Detection System
NAD83	North American Datum of 1983
NAD88	North American Datum of 1988
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NCR	Nonconformance Report
NEW	Net Explosive Weight
NORCAL	NORCAL Geophysical Consultants, Inc.
NRL	Naval Research Laboratory
OAO	Ordnance Accountability Officer
OD	open detonation
ODDS	Ordnance Detection and Discrimination Study
OE	ordnance and explosives
OESM	Ordnance and Explosives Safety Manager
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PCAS	Project Conformance Audit Schedule
PM_{10}	particulate matter equal to or less than 10 microns in diameter
PPP	Public Participation Plan
PR	purchase requisition
QA	quality assurance
QC	quality control
QDN	Quality Deficiency Notice
RAO	remedial action objective
RAP	Remedial Action Plan
RAW	Remedial Action Work Plan Investigation
RCRA	Resource Conservation and Recovery Act
RDD	Remedial Design Document
RI	Remedial Investigation
RRR	Records Research Report
RTK	real-time kinematic
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SCM	site conceptual model
SFBAAB	San Francisco Bay Area Air Basin
S/N	signal-to-noise
SSHP	Site-Specific Safety and Health Plan
SSO	Site Safety Officer
SUXOS	Senior UXO Supervisor
SWPPP	Storm Water Pollution Prevention Plan
TDEM	time domain electromagnetic
TMF	total magnetic field

GLOSSARY OF TERMS

Anomaly. A significant deviation from the background geophysical response indicative of a buried item that might be OE.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Federal law (Public Law 96-510 and codified as 42 U.S. Code [U.S.C.] 9601 et. seq.; and 26 U.S.C. 4611, 4612, 4661, 4662, 4671, and 4672) passed on December 11, 1980, which provides a series of programs to address clean-up of hazardous waste disposal and spill sites. CERCLA has been modified several times, most significantly in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

Cultural resources. Prehistoric and historic districts, sites, buildings, objects, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, religious, or any other reason.

Demilitarized. The mutilation, cutting, crushing, scrapping, melting, burning, or other alteration of military equipment or material designed to prevent it from being used for its originally intended military purpose.

Detonation. A chemical reaction that propagates with such rapidity that the rate of advance of the reaction zone into the unreacted material exceeds the velocity of sound and explodes.

Dig team. A team of UXO specialists that search for and excavate geophysical anomaly sources below the ground surface.

Electromagnetic (EM). A geophysical survey instrument that utilizes the rate at which EM signals in the ground decrease to detect and map metallic objects that are buried near ground level (less than 10 feet below ground surface).

Explosive Ordnance Disposal (EOD). The detection, identification, field evaluation, rendering safe, recovery, evacuation, and disposal of explosive ordnance that has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material.

Exposure. An "exposure" to OE is defined as occurring when a person traversing or working on the site is in "close proximity" to ordnance, whether or not the person knows the ordnance is present (it could be buried). An accident or injury is not necessarily assumed to occur when an exposure takes place. The definition of "close proximity" varies depending on the specific activity.

Fuze. A device with explosive components designed to initiate a train of fire or detonation in an item of ammunition by an action such as hydrostatic pressure, electrical energy, chemical action, impact, mechanical time, or a combination of these.

Inert. Ordnance, or components thereof, that contains no explosives, pyrotechnic, or chemical agents.

Live. A slang term indicating ordnance containing explosives or active chemicals.

Memorandum of Agreement. A record between government agencies agreeing upon a specific action item.

Military munitions. A term used to define all types of both conventional and chemical ammunition products and their components, produced by or for the military for national defense and security.

Minimum Separation Distance (MSD). A safety area surrounding an OE excavation site from which all but UXO-qualified personnel are excluded while excavation activities are being performed. Excavation operations halt once unauthorized personnel enter the MSD area and resume once those individuals exit the area. The MSD may vary in size depending on the suspected OE under investigation.

National Oil and Hazardous Substance Pollution Contingency Plan (NCP). The NCP is the Environmental Protection Agency's (EPA's) blueprint for implementing a Superfund law that addresses the legal requirements for responding to a potential hazard at a CERCLA site. The plan defines responsibilities and activities of affected parties within the site (which could include a Superfund site). The NCP is also the process used to address non-Superfund-contaminated sites.

Non-OE. Items that are non-ordnance-related including, but not limited to, wooden boxes, wire, banding material, trash, auto parts, rocks, and nails. Geological and terrain features causing geophysical anomalies are non-OE items.

OE clearance. The surface or subsurface removal of identified OE from a defined area.

OE-Like Item. An item that has a similar geophysical signature to an OE item.

OE scrap. Includes those items that are fragments of functioned ordnance, as designed or intentionally destroyed, and that contain no explosive or other items of a dangerous nature. OE scrap is inert and does not pose a safety risk.

Ordnance and explosives (OE). OE consists of either: (1) Ammunition, ammunition components, chemical or biological warfare material, or explosives that have been fired, armed or deployed, or abandoned, expelled from demolition pits or burning pads, lost, discarded, buried, or fired; such ammunition, ammunition components, and explosives are no longer under accountable record control of any Department of Defense organization or activity; OR (2) Explosive Soil (see definition under "Explosive Soil").

Quality Assurance (QA). QA assures that quality control is working and that the end product complies with the quality established by this remedial design.

Quality Control (QC). QC is the performance of tasks that verify that the remediation is performed according to plans and specifications.

Risk. Exposures to the chance of injury or loss, or a function of the probability that an accident (or adverse situation) will occur within a certain time, as well as the accident's consequences to people, property, or the environment.

Small arms rounds. Small arms ammunition consists of cartridges and shells used in rifles, pistols, machine guns, and shotguns.

State plane coordinates. A mapping system that measures in distance the position or coordinates of objects north and east of a known position in any given state.

Subsurface OE investigation. Consists of excavating to a prescribed depth to identify potential subsurface OE.

Surface clearance. The process in which OE are visually searched for and removed from the ground surface, without conducting any intrusive activities, and properly disposed of.

Unexploded Ordnance (UXO). Military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

1.0 INTRODUCTION

This ordnance and explosives (OE) remedial design document (RDD) describes the methods and procedures used to locate and remove OE and eliminate exposure pathways to OE at the Tourtelot Remediation Project Site, Benicia, California. The OE RDD is one of a series of documents and/or actions in response to the Imminent and/or Substantial Endangerment Determination and Remedial Action Order (Docket No. I/SE 98/99-011), signed June 1, 1999 (the "Order"), issued for the Project Site by the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC). A final remedial investigation (RI)/feasibility study (FS) report (Earth Tech, 2001) was prepared that presented the results of the soil, surface water, and groundwater sampling and analysis activities; a summary of OE investigations performed to date; and additional data gathered regarding the extent of OE at the Tourtelot Project Site. The final RI/FS report also developed and evaluated alternatives for the remediation of both OE and chemically affected soil at the site. This OE RDD describes how Alternative 5, the recommended alternative, of the final RI/FS report will be implemented with regard to OE cleanup.

The Tourtelot Project Site is in the City of Benicia, Solano County, California, approximately 30 miles northeast of San Francisco (Figure 1-1). The Project Site, which includes a portion of the Unit D-1 fill that extends onto the adjacent Valero property, and the extension of TNT Strips into the City of Benicia property are referred to in this OE RDD as the "Project Site" (Figure 1-2). The Project Site has rolling topography that includes areas referred to as the North Valley and the South Valley; it is bordered by the Southampton residential development to the west and south, industrial and commercial facilities to the east and south, and open space to the north. The Tourtelot Remediation Project proponents are Granite Management Corporation (Granite), who is the current owner of the Project Site, and the U.S. Army Corps of Engineers (USACE).

When investigating sites that may contain OE, unexploded ordnance (UXO), and OE scrap (inert and nonhazardous), the Department of Defense (DOD) often intends the term "OE" to be inclusive of all ordnance items that may be found at a site. The terms used in this document are defined below:

(1) Ammunition, ammunition components, chemical or biological warfare material or explosives that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, buried, or fired. Such ammunition, ammunition components, and explosives are no longer under accountable record control of any DOD organization or activity (Headquarters, Department of the Army Policy Memorandum, "Explosives Safety Policy for Real Property Confirming Conventional OE").

(2) UXO, military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause (Military Munitions Rule, 40 Code of Federal Regulations [CFR] Part 266.200).

(3) Explosive soils (mixtures of explosives in soils, sand, clay, or other solid media) at a concentration (10 percent or above by weight) such that the mixture itself is explosive (U.S. Army Corps of Engineers, 2000).

(4) OE scrap includes those items that are fragments of functioned ordnance, as designed or intentionally destroyed, and that contain no explosive or other items of a dangerous nature. OE scrap is inert and does not pose a safety risk (U.S. Army Engineering and Support Center, 1998a).

(5) OE-like item has a similar geophysical signature to an OE item (Personal Communication, Austreng, 2001).

Based on historical research and OE cleanup operations to date, it has been established that the OE at the Project Site did not originate from artillery firing or bombing range activities, but from demilitarization activities restricted to specific areas of the former arsenal locations where demilitarization activities are reported to have occurred. Therefore, UXO is not expected to be found on the Project Site. Suspected demilitarization areas are shown on Figure 1-3.

1.1 REMEDIAL DESIGN GOALS AND OBJECTIVE

The objectives of the project are as follows:

- Remediate the Project Site in a manner and to standards that would allow DTSC to determine that all appropriate response actions have been completed and that no further removal/remedial action is necessary for the Project Site under the Order issued by DTSC on June 1, 1999 (Docket No. I/SE 98/99-011).

- Remediate the areas of the Project Site that are zoned for residential use to a standard suitable for unrestricted residential use.

- Remediate the other areas of the Project Site to a standard suitable for open space use consistent with the City of Benicia General Plan (City of Benicia, 1999) and Zoning Ordinance (City of Benicia, 1987). Copies of the City of Benicia General Plan and Zoning Ordinance can be obtained by contacting the City of Benicia Planning Department.

In order to meet these project objectives, the Tourtelot Remediation will include remediation of OE and the identification, characterization, treatment, and removal of soil containing chemical concentrations exceeding remedial action objectives

(RAOs), as detailed in the Remedial Action Plan (RAP). Two RDDs have been prepared detailing the remedial design to achieve these objects, this document for OE remediation and one for remediation of chemically affected soils. Broadly, the OE site remediation will consist of several coordinated activities:

- Point clearance of OE, OE scrap, and non-OE metallic debris from the entire site
- OE clearance of chemically affected soil requiring off-site disposal to determine that it is free of OE
- Homogenization, excavation, and stockpiling of TNT-affected soil with TNT concentrations of 10 percent or more by weight (as measured prior to homogenization),

Areawide clearance in order to assure clearance of OE from areas that are planned for future residential use in the South and North Valleys and on the Ridge, the area between the North and South Valleys.

The goal of the OE remedial design is to identify and remove OE and OE scrap from the Project Site, and to eliminate potential risk that OE poses to human health and the environment. This OE RDD meets the requirements of Section 5.11 of the DTSC Order, which include:

- Specific criteria to be used in deciding whether to blow in place (BIP) or move the OE for on-site disposal, including the potential for impacts to the surrounding neighborhoods, schedules of the activities (digging/BIP), and duration.
- A geophysical mapping plan addressing geophysical data collection, data processing, preparation of maps and dig sheets, and reacquisition and marking of anomalies.
- Design criteria and process diagrams for the Project Site.
- A description of equipment used to excavate, handle, and transport OE.
- A field sampling plan addressing sampling for achievement of the performance objectives for the OE removal action.
- Identification of any necessary permits and agreements.
- A schedule for implementing the proposed OE point and areawide clearance actions to the extent that areawide clearance can be identified.

The objective of the OE remediation is to remove OE, OE scrap, and metallic debris, thus eliminating any potential pathway for OE exposure. OE remediation will be implemented in three phases. The first phase will identify and remove detected OE, OE scrap, and metallic debris through completion of a point clearance, as defined below. The second phase entails an areawide clearance operation that will remove soil that has been point cleared from areas that contained OE or have the potential to contain OE and placing the soil as engineered fill in the North Valley. The determination of whether soil meets the criteria for areawide clearance will be based upon the evaluation of the distribution of OE and OE scrap removed in Phase 1. The third phase involves grading of the site to establish a minimum of 14 feet of OE-free crushed bedrock over the areawide cleared soils.

At the conclusion of the fieldwork, an OE Project Closure Report documenting implementation of the OE RDD and an Operation and Maintenance Plan will be prepared and submitted to agencies. The OE remediation schedule is included as Appendix A.

1.2 COMMUNITY OUTREACH/PUBLIC PARTICIPATION

The adjoining community and other interested parties will be informed of the activities conducted at the Project Site, in accordance with the Public Participation Plan (PPP) and the final Minimum Separation Area (MSA) Notification and Implementation Plan (MSAP). Public meetings will be held and fact sheets prepared as major milestones in the OE removal/remediation are achieved, in accordance with the PPP for the Project Site (Granite Management Corporation, September 1999). The process for providing information to the community, including public meetings, is described in the MSAP (Appendix B).

1.3 REGULATORY OVERSIGHT

On June 1, 1999, DTSC issued an Order stating that removal and remedial action are necessary at the Project Site because there may be an imminent or substantial endangerment to the public health or welfare or to the environment. The DTSC is the lead agency overseeing the investigation and remediation of the Project Site.

It is intended that work being performed under the Order will be consistent with, and based on, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S. Code [U.S.C.], 9601 et seq.), as amended; the National Hazardous Oil and Substance Pollution Contingency Plan (NCP) (40 CFR Part 300), as amended; the Health and Safety Code (H&SC) Section 25300 et seq., as amended; state laws and regulations, as amended; and other current and applicable Environmental Protection Agency (EPA) and DTSC guidance and standards.

The Superfund Amendments and Reauthorization Act (SARA) requires that remedial actions at federal Superfund sites achieve a cleanup level that protects human health and the environment. In addition, cleanups must attain "legally applicable or relevant and appropriate" requirements (ARARs) that are promulgated under federal or state law, unless a waiver is warranted. Although the Project Site is not a Superfund Site, the concept of ARARs has been used to evaluate and select final remedial actions for the proposed future residential and open space use of the Project Site. In addition, the work being performed will be consistent with the following DOD guidance and standards.

- Ammunition and Explosives Safety Standards, Department of Defense, DOD 6055.9.STD
- Safety and Health Requirements, U.S. Army Corps of Engineers, EM 385-1-1
- Explosives Safety Program, U.S. Army, AR 385-64
- Accident Reporting and Records, U.S. Army Corps of Engineers Supplement I to AR 385-40
- Ordnance and Explosives Response, U.S. Army Corps of Engineers, EM 1110-1-4009
- Establishing and Maintaining Institutional Controls for Ordnance and Explosives (OE) Projects, U.S. Army Corps of Engineers, EP 1110-1-24.

The following local, state, and federal agencies have jurisdiction over remedial activities at the Project Site:

- California DTSC (the lead regulatory agency for investigation and cleanup of the Project Site)
- USACE (issuance of a Section 404 permit for filling of 0.093 acre of wetlands in the North Valley and 0.206 acre of seep wetlands on the north slope of the South Valley)
- U.S. Fish and Wildlife Service (USFWS) (endangered species consultation if required by Section 404 permit)
- California Department of Fish and Game (CDFG) (issuance of a Section 1603 stream bed alteration agreement may be required. The water body in the South Valley does not appear to meet the definition of a stream because it does not exhibit a well-defined stream bed and a bank, rather, it supports characteristics of a wetbed rather than a stream)

- Bay Area Air Quality Management District (BAAQMD) (responsible for protection of air quality)
- California Occupational Safety and Health Administration (Cal/OSHA) (has oversight authority for worker protection during removal activities)
- California Regional Water Quality Control Board (RWQCB) (has responsibility for protection of groundwater and surface water quality)
- City of Benicia (has authority to issue grading and zoning permits and/or special use permits for grading and fire code permits for explosives storage for the Project Site)
- Solano County Department of Environmental Management (has authority to issue well permits and oversee underground storage tank [UST] removals).

1.4 ORDNANCE AND EXPLOSIVES SAFETY ISSUES

OE has been found on the Project Site. Soils containing trinitrotoluene (TNT) or TNT degradation products at concentrations greater than 10 percent have been identified on the Project Site. Nine live OE items have been removed from the Project Site. Soils containing explosives or undiscovered OE may present a hazard to the public. Currently, the Project Site is fenced, and security guards/patrols are maintained, which limit public ingress to the Project Site. An Explosives Safety Submission (ESS), which summarizes OE safety issues for the site, has been prepared (Appendix C).

1.5 BACKGROUND

Information presented in these sections was taken from the *Archives Search Report* [ASR] *Findings, Benicia Arsenal, Benicia, Solano County, California* (U.S. Army Corps of Engineers, St. Louis District, 1994a); Vertical Magnetic Gradient Data (NORCAL Geophysical Consultants, Inc., 1996); Intrusive Investigation Data (Explosive Disposal Engineering and Technology, 1996); *Supplement to the March 1994 Archives Search Report for Benicia Arsenal, Benicia, Solano County, California* (U.S. Army Corps of Engineers, St. Louis District, 1997); *Environmental Assessment, Benicia Arsenal Site Investigation, Benicia, California* (U.S. Army Corps of Engineers, Sacramento District, 1997); *Final Benicia Arsenal Records Research Report* [RRR] (Jacobs Engineering, 1999); *Final Engineering Evaluation/Cost Analysis [EE/CA], Former Benicia Arsenal, Solano County, California* (U.S. Army Engineering and Support Center, Huntsville, 2000); and the final RI/FS report (Earth Tech, 2001).

1.5.1 Site Topography

The Project Site is situated in a hilly area dominated by a central, east/west-trending ridge (referred to in this OE RDD as the "Ridge") (see Figure 1-3) that acts as a drainage divide between a major drainage swale to the south, referred to as the South Valley, and a smaller drainage swale to the north, referred to as the North Valley. Project Site elevations range from approximately 60 feet to 300 feet above mean sea level (MSL) in the South Valley and 110 feet to 260 feet above MSL in the North Valley. The top of the Ridge, which was excavated as part of previous grading activities, is approximately 230 feet above MSL toward the east end and approximately 260 feet above MSL toward the west end. The maximum current elevation on the ungraded western portion of the Ridge is approximately 300 feet above MSL.

1.5.2 Geologic Conditions

The bedrock at the Project Site, as observed in test pits, soil borings, and geophysical investigation throughout the area, is weathered and fractured and consists mostly of claystone with various interbedded deposits of sandstone and siltstone. Bedding units generally strike to the northwest and dip to the south.

Quaternary alluvium is present in the bottom of the North and South Valleys. The total thickness of the alluvium in the North Valley is as deep as 30 feet. Various amounts of colluvium blanket the slopes of the hills. The colluvium is generally a silty or sandy clay and ranges in thickness from a few feet to more than 12 feet.

Investigations at this site reveal that the depth to weathered bedrock ranges from approximately 2 to 11 feet below ground surface (bgs) on the south slope of the South Valley, while the depth to weathered bedrock ranges from approximately 8 to 10 feet bgs on the north slope of the South Valley. The shallow soil depths on the north slope were found at the top of the slope. The alluvium in the South Valley floor is interpreted to attain depths of up to 15 feet and probably consists of fat clay, which includes weathered fragments of shale, siltstone, and sandstone.

1.5.3 Environmental Resource Data

Tourtelot Remediation/Environmental resource data are provided in the Final Environmental Impact Report (EIR) Cleanup Project. The Final EIR describes the plant and animal resources present at the Project Site. The majority of the Project Site is covered with nonnative annual grassland vegetation. The hillsides, ridgetops, and some of the valley floor areas of the Project Site are dominated by weedy introduced plant species. The unnamed creek that crosses the south portion of the Project Site (South Valley) supports both willow riparian and freshwater marsh vegetation/habitat. Wetlands vegetation is present in creek and seep areas on the hillsides.

1.5.4 Past Land Uses

The previous military uses of the Project Site are depicted in Figure 1-3. 2,4,6-TNT was laid out in strips (TNT Strips) along the hillside and may have been burned. Approximately 3.5 acres in the North Valley were developed with roads and structures where the accuracy of howitzer gun barrels was checked (Howitzer Test Facility), and ordnance was inspected and renovated, and primers were destroyed in a "squirrel cage" (Ammunition Renovation/Primer Destruction Site). There was also a disposal area referred to as the "North Valley Military Landfill" in the North Valley. Part of the Ridge was reportedly used to dispose of aged, out-of-service dynamite (Dynamite Burn Site).

In the South Valley, there was a Flare Site and three suspected demolition sites (Demolition Sites #1, #2, and #3). (As discussed in Section 1.5.4.8, Demolition Site #2 is no longer considered to have been used as a demolition site.) The Flare Site was used to burn old, out-of-service flares. Demolition activities generally consisted of placing various amounts of out-of-service munitions in a "pit," placing a countercharge on top of the items, and detonating them.

1.5.4.1 TNT Strips.

The TNT Strips are visible on the hillside to the north of the North Valley, as evidenced by a lack of ground cover and soil analytical testing results. The strips are clearly visible in a December 1947 aerial photograph, but are not visible in a January 1945 aerial photograph. Historical records do not indicate when actual TNT destruction operations took place, nor do they indicate the method of destruction. There are five strips and one suspected strip. The identified strips vary in length from approximately 100 feet to 800 feet; each is approximately 6 feet wide. Exposed soil along the strips is characterized by a deep red color with crystalline materials observed in the dry season. It has been assumed that the burning of explosives, similar to that reported for the Dynamite Burn Site, resulted in the TNT Strips on the hillside above the North Valley.

1.5.4.2 Howitzer Test Facility.

The Howitzer Test Facility consisted of four structures in the North Valley. The first structure, Building 181, consisted of two parallel concrete tunnels constructed in 1945 on an excavated pad into the northeast-facing flank of the Ridge; each had a 10-foot by 10-foot opening and extended approximately 100 feet toward the hillside. The concrete tunnels were oriented approximately north-south and were partially covered with soil. The second structure, Building 182, contained the open test firing butts and was also constructed in 1945, in the middle of the North Valley, at the base of the southwest-facing hillside, approximately 450 feet north of the entrance to the tunnels. The third structure, Building 183, was a concrete powder loading room constructed in 1945, immediately west of the test firing butts. The fourth structure consisted of two buildings (Buildings 540 and 542) and included another unidentified structure. This structure was situated between the

firing butts and the test tunnels. Reportedly, the buildings, which were built in 1957 (Building 540) and 1958 (Building 542), had several uses after the Howitzer Test Facility ceased operations. Building 540 was 12 feet by 20 feet, but no records of the size of Building 542 are available. None of the buildings is present on the site today.

The tunnels and firing butts were used to test howitzer barrels and propellant by firing various-sized howitzer projectiles filled with concrete or gravel into the gravel-filled tunnels. This was performed in order to determine if the barrels functioned correctly and whether the propellant was the right mixture. Gravel was dropped into the tunnels from two gravel fill ports, one on top of each tunnel. The gravel was used to absorb the howitzer rounds fired into the tunnels. The facility was in operation from approximately 1945 to 1955. A disposal area where shell casings, OE scrap, and debris that had been dug out from the test tunnels were discarded is believed to have been adjacent to and northeast of the entrance to the tunnels.

All structures within the Howitzer Test Facility have been dismantled. Most of the building construction debris and inert OE scrap was removed from the Project Site during these activities. A large number of concrete-filled howitzer shells were unearthed during the dismantling activities in 1996, particularly in the vicinity of the test tunnels.

During the initial site preparation activities, gravel/debris was removed from inside the test tunnels. The soil cover over the concrete tunnels was also removed, and the tunnels and other structures in the area were dismantled. The removed gravel/debris and soil were screened under the observation of a qualified explosives specialist. The debris from inside the tunnels consisted primarily of gravel and howitzer shells filled with pea gravel or plaster and inert scrap. Some non-DOD-related debris was also removed (e.g., a burned-out car).

The soil removed from over the tunnels also contained gravel- or plaster-filled howitzer rounds. The gravel/debris and soil were screened for OE, and as much as possible were sorted into two stockpiles. One soil stockpile was relatively free of OE scrap; the other had gravel and small fragments of OE scrap. As dismantling activities continued, OE scrap (inert ordnance and spent fuzes) was found beneath Building 540. The Howitzer Test Facility area was geophysically mapped, and all observed anomalies were investigated and removed. Excavated and screened soil from the OE clearance activities was also placed in the soil stockpile. The two stockpiles were subsequently moved around the Howitzer Test Facility area to accommodate a complete geophysical survey of the area. The two stockpiles were eventually consolidated into a single stockpile (Stockpile #3). No live OE items resulting from the howitzer test activities have been reported or discovered.

1.5.4.3 North Valley Military Landfill.

Based on historical information, the disposal area referred to as the North Valley Military Landfill is thought to have existed in the North Valley, just east of the Howitzer Test Facility. The disposal area was apparently first used when the tunnels were constructed in 1945 and was in operation until approximately 1955, when the testing activities ceased. The area was originally a poorly defined drainage pathway that was reported to have been gradually filled with shell casings, inert scrap, and debris dug out of the test tunnels after artillery testing. During the 1996 initial site preparation activities at the Howitzer Test Facility, an area of debris consisting of wood crates, wood pallets, and packing materials was encountered northeast of the previously estimated disposal area to a depth of no more than 5 feet bgs. Some inert ordnance, including practice 155-millimeter (mm) howitzer rounds (gravel or plaster-filled), was also recovered and removed from this area during the OE clearance of the Howitzer Test Facility. The wood debris and packing materials were added to the screened soil stockpile and eventually consolidated into Stockpile #3. No live OE has been reported or discovered in the suspect landfill area.

In May 2000, the landfill was investigated as part of the site RI. During this investigation, the landfill was investigated using back hoe-excavated test pits. Each test pit was cleaned of metallic anomalies by OE technicians. Approximately one-half of the anomalies investigated were classified as OE scrap. No live OE items were recovered.

1.5.4.4 Ammunition Renovation/Primer Destruction Site.

The Ammunition Renovation/Primer Destruction Site is in the North Valley adjacent to the Howitzer Test Facility. The Primer Destruction Facility and, subsequently, the Ammunition Renovation Facility were at this site.

The Primer Destruction Facility was constructed on a relatively flat surface partially paved with asphalt at the upper reaches of North Valley, near the drainage divide, and was operational from 1945 to 1947. Typically, at primer destruction facilities, primers were destroyed by being dumped and burned in a "squirrel cage," or metal tank. Primers for various munitions were pulled out, removed, and placed onto a conveyor belt, then dropped into a cage and burned. An oil burner was usually attached to the cage or tank and was left running constantly in order to ignite the primers.

The Ammunition Renovation Facility consisted of two wooden buildings and two canvas shelters (Jacobs Engineering, 1999), which were used to inspect and refurbish ordnance items stored at the former Benicia Arsenal. The RRR stated that the area was used for breakdown operations, cleaning, and processing of ammunition casings in preparation for painting (Jacobs Engineering, 1999).

During the 1996 initial site preparation activities, the wooden structures were dismantled and the construction debris removed from the Project Site. Asphalt paving, which partially covered the Ammunition Renovation/Primer Destruction Site, was removed, along with 1 to 2 feet of underlying soil and placed in two stockpiles along the north edge of the Project Site. No OE items were found, and none were expected based on the types of activities conducted in this area.

1.5.4.5 Dynamite Burn Site.

On the Ridge, aged, out-of-service dynamite was reportedly disposed of through burning. Aged dynamite was burned by placing multiple sticks of dynamite in rows up to 100 feet long on a piece of paper and igniting the paper. This area is reported to have been used continuously for 3 months in 1947 and 1948 until all of the dynamite was destroyed (Jacobs Engineering, 1999). Inspection of aerial photographs taken on December 1, 1947, reveals a criss-cross pattern of dark and lighter strips oriented approximately northeast-southwest and northwest-southeast, which is interpreted to represent the burn strips.

The Ridge containing the Dynamite Burn Site was excavated during grading activities associated with the Southampton development in 1990. Based on an analysis of past grading activities, soil from the historical location of the Dynamite Burn Site appears to have been placed as fill at or near the base of the McAllister Drive Land Bridge.

1.5.4.6 Flare Site.

The Flare Site is situated in the South Valley, on the south side of the wetlands, and is visually evident by the residual ash on the ground surface (see Figure 1-3). The inspection of aerial photographs indicates that the site was situated over a landslide evident on the earliest available aerial photographs (1937). The Flare Site was used to dispose of flares by burning them (Jacobs Engineering, 1999). This usually consisted of placing flares on the ground in rows and igniting them. Although no evidence of burning was visible in the aerial photographs, physical evidence of burning (i.e., residual ash) remains at the Flare Site, as observed during recent site visits. It is uncertain if the Flare Site was used to dispose of ordnance. A relatively large number of anomalies is evident in the geophysical data.

1.5.4.7 Demolition Site #1.

Demolition Site #1 is situated near the bottom of the South Valley on the south side of the wetlands (see Figure 1-3). A small drainage runs down the south slope of the South Valley immediately to the east of the suspected demolition site. The site is clearly visible in a number of the historical aerial photographs and first appears circa 1945, although no evidence of the type of use is evident on the photographs. No live ordnance items have been recovered from this site during previous investigations; however, OE scrap and fragments have been recovered

around and near the site. The site was included in the sitewide geophysical survey performed by NORCAL Geophysical Consultants, Inc. (NORCAL), in 1997, and a large, magnetic anomaly is evident in the data at the south end of the suspected site. Several smaller anomalies are also evident from the data in the north portion of the site. An electronic copy of the NORCAL geophysical data, the dig sheets, and a summary of the ordnance data are provided as Appendix D.

1.5.4.8 Demolition Site #2.

The area identified as Demolition Site #2 shows little or no evidence of use as a demolition site. The site is on the south side of the South Valley between the Flare Site and Demolition Site #1 (see Figure 1-3). The site appears disturbed or barren in several of the historical aerial photographs. However, disturbance in this area is also associated with a landslide/earthflow identified in that area on the 1945 and later photographs. Review of the sitewide geophysical data does not indicate a high anomaly count, similar to those of Demolition Sites #1 and #3, nor is there evidence of chemically affected soils.

Because there is little or no physical evidence that this site was used as a demolition pit, it has been concluded that this site was not used.

1.5.4.9 Demolition Site #3.

Demolition Site #3 is situated on the north side of the South Valley (see Figure 1-3). Several OE items were recovered from this site both by Granite and USACE (see Appendix D). Also, a half-track armored personnel vehicle was removed from this site, hauled up the north slope of the South Valley, and cut into pieces, which were recycled at a local metal fabrication shop. Demolition Site #3 is evident in the sitewide geophysical data and on the aerial photographs (since 1947); it coincides with a bench cut into the hillside. The topographic map shows the bench cut at an approximate elevation of 105 feet above MSL. The surface of the bench appears disturbed in several of the photographs.

1.5.5 Ordnance and Explosives Type, Composition, Quantity, and Depth Distribution

DOD conducted OE clearance activities in the South Valley in 1955 (U.S. Army Corps of Engineers, St. Louis District, 1994a) in anticipation of disposal of part of the property. However, during a later inspection of the South Valley in 1955, several live OE items were found, and it was recommended that a second clearance be performed. During this inspection, four hand grenades, two 37mm high-explosive (HE) projectiles, three 60mm mortars, and one 75mm (HE) projectile are reported to have been found. No record of a possible second clearance could be found. No other DOD-initiated clearance actions were reported in the RRR (Jacobs Engineering, 1999) and ASR Supplement (U.S. Army Corps of Engineers, St. Louis District, 1997).

The next reported OE clearance activity was initiated when a concrete-filled howitzer shell was encountered during preliminary site preparations in mid-1996. On May 3, 1996, Cal/EPA, DTSC, performed a site visit in response to concerns raised by local citizens about possible hazards on the property due to past DOD-related activities. Following that site visit, DTSC recommended that a thorough investigation of the site be performed, including a Preliminary Endangerment Assessment and an OE Waste Assessment. DTSC also recommended that development activities at the site be curtailed pending completion of the investigation of the site. Granite retained OE experts and initiated OE investigations on the Project Site. The work included geophysical mapping and OE removal.

The initial geophysical surveys at the site were limited to the Howitzer Test Facility and limited dispersed data collection areas across the Project Site. The initial survey areas are shown on Figure 1-4 (areas A through Q, cleared by Granite August 6-30, 1996). An EM61, a high-resolution, time-domain metal detector, was used to collect data for the initial surveys. In August 1996, an OE clearance was performed at the Howitzer Test Facility using the EM61 data. The clearance was conducted to support the dismantling of the howitzer tunnels and related structures. In addition, areas at the Ammunition Renovation/Primer Destruction Site (Area E on Figure 1-4), and along portions of the north and east Project Site boundaries (Areas F through O) were investigated and cleared using the electromagnetic (EM) data to identify anomalies and magnetometers to reacquire the points. No OE items were recovered during the August 1996 clearance activities. Appendix D, Table D-1, summarizes the OE data collected from this investigation. A copy of the dig sheets and a CD with the raw EM data collected during this investigation are also included in Appendix D. In November 1996, while removing a concrete floor slab from beneath former Building 540, several howitzer dummy 155mm shells and 18 practice land mine fuzes with pins were found. They were inspected by a number of OE specialists and determined to be OE scrap. The areas cleared are shown on Figure 1-4.

In fall 1996, NORCAL performed a total magnetic field (TMF) vertical gradient survey to assess the distribution of OE. Appendix D includes a CD (NORCAL Vertical Magnetic Gradient Data) with the TMF data collected. This survey consisted of the investigation of contiguous 200-foot by 200-foot grids (as shown on Figure 1-4) utilizing cesium vapor magnetometers arrayed to measure the vertical gradient of the TMF. The magnetometer survey did not include Ridge cut areas where surficial materials had been stripped to bedrock, the west portion of the South Valley, or the wetland in the South Valley.

Approximately 8.5 acres of the Project Site was cleared of OE in December 1996 using the magnetometer data. The identified magnetic anomalies were investigated by excavating the location of the anomaly until an anomaly source was located. When OE was encountered, it was identified and removed. Six OE items were removed from the Project Site in November and December 1996, including two 37mm HE rounds, two 40mm anti-aircraft HE rounds, one 60mm HE

mortar shell, and one 76mm armor-piercing HE round. The OE clearance was suspended pending further investigation of the former Benicia Arsenal by USACE. The location of the OE items recovered and the area cleared are shown on Figure 1-4 (cleared by Granite Dec. 2-13, 1996). Appendix D includes the dig sheets and Table D-2 lists the depth, location, quantity, and number of anomalies investigated during this clearance activity.

Engineering Evaluation/Cost Analysis Investigation. USACE conducted an EE/CA investigation for the entire former Benicia Arsenal, including the majority of the Project Site. Portions of the Project Site and adjacent property were geophysically mapped, and subsurface anomalies that were identified were sampled to determine the presence or absence of OE. Two OE items were encountered within the Project Site (one 75mm unfuzed shrapnel projectile and one 37mm fuzed projectile) during the EE/CA field investigation. These items were disposed of by demolition (U.S. Army Engineering and Support Center, 2000). The locations of these items are also shown on Figure 1-4. No OE or OE scrap was recovered from property immediately adjacent to the north of the Project Site during the EE/CA investigation. Appendix D, Table D-3, lists the depth, location, quantity and number of anomalies investigated.

EE/CA Geophysical Investigation. Twenty-one 100-foot by 100-foot grids (4.82 acres) on the Project Site were investigated using magnetometer data previously collected by NORCAL. For areas where previously collected magnetometer data were not available and to assess the quality of the magnetometer data previously collected, a Geonics EM61 high-sensitivity metal detector was used to detect and map the location of subsurface anomalies and record the geophysical character. A total of 12 grids (2.75 acres) within the Project Site and an additional 7 grids (1.61 acres) immediately adjacent to the Project Site were geophysically mapped using the EM61 (see Figure 1-4).

Removal Action Work Plan Investigation (Raw). The removal action investigation phase of the non-OE RI included clearing anomalies from proposed excavation locations at the North Valley Military Landfill to facilitate the non-OE characterization of soil beneath the landfill. Geophysical techniques were utilized to locate subsurface anomalies within the North Valley Military Landfill. Anomalies identified in the footprint of a proposed exploratory test pit location were intrusively investigated to determine the source of the anomaly and to clear any OE encountered. OE scrap was encountered in approximately one-half of the excavations. No OE was recovered from the North Valley Military Landfill. However, as part of preparing for the Removal Action Investigation, an inventory was taken of the on-site ordnance storage magazine. Two rusted grenade fuzes were stored in the magazine. It is unknown from where these fuzes were recovered. Appendix D, Table D-4, lists the depth, quantity, and anomalies investigated during this removal action.

RAW Geophysical Characterization. A Geonics EM61 high-sensitivity metal detector was used to detect and map the location of subsurface anomalies and record the geophysical character. A total of 0.26 acre within the North Valley Military Landfill were geophysically mapped using the EM61. Appendix D includes

a CD (Removal Action Work Plan Investigation North Valley Landfill EM61 Data) with the RAW geophysical data.

Other OE finds

In May 1999, a potentially live expelling charge was encountered in the South Valley during the interim investigation phase of the non-OE RI. The expelling charge was discovered on the surface by UXO personnel that was accompanying the field crew while accessing 1 of 12 proposed test pit locations on the Project Site. The Explosive Ordnance Disposal (EOD) unit from Travis Air Force Base responded and removed the item. No official determination could be made as to whether the expelling charge was live; however, it has been classified as OE for the purpose of this discussion. The location of this item is shown on Figure 1-4.

Distribution of Recovered Anomalies

The majority of OE-related items recovered from the Project Site during previous OE clearances, the EE/CA investigation, and the removal action investigation were classified as OE scrap. OE scrap includes inert items such as gravel- or plaster-filled howitzer rounds, expended 105mm projectiles, and fragments of demolished ordnance. All non-OE-related items found during the previous clearances and investigations were classified as non-OE scrap. These items include, but are not limited to wooden boxes, wire, banding material, trash, and nails. A listing of OE-related items recovered from the Project Site during the August and December 1996 OE clearances, the EE/CA investigation, and the removal action investigation, is provided in Appendix D.

During the OE clearance of the Howitzer Test Facility and dispersed areas across the Project Site in August 1996, a total of 180 anomalies were intrusively investigated. A total of 69 anomalies (39 percent) were classified as OE scrap, and 95 anomalies (52 percent) were classified as non-OE scrap. There were no OE items recovered from the Project Site during the initial clearance in August 1996. A total of 16 anomalies (9 percent) were classified as "unable to locate." An anomaly was classified as unable to locate when either the OE dig team could not reacquire a magnetic signal at the location specified in the data collected by the geophysical investigation team or when a magnetic signal was reacquired and intrusively investigated, no magnetic source was found.

During the OE clearance conducted in December 1996, a total of 1,182 anomalies were identified at the Project Site and intrusively investigated. A total of 3 anomalies (less than 1 percent) were classified as OE, 842 anomalies (71 percent) were classified as OE scrap, and 337 anomalies (29 percent) were classified as non-OE scrap. In addition, three OE items were recovered from the Project Site in November 1996 prior to the December clearance activities. During the RAW investigation, two rusted grenade fuzes were noted in the inventory for the existing on-site magazine. The available dig sheets from previous

investigations do not list the fuzes. Most likely, the grenade fuzes were recovered and placed in the magazine during the November/December clearance activities.

Of the 274 anomalies intrusively investigated at the Project Site during the EE/CA investigation and determined to be associated with OE or OE scrap, 233 (85 percent) were recovered at depths ranging from 0 to 12 inches (i.e., within the first foot). A total of 36 anomalies (13 percent) were recovered at depths ranging from 12 to 24 inches. A total of four anomalies (1 percent) were recovered from between 24 and 36 inches, and one anomaly (less than 1 percent) was recovered at a depth of 48 inches. A summary of the nine OE items recovered from the Project Site is presented in Table 1-1.

The nine OE items recovered from the Project Site were found at depths ranging from 0 to 2 feet bgs. All OE scrap recovered from the Project Site, outside of the demolition pits, were recovered at depths of 2 feet bgs or less, with the following exception. Two grids (Grids 0313 and 0311) outside the demolition pits were found to contain OE scrap at depths up to 3 feet and 4 feet bgs, respectively. These grids were adjacent to areas disturbed by grading activities that may have dumped various amounts of fill over the area. The absence of OE scrap at depths greater than 2 feet bgs, except as noted above and the actual demolition pits, indicates that any OE at the Project Site would be shallowly buried. Penetration depth of OE at the site is unlikely to be associated with ballistic trajectories. All subsurface OE has been buried either by natural processes or by man. Using the impact velocities for various free-fall heights ranging from 50 to 500 feet, the maximum penetration depth in clayed soil for 37mm projectiles would be 0.187 inch to 1.81 inches. Similarly, the maximum penetration depths for a 60mm projectile would be 0.267 inch to 2.59 inches (Estimating Ordnance Penetration into Earth, CEHNC-ED-CS-S [Appendix E]). The calculated depth of soil penetration by soil type for a 37mm projectile and a 60mm mortar is shown in Table 1-2.

The depths of penetration were calculated using the algorithm presented in Appendix E. These calculated depths represent a site specific maximum penetration because all buried OE at the site (other than in disposal pits) derives solely from kickouts. The only penetration energy the kickouts have is the result of whatever trajectory height that may have been attained by objects ejected from the disposal operations.

1.5.6 Off-Site Issues

The final RI/FS for the Project Site identified two potential off-site issues: (1) TNT-affected soil may exist off site to the east and/or north of the TNT Strips, and (2) off-site fill areas. As noted in the final RI/FS, the areas where it is expected that soils may contain 10 percent or more explosives by weight have been included within the Project Site boundary and will be remediated along with the on-site TNT Strips. Soil and bedrock that was originally located within the Project Site boundary was moved in 1990 during grading activities. A portion of

the soil and bedrock was used to construct the on-site land bridge. In addition to the on-site uses, these materials were used as fill in residential subdivisions south and southwest of the Project Site. It is not known if the soil transported off site contained OE and/or OE scrap.

On August 10, 2000, a Benicia resident reported to local authorities that he had encountered an ordnance-related item on his property. Granite's OE Specialist and USACE have inspected the item and have come to the following conclusions:

- The tail fin is from a mortar.
- The condition of the tail fin indicates that the mortar was destroyed by demolition.
- The mortar had not been fired as evidenced by the unpierced percussion primer at the base of the tail fin.
- Given that no firing ranges have been identified at the former Benicia Arsenal, the likely point of origin for the tail fin was an open detonation (OD) site.
- The tail fin has been determined to be OE scrap.
- A total of 15 tail fins were found during the EE/CA investigation; 5 of these items were recovered in Sector 3B (a portion of the Project Site) and 10 were recovered in Sector 5 (the Camel Barn area). USACE designated all these items as OE scrap.
- The tail fin is nonhazardous and does not pose a safety risk.
- There is currently no basis to believe that a dangerous condition exists at the residential lot.
- At this time, additional information is needed to assess the likelihood that OE items exist in areas that have previously received fill soils.

Discussions have occurred between DTSC, USACE, and Granite concerning future activities that are appropriate to address the off-site issue. The following three points have resulted from these discussions:

- During the clearance work to be conducted at the Project Site and the former Benicia Arsenal (the Gonzalves property), additional information regarding potential source areas and the distribution of OE and OE scrap will be obtained. This information, combined with existing information, will be evaluated by DTSC, USACE, and Granite and will be used to determine if further action is warranted
- USACE is currently developing a Community OE Safety Program. The program focuses on educating the City of Benicia emergency staff on ordnance recognition, proper safety procedures and notification,

community education through workshops for adults and children, fact sheets, and newsletters.

- The final site conceptual model will be based on data collected during the point clearance phase of the OE investigation and remediation at the Project Site, which is scheduled to begin in January 2002, and during the work at the former Benicia Arsenal, which began in May 2001. Evaluation of the data may be available in the first quarter of fiscal year 2002. Based on the final site conceptual model and consistent with USACE procedure, if DTSC determines that OE was distributed to residential areas outside the Project Site boundary and as a result there is risk that OE items can be encountered in a manner presenting a significant risk of injury or death, then concurrent with the areawide clearance phase of work activities, a plan will be developed in accordance with an order or agreement to identify and address these off-site areas. This plan will be presented to the public. If required, the plan will include an analysis of response alternatives for these areas. Response alternatives may include the development of a Community Awareness Plan to educate the public, institutional controls, surface clearance of OE, and/or detection and clearance of OE to depth.

1.5.7 Current and Future Land Use

The Unit D-1 portion of the site, which is south of the South Valley, has been graded for residential development, with streets and utilities installed. One unoccupied house has been constructed in the Unit D-1 area.

The South Valley remains relatively undisturbed, except for the past activities previously described. The Ridge was used as a soil borrow area and, subsequently, as a soil stockpile area. As described above, the bottom of the North Valley has had a number of buildings installed and subsequently removed.

The Ridge, a majority of the North Valley, and Unit D-1 areas are planned as a residential development. The South Valley will remain as open space (Figure 1-5).

1.5.8 Man-made Features Potentially Affected by Removal Actions

The Ridge was used as a borrow area. Aerial photographs of the area indicate that some of the removed soils were used to construct the McAllister Drive Land Bridge. A sewer bench runs on the south slope of the South Valley parallel to a portion of Unit D-1. The sewer bench was constructed by cutting and filling and, therefore, the fill areas along the sewer bench may contain soils affected by OE. Additional fill areas within the Project Site where OE-affected soil may have been used as fill include fill areas in Unit D-1, the McAllister Drive Land Bridge, several landslide repair areas, and minor amounts of fill soils in the bottom of the North Valley. Soils in these areas will be cleared of OE through point clearance or point clearance and areawide clearance during the remedial action to ensure that no OE/pathway remains for interaction with the public.

1.6 ORDNANCE AND EXPLOSIVES REMEDIAL DESIGN DOCUMENT FORMAT

This document is organized as follows:

- **Chapter 1.0 - Introduction:** Discusses the OE remedial design goals and objectives, regulatory oversight, site physical features, site history, off-site issues, and current and future land use.

- **Chapter 2.0 - Remedial Design:** Provides a summary of the site ordnance and explosives remediation, descriptions of sub areas of the site to be investigated, and the sequence of work activities.

- **Chapter 3.0 - Design Basis:** Details the basis for the OE remedial design and describes the extent of the OE removal/remediation, site safety, environmental controls, regulatory considerations, public safety, technical approach, and data management for the detection and removal of OE.

- **Chapter 4.0 - Fieldwork:** Describes the detailed fieldwork required to implement the OE remedial design and criteria defined in Chapter 3.0, using the sequence of work outlined in Chapter 2.0.

- **Chapter 5.0 - Project Closure:** Describes the demobilization activities and preparation of the Project Site Closure Reports and Operation and Maintenance Plans.

- **Chapter 6.0 - Quality Control Plan:** Defines the roles and responsibilities for the quality assurance (QA)/quality control (QC) of the OE remediation activities and establishes procedures for QA/QC for the OE remediation.

- **Chapter 7.0 - Remedial Design Management Plan:** Identifies the Project Management organization including regulatory oversight and describes community outreach activities including key points of contact.

- **Appendix A - Project Schedule:** Includes the schedule for the fieldwork.

- **Appendix B - Minimum Separation Area Notification and Implemention:** Provides the procedures for public notification of project activities and establishes procedures for the evacuation of personnel from areas during hazardous operations.

- **Appendix C - Explosives Safety Submission:** Includes the Explosives Safety Submission to the Department of Defense Explosives Safety Board (DDESB).

- **Appendix D - NORCAL Geophysical Data:** Provides 2000EM61 data, electronic copies of the data developed by NORCAL's 1996

geophysical mapping, summary tables of investigations from 1996 to 2000, and field data forms (dig sheets).

- **Appendix E - Estimating Ordnance Penetration into Earth:** Provides the methodology used by USACE for determining ordnance penetration into Earth.

- **Appendix F - Ordnance and Explosives Site-Specific Health and Safety Plan:** Provides the health and safety standards and procedures to be followed for all personnel accessing the Project Site during the OE remediation.

- **Appendix G - Minimum Separation Distance Calculations:** Provides the USACE letters of approval and calculations used to establish minimum separation distances (MSDs) for conducting OE clearance activities on the Project Site.

- **Appendix H - Earth Tech Field Forms:** Includes reproducible copies of the field forms to be used during the OE remediation.

- **Appendix I - Standard Operations Procedures - Demolition/ Disposal Operations:** Provides the detailed operating procedures for preparation, demolition, and disposal of OE found on the Project Site during the remediation activities.

- **Appendix J - Blow-in-Place Engineering Controls:** Describes the engineering controls to be used for the preparation of OE items to be destroyed in-place without relocating them to the designated demolition/disposal area.

- **Appendix K - MTADS Standard Operating Procedures:** Provides the methodology to be used for operation Multi-sensor Towed-Array Detection System (MTADS) on the Project Site.

- **Appendix L - Resumes:** Includes resumes of key personnel.

- **Appendix M - References:** Includes the list of references used to prepare the OE RDD.

- **Appendix N - T-10 Transportable Donovan Blast Chamber Standard Operating Procedure:** Provides the methodology to be used for operation of the Donovan Blast Chamber on the Project Site.

- **Appendix O - Standard Operating Procedure Third-Party Quality Assurance:** Describes the quality assurance process to be used for activities on the Project Site.

Table 1-1. Summary of OE Found on the Tourtelot Property

Grid	Easting[a]	Northing[a]	Type	Description	Depth (inches)	Disposition	Date Found
NA[b]	6518714	1792353	OE	37mm HE projectile	unknown	Destroyed by Travis AFB EOD Unit	11/12/96
NA[b]	6518717	1792344	OE	76mm APHE round	unknown	Destroyed by Travis AFB EOD Unit	11/12/96
NA	6519242	1792111	OE	37mm HE projectile	unknown	Destroyed by Travis AFB EOD Unit	12/96
I-14	6519030	1792468	OE	40mm AA HE	12	Destroyed by Travis AFB EOD Unit	12/02/96
O-15	6520319	1792264	OE	60mm mortar, fuzed	2	Destroyed by Travis AFB EOD Unit	12/05/96
P-15	6520425	1792250	OE	40mm AA, unfired	8	Destroyed by Travis AFB EOD Unit	12/06/96
0312	6518714	1792342	OE	37mm HE projectile, fuzed	24	Destroyed on-site	02/23/99
0312	6518710	1792352	OE	75mm shrapnel HE projectile, unfuzed	6	Destroyed on-site	02/23/99
NA	6519085	1792150	OE	Expelling charge	surface	Destroyed by Travis AFB EOD Unit	05/06/99

Notes: (a) Easting and northing coordinates are estimated based on the location of the item within the sampling grid.
(b) Item found in EE/CA grid 0312, prior to the 1999 EE/CA investigation.

AA = anti-aircraft
AFB = air force base
APHE = armor-piercing, high explosive
EOD = explosives and ordnance disposal
HE = high explosive
NA = not applicable
OE = ordnance and explosives

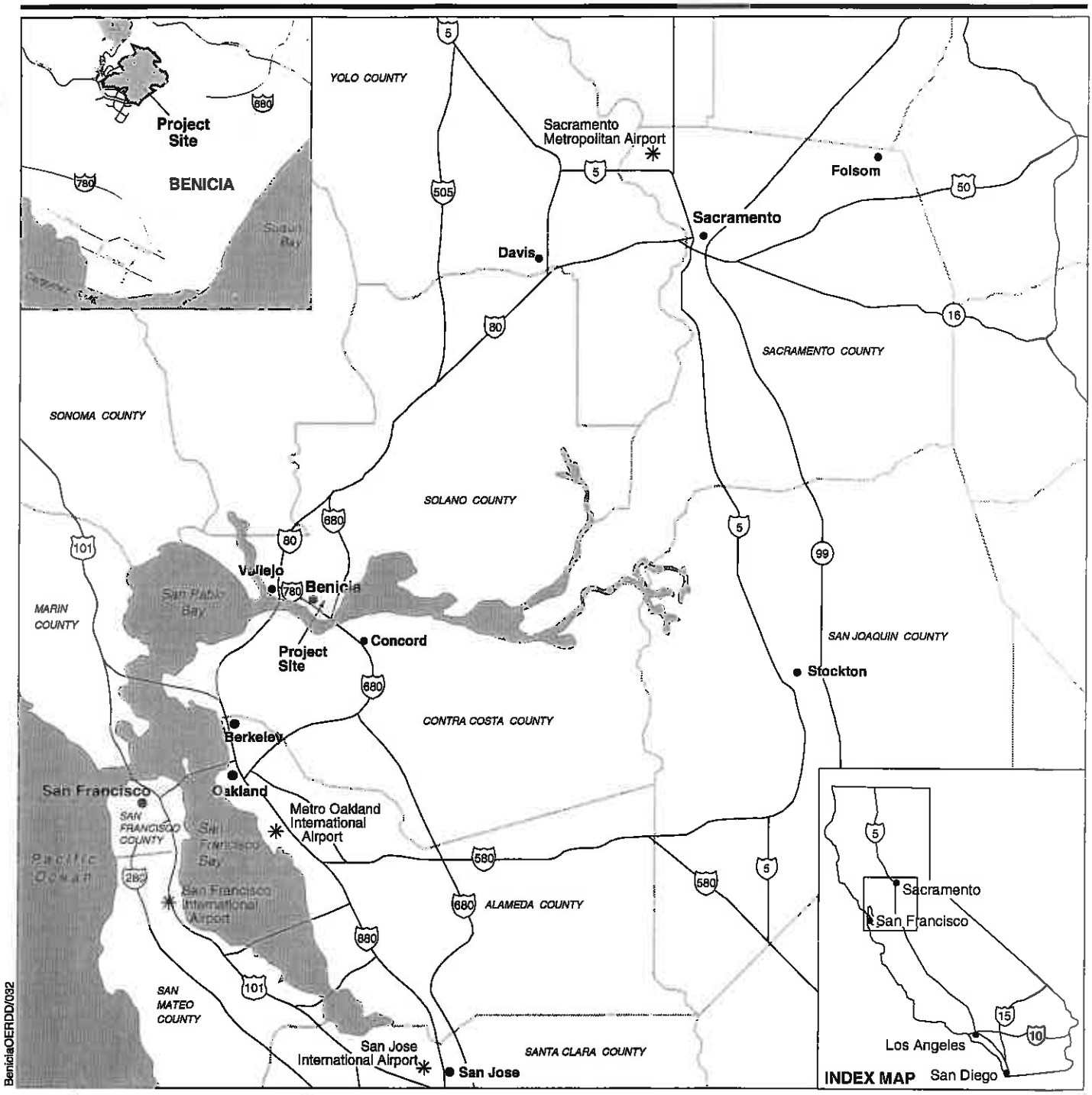
Table 1-2. Depth of Penetration (inches) for 37mm and 60mm Projectiles Based on Soil Type[a]
Page 1 of 2

Height (feet)	Limestone	Sandy Soil	Vegetated Soil	Clay Soil
37mm Projectiles				
50	0.014	0.093	0.123	0.187
100	0.027	0.186	0.245	0.373
150	0.041	0.278	0.366	0.558
200	0.054	0.370	0.486	0.741
250	0.067	0.461	0.605	0.923
300	0.081	0.551	0.724	1.104
350	0.094	0.640	0.841	1.283
400	0.107	0.729	0.958	1.461
450	0.120	0.817	1.074	1.638
500	0.133	0.905	1.189	1.814
550	0.145	0.992	1.304	1.988
600	0.158	1.079	1.417	2.161
650	0.171	1.164	1.530	2.333
700	0.183	1.250	1.642	2.504
750	0.195	1.334	1.753	2.674
800	0.208	1.419	1.864	2.843
850	0.220	1.502	1.974	3.010
900	0.232	1.585	2.083	3.176
950	0.244	1.668	2.191	3.342
1,000	0.256	1.750	2.299	3.506
60mm Mortar				
50	0.020	0.133	0.175	0.267
100	0.039	0.266	0.349	0.532
150	0.058	0.397	0.522	0.796
200	0.077	0.528	0.693	1.057
250	0.096	0.657	0.863	1.317
300	0.115	0.786	1.032	1.574
350	0.134	0.913	1.200	1.830

Table 1-2. Depth of Penetration (inches) for 37mm and 60mm Projectiles Based on Soil Type[a]

Height (feet)	Limestone	Sandy Soil	Vegetated Soil	Clay Soil
60mm Mortar (cont'd)				
400	0.152	1.040	1.366	2.084
450	0.171	1.166	1.532	2.336
500	0.189	1.291	1.696	2.587
550	0.207	1.415	1.859	2.835
600	0.225	1.538	2.021	3.083
650	0.243	1.661	2.182	3.328
700	0.261	1.785	2.342	3.572
750	0.279	1.903	2.500	3.814
800	0.296	2.023	2.658	4.054
850	0.314	2.142	2.815	4.293
900	0.331	2.261	2.970	4.530
950	0.348	2.378	3.125	4.766
1,000	0.366	2.495	3.278	5.000

Note: (a) Depth of penetration calculations do not account for air friction.
mm = millimeter



EXPLANATION

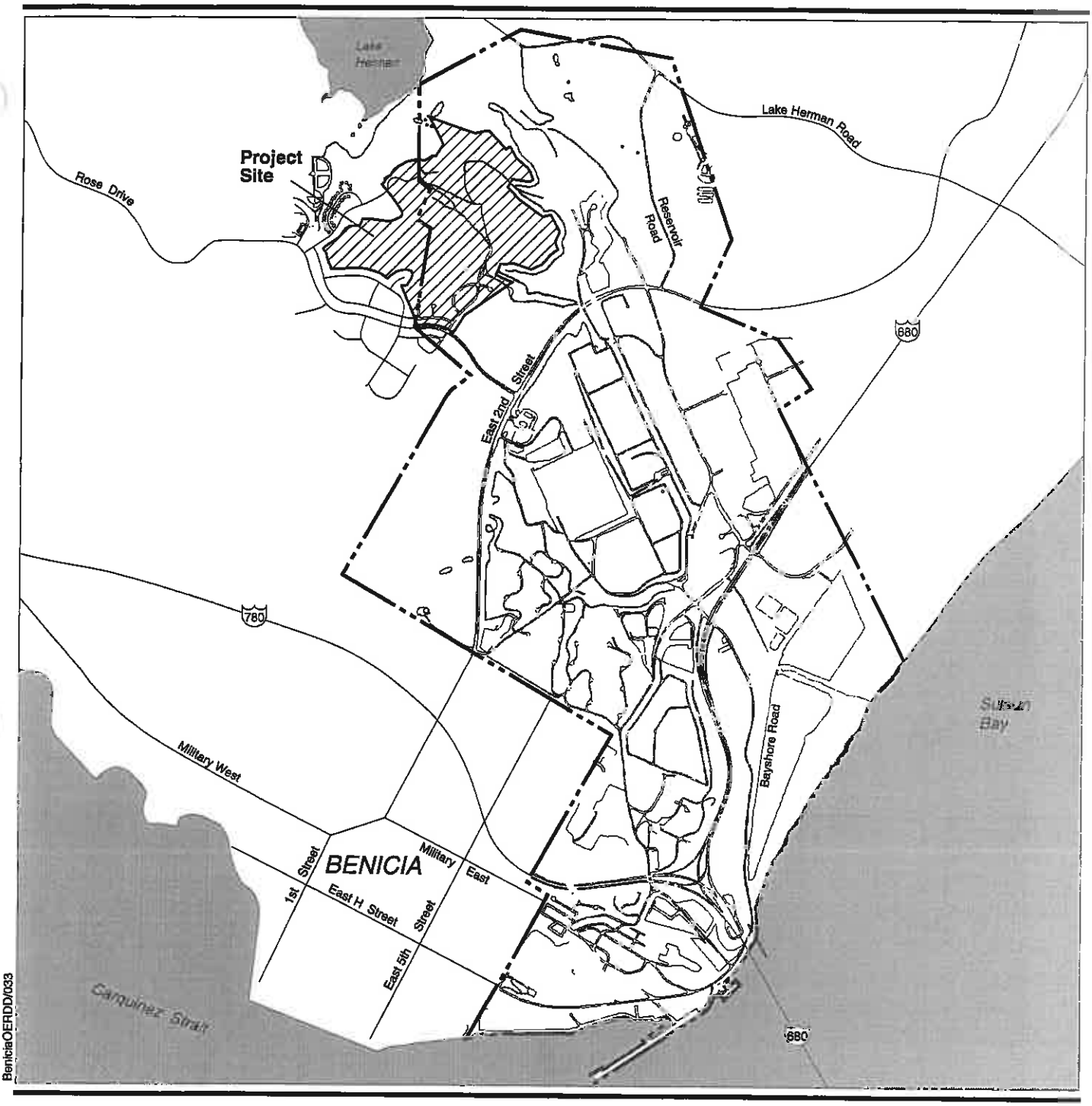
- ✳ Airports
- (99) California State Highway
- (101) U.S. Highway
- (280) Interstate Highway
- County Boundary

0 3.5 7 14 Miles

Regional Map

Final

Figure 1-1



EXPLANATION

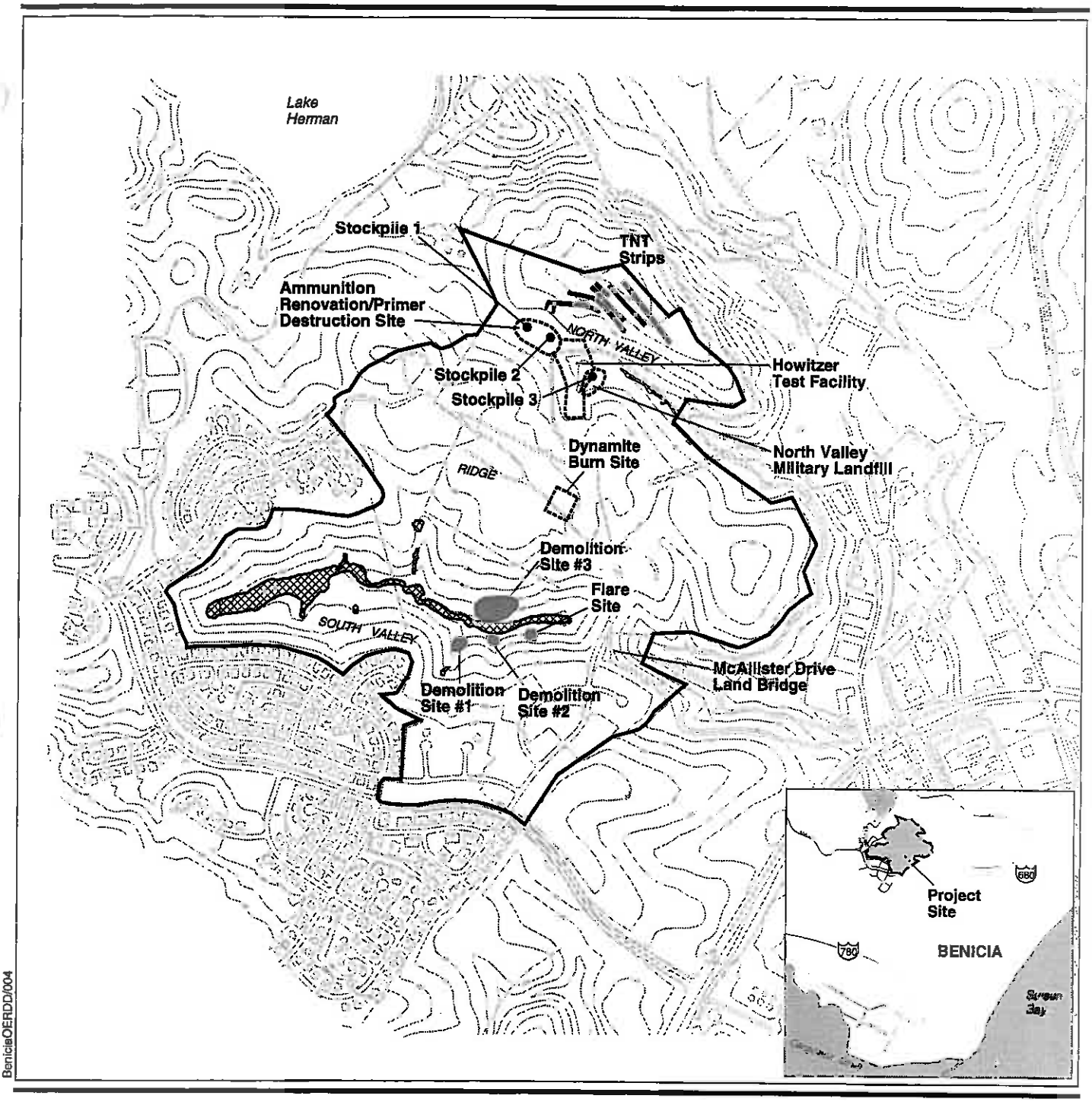
- 680 Interstate Highway
- Former Benicia Arsenal Boundary (estimated)
- Project Site

0 .125 .25 .5 Mile

Project Site Location Map

Final

Figure 1-2



BenicieOERDD/004

EXPLANATION

Project Site Boundary

Wetlands

Project Site Layout Map

Final

0 250 500 1000 Feet

Note: Contour interval equals 25 feet.

Figure 1-3

50 0 150 300 450 600 Feet

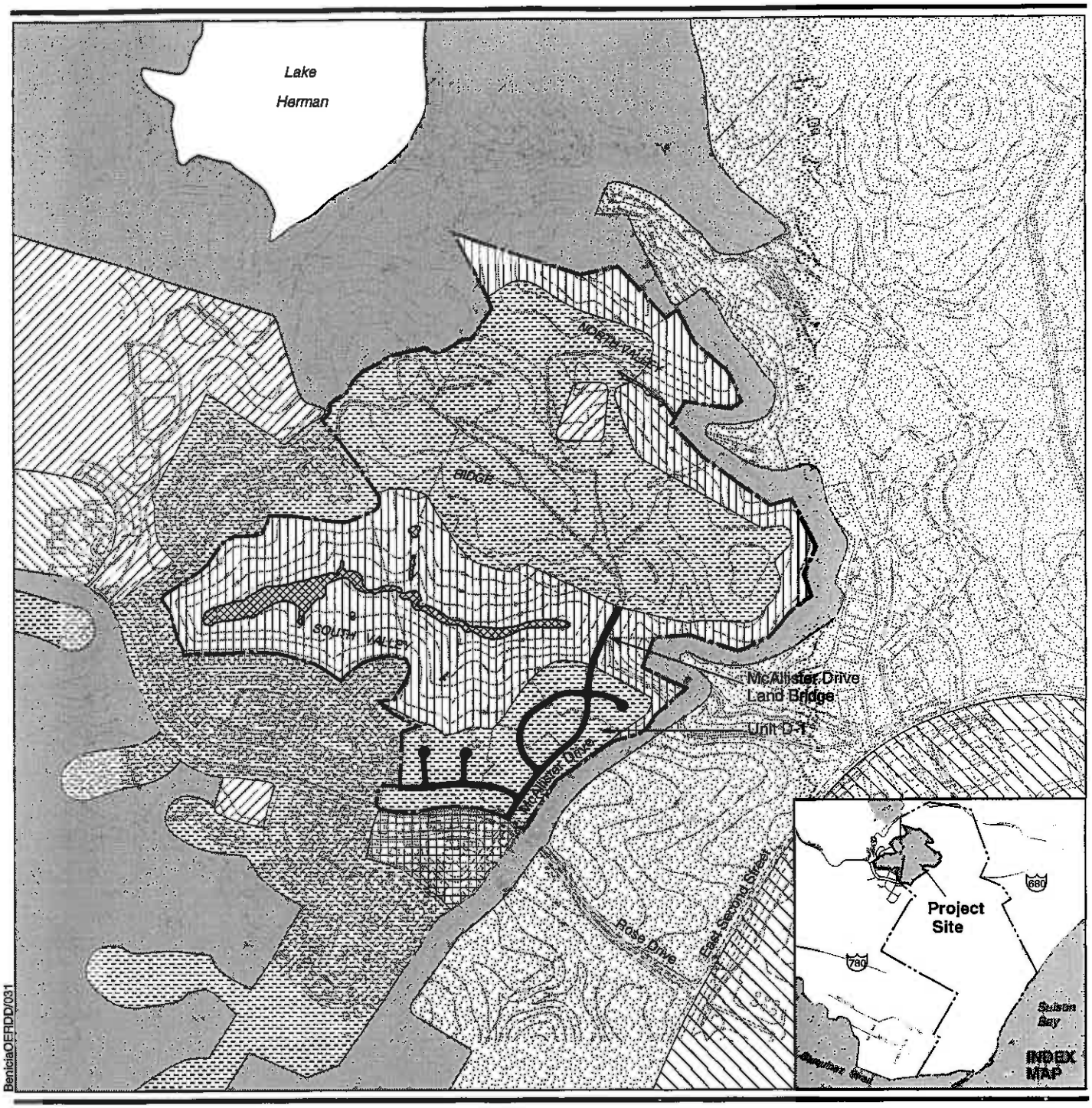
See City Attorney's Office for original.

Scale: 1" = 150'

FIGURE 1-4
mmary of Ordnance Data

ourtelot Cleanup Project
Benicia, California

February 2002



EXPLANATION

- Single Family Residential
- General Open Space
- Parks
- Light Industrial
- School
- Medium Density Residential
- General Industrial
- Jurisdictional Wetlands
- Restricted Open Space
- Restricted Paved Areas
- Project Site Boundary

0 250 500 1000 Feet

Note: Contour interval equals 25 feet.

Future Land Use

Final

Figure 1-5

2.0 REMEDIAL DESIGN

2.1 SUMMARY OF SITE ORDNANCE AND EXPLOSIVES REMEDIATION

The Tourtelot OE Remediation Project will investigate, detect, identify, and remove OE, OE scrap, and non-OE metallic debris from the Project Site. OE may be present on the entire Project Site except a portion of the bottom of the North Valley TNT sloping hillsides. Project Site OE remediation will consist of six significant coordinated activities, including:

- Surface preparation
- Point clearance of all detected anomalies across the entire Project Site, including appropriate disposal of any OE, OE scrap, and non-OE items
- Homogenization, excavation, and disposal of existing TNT-affected soil with TNT concentrations at or above 10 percent by weight
- Evaluation of ordnance data collected on the Project Site during OE point clearance
- Areawide clearance in order to assure clearance of OE from areas that are planned for future residential use in the South and North Valleys and on the Ridge where OE may be present after point clearance
- OE support of grading to provide OE-free, clean, crushed bedrock below final site grades in future residential areas of the property.

The Project Site has been divided into sectors to facilitate prioritization of an OE clearance and sequencing of associated tasks. Figure 2-1 presents the sector boundaries and significant features within each sector. Table 2-1 presents a description of each sector.

The six activities that will comprise the OE remediation are described in the following paragraphs. Detailed tasks associated with each of these activities are discussed in Chapter 4.0.

Surface preparation includes vegetation clearance, interior fence removal, removal and disposal of nonhazardous construction debris, and surveying and marking of grids used to control/track the progress of OE clearance activities.

As used in this OE RDD, the term "point clearance" refers to an OE cleanup approach that locates and removes individual surface and subsurface metallic anomaly sources. Point clearance will be performed over the entire Project Site and comprises a surface clearance to remove OE, OE scrap, and other metallic

debris from the surface; geophysical survey of all areas to detect and map potential OE; intrusive investigation of mapped anomalies; followed by a QC check consisting of a 100-percent remapping of the Project Site; and removal of any discovered anomaly sources. QA will include an internal review of the field data and an independent review and analysis of the geophysical and intrusive investigation results by a third-party entity.

At the completion of the point clearance and QA activities for Sector 9, TNT-affected soils in areas where the concentrations of TNT are potentially equal to or exceed 10 percent by weight will be homogenized. It has been conservatively assumed for the remedial design, based on RI data, that the TNT concentrations equal to or greater than 10 percent are confined to the unvegetated portions of the TNT Strips. Once these soils have been determined safe to move (i.e., below explosives limits) by confirmation sampling, they will be transported to an off-site landfill that is permitted to receive the TNT-affected soils.

At the completion of point clearance and QA/QC activities throughout the entire Project Site, an evaluation of the distribution of OE and OE scrap at the Project Site will be performed for the purpose of developing a final site conceptual model that will be used for assessing if it can be concluded that any areas of the Project Site are not suspected of containing OE below the depth of the point clearance and QC scans and, therefore, will not require areawide clearance.

Areawide clearance includes the removal of soil in future residential areas that contains or has the potential to contain OE, as determined by the final site conceptual model. In addition, if outlier OE items are identified, an area within 200 feet of an outlier (Additional Scan Area) will be areawide cleared if the area is within a future residential area. An outlier is defined as an OE item located in an area that would not otherwise be considered to have the potential to contain OE.

Areawide clearance soils will be scanned in lifts before they are excavated and will be scanned again in lifts after placement in the North Valley. Any anomalies detected will be removed through point clearance. The depth of the lifts will be 6 inches less than the reliable depth of the geophysical instrument as determined by the Equipment Performance Verification procedures outlined in Chapter 4 (see Section 4.8). Lifts will be geophysically scanned, cleared of anomalies, excavated, placed in the North Valley in 8-inch lifts, and scanned again. The criteria for ceasing scanning will be finding two consecutive clear lifts. A clean lift is a lift that does not contain any OE or OE scrap items. The presence of two clear lifts means that soil beneath the second clear lift is no longer suspected of containing OE. The criteria for ceasing scanning is fully described in Chapter 3.0.

A PPP (Granite Management Corporation, September 1999) has been developed for the Project Site. Project personnel will participate in public meetings to discuss project progress and activities in accordance with the PPP.

Prior to initiation of any proposed activities, businesses and residents near the Project Site will be informed of the proposed project activities in accordance with the MSAP (Appendix B). This notification will include information on a 24-hour public information telephone line that will be established and maintained to provide updated information on project activities, including information on planned or accidental detonations of OE, if applicable. The telephone line will also allow residents and businesses to express concerns or ask questions regarding project activities. All appropriate city, county, state, and federal officials will also be kept informed by direct mail and telephone notification.

2.2 SURFACE PREPARATION

2.2.1 Surface Preparation

2.2.1.1 Vegetation Clearance.

To prepare the Project Site for surface clearance activities and geophysical mapping, the area will be cleared of vegetation to a height of 6 inches or less to enhance ground visibility and facilitate site access. The majority of the vegetation will be removed by mechanical means (e.g., self-propelled and/or tractor-pulled mowing equipment). Most of the jurisdictional wetlands in the South Valley (approximately 2 percent of the site) will be cleared by a crew using hand-held manual and/or gasoline-powered equipment. Vegetation clearance will be preceded by a visually surface search performed with the aid of a site-tested metal detector. This work will be conducted by UXO teams as described in Section 4.3.

2.2.1.2 Soil Stockpiles.

All previously stockpiled construction debris from the Project Site will be removed during the surface preparation phase, including construction debris from Unit D-1, the Ridge, and the North Valley stockpiles (Figure 2-2). The soils mixed in with the construction debris will remain at each stockpile location until they can be point cleared for OE. Following the point clearance of stockpile soils, the soil will either be moved and stockpiled in Sector 10B and/or Sector 7 or will be loaded into trucks and taken to a suitable landfill for disposal.

2.2.1.3 Fencing.

Any fencing on the interior of the Project Site will be removed during the site preparation. Exterior fencing will also be temporarily removed (and replaced as soon as possible) to facilitate geophysical mapping around the borders of the site.

2.2.1.4 Surveying of Grids.

Survey crews will lay out a 100-foot by 100-foot grid pattern on the entire Project Site using corner stakes to indicate grid corners. The grid system will allow

geophysical and OE surface and subsurface clearance crews to accurately track their progress as they locate and clear OE, OE scrap, and non-OE metallic debris from the Project Site.

2.3 ORDNANCE AND EXPLOSIVES REMEDIATION

OE remediation will be accomplished through detection and removal of metallic anomaly sources from the Project Site using OE clearance activities that include OE surface clearance, geophysical investigation and mapping, and OE subsurface clearance. QC verification will include geophysical remapping of the entire Project Site and, as necessary, further OE subsurface clearance activities. These activities will be followed by non-OE remediation. The final remediation step will be an areawide clearance of soils within areas suspected of containing OE below the surface scans, within future residential areas that will be developed for residential use.

2.3.1 Ordnance and Explosives Point Clearance

2.3.1.1 Surface Clearance.

Survey crews will lay out a 100-foot by 100-foot grid pattern on the entire Project Site using corner stakes to indicate grid corners. The grid system will allow geophysical and OE surface and subsurface clearance crews to track their progress accurately as they locate and clear OE, OE scrap, and non-OE metallic debris from the Site. OE surface clearance activities involve a systematic search of the ground surface visually and with hand-held geophysical search equipment using a walking sweep line to clear each grid of OE, OE scrap, and non-OE surface metallic debris that could impact subsurface detection and mapping of potential OE sources.

The OE crew will identify each item as potential OE, OE scrap, or non-OE metallic items. Potential OE items will be left where found for inspection by the demolition crew, and OE scrap and non-OE metallic debris will be placed at the southwest corner of the grid in which it was found for subsequent collection and disposal as appropriate. OE, OE scrap, and non-OE metallic items will be identified and handled as described in Chapter 4.0.

2.3.1.2 Geophysical Investigation and Mapping.

Geophysical performance verification tests will be performed to determine instrumentation performance criteria .

Geophysical data will be collected using EM instrumentation, specifically, an MTADS because magnetometer systems can not detect nonferrous OE that may be present at the site. Where the towed array cannot be used (mainly on the steeper terrain and in portions of the South Valley wetlands), a dual-sensor, hand-towed, portable geophysical detector will be used (man-portable adjunct [MPA]

MTADS). Approximately 70 percent of the Project Site will be mapped with towed-array equipment; 30 percent of the Project Site will be mapped with portable equipment. The performance capabilities and limitations of the EM MTADS and MPA MTADS will be identified at an equipment test plot established for this project.

Geophysical and location data from a Global Positioning System (GPS) will be digitally collected and post-processed to identify anomaly locations. Identified anomaly locations will be recovered in the field using real-time kinematic (RTK) GPS instrumentation and marked for subsequent intrusive investigations.

2.3.1.3 Ordnance and Explosives Subsurface Clearance.

OE subsurface clearance includes:

- Excavation and identification of geophysical anomalies
- Removal of anomalies
- Disposal of OE and OE scrap.

Each marked location will be excavated to identify the source of the anomaly. OE dig teams will perform excavations using hand tools to uncover anomaly sources at depths between the ground surface and approximately 2 feet bgs, and a backhoe for anomaly sources deeper than 2 feet bgs. Non-digital, hand-held EM equipment will be used to ensure personnel safety during intrusive operations. The specific equipment will be identified and tested at the project equipment test site prior to field use. Anomaly sources will be categorized as OE, OE scrap, or non-OE debris. A detailed description of each recovered OE anomaly will be recorded. All discovered OE will be explosively destroyed. The procedures for OE and OE scrap disposal are described in Section 4.10 and 4.11.

2.3.1.4 Point Clearance of Stockpiles #1, #2, and #3; Ridge Stockpiles #1 through #9; Debris Piles in Unit D-1 Area; Fill Areas in Sector 8; and Sector 2.

As part of point clearance activities, soil remaining from debris piles in Unit D-1 Stockpiles #1, #2, and #3, and Ridge Stockpiles #1 through #9 will be point cleared in lifts. Heavy equipment will be used to spread out the soil. The spread out stockpiles will be scanned in lifts with MPA MTADS geophysical equipment operated by a qualified UXO Technician. The debris piles in Unit D-1 and Stockpiles #1, #2, and #3 will be scanned in a real-time (non-digital recording) mode. The technician will identify and flag anomaly locations by reference to the system audio output and digital display. After scanning and removing the anomaly sources in soils from Stockpiles #1, #2, and #3, the soil will be transported to a suitable landfill for disposal. The Ridge stockpiles #1 through #9 will be digitally scanned. The technician will record the anomaly locations, the digital data will be analyzed to locate anomalies, and the anomalies will be relocated in the field by a reacquisition team. Ridge stockpile soils and soil remaining from the debris pile in

Unit D-1 will either be temporarily stored in Sectors 7, 10A, and 10B, or transported to a suitable landfill for disposal.

Areas of the Project Site where on-site soils have been used as fill including the Unit D-1 fill areas in Piercy Court (Sector 2) and the fill on the bottom of the North Valley (Sector 8) will be point cleared in lifts. Each lift will be scanned with MPA MTADS geophysical equipment operated by a qualified UXO Technician, and all identified anomalies will be removed and, as necessary, OE items, OE scrap and non-OE debris will be disposed of. Heavy equipment will be used to remove the fill soils. Point clearance will continue in lifts until all the fill material has been removed.

Excavated fill materials from the Unit D-1 fill areas will be temporarily stored in Sector 10A or 10B until the North Valley has been prepared to accept fill soils.

2.3.1.5 Quality Control Verification.

A QC check of the detection and removal efficiency of the point clearance process will be performed by re-mapping the entire site, recovering and investigating any newly discovered anomalies, and categorizing the anomaly sources. Any anomalies found during the re-mapping will be excavated as described above. After each mapping/intrusive investigation activity is complete, a QC evaluation will be performed and documented, as outlined in Section 6.3.

2.3.2 Remediation of TNT-Affected Soil

TNT-affected soils with TNT concentrations of 10 percent or more by weight will be homogenized to a depth of 2.5 feet bgs or deeper, as necessary, in the strips that are devoid of vegetation. Field test kits and fix lab samples will be used to determine if the homogenization process has been successful. The homogenization process is described in Section 4.12.

2.3.3 Areawide Clearance

The areawide clearance activities on the Project Site will commence upon completion of OE point clearance and, evaluation of OE site data, and will include:

- Preparation of the North Valley to accept fill from the site.
- Removal of soils in future residential areas that at one time contained OE or is considered to have a potential to contain OE or within a 200-foot radius of an OE item that is in an area not otherwise considered to have a potential to contain OE. These soils will be placed in 8-inch lifts, scanned and used as engineered fill in the bottom of the North Valley.

Grading on the Project Site may be (1) associated with the excavation of previously placed fills (point clearance grading); (2) associated with areawide clearance (areawide clearance grading); or (3) grading in an area that does not meet the criteria for areawide clearance.

2.4 SEQUENCE OF WORK

The sequence of OE remediation activities has been planned to expedite completion of the Tourtelot OE Remediation Project while maintaining strict adherence to ensuring the health and safety of both project personnel and the general public. The first area that will be remediated is the Unit D-1 area. This area has been previously graded generally by cutting into bedrock to create finished residential lots. OE clearances within the Project Site will progress in the sequenced steps, as follows:

Step 1	Complete surface preparation activities across the Project Site including vegetation clearance, internal fence removal, and setting of grid stakes. Planned sector sequence is Sectors 10A/10B, 1, 2, 3, 9, 4, 7, 5, 6, and 8. Concurrent with site preparation is removal and off-site disposal of construction debris from debris stockpiles.
Step 2	Complete surface clearance activities across Project Site. All grids within 200 feet of the Project Boundary will be cleared followed by Sectors 10A/10B, 1, 2, 3, 9, 4, 7, 6, 8, and 5.
Step 3	Geophysically map, process data, and mark anomaly sources. Planned sector sequence is Sectors 10A/10B, 1, 3, 2, 4, 9, 8, 6, 5, and 7.
Step 4	Start point clearance activities across the Project Site. Planned sector sequence is Sectors 10A/10B, 1, 3, 2, 4, 9, 8, 6, 5, and 7.
Step 5	Point clear soils in Stockpiles #1, #2, and #3 in the North Valley, Stockpiles #1 through #9 on the Ridge, and stockpiles in Unit D-1. Relocate stockpiles to Sectors 7, 10A, and 10B, or dispose off site after they are cleaned.
Step 6	Repeat process in steps 4 and 5 across the Project Site as a QC process.
Step 7	Repeat process in steps 4 and 5, as necessary, in those grids that were identified during the second 100-percent geophysical mapping as still containing anomalies.
Step 8	Areawide clearance of the top of the south slope of the South Valley after completion of the QC scan of Sectors 1 and 3 (Unit D-1).

Step 9	Complete non-OE remediation; complete human health and ecological risk assessment.
Step 10	Evaluate point clearance data to assess if there are any areas of the Project Site that are not suspected of containing OE beneath the surface scans.
Step 11	Prepare North Valley to accept fill.
Step 12	Move temporarily stockpiled soils from Sectors 7, 10A, and 10B into the North Valley and scan the soils as they are being placed.
Step 13	Areawide clearance of portions of the Project Site where it is suspected that OE could be present beneath the surface scans; scanning these soils before excavation (first lift will have already been scanned) and as they are being placed in the North Valley.
Step 14	Construct OE free crushed bedrock fill over areawide cleared soil.

Steps 9 and 10 are expected to be performed concurrently.

Table 2-1. Project Site Sector Description

Sector	Description
1	Unit D-1
2	Fill area in Unit D-1
3	The portions of the South Valley within 200 feet of Unit D-1 boundary
4	The portion of the South Valley that is within 1,181 feet of Matthew Turner Elementary school (maximum fragmentation distance of 37mm HE projectile)
5	The remainder of the South Valley outside the limits of construction. This sector includes Demolition Sites #1 and #3 and the Flare Site
6	Relatively undisturbed portions of the Ridge and South Valley within the limits of construction for residential development
7	The Ridge that has been previously excavated to bedrock
8	The bottom of the North Valley as defined by the maximum extent of alluvial and/or fill materials
9	The north slope of the North Valley including the TNT Strips and estimated maximum extent of TNT-affected soils
10A	Soils borrow area for fill in Unit D-1
10B	Field verification of geophysical performance evaluation and stockpile area on the Ridge for fill soils or soils that were temporarily removed for point or areawide clearance

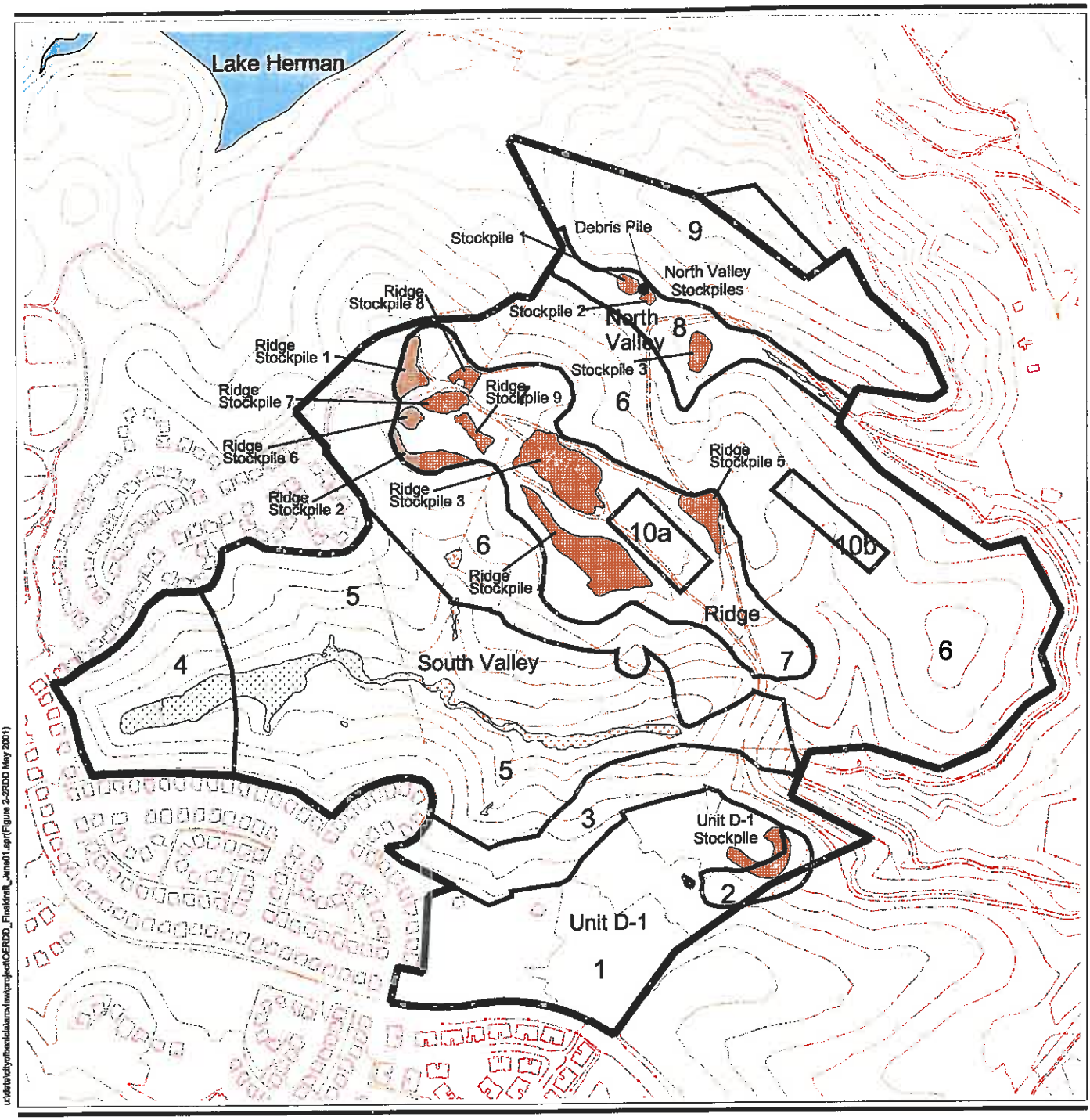
See City Attorney's Office for original.

FIGURE 2 - 1

Project Site Sectors

Tourtelot Cleanup Project
Benicia, California

February 2002



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EXPLANATION

- Project Site Boundary
- Sector Boundaries
- Stockpiles
- Wetlands
- 1,2,3,... Sector Numbers

Planimetric features

- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

350 0 350 700 Feet

Soil Stockpiles in Project Site Sectors

Final

Figure 2-2

3.0 DESIGN BASIS

This section details the basis for the OE remedial design. The extent of the OE removal/remediation, site safety, environmental controls, regulatory considerations, public safety, technical approach, and data management for the OE point clearance and areawide clearance are described.

The OE remediation was designed assuming that OE could be encountered in any soil area within the Project Site (lateral and vertical). In addition, the remediation design takes into consideration the future land use for the site, capabilities of current detection technologies, and required phasing of project activities. The future land use for the site is planned open space and residential use (see Figure 1-5). Because current detection technologies cannot guarantee 100-percent detection rates at depth, multiple geophysical scans using the best available technology and methods, soil excavation and rescanning activities as the material is placed in the North Valley was selected as the remedial design in residential areas. In addition, the soils derived from area wide clearance will be overlaid by a minimum of 14 feet of OE-free, crushed bedrock from the Ridge. For open space areas and in areas where pavement, sidewalks, and utilities are currently in place in Unit D-1 and the McAllister Drive Land Bridge, institutional controls will be implemented to limit subsurface disturbance without proper OE safety specialist support.

Soil mixtures with 10 percent or more explosives by weight are also considered OE. The design basis for the remediation of explosive soils was to find a safe and effective way to allow the TNT-affected soil to be excavated and transported from the Project Site to an appropriate landfill. Addition of water and discing (homogenization) to eliminate the heterogeneous high concentration (crystalline structure) and the explosive potential in the soil was selected as the remediation method. As determined by the analysis of alternatives in the final RI/FS report (Earth Tech, 2001), homogenization of explosive impacted soil would be the most effective way to reduce the reactivity of the soil to safe levels for handling.

Phasing of the project was influenced by several factors. The relocation of soil to the North Valley cannot occur until after completion of non-OE remediation. Point clearance of Unit D-1 (Sectors 1 and 2) and a 200-foot MSD from Unit D-1 (Sector 3) has been phased early in the sequence of events to allow the early construction start for homes in Unit D-1 before OE remediation is completed on the remainder of the Project Site. In addition, point clearance on a portion of the South Valley (Sector 4) will be phased in the project sequence to reduce impacts on residents and to the Matthew Turner Elementary School from voluntary evacuations when school is in session.

3.1 EXTENT OF REMOVAL/REMEDIATION

It has been assumed that OE should be expected in any soil area within the Project Site boundaries. However, the greatest likelihood of detecting OE is expected to occur within or near areas of the Project Site that have been used for demilitarization of OE by DOD. A preliminary site conceptual model (SCM) based upon the results of previous OE investigations is shown on Figure 3-1. A final site conceptual model will be developed that is based on data collected during the point clearance phase of this OE investigation and remediation and the work at the Former Benicia Arsenal, which began in May 2001. Horizontal distribution of OE resulted from OE or OE scrap being expelled or "kicked out" from a demolition site during disposal operations.

Vertical distribution of OE through the soil column is dependent upon how the Project Site was used by DOD. There are two suspected demolition sites (Demolition Sites #1 and #3) and a Flare Site in the South Valley (see Sections 1.5.4.6, 1.5.4.7, and 1.5.4.9). There was a Howitzer Test Facility where inert artillery rounds were fired into test tunnels. There were no artillery ranges and/or bombing activities at the Project Site. Therefore, there has been no OE found that penetrated as a result of ballistic trajectories anywhere on site.

All subsurface OE has been buried either by natural process or by man or has been expelled or kicked out from demolition activities. OE outside Demolition Sites #1 and #3 in undisturbed areas would be expected to be distributed in the top 1-2 feet of soil. This finding is consistent with the data collected in the Former Benicia Arsenal EE/CA and the maximum penetration depth for a 37mm and 60mm based on the impact velocities for a free-fall height of 500 feet. Based on this information, two conclusions have been made: (1) OE outside the defined demolition sites in undisturbed areas would be relatively shallowly buried below the surface (i.e., less than 2 feet bgs); and (2) OE could not be present within the bedrock at the Project Site; therefore, bedrock is considered to be free of OE.

No federal or state requirements (i.e., ARARs) have been promulgated that prescribe OE remediation levels in soil. Therefore, remediation goals have been conservatively developed in this OE RDD to allow unrestricted development of the planned residential areas of the Project Site and to remediate open space areas to acceptable levels. Risk-based cleanup goals were developed for TNT and are presented in the final RI/FS report.

In order to meet the OE remediation goals for the Project Site, a two-step approach was developed to (1) remove all detectable metallic anomalies down to the limit of the equipment detection over the entire Project Site, except paved areas of Unit D-1 and McAllister Land Bridge and areas where soil will be excavated and scanned in lifts such as the identified demolition sites and fill areas; and (2) geophysically scan and remove surficial soils in residential areas that potentially could contain undetected OE (areawide OE clearance) and scan again after placement in the North Valley; until two OE and OE scrap-free lifts or bedrock

are obtained. In the demolition site areas the excavation and scanning in lifts will be continued until bedrock is encountered.

The extent of areawide OE clearance within the residential areas will be determined by an evaluation of the point clearance data. The distribution of OE and OE scrap will be analyzed to identify patterns of OE and OE scrap and assessed to determine whether or not these patterns are considered to be kicked out of demolition sites. The distribution of OE and OE scrap will be used to define the extent of the areas where areawide clearance is required. If an OE item is not associated with a pattern, it will be considered an outlier, and a 200-foot-radius additional scan area around the location of the OE item will be identified. Areawide clearance will be conducted within the 200-foot radius if it is within a future residential area.

3.2 ENVIRONMENTAL CONTROLS

Environmental control criteria included in this OE RDD address the following:

- Air quality monitoring
- Noise abatement
- Excavation and erosion control
- Storm water runoff control.

3.2.1 Air Quality Control

The City of Benicia is in the BAAQMD jurisdiction area, which encompasses the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB is designated as a nonattainment area (California Ambient Air Quality Standards [CAAQS]) for ozone and for particulate matter equal to or less than 10 microns in diameter (PM_{10}). Monitoring of Project Site boundary concentrations of airborne dust (PM_{10}) will be performed during all Project Site excavations in chemically affected soil areas (Flare Site, Demolition Sites #1 and #3, and the TNT Strips) and during detonations.

To conduct the monitoring, a total of three PM_{10} monitors will be used, where:

- One monitor is placed at the upwind Project Site boundary
- Two monitors are placed at least 100 feet apart along the downwind Project Site boundary.

The predominant wind direction prevails from the west. However, wind conditions will be assessed continually during site activities to determine if monitoring locations need to be modified. Mean wind speeds range from 7 to 14 miles per hour (mph). Sample filters will be recovered each day monitoring is performed and placed in appropriate labeled containers indicating the date, sample location, sample collection time (total plus on/off times), and total air volumetric flow through the sampler. Samples will be sent off site for measurement of total collected

mass (gravimetric analysis), which will be used to determine average dust concentrations at the upwind and downwind boundary monitoring locations.

If results from any day show that any downwind concentration (minus upwind background concentration) exceeded 0.15 milligrams per cubic meter (mg/m^3), the OE Site Safety Officer (OE SSO) will be contacted to determine if work procedure modifications, improved emission controls, or revised work site monitoring procedures are warranted.

In order to control off-site emissions, work area monitoring will be performed to assess and control airborne dust emissions.

Monitoring will be performed using a real-time aerosol monitor capable of accurately measuring airborne dust concentrations to less than 1 mg/m^3 (MIE Model pdm-3 Miniram or equivalent). Readings will be taken at the work area where excavations in chemically affected soils are occurring at 30-minute intervals and recorded in the field log book. Reading locations will include, at a minimum:

1. The location 25 feet upwind of the active work area (baseline concentration).
2. The location 10 feet downwind of the active work area.
3. The equipment operator's breathing zone.
4. The breathing zone of one other worker near the active work area.

The baseline concentrations result (upwind location) will be subtracted from each of the subsequent readings, and the results will be used to determine whether dust control measures are adequate, based on the following:

Dust Concentration Above Background	Response
0 – 1.0 mg/m^3	No action required.
1.0 – 1.5 mg/m^3 measures	Implement additional dust mitigation (see SSHP Addendum 1 Section 5.4)
> 1.5 mg/m^3 (two consecutive readings)	Cease work until emissions can be controlled to less than 1.0 mg/m^3

In addition, at 30-minute intervals, an assessment will be made of the Project Site boundary conditions at all areas downwind of active work locations. No visible dust emissions are permissible leaving the Project Site boundary at any time. Failure to meet this criteria will necessitate work stoppage until environmental

conditions (wind speed/direction) or operational procedures will allow work without visible emissions at the boundary.

Since inhalation exposure of chemicals is related to dust emissions, the following requirements will be implemented at all times.

1. Active soil stockpiles and active excavation areas will be wetted using water. Sufficient wetting will be used to control dust emissions to acceptable levels.

2. When not active, soil stockpiles will be covered with plastic sheeting or a similar material. All piles will be covered at the end of each work day.

3. Soils will be carefully dumped/handled to minimize dust emissions. Dumping at heights greater than 2 feet is prohibited when loading trucks.

4. Haul roads will be watered at least once each hour, or more frequently if roads are observed to be dry or if visible emissions are produced by normal vehicular traffic.

In the event that on-site monitoring indicates the excessive release of dust, one or more of the following mitigation procedures will be implemented:

1. Additional water will be placed onto active surfaces to wet soils.

2. The work rate will be reduced to reduce emissions.

3. Excavation equipment will be replaced with other equipment to reduce emissions.

If mitigation measures are ineffective, work operations will stop and the OE SSO will be consulted for additional guidance.

3.2.2 Noise Abatement

The project includes three operations that could result in noise impacts: (1) brush and vegetation removal by gas-powered weed cutters and tractor-pulled mowers; (2) heavy equipment operations during OE point and areawide clearance; (3) other grading activities; and (4) detonation of OE.

All heavy equipment will be equipped with mufflers and air intake silencers to reduce noise emissions. Hours of operation will be limited to working hours (7:00 a.m. to 5:30 p.m.). Maintenance of construction equipment may occur up to 10:00 p.m. During a BIP detonation, noise monitoring will be conducted at the

Project Site boundary and/or the property lines of the residences nearest the detonation.

Noise levels generated by Project Site activities will not exceed the Noise Level Performance Standards contained in the City of Benicia's noise ordinance (Chapter 8.20.010).

3.2.3 Surface and Groundwater Contamination Control

The size of the Project Site and the nature of the proposed activities do not present the potential for depletion or degradation of groundwater, nor will they affect groundwater recharge. During project activities, there is no long-term requirement for water usage. Water will be brought on site for dust suppression and soil compaction.

A storm water pollution prevention plan (SWPPP) will be developed prior to excavation activities. The SWPPP will include a plan drawing of the Project Site showing where specific types of erosion and sediment control measures will be used, detail drawings of each measure, and a list of specifications on how each measure is to be implemented. Surface drainage at the Project Site will be controlled as detailed in the SWPPP to reduce the potential for erosion as a result of project activities.

3.2.4 Excavation and Erosion Control

Unstable earth conditions resulting from OE point clearance excavations will not be significant because the depth of the excavations is not expected to exceed 2 feet in any of the grid locations, with the exception of the demolition sites. Erosion control requirements will be implemented as required by the approved Grading Plan and the SWPPP.

Use of silt fences downslope of excavation areas will reduce movement of sediments into wetland areas. Soil stockpiles potentially containing chemicals of potential concern will be placed on, and covered with, non-permeable plastic sheeting to separate these soils from underlying soils-bedrock.

3.2.5 Grasslands and Jurisdictional Wetlands

Figure 3-2 shows the areal extent of the delineated jurisdictional wetlands within the Project Site boundary. Prior to beginning any work, the CDFG will be notified of the proposed activities through the Notification of Lakes and Streambed Alteration Form FG2023 and Project Questionnaire Form (FG 2024). CDFG will notify project proponents if a permit is needed.

Vegetation clearance adjacent to the wetlands, hand-excavation of anomalies, and BIP activities in and around the wetlands will require control measures to prevent

erosion (detachment of soil particles) or control the movement of mobilized sediment.

The project will implement regular maintenance activities to prevent soil, petroleum products, and litter from accumulating on the Project Site and degrading water quality through surface runoff. Fueling areas will be designated on maps and situated at least 50 feet from all drainages and 300 feet from wetlands. Construction debris will be placed in a designated area away from the aquatic habitats to prevent wind- or water-borne debris from entering the water bodies.

A qualified biologist will review grading plans, mark sensitive habitats on maps, and flag all sensitive habitats that are to be avoided, prior to the onset of construction. A contractor education program will be implemented to ensure that the contractors and all construction personnel are fully informed of the biological sensitivities associated with the Project Site.

A survey will be conducted by a qualified biologist to determine if grassland avian species or tricolored blackbird (*Agelaius tricolor*) nesting sites are present. Any nesting locations will be flagged and destruction of such sites will be avoided to the maximum extent possible. Construction activity near these locations will be avoided until the nesting period is over and the young have left their nest.

Exposed slopes will be hydroseeded. Seeding mixtures and types of plant species to be seeded will be coordinated with CDFG by the project proponent. Following completion of project activities, the drainage area supporting the South Valley wetlands will be restored to reestablish marsh and riparian vegetation similar to the one that has been disturbed or lost.

Following completion of all remediation activities on the Project Site, the proponent will implement a mitigation program approved by USACE (Regulatory) to compensate for the loss of approximately 0.215 acre of the North Valley and South Valley seep jurisdictional wetlands. A wetlands replacement ratio of 2:1 may be implemented as compensation.

3.3 SITE WORKER AND PUBLIC SAFETY

3.3.1 Minimum Separation Distance

The OE Site-Specific Safety and Health Plan (SSHP) (Appendix F) provides strict safety procedures for site activities to ensure that the remediation is conducted in compliance with applicable safety regulations. The OE SSHP requires the establishment of an MSD around the work area to provide safety to support personnel and the public during OE remediation activities. The MSD is the distance beyond which personnel, except for personnel conducting the proposed activities, withdraw for safety purposes. The MSD is based on an accidental detonation on the ground surface in which no engineering controls are in place. The MSD may be larger than is required for intentional detonations where use of

engineering controls will contain the fragments and reduce the associated noise and dust. The MSD is 200 feet, based on the most probable munition (MPM) of a 37mm HE projectile and the 60mm HE mortar (U.S. Army Corps of Engineers, 2000) (Figure 3-3). The MSD is based on USACE's *Methods for Calculating Range to No More Than One Hazardous Fragment per 600 Square Feet* (HNC-ED-CS-S-98-2) for accidental detonations. If, during the course of the OE remediation it is determined that a different MPM is appropriate, all intrusive operations would cease and the USACE Safety Specialist would be notified. A new MSD would be determined and an amendment to this OE RDD shall be submitted for approval. Until this amendment is approved, the specified default distances in DOD 60559-STD, Chapter 5, Table C5.T.1 will be used.

Additionally, remediation of TNT-affected soil with TNT concentration of 10 percent or more by weight will require an MSD of 412 feet, based on blast distance calculations derived from the potential net explosive weight of TNT in the soil. These calculations are based on the procedures included in "Ammunition and Explosive Safety Standards," Department of the Army Pamphlet PAM 385-64. These calculations are provided in Appendix G.

The MSD must be maintained during OE surface clearance, the excavation of OE-related anomalies, disposal of OE, and homogenization of TNT-affected soils with a TNT concentration of 10 percent or more by weight. Only OE crews, geophysical crews, and other support crews that are essential to the OE remediation on the Project Site will be allowed within the MSD. However, a safe separation distance of not less than 200 feet must be maintained at all times between the various work crews.

3.3.2 Minimum Separation Areas

Because of a potential for an accidental or intentional detonation that could cause an impact to on- and off-site personnel and the public, an MSA based on the MSD will be established to identify areas where the public and nonessential personnel will be excluded during OE excavations. The MSA includes the surface area within the radial MSD of the OE excavations. An MSA will be established each work day for OE surface clearance and all excavations to be completed during the day. Each daily MSA will be defined using the following criteria:

- The number and location of grid to surface cleared or anomaly excavations affecting a specific off-site area
- The number and location of grids to be surface cleared or the anomaly excavations to be completed during an 8-hour work period
- The number of available OE crews.

The MSA will be cleared of non-essential personnel during the execution of OE surface clearance or OE anomaly removal activities and excavation of TNT-affected

soils containing concentrations of explosives of 10 percent or more at the Project Site.

3.3.3 Voluntary Separation Distance

Residents and businesses outside an MSA, but within the distance that fragmentation could conceivably travel in the event of an accidental detonation, will also be notified of the potential hazards associated with clearance activities at distances beyond the MSD. The applicable distances for this broader notification, or voluntary separation distance (VSD), will be based on the maximum distance a fragment could travel in the unlikely event of an accidental detonation. For this project, USACE has calculated 1,080 feet for the 60mm HE mortar and 1,181 feet for the 37mm HE projectile as the maximum fragmentation distance for these items. Notification will include a public meeting to be held prior to mobilization for the field effort and specific notification prior to work within an area where homes, businesses, or schools would be within the VSD of OE surface clearance activities or an intrusive OE operation, in accordance with the MSAP (see Appendix B). The VSD for the Project Site is shown on Figure 3-4. These distances will remain constant unless site data collected during remedial activities indicate that a different munition should be used to establish the VSD.

3.3.4 Mandatory Public Withdrawal

Land areas bordering the Project Site that are within the 200-foot MSD are shown on Figure 3-3. Residents within this area, designated as the MSA will be required to vacate during OE excavation activities, but residents will be able to return to their homes at the end of each work day. The public withdrawal and relocation of residents within the MSA will proceed as detailed in the MSAP (Appendix B).

OE clearance activities will be conducted over the entire Project Site. As currently extended, the mandatory MSA will affect approximately 191 homes (see Figure 3-3). Each home may be affected for 1 day during OE surface clearance and a period of up to 8 days during OE intrusive investigations. An example daily evacuation area is shown in Figure 3-5.

3.4 TECHNICAL APPROACH

The entire Project Site will be geophysically scanned and all detected anomaly sources will be excavated and removed. In Demolition Sites #1, #3, the Flare Site, fill areas in the North Valley, and the fill area in Unit D-1 where the potential for OE may be greater at depths, the soils will be scanned, cleared of anomalies, and excavated in lifts to remove all detected anomalies. In addition, all areas of the Project Site where OE and OE scrap were detected will be evaluated to determine the area's potential to contain OE. Based on the results of this analysis, further scanning and excavation of subsurface soils will occur in areas of the Project Site that are within a future residential area if the area is considered to have a potential to contain OE. Institutional controls will be implemented and maintained in open

space areas of the Project Site and in the paved portion of the McAllister Drive Land Bridge and the paved portion of Unit D-1.

The sequencing of the removal/remediation activities has been planned to expedite completion of clearance activities in Unit D-1 and adjacent areas to allow commencement of an early construction start of Unit D-1. Completion of an OE removal/remediation in Sectors 1, 2, and 3 will create at least a 200-foot buffer between construction activities in Unit D-1 and OE remediation activities in the rest of the Project Site. Work on the west side of the South Valley will be scheduled to reduce impacts to the Matthew Turner Elementary School from voluntary evacuations. However, this is dependent upon the project start date and school schedule.

3.4.1 Surveying of Grids

Plastic or wooden hubs will be used for all basic survey control points. Horizontal and vertical control of "Class I, Third Order (1:1000)" or better will be established for the grid network of monuments. Horizontal control shall be based on the English system and referenced to the North American Datum of 1983 (NAD83) and the State Plane Coordinate Grid System. Vertical control shall also be based on the English system and referenced to the North American Datum of 1988 (NAD88). All control points (monuments, aerial targets, and property corners) recovered and/or established at the Project Site will be plotted at the appropriate coordinate point on a planimetric or topographic map at a scale of 1 inch = 200 feet (1:2,400).

3.4.2 Surface Clearance

Each grid will be cleared of surface OE and OE scrap. In addition, non-OE surface metallic debris that may interfere with the geophysical instrument will be removed. Identification and handling of these materials is described in Chapter 4.0.

3.4.3 Detection and Mapping of Ordnance and Explosives

Inductive time domain EM (TDEM) instruments will be used for this work because equipment tests previously conducted at the Project Site, as described in the EE/CA Work Plan for the former Benicia Arsenal showed that EM devices have greater detection capabilities than magnetometer systems (U.S. Army Engineering and Support Center, 1998b). Additionally, nonferrous OE such as World War II projectile fuzes, primers, burster tubes, and flare tubes is a significant concern at disposal sites (more so than on impact ranges); therefore, magnetometer systems are not being considered for use on the Project Site. The MTADS EM, MPA MTADS EM, and hand-held EM instrumentation, White Pulse Induction metal detectors will be used for the project. The operational limitations of these systems will be defined during equipment performance verification tests. TDEM systems are used to map the apparent conductivity of the ground and near-surface material. Discrete anomalies or peaks represent possible OE sources and can be mapped by tracking the position of the EM instrument along the traverse. Inductive EM

geophysical methods are practical for locating isolated targets, as well as buried trenches and pits containing OE.

EM systems have been proven by both independent government evaluation and field implementation to be one of the most effective means for the detection of OE. With all geophysical instrumentation, the percentage of detection is a function of the size and depth of burial of the OE item being acquired. The larger and shallower the item, the more effective the TDEM technology will be in locating the item. The shallow burial depths across most of the Project Site lend themselves to higher detection rates.

TDEM data will be collected to discern anomalies for excavation. Tabulated anomaly lists will be reviewed by the project geophysicist prior to delivering target lists (dig sheets) to the OE investigation teams. Once anomalies are identified in the data, the anomalies will be reacquired in the field.

For the OE point clearance phase, two digital geophysical surveys using an MTADS in accessible areas and an MPA MTADS in areas that are difficult to access will be completed for the entire Project Site. The second survey will provide a 100-percent QC check of the detection and mapping performance. The second geophysical survey mapping direction will be parallel (i.e., the same direction) to the first geophysical survey mapping direction. If an anomaly that is not a false-positive (i.e., an item is recovered from the location) is detected in the second scan, a third scan of that grid will be required.

The Naval Research Laboratory (NRL) has documented and explained the responses of the MTADS to the same target along orthogonal survey passes in *Electromagnetic Induction and Magnetic Sensor Fusion for Enhanced UXO Target Classification* (Naval Research Laboratory, 2000). The orientation differences derive from the directionality of the current field generated by the dipole transmitters of the EM systems with the result that the transmitter primary signal couples best with elongate conductive objects that have their major axis parallel to the lines of current.

The magnitude of the secondary field induced in the conductive object is directly determined by the strength of the coupled signal. The best coupling occurs when the major axis of the target source is vertical and the object is directly below the transmitter. Next best after the vertical alignment is coupling with an horizontal object under the edges of the transmitter with the major axis of the conductive body parallel to the field direction. For an EM61 transmitter (the MTADS is composed of multiple EM61s) this occurs when the long axis of the target lies perpendicular to the square loop transmitter of the system (i.e, parallel to the survey direction).

The data presented by the NRL indicate that the orientation of elongated targets, such as an 81mm mortar rocket or larger artillery projectile, can result in 30 to 40 percent variations in the geophysical responses amplitude, depending on the

transverse direction over the target. Additionally, the shape of the geophysical profile plot over such ordnance will also be significantly different. The strength of the geophysical response to these OE is, however, great enough that 81mm and larger munitions are typically detectable at greater than 30 inches bgs, even for the least-coupled response.

Conversely, the results of the *Ordnance Detection and Discrimination Study* (ODDS) *Seeded Test Technical Memorandum, Former Fort Ord, California* (U.S. Army Corps of Engineers, Sacramento District, 2000) indicate that it is the proximity of the target to the transmitter array that is the dominant detection parameter for smaller OE, such as 37mm projectiles. To ensure detection of these smaller OE it is essential that complete coverage of the survey area is achieved. To accomplish this requirement, the transmitter/receiver footprint must pass over every portion of the search area. This is best accomplished by controlling the survey line spacing to ensure that some overlap occurs along the edges of each contiguous survey swath.

The MTADS proposed for the Tourtelot project has a 6.5 foot wide array comprised of three 3.28-foot square EM61 antennas interlaced such that there is 1.6 feet between the antenna coil centers. Deploying this system along survey lines spaced five feet apart provides 1.6-foot line spacings on the inside of the array track and 2.5-foot spacings along the track edges, yielding the requisite footprint overlap for optimal detection of small OE. The MPA MTADS consists of a single 3.28-foot-square transmitter/receiver. To obtain similar overlap with this system, the MPA should be deployed at no greater than 2.5-foot line spacings.

QC to assure complete coverage of the survey area will be achieved by ensuring proper line spacings are maintained. This will be accomplished by posting the centerline of the survey track (using a symbol size proportional to the required swath width) on a plot of the survey path and identifying all areas where the track centers of adjacent lanes are more than 2.5 feet apart. The geophysical survey teams would then return to collect fill-in data where these data gaps are identified.

As suggested by the ODDS test results, orthogonal surveys do not provide the same benefit for assuring the detection of smaller OE as can be gained by carefully controlled lane separations. Further, while an orthogonal survey will reduce target orientation/instrument coupling effects, it does not provide the means of checking the data quality in terms of repeatability, completeness, or appropriateness for detection of the intended targets. To properly validate the geophysical data, as well as the detection and disposal of OE requires that geometries be repeated. This is especially critical for smaller OE where a very subtle response in one directional may well be indistinguishable from the background "noise" response in an orthogonal pass over the same target source.

During OE point clearance activities, detection performance verification will be performed in 25 percent of the grids (each grid will be 100 feet by 100 feet) being cleared to verify actual field performance. This will be accomplished by seeding

the grids with one or more inert items. Detailed performance criteria and QC measures to be used during geophysical mapping are presented in Chapter 4.0.

Detection performance verification will be performed using a test plot to determine the reliable scan depth, effective scan width, and optimal rate of scanning for each geophysical instrument package to be used at the Project Site. The reliable depth is defined as the depth at which a specific geophysical instrument detects 100 percent of the objects buried in the test plot that are equal to or larger than the size of interest (37mm HE projectile).

All geophysical instruments will be subject to detection performance verification as detailed in Section 4.8 Results of the verification test will be used to determine the maximum excavation depth for point clearance lifts and the maximum lift thickness for fill soils to be placed in the North Valley.

For planning purposes, a reliable depth of 1.5 feet has been assumed for the fieldwork described in Chapter 4.0 for MTADS and MPA MTADS geophysical equipment. Field procedures and lift thickness may require adjustments in the field based on the verification test results and the detection performance verification.

Data deliverables for geophysical field tasks include:

Daily

- Standardization data
- Field notes
- Data processing logs.

Weekly (5 days)

- Raw data, processed data, and interpreted data (target picks)
- Images of the digital data
- Data profiles over targets of interest
- QC audit summary.

These deliverables are discussed in detail in Sections 4.9 and 6.49.

3.4.4 Ordnance and Explosives Subsurface Clearances

3.4.4.1 Existing Stockpiles.

Concrete, asphalt concrete, and other non-soil debris will be removed from the Unit D-1 stockpiles, Ridge Stockpiles #1 through #9, and Debris Stockpiles #1, #2, and #3 in the North Valley. The debris will be inspected by UXO personnel during loading and prior to being removed from the site. No scanning of the debris will be required. The debris that is removed will be disposed of off site at a materials recycler or suitable landfill.

For the Unit D-1 Stockpiles, if a soil stockpile is present, the soil will be sampled and analytical testing will be performed to assess the soil quality. The non-OE RDD provides details regarding sampling and analytical testing of soil. If the soils are chemically affected, the stockpile will be graded flat on impermeable sheeting. These soils will be mapped with an MPA MTADS, and all anomalies will be removed. For the purposes of reducing the risk to equipment operators and UXO technicians during the excavation, the cleared soil will be excavated to a depth of 6 inches less than the reliable depth of detection for the geophysical instrument. This process will be repeated until all soils have been scanned. These soils will be either temporarily stockpiled on site or transported off site to an appropriate landfill.

Stockpiles #1, #2, and #3 in the North Valley will be graded flat on impermeable material. The soils will be scanned, and the anomalies will be removed. The cleared soil will be excavated to a depth of 6 inches less than the reliable depth of detection for the geophysical instrument. This process will be repeated until all soil has been scanned. Stockpiles #1, #2, and #3 will be transported off site to a suitable landfill for disposal.

After removal of debris from Ridge Stockpiles #1 through #9, the stockpiles will be graded flat to facilitate geophysical scanning and removal of anomalies. These soils will be mapped with MPA MTADS or MTADS, and the anomalies will be removed. The cleared soil will be excavated to a depth of 6 inches less than the reliable depth of detection for the geophysical instrument. The process will be repeated until the excavation encounters the bottom of the stockpile. The cleared soil may be temporarily stockpiled on site or may be transported off site to an appropriate landfill.

3.4.4.2 Project Site Subsurface Clearance.

Following completion of the geophysical survey (digital data collection, processing, interpretation, and review), anomalies identified over the entire project area will be reacquired by the reacquisition teams in the field using MPA MTADS and intrusively investigated to discover the anomaly source. Field investigations will continue until the source for each anomaly has been found. The minimum excavation will be 36 inches wide and 18 inches deep. If no evidence of an anomaly is located when the minimum excavation is reached, the data will be reviewed by the project geophysicist and OE team supervisor(s). Anomaly data will be electronically recorded and will include:

- Description of the item (OE [OE scrap with explosive residue or other energetic material], OE-like item, OE scrap)
- Location (northing and, easting, or lat/long, surface, subsurface including depth)
- Orientation of intact items (relative to cardinal directions)
- Condition of item (evidence of demolition)

- Area of site (sector, demolition pit, fill, native material)
- Size and weight of item (estimated)
- Type of material in which the item was imbedded.

Intrusive investigations in the D-1 area will be performed to remove metallic anomalies, except in the paved roadways and utility stub locations. In locations where utility stubs are located, they will be exposed through excavation to verify that anomalies are associated with the utility lines.

After completion of the geophysical surveys in Unit D-1, Unit D-1 fill areas (Sector 2) will be excavated to a depth of at least 6 inches less than the reliable depth of the geophysical instrument. The excavation surface will be scanned; if anomalies are found, they will be intrusively investigated. This procedure will be repeated until the excavation encounters bedrock or reaches the bottom of the fill. If colluvial and/or alluvial material is encountered below the fill it will be scanned and removed in lifts until bedrock is encountered or until two clear lifts have been found.

The TNT Strips will have been scanned two times from the surface. The unvegetated portion of the TNT Strips will be wetted with water and homogenized using a disc to a depth of at least 6 inches less than the reliable depth of the geophysical instrument. Field confirmation samples will be taken of the disced material. All field confirmation samples will be obtained using EPA methods or Evaluation of the Attainment of cleanup standards: Volume 1-Soils and Solid Media (U.S. Environmental Protection Agency, 1989). If the TNT concentrations are less than 10 percent by weight, the soil will be excavated and stockpiled on site. The stockpiled material will be sampled in accordance with the requirements of the landfill accepting the material before off-site disposal (see non-OE RDD). Field confirmation samples will be taken in the excavated surface. If there are any areas where concentrations of TNT are equal to or exceed 10 percent by weight, a second scan, wetting, excavation, and field confirmation sampling and removal will be performed. This process will continue until all soils with concentrations equal to or greater than 10 percent by weight has been removed from the TNT Strips.

In the areas outside the unvegetated TNT Strips where explosive concentrations exceed the cleanup levels as determined by the non-OE RDD, the soils will have been scanned twice from the ground surface. These soils will be excavated to a depth of 6 inches less than the reliable depth of detection for the geophysical instrument. The excavated soil will be sampled as required by the non-OE RDD and transported off site to an appropriate landfill. The excavation surface will be scanned; if any anomalies are found, they will be intrusively investigated. The process of excavation, scanning, and intrusive investigation will continue until the soil explosive concentrations are below the cleanup level, as determined by the non-OE RDD and no further anomalies are found by the scanning process.

The bottom of the North Valley includes the Howitzer Test Facility, Ammunition Renovation/Primer Destruction Site, the North Valley Military Landfill, and other portions of the valley floor. Portions of these areas are underlain by a relatively thin layer of soil fill (generally 3 to 5 feet, but in the landfill as deep as 8 feet). The fill areas will have been scanned two times from the surface and will be excavated to a depth of at least 6 inches less than the reliable depth of the geophysical instrument. The excavated soil will be temporarily stockpiled on site. The excavation surface will be scanned; if anomalies are found, they will be intrusively investigated. The areas will again be excavated to at least 6 inches less than the reliable depth of the geophysical instrument. The process of excavation, scanning, and intrusive investigation will continue until the excavation encounters the original ground surface or bedrock. When the original ground surface or bedrock is encountered, the original ground surface or the top of bedrock will be scanned. If anomalies are found, they will be cleared and the area will be rescanned as a final QC.

The fill soils removed from the bottom of the North Valley will be placed back in the North Valley after the valley has been prepared to accept fill. If any OE items are found during the point clearance intrusive investigation or during removal of the fill the fill soils will be placed in the North Valley and QC scanned in 8-inch lifts. If no OE items are found, the fill soils will be placed without scanning. DTSC will review the results of the point clearance activities and may require scanning of the fill soils in 8-inch lifts if the reliability of the scans are in question due to the density of metallic anomalies.

Institutional controls will be applied to portions of the Project Site through a Covenant to Restrict Use of Property recorded with Solano County. The institutional controls will affect the paved streets and sidewalks in Unit D-1 and the open space parcels in the North and South Valleys, including a portion of the McAllister Drive Land Bridge. The restrictions will permanently apply to the affected areas and will restrict any excavation or other activities that would penetrate the ground. Any planned excavation in this area will require that notice be provided to the City of Benicia, DTSC, and USACE, and that the activities would only be conducted using support by UXO Technicians. The restrictions will also prevent the owners of the affected areas from obtaining any change in the land use designation or zoning for the North and South Valley open space parcels.

The exposed bedrock portion of the Ridge will be scanned two times from the ground surface. Intrusive investigations will be performed to remove metallic anomalies, if encountered. If no OE or OE scrap is found in the in-place bedrock, the in-place bedrock is considered to be free of OE, no further scanning is proposed.

After completion of the first two geophysical surveys in Sector 5, Demolition Sites #1 and #3 will be excavated in 1-foot lifts, geophysically scanned, and the anomalies will be removed. The excavation in 1-foot lifts, scanning, and intrusive investigation will be repeated until bedrock is encountered. Any soil outside the

demolition sites that is associated with the demolition sites that has chemical concentrations exceeding the soil cleanup levels will be excavated and scanned in 1-foot lifts to depths necessary to remove the affected soil. Confirmation sampling will be used to determine depth of removal. The non-OE RDD provides details regarding the confirmation sampling program.

After completion of the first two geophysical surveys in Sector 5, the Flare Site will be excavated in 1-foot lifts, geophysically scanned, and anomalies removed. The excavation in 1-foot lifts and point clearance will be repeated until no further anomalies are found and confirmation sampling and testing confirms that soils with chemical concentrations exceeding cleanup goals are removed. The non-OE RDD provides details regarding the confirmation sampling program.

3.4.4.3 Areawide Clearance.

The database developed from the point clearance activities will be used to refine the preliminary SCM (see Figure 3-1) for the distribution of OE and OE scrap across the Project Site. Information that will be developed into presentation maps for the refined SCM are listed in Section 3.4.4.2.

The preliminary SCM will be refined based on the surface clearance and point clearance data. Surface and subsurface OE and OE scrap will be evaluated and presentation maps will be prepared using the site geographic information to show the location, depth, orientation, condition, size, and weight of OE and OE scrap identified during the point clearance activity. DTSC, USACE, the OE contractor, and Granite will evaluate the refined SCM to determine areas of the site that have a potential to contain OE based on the OE distribution pattern. Areas of the Project Site that have been identified as areas with no potential to contain OE will be excluded from further investigation. Those areas of the site with a potential for containing OE and that are situated in a restricted area will be identified for institutional controls. Those portions of the Project Site with a potential for OE that are defined by an OE distribution pattern and that overlay an unrestricted portion of the Project Site will be identified for areawide clearance. An OE item or area that is not part of the identified pattern will be considered an outlier, and areawide clearance will be completed for the area within a 200-foot radius of the item that overlays an unrestricted portion of the Project Site (Figure 3-6).

The portions of the Project Site that are subject to areawide clearance will be excavated to a depth of at least 6 inches less than the reliable detection depth of the geophysical instrument. The resulting soil will be placed in the bottom of the North Valley and will be QC scanned in 8-inch lifts. If no OE or OE scrap is found, it will be considered a clear lift. The excavated surface will be scanned and any anomalies regardless of depth will be point cleared. The second layer will be excavated; will be placed in the bottom of the North Valley and QC scanned in 8-inch lifts. If no OE or OE scrap is found when the excavated surface is scanned or when the excavated soil is placed in the North Valley, the second layer will be considered a clear lift. If OE or OE scrap is found, then this second lift will not be

considered a clear lift. Two clear lifts are required below the deepest anomaly found. The process of scanning, excavation, and QC scanning in the North Valley will continue until two consecutive clear lifts are found or bedrock is encountered. The thickness of the second and subsequent excavated soil layers will be at least 6 inches less than the reliable detection depth of the geophysical instrument. If two consecutive clear lifts are encountered and no deeper anomalies were detected or bedrock was encountered no further scanning will be required when excavating in the area or when the excavated soil is placed in the North Valley (Figure 3-7).

3.5 DATA MANAGEMENT

A Geographic Information System (GIS) has been developed to support initial investigations and site planning. This GIS will be used in the OE remedial action process to support:

- Project management
- Data management
- Data analysis
- Information storage, retrieval, and dissemination.

The project GIS will be used to manage field data. Data will undergo a series of processes in the field; the final stage is integration into the GIS. In general, the data will undergo:

- Collection using GPS, geophysical and data-logging equipment
- Post-processing using GPS software
- Data analysis using geophysical modeling software
- Data conversion using Commercial-off-the-Shelf database and other utilities that are customized specifically for this project
- Integration into the project GIS.

The project GIS will be used as a QC element of the previous steps; the GIS will verify that locations are reasonable and accurate by overlaying the GPS data on known coordinates of features; it will also be used to model a sample of the geophysical data (using a separate set of software parameters) to verify consistency.

Project GIS personnel will perform the following QA/QC procedures to ensure quality of the GIS data:

- Use standardize naming conventions for project data

- Keep records of activities performed on the project data (e.g., a daily log of operations performed)
- Keep records of metadata (e.g., a spreadsheet or database table that lists files created, their purpose, and currency)
- Use logical directory structures (folders) to store and maintain data
- Perform regular (daily/weekly) data backups/archives to minimize data loss
- Transmit relevant data to Granite/USACE/DTSC on a an as- requested frequency.

3.5.1 Reference System/Existing Geographic Information System

The GIS is based on 1998 aerial photographs flown for earlier phases of this project; these photographs were orthorectified and standardized to (approximately) 1-foot accuracy. The photographs were used to develop GIS vector data showing roads, fences, structures, 5-foot topographic contours, and other features. The coordinate system for these data is the California State Plane (CSP) Coordinate System, Zone 2, based on the NAD83 in feet.

During subsequent studies, numerous additional data layers have been integrated into the project GIS, including areas of historic activity on the Project Site (based on historic aerial photography, site maps, and other records), results of the ordnance EE/CA for the Former Benicia Arsenal (grids where sampling was performed, sampling results), locations where samples were taken for chemical analysis, etc. From these empirical data layers, additional data layers have been interpolated, including the development of proposed sampling sectors, various safety buffers based on numerous variable site characteristics, chemical concentrations (based on sampling results), etc.

3.5.1.1 Mapping and Location Surveys.

The GIS will be used during pre-field activity for purposes of planning and scheduling. Coordinates of sector boundaries, grids, and historic activity areas, will be prepared and provided to surveyors/field technicians for field staking and related preparation activities.

3.5.1.2 Public Withdrawal.

A database of local residents, businesses, and other public entities in the vicinity of the project site will be provided. This database will be linked to the project GIS so that spatial queries can be performed to identify who needs to be informed of specific activities during the field program. These queries will be used to support public withdrawals and notifications to the community.

The GIS database of local interests will also be related to project safety distances to ensure that project safety goals, MSAs, VSDs, and public withdrawals are met, as discussed in Appendix B. The MSD and VSD for each sector are shown on Figures 3-8 through 3-17.

3.5.1.3 Point Clearance.

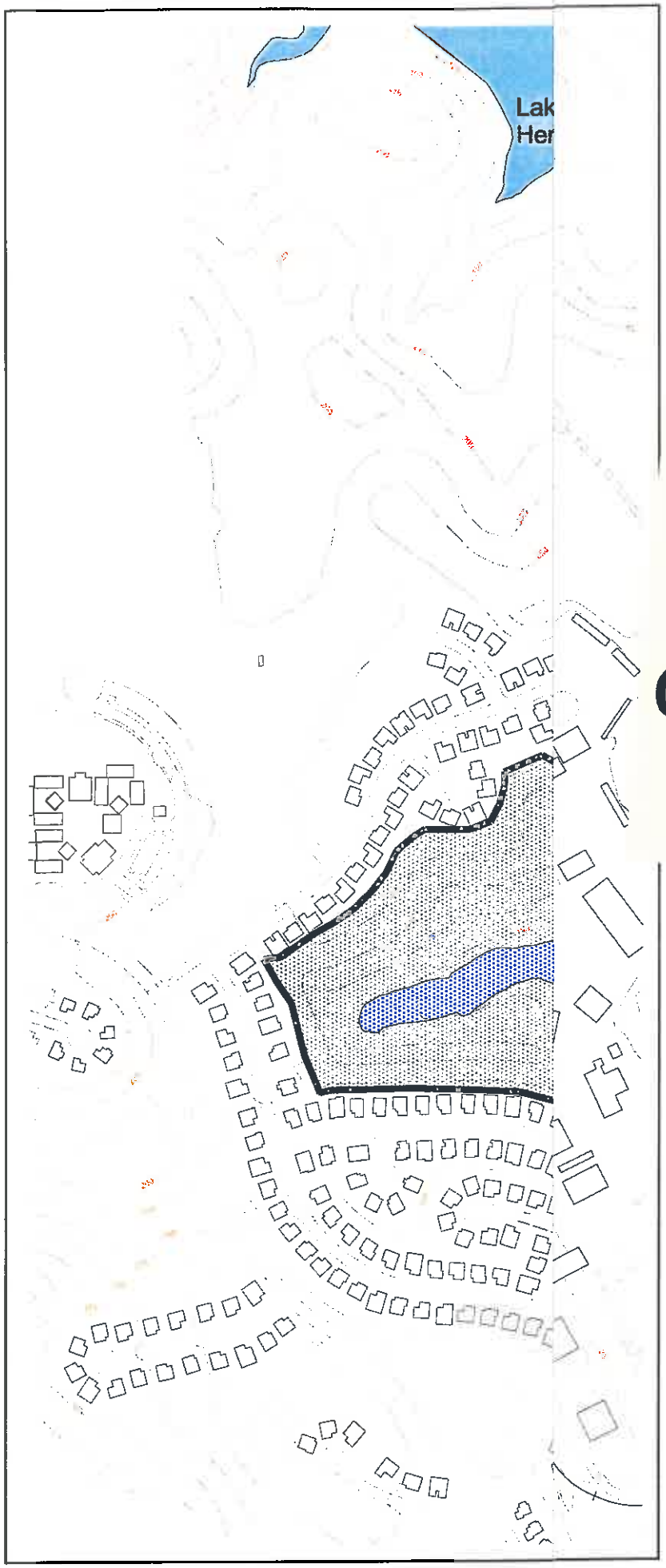
As geophysical mapping, anomaly detection, and OE detection and removals are performed as part of the point clearances (as outlined in Chapter 4.0), the GPS data will be used to integrate the results into the project GIS. These data can then be manipulated to:

- Identify progress for project managers
- Support data QA and QC objectives
- Analyze and display OE locations, densities, and types, for technical personnel
- Display project results for public relations support.

3.5.1.4 Areawide Clearance.

Point clearance data will be evaluated to determine the distribution of OE and OE scrap at the Project Site. The distribution of OE and OE scrap will be used to determine if certain areas of the Project Site can be eliminated from the portion of the Project Site requiring areawide clearance. In preparation for the evaluation, the OE and OE scrap find locations, depths, and orientation will be plotted on a Project Site map. The dig sheets and other pertinent information, such as signs of the damage to OE from demolition and the location relative to the site features, will be documented.

The project GIS will be used to prepare the presentation maps that will be the basis of the SCM. The OE and OE scrap identified in the surface and point clearance anomalies will be included in these maps along with other data described in Section 3.4.4.3.



Explanation

- Project Site Boundary
- Wetlands with Potential for OE
- TNT Strips (OE Where Explosives Concentration >= 10% by Weight)
- Existing Open Space with No Suspected OE
- Existing Open Space with Potential for OE
- Bedrock Area with No Suspected OE
- Stockpile Areas with Potential for OE
- Demo Sites with Potential for OE

See City Attorney's Office for original.

N

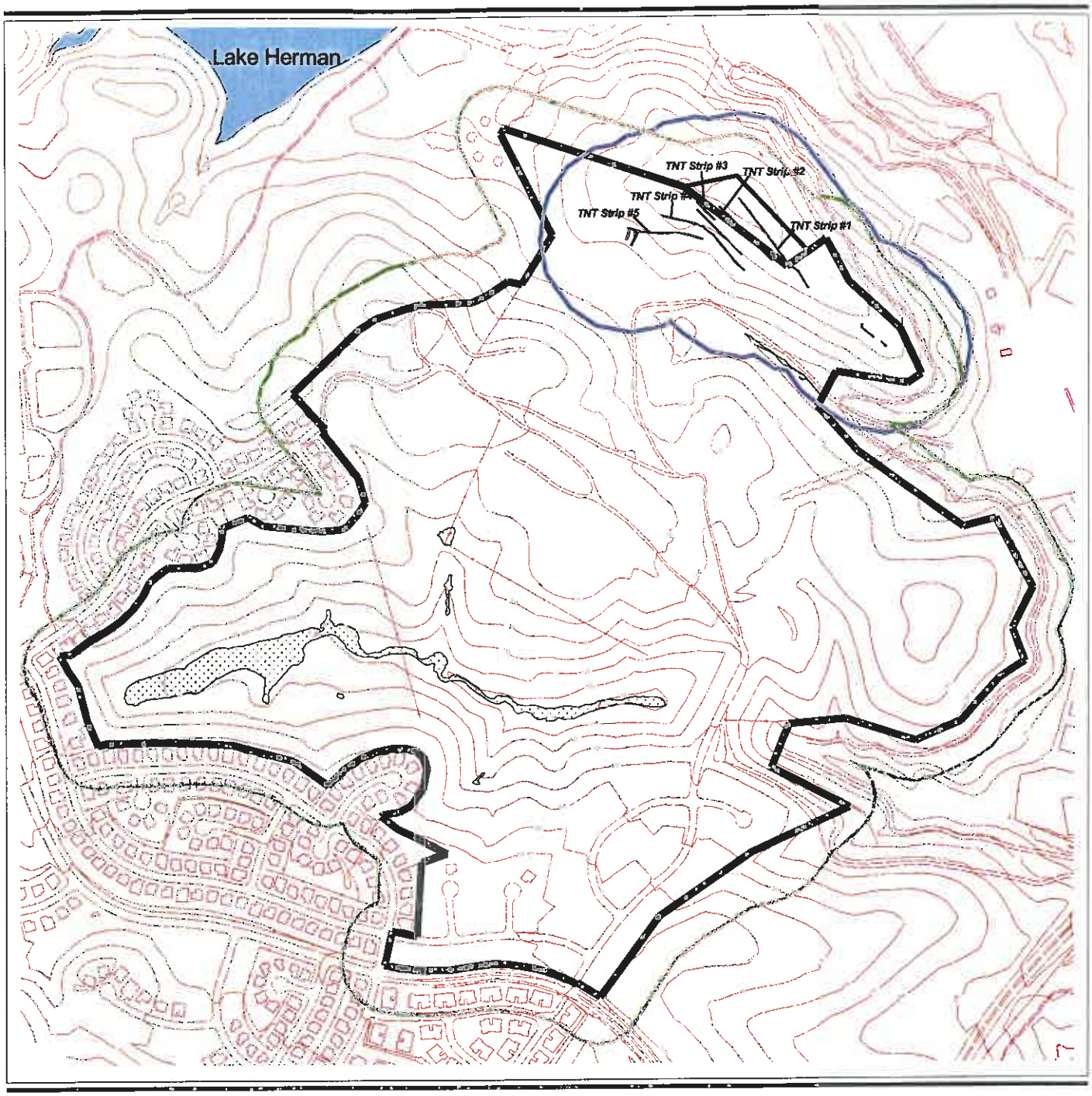
250 0 250 500 750 Feet

FIGURE 3-1

Preliminary Site Conceptual Model

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



u:\data\cityofbenicia\enc\dev\project\OERDD_Finaldraft_June01.apr(Figure 3-3RDD May 2001)

EXPLANATION

- Project Site Boundary
- Wetlands
- 200 Foot MSD
- TNT Strips
- 412 Foot MSD/VSD

Planimetric features

- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour

350 0 350 700 Feet

Minimum Separation Distances

Final

Figure 3-3

u:\data\city\benicia\arcview\project\OERDD_FinalDraft_June01.apr(Figure3-4RDD May 2001)

EXPLANATION

- Project Site Boundary
- Wetlands
- 37mm Projectile MPM
- 60mm Projectile MPM
- 1080 Foot VSD
- 1181 Foot VSD

Planimetric features

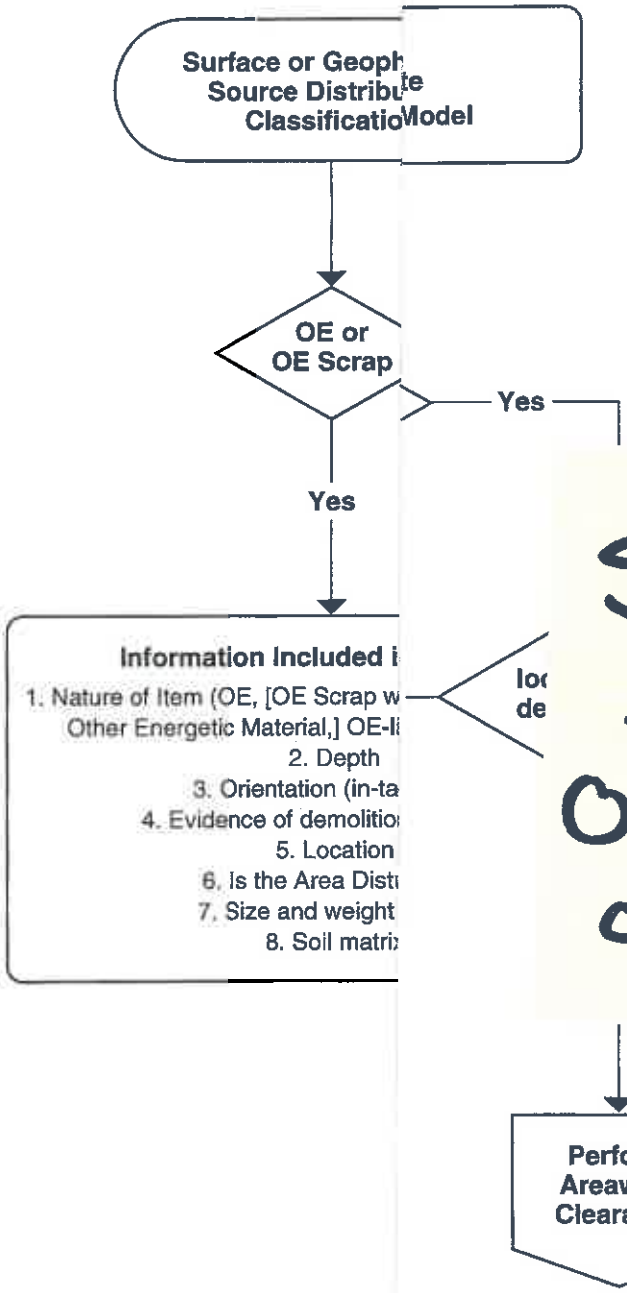
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

500 0 500 1000 1500 Feet

Project Site
Voluntary Separation Distance (VSD)

Final

Figure 3-4



See City Attorney's Office for original.

Figure 3-6

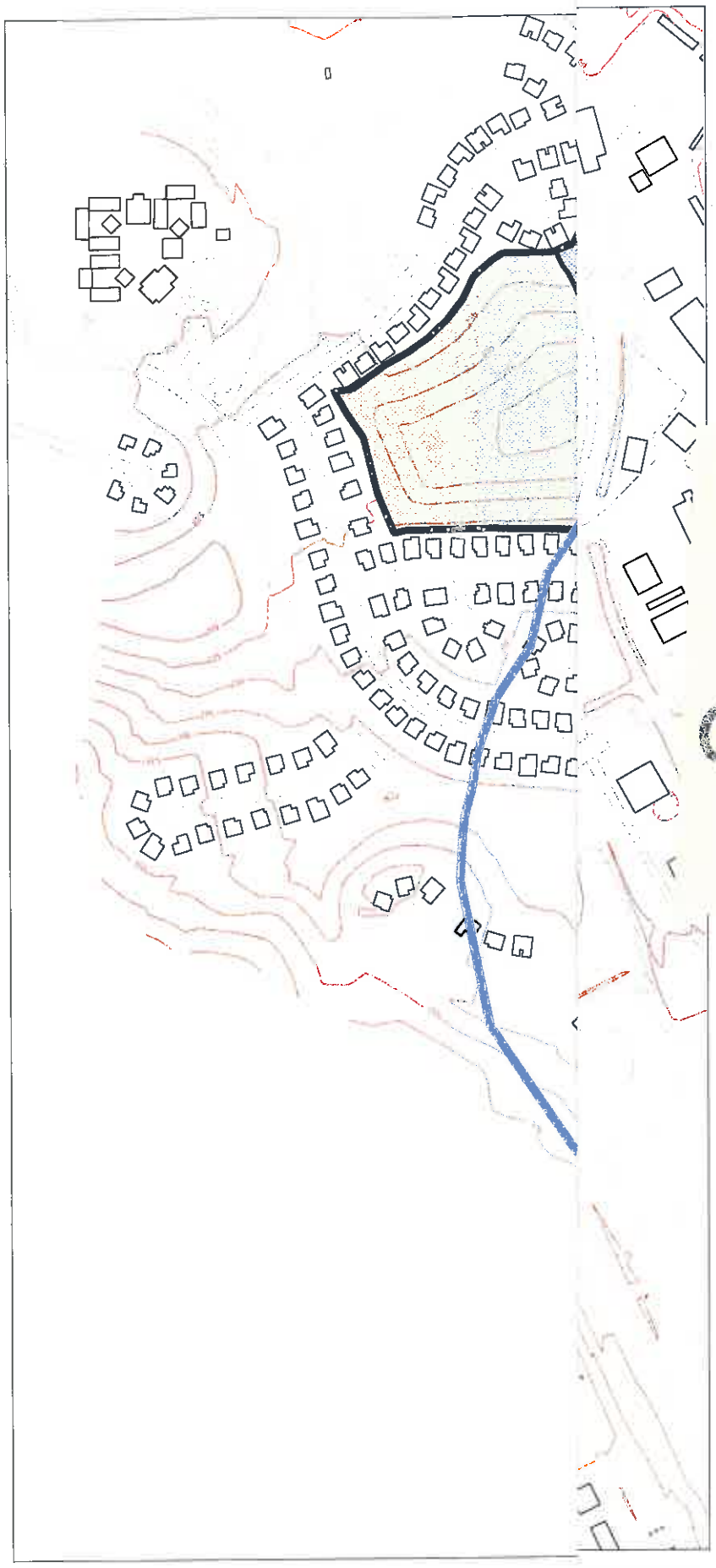
Evaluation of OE and OE Scrap Distribution

Final

EXPLANATION

OE Ordnance and Explosives

BenicidaOERDD/024



Explanation

Project Site Boundary

VSD (1181 Feet)

MSD (200 Feet)

Planimetric features

Buildings

Roads/Trails

25 Foot Contour

See City Attorney's Office for original.

N

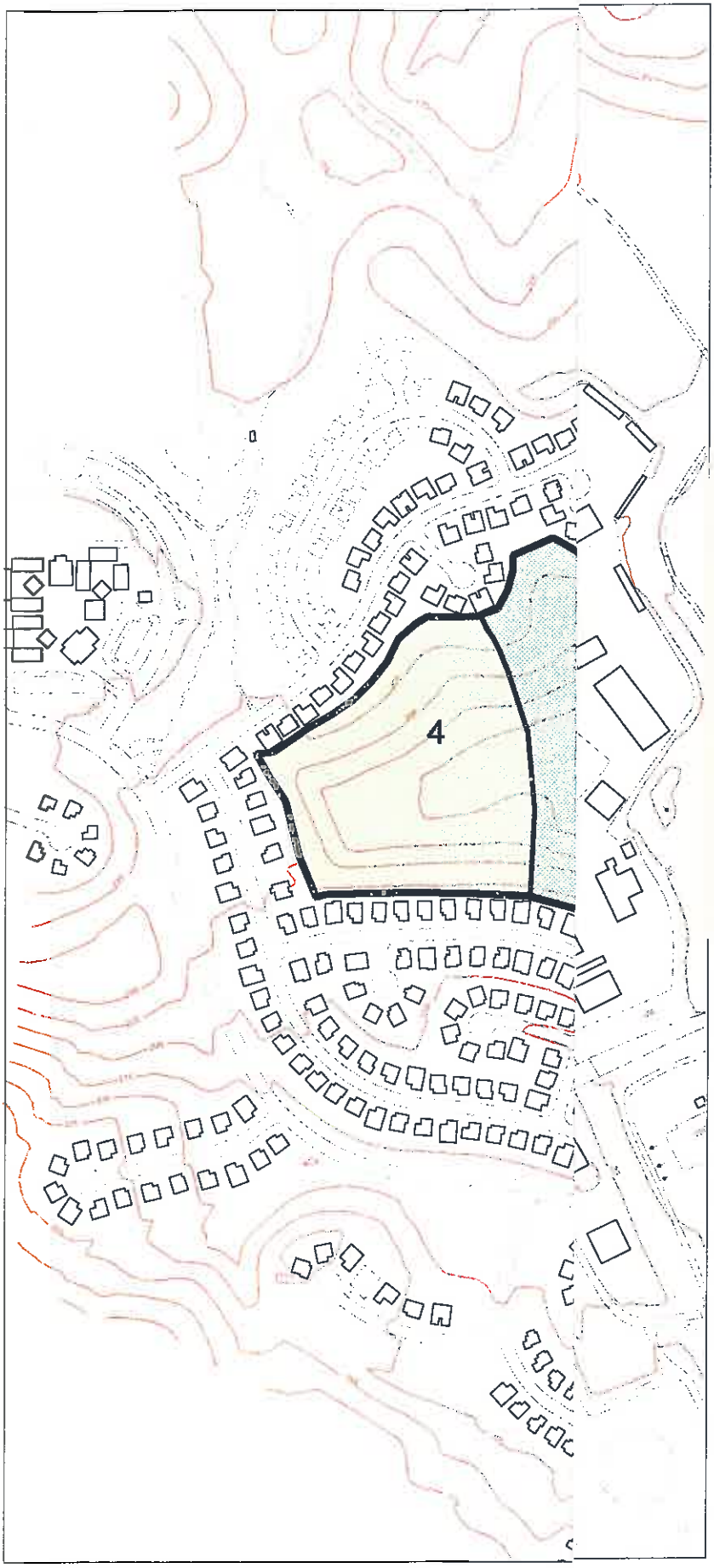
250 0 250 500 Feet

FIGURE 3-8

MSD/VSD, Sector 1

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1181 Feet)

MSD (200 Feet)

Planimetric features

Buildings

Roads/Trails

25 Foot Contour

See City Attorney's Office for original.

N

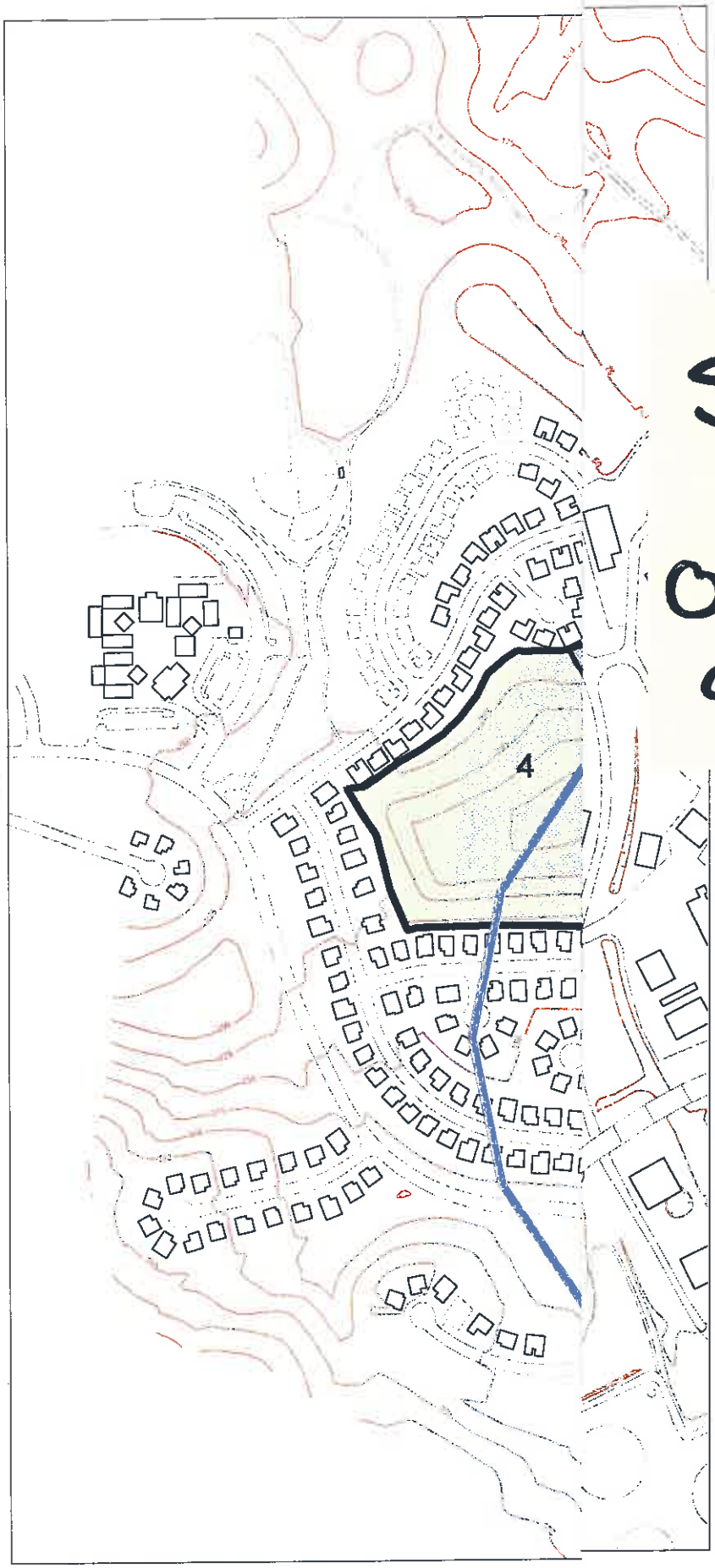
250 0 250 500 Feet

FIGURE 3-9

MSD/VSD, Sector 2

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1181 Feet)

MSD (200 Feet)

See City Attorney's Office for original.

Final

N

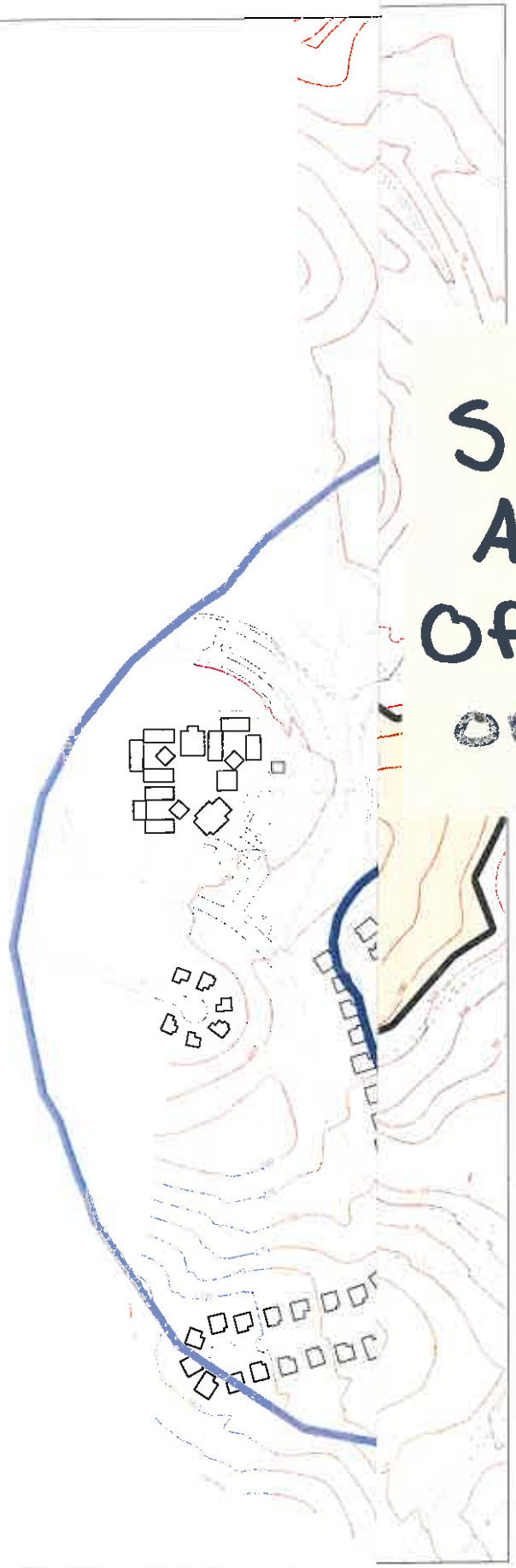
250 0 250 500 Feet

FIGURE 3-10

MSD/VSD, Sector 3

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1181 Feet)

MSD (200 Feet)

Planimetric features

See City Attorney's Office for original.

Final

N

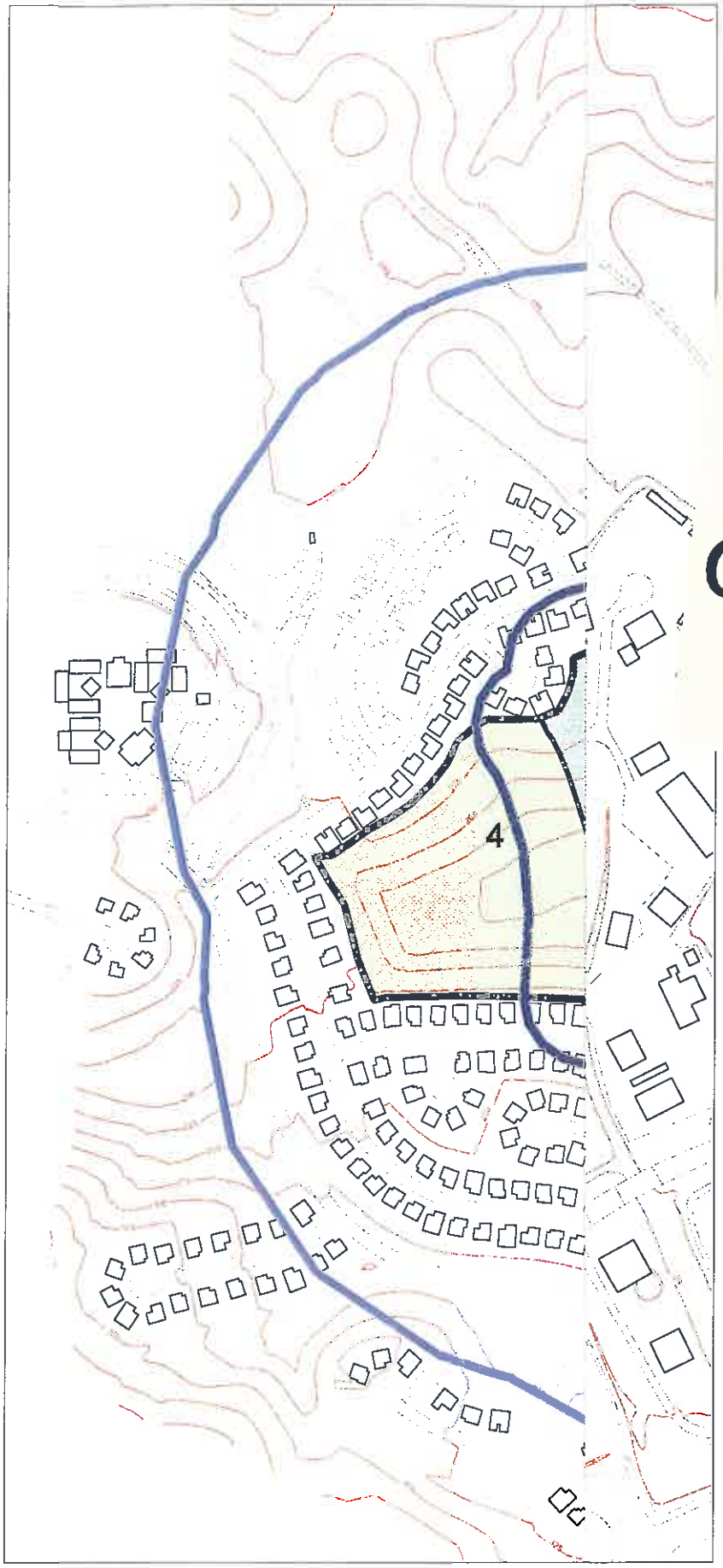
250 0 250 500 Feet

FIGURE 3-11

MSD/VSD, Sector 4

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1181 Feet)

MSD (200 Feet)

See City Attorney's Office for original.

Final

N

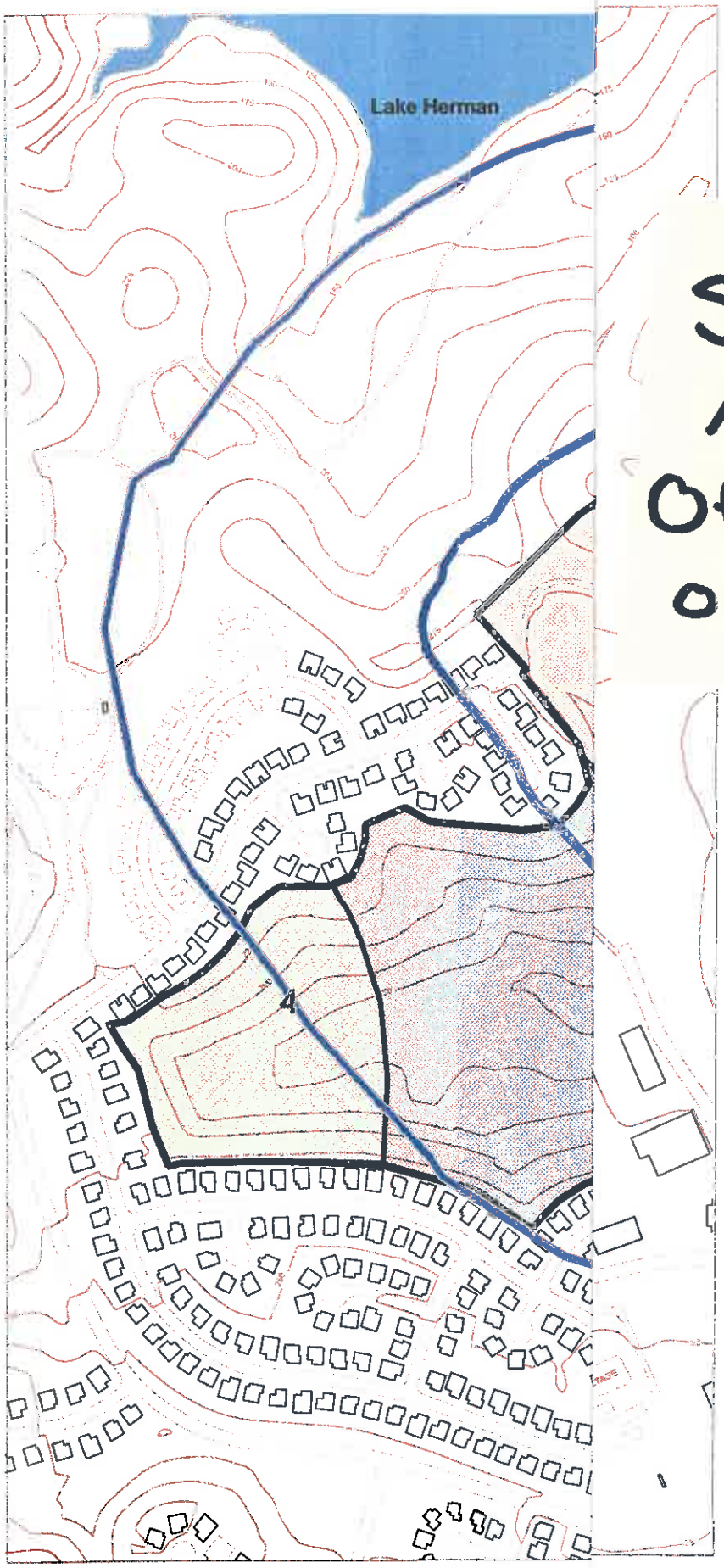
250 0 250 500 Feet

FIGURE 3-12

MSD/VSD, Sector 5

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD
-1080 Feet in North Valley
-1484 Feet in South Valley

See City Attorney's Office for original.

2714/data/cityofbenicia/arcview/projects/...ps.apr

Final

N

250 0 250 500 Feet

FIGURE 3-13

MSD/VSD, Sector 6

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002

Explanation

Project Site Boundary

VSD (1080 Feet)

MSD (200 Feet)

Planimetric features

Buildings

See City Attorney's Office for original.

N

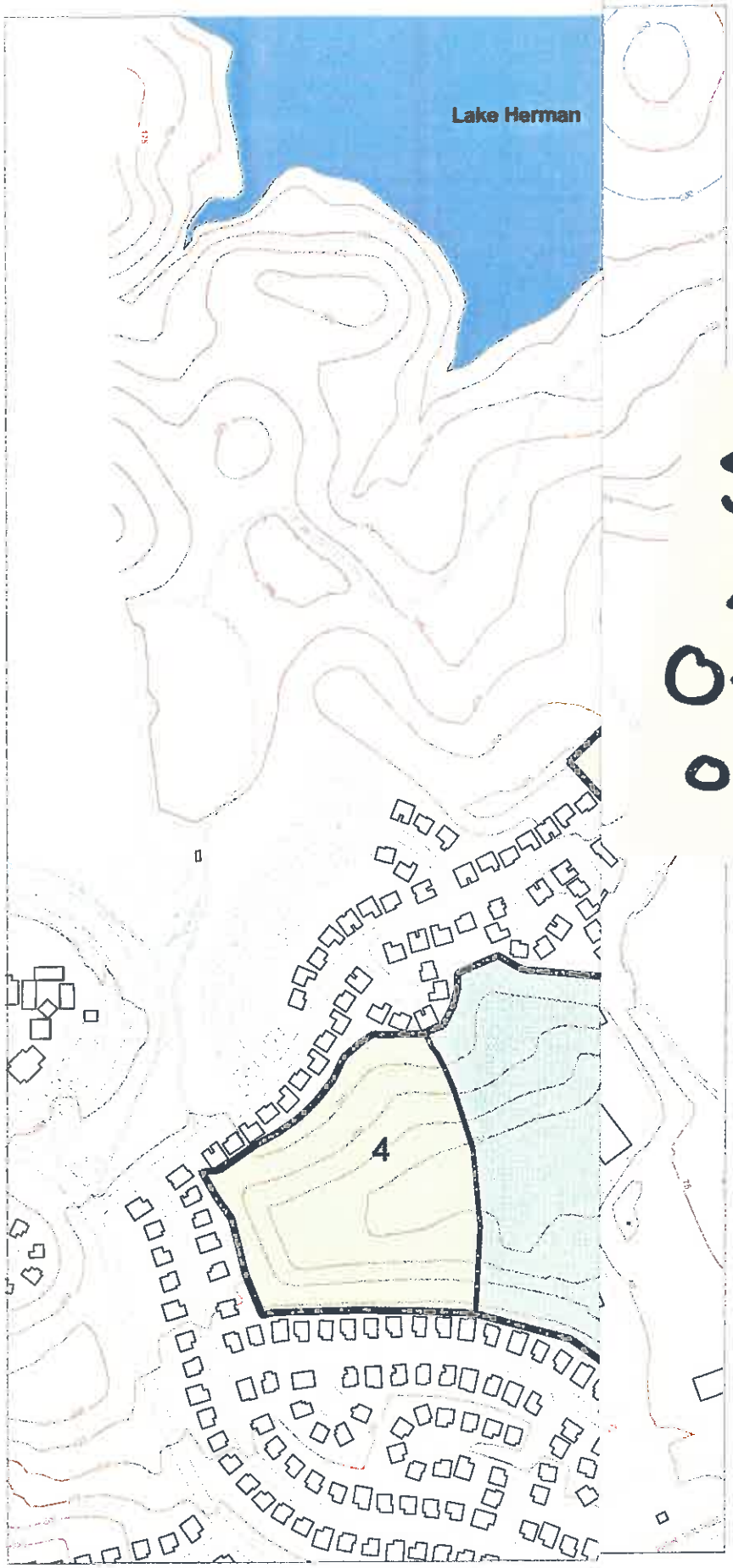
250 0 250 500 Feet

FIGURE 3-14

MSD/VSD, Sector 7

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1080 Feet)

MSD (200 Feet)

Planimetric features

Buildings

Roads/Trails

See City Attorney's Office for original.

N

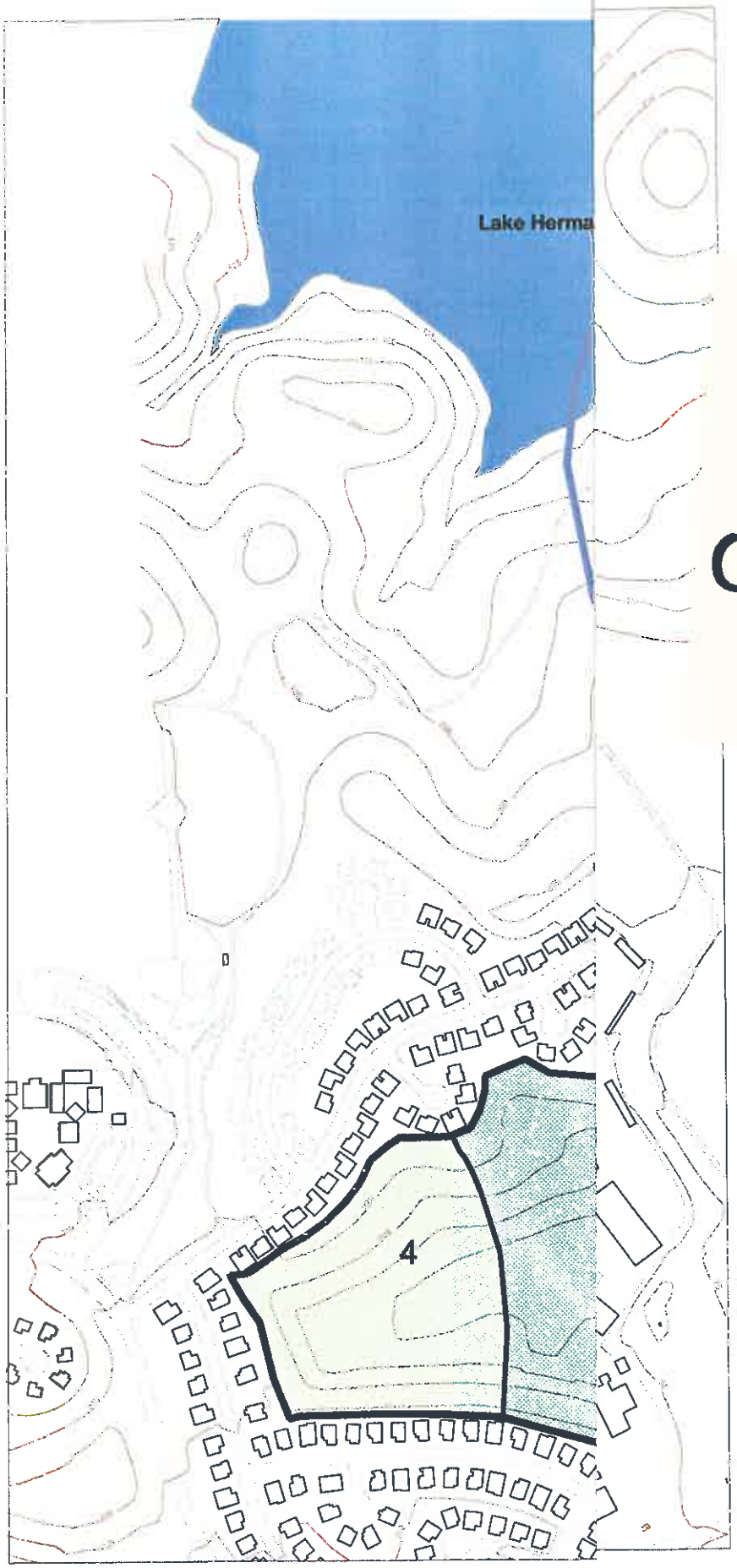
250 0 250 500 Feet

FIGURE 3-15

MSD/VSD, Sector 8

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1080 Feet)

MSD (200 Feet)

TNT Strip MSD (412 Feet)

See City Attorney's Office for original.

Final

N

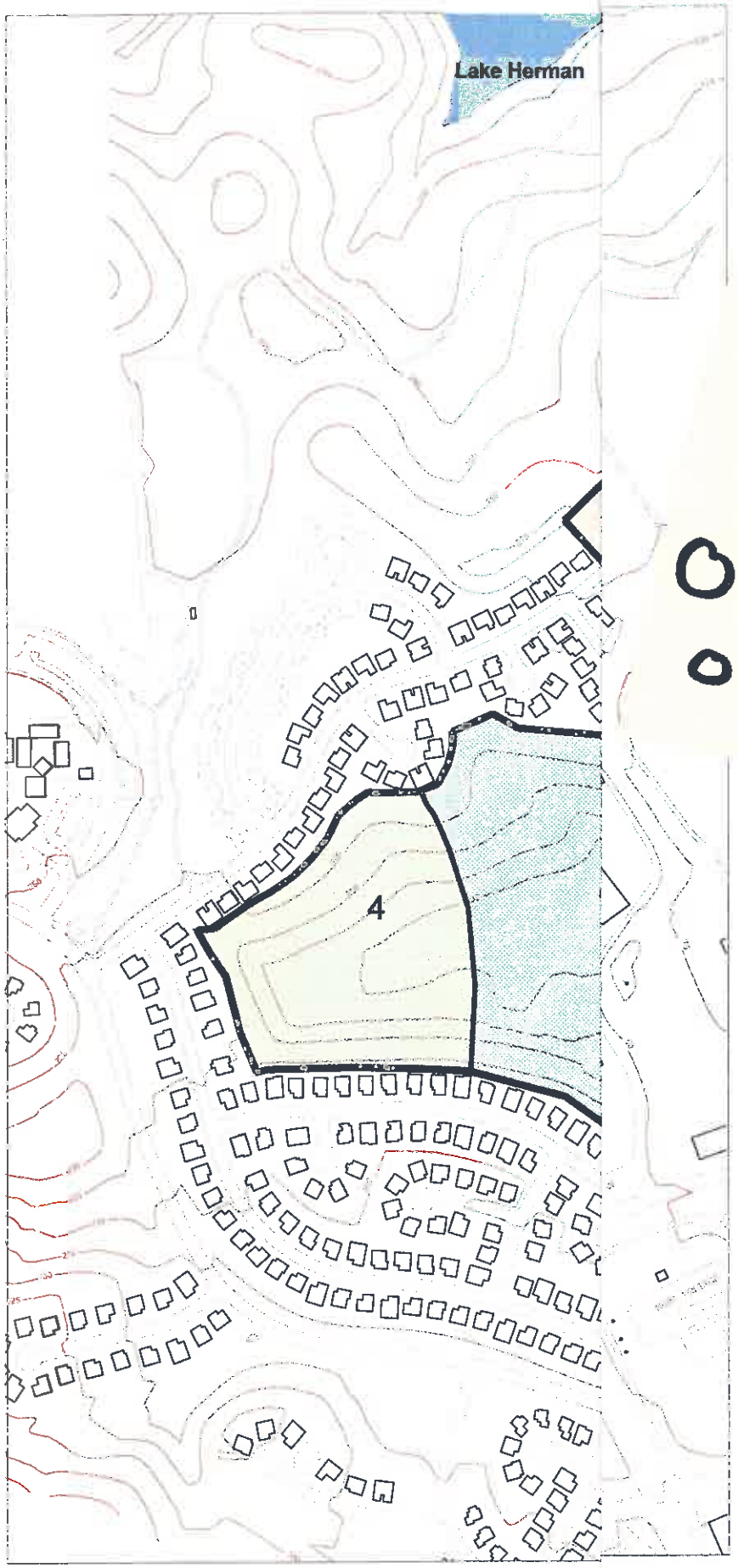
250 0 250 500 Feet

FIGURE 3-16

MSD/VSD, Sector 9

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



Explanation

Project Site Boundary

VSD (1080 Feet)

MSD (200 Feet)

See City Attorney's Office for original.

Final

N

250 0 250 500 Feet

FIGURE 3-17

MSD/VSD, Sector 10

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002

4.0 FIELDWORK

The removal of OE from the Project Site will consist of a multi-step approach including mobilization and surface preparation, OE point clearance (geophysical and subsurface investigation), remediation of TNT-affected soils, areawide clearance, and grading to provide 14 feet of clean, crushed bedrock below final site grades in future residential areas.

This chapter provides the detailed field procedures required to complete OE remediation on the Project Site, as described in Chapters 2.0 and 3.0. The OE remediation (excluding areawide clearance) will require approximately 66 weeks. The preliminary site conceptual model will be revised based on the evaluation of the OE point clearance data to determine areas of the Project Site where areawide clearance is required. A schedule for areawide clearance will be developed following the evaluation. The proposed project schedule is provided in Appendix A. Soils will not be relocated to the North Valley until the non-OE remediation in the North Valley is completed, and the post remediatiion Human Health and Ecological Risk assessments are complete as shown on this schedule. Detailed field procedures are discussed in the following subsections.

- Site Safety, Public Outreach, and Security
- Mobilization/Demobilization
- Biological Survey
- Vegetation removal
- Removal and disposal of construction debris
- Relocation of stockpiles
- Removal and disposal of interior fencing
- Surveying and marking of grids
- Surface clearance
- Detection performance verification
- Detection and Mapping
- Intrusive investigations
- Disposal of OE and OE scrap
- Homogenization and disposal of TNT-affected soils
- Point clearance grading
- Areawide clearance grading
- Grading (cutting and filling to final grade)
- Environmental restoration.

4.1 SITE SAFETY, PUBLIC OUTREACH, AND SECURITY

4.1.1 Site Safety

Prior to the start of any OE field investigation activities, all field personnel will be required to read and sign the OE SSHP (Appendix F). Visitors will be required to attend a safety briefing, sign visitor logs, and be escorted on site. Site-specific training will be conducted for all personnel at the beginning of the project and prior to commencing fieldwork. As new personnel arrive at the site, they will be provided site-specific training prior to commencing fieldwork. A site safety meeting will be held each morning in accordance with the guidance in the OE SSHP. A HSO will be principally responsible for execution of all health and safety operations for field activities. In addition, an OE SSO will be responsible for execution of all OE operations for field activities. The HSO and OE SSO will have the authority to stop work, when necessary, to prevent injury or illness associated with the remedial actions and to ensure personnel and environmental health and safety. The USACE Safety Specialist will monitor OE field investigation activities to verify all operations are conducted in accordance with the OE SSHP and this OE RDD. The USACE Safety Specialist has the same stop work authority as the OE SSO.

Prior to the start of any OE surface clearance or excavations and intrusive OE investigations, an MSD (200 feet for OE, 412 feet for TNT-impacted soil) will be implemented and an MSA will be established for the community and remediation personnel not directly involved with OE detection and removal activities. A clearly marked security boundary around each designated MSA within the public area bordering the Project Site will be established no later than 8:30 a.m. on the day of the withdrawal.

A VSD will be established for all residents living within the maximum fragmentation distance of the most probable munition (37mm HE projectile [1,181 feet] or 60mm mortar, [1,080 feet]). Residents, businesses, and schools within the VSD will be notified of the OE remediation activities that are taking place on the Project Site and the risks associated with the work, as detailed in the MSAP (Appendix B). All residents within the VSD wishing to withdraw will be provided the same support as those residents living within the MSD.

Roads will be blocked using traffic barricades. Signs will be used to indicate that entry is not permitted. Between road access points, the boundary will be marked, as necessary, using yellow caution tape and signs. The marked security boundary will be removed as quickly as possible after completion of the intrusive work on the Project Site, but no later than 5:00 p.m.

4.1.1.1 Procedures to Ensure All Affected Residents are Out of Their Homes.

At the beginning of the withdrawal period, a walk-through of the entire MSA will be conducted. A representative of the project staff will knock on each door to assess

if residents have withdrawn. Intrusive work on the Project Site will not begin until the OE SSO is notified that the area is clear.

4.1.1.2 Perimeter Control of Established Area by Security Personnel.

Each access road will be manned by a qualified traffic control person. Additional personnel will be used to provide 100-percent visibility around the established perimeter.

4.1.1.3 Traffic Control Procedures.

Traffic control devices will be designed, installed, and maintained using the standards required by the City of Benicia, and the Manual of Uniform Traffic Control Devices. Applicable barricades, signs, lighting, markings, and hand signaling devices will be used for all traffic control on public streets.

4.1.1.4 Communication Procedures.

Radio contact will be maintained at all times during the period of time that the MSA is active. Positive radio contact will be verified at the beginning of the work between the Field Manager, Senior UXO Supervisor (SUXOS), OE SSO, USACE OE Safety Specialist, security personnel, and traffic control personnel. At a minimum, hourly radio checks will be made between these personnel during the period the MSA is active.

A public information telephone line will be established and maintained to provide updated information on project activities. The telephone line will also allow residents and businesses to express concerns or ask questions regarding project activities. Residents and businesses near the Project Site will be informed and notified to call the 24-hour information telephone line, rather than contact the police or fire department, in the event of a nonemergency, project-related question or concern. The point of contact for project activities is presented in Table 7-1.

In the event of an unintentional detonation, the emergency contingency plan in the OE SSHP would be followed. The public information telephone line would be updated to indicate that an unintentional detonation had occurred. The Occupational Safety and Health Administration (OSHA) and USACE personnel would conduct an evaluation of the incident, and the results of the investigation would be made available to the public on the 24-hour information telephone line.

Should an unintentional detonation result in any damage to a structure or other real property, all damage would be repaired; other private property damage would be repaired or replaced in kind.

4.1.2 Public Outreach

Notification of homeowners, schools, businesses, and supporting agencies concerning OE remediation activities will be initiated by the project proponents approximately 60 days prior to clearance activities. The project proponents will brief the Community Advisory Group, the City of Benicia, the Benicia Fire Department, and the Benicia Police Department approximately 30 days prior to commencement of intrusive or excavation activities. The briefing will include the anticipated dates of withdrawal for addresses falling within the MSA, and general withdrawal and relocation procedures.

Notices of the dates and times of the required withdrawal and relocation information ("Withdrawal and Relocation Notice") will be distributed approximately 30 days, 10 days, and 72 hours in advance of the scheduled withdrawal and relocation. On the evening before the planned withdrawal, representatives for the project proponents will go door-to-door in the MSA to remind residents about the next day's activities and to address any special needs. It is anticipated that residents will be required to withdraw from their homes from 8:30 a.m to 5:00 p.m. on the scheduled dates.

In addition, residents who live in areas outside the MSA whose homes are not affected by the MSA, but whose ability to travel to and from their residences may be impeded by the closure of streets within the MSA, and residents, schools, and businesses outside an MSA, but within the distance that fragmentation could conceivably travel in the event of an accidental detonation (VSD), will also be notified of the potential hazards associated with clearance activities at distances beyond the MSD.

If there are schedule or other changes between the 72-hour notification and the date on which the OE clearance activities are to be performed, the residents will be contacted and encouraged to contact the 24-hour information telephone line or check the project website to make sure the planned withdrawal is on schedule.

During the time that the withdrawal area is in effect, the Project Manager will provide the required withdrawal distances, length of withdrawal time, and OE work schedule to local City of Benicia safety officials, USACE, and DTSC.

Relocation and Hospitality Services

A Hospitality Center, which will be established for residents who are required to withdraw, or who voluntarily withdraw from their homes during the day, will provide refreshments and the use of telephones and other amenities. The Hospitality Center will be established at the Best Western Heritage Inn at 1995 East Second Street in the City of Benicia (Figure 4-1). This location is close to the residences and has sufficient conference room space for the number of residents that are expected to utilize this facility. Directions to the Hospitality Center and personnel

to contact for additional information will be provided in a newsletter that will be provided to residents within or affected by the MSD.

Transportation between the MSA and the Hospitality Center will be provided for residents. Granite will have a representative available to coordinate all issues related to the Hospitality Center. Granite will work closely with the school and local residents to address issues related to the Hospitality Center during fieldwork hours.

Special arrangements will be made for the transportation of handicapped individuals.

4.1.3 Project Security

A fence has been installed to limit public access to the Project Site. The location of the fence is shown on Figure 4-2. The main access point to the Project Site is at the corner of McCall Drive on the western approach to Panorama Drive, adjacent to the current manned guard shack. Two secondary access gates are available. One access gate is across McAllister Drive where it crosses Rose Drive. This gate is visible from the guard shack at the main access point. The existing gate at the end of Kearney Street will also be used. The Kearney Street gate will be used only by remediation personnel and will remain locked at all times. Access to the North Valley may be gained through private property bordering the Project Site on the east end of the North Valley. As necessary, portions of the perimeter fencing will need to be removed to facilitate geophysical mapping of the Project Site. Temporary fencing will be installed in these areas, as necessary, to ensure that there are no breaches in the perimeter fencing during OE remediation.

Signs have been attached at 200-foot intervals on the fencing along the north, east, and south portions of the Project Site boundaries, except along the fence on Rose Drive and Panorama Drive, where signs have been placed on stakes behind the fence. These signs read "Keep Out, Former Military Property, Hazardous Conditions May be Present" in English and Spanish. Signs have also been placed every 100 feet along the perimeter fence contiguous with the TNT Strips and along the fence around the TNT Strips. These signs read: "Caution: Hazardous Substances Area, Unauthorized Persons Keep Out, Cal. EPA, DTSC – (916) 255-3545" in English and Spanish.

Granite will continue to support a private security force to patrol the Project Site. Patrol duties will include the following:

- Maintain a security force on site consisting of at least two patrol officers between the hours of 5:00 p.m. and 7:00 a.m. One officer will be posted at a guard shack near the public access point on McAllister Drive; the other officer will roam the Project Site on designated patrol routes.

- Maintain a logbook at the guard shack documenting the arrival and departure times of all visitors to the Project Site, the purpose of their visit, and the agencies or organizations they represent. A list of preauthorized personnel allowed to enter the Project Site after hours is kept at the guard shack.

- Inspection of all fencing and sign postings on site on a weekly basis for breaches or disrepair. Any portions of the fence in need of repair are noted and reported. Repairs or replacement of signs will be facilitated within 2 working days after they are reported.

- Patrol officers are required to carry radios and to check with each other at least once per hour. A telephone (cell or land-line) is maintained at the guard shack at all times. A copy of the OE SSHP will be kept at the guard shack documenting procedures to be followed in case of an accident.

4.2 MOBILIZATION/DEMOBILIZATION

Mobilization of personnel to support field activities will be staggered based on fieldwork requirements. Table 4-1 illustrates the crew composition, number of crews for each task, and the anticipated production rate for each task. A Command Post will be established consisting of two temporary office trailers and one storage annex in the Unit D-1 area prior to mobilization. The management staff will consist of a Project Manager, SUXOS, OE SSO, and Site Geophysicist. USACE, Sacramento District, will provide safety oversight for the project through an on-site OE safety specialist.

Air Monitoring Stations. Two PM_{10} air monitoring stations will be installed downwind of the site and one PM_{10} monitoring station will be installed upwind of the site to monitor PM_{10} from site excavations during certain OE remediation activities and during non-OE remediation (Figure 4-3). Air monitoring will be accomplished in accordance with the criteria specified in Section 3.2.1 during all site excavations in chemically affected soil areas and during OE detonations. Chemically affected soil areas include the Flare site; Demolition Sites #1 and #3; the TNT Strips; North Valley Stockpiles #1, #2, and #3; and may include the Unit D-1 Stockpile (If chemically affected).

4.3 VEGETATION REMOVAL

The Project Site will be cleared of vegetation to a height of 6 inches or less. Approximately 165 acres of the vegetation will be removed by mechanical means. Side-mounted mowers will be used to clear vegetation from a portion of the wetlands that is accessible to vehicle-supported equipment. The remaining 55 acres of the Project Site (including the jurisdictional wetlands) may be cleared by personnel using manual or hand-held gas-powered weed cutters equipped with spark suppression systems. The sequence in which vegetation will be cleared is

shown on the Project Schedule (Appendix A). UXO personnel will proceed ahead of the vegetation clearance crews to search for OE items on the surface, both visually and with the aid of a site-tested metal detector, to assist visual reconnaissance in detecting OE items on the surface. If a surface OE is discovered during vegetation removal, the item will be clearly marked for avoidance and will be reported to the SUXOS and the Project Manager for recording, moving, and disposal. Surface OE will be disposed of using the procedures in Section 4.11.

Cuttings will be removed from the Project Site and transported to either Altamont Pass, Keller Canyon, or Potrero Hills landfill.

Brush-clearing supervisors will ensure that all team members have the appropriate safety equipment (i.e., work gloves, safety goggles, hearing protection) during vegetation removal activities in accordance with the requirements of the OE SSHP (Appendix F).

4.4 NONHAZARDOUS CONSTRUCTION DEBRIS AND STOCKPILES

All nonhazardous construction debris will be removed from stockpiles in Sectors 1 and 2 (Unit D-1), the Ridge (Sector 7), and the North Valley (Sector 8) (see Figure 2-2). Construction debris will be removed from these stockpiles concurrent with vegetation removal, interior fence removal, and survey and marking activities. Construction debris will be inspected by UXO Technicians to ensure that it is free of OE; nonhazardous construction debris will be loaded onto trucks and hauled off site to either the Alta landfill material recycler or the Altamont Pass, Keller Canyon, or Potrero Hills landfill. Construction debris will be removed from these stockpiles concurrent with vegetation clearance (shown on the Project Schedule [Appendix A]). Tarpaulins will be used to cover soils and debris being hauled off site to prevent fugitive dust, and soil stockpiles will be watered, as necessary, to prevent any dust from entering the air.

Soil stockpiles will be either removed or relocated during the course of the field efforts. Any OE discovered while handling the stockpiles will be identified as requiring a "BIP" or "safe to move" and will be disposed of, as discussed in Section 4.11.

Stockpiled soil in Unit D-1 and the North Valley will be geophysically scanned in a real-time EM scan and anomaly marking (magnetic and flag) mode using the MPA MTADS (see Section 4.9). Equipment operators will monitor both visual and audio output. The position of anomalous responses will be confirmed by returning and passing the instrument over suspect locations in at least two different directions to confirm the presence of a metal source. Stockpiles on the Ridge will be digitally mapped, the data processed, and identified anomalies reacquired and marked.

Following each pass over the stockpiled material, the anomaly locations will be intrusively explored and the anomaly sources removed and disposed of in accordance with the requirements of Sections 4.10 and 4.11.

4.4.1 Unit D-1 Debris Stockpile

It is not anticipated that an MSD will be implemented for the removal of construction debris from these stockpiles. However, UXO Technicians will inspect the debris for OE and explosives as it is being removed. After removal of the construction debris from the stockpile in Sectors 1 and 2 (Unit D-1), the soil will be sampled and analytical testing will be performed to assess the soil quality. An MSD (Figure 4-4) will be established before the soil is relocated. If chemical concentrations in the soil exceed cleanup goals, the piles will be graded flat with heavy equipment (dozer). The soil layers will be scanned and anomalies, if any, will be removed (see Section 4.10). Any OE discovered will be identified as requiring a BIP or safe to move and disposed of as discussed in Section 4.11. A QC scan will be performed and the soil will be excavated in lifts 6 inches less than the reliable scan depth, loaded into trucks, and disposed off site at a suitable landfill. Once soils are removed, the underlying material will be sampled in accordance with the non-OE RDD to determine if the underlying material has been chemically impacted. If samples determine that the underlying material is impacted, the process of scanning, excavating, and sampling will continue until all chemically impacted material has been removed. If chemical concentrations do not exceed cleanup goals, the soil will be leveled within the boundary of Sector 2. The leveled stockpile will be geophysically scanned, point cleared, and hauled off-site to a landfill or temporarily relocated to Sector 10 as part of the detection and mapping of Sector 2. The Project Schedule (Appendix A) assumes that the stockpiled soils do not exceed cleanup goals.

4.4.2 North Valley Stockpiles #1, #2, and #3

Because the construction debris in Stockpiles 1, 2, and 3 in the North Valley is commingled with soils, these soil and debris piles will be excavated and spread to remove the debris. Stockpiles 1 and 2 will be spread in a southerly direction and Stockpile 3 will be spread in a northeastern direction. The footprint of Stockpiles 1, 2, and 3 will be maintained within the Sector 8 boundaries. An MSD will be established for the grading of the stockpile and for any intrusive activities (Figure 4-5). The construction debris will be separated from the soil as each stockpile is being graded flat, inspected to determine that it is free of OE, loaded onto trucks, and hauled off site to either Altamont Pass, Keller Canyon, or Potrero Hills landfill.

After the construction debris is removed, the remaining soil will be geophysically scanned, as described above. Any anomalies found during the scanning will be intrusively explored and the anomaly sources removed and disposed of in accordance with the requirements of Sections 4.10 and 4.11. A QC scan will be performed over the spread soil and a lift of soil will be excavated, loaded onto

trucks, and hauled off site to a suitable landfill. The soil stockpiles will again be scanned, any anomalies will be removed, QC scanned, and a lift excavated. The soil will be hauled to a suitable off-site landfill. This process will be continued until all of the stockpiled soil in the North Valley has been disposed of off site. The Project Schedule (Appendix A) assumes that the stockpiled soils can be removed in three lifts.

4.4.3 Ridge Stockpiles #1 thru #9

Because no OE is associated with the construction debris, an MSD will not be implemented for its removal from these stockpiles. After removal of the construction debris from the stockpiles in Sector 7, an MSD will be established and the nine stockpiles will be graded flat with heavy equipment (dozer) in Sector 7 (Figure 4-6). The soil will be geophysically scanned, as described above. Any OE discovered will be identified as requiring a BIP or safe to move and disposed of as discussed in Section 4.11. The cleared lift will be QC scanned, removed, and either disposed of off site or re-stockpiled in Sector 10A or 10B. The soil will again be scanned and any anomalies will be removed. The lift will be QC scanned and a second lift (nominally 1 foot thick) will be removed. This process will be continued until all of the stockpiled soil on the Ridge has been scanned and cleared of OE or OE scrap. The Project Schedule (Appendix A) assumes that the stockpiled soils can be removed in three lifts.

4.5 INTERIOR FENCE REMOVAL AND DISPOSAL

Interior fencing that is not providing security on the outer boundary of the site will be removed and disposed to facilitate unobstructed access to all sectors on the site (Figure 4-7). Outer or boundary fencing will be temporarily removed and re-installed, as necessary, to allow geophysical mapping crews to map the boundaries without magnetic interference from the fencing. Non-metallic, temporary construction fencing may be used during the geophysical surveys. Fence removal and re-installation crews will be escorted by a qualified UXO Technician using OE avoidance techniques outlined in the OE SSHP. Any OE discovered on the ground surface will be identified as requiring a BIP or safe to move and disposed of, as discussed in Section 4.11. Interior fencing is scheduled to be removed concurrent with vegetation clearance (Appendix A).

4.6 SURVEY AND MAPPING

Surveyors will install semipermanent markers (36-inch survey stakes) in lines at 100-foot intervals across the property until the entire search area is covered with a 100-foot by 100-foot grid mesh (Figure 4-8). A combination of Differential Global Positioning System (DGPS) and Total Station surveying equipment will be used to locate and install semipermanent markers throughout the Project Site. Survey and mapping of the Project Site will follow vegetation clearance tasks (Appendix A).

UXO personnel will escort the surveyors during this task using OE avoidance techniques. The escorts will visually check the surface and scan the locations (using a site-tested metal detector) where the stakes will be driven for monuments. Locations coincident with anomalies will be avoided by setting witness stakes 36 inches from the monumented location. OE encountered during visual sweeps will be marked and reported to the SUXOS and the Project Manager for recording and disposal.

Survey stakes will be wood and will be painted with a nontoxic, fluorescent orange paint to provide easy visual location. The southwest corner stake for each grid will be embossed with a discrete identifying number. Alpha characters will denote grid position progressing alphabetically west to east while a sequential numeric code will identify the northing reference for the grid (from south to north). The origin for the survey grid will be set at a point in Sector 1 at 1,791,000 north and 6,518,900 east (CSP grid). Once the grids are constructed, maps will be developed illustrating grid location for use in operation planning and team assignments. All field books, sketches, and computation sheets will be maintained in the project documentation files. Surveying and mapping products will be required in English units.

Control points will be identified on the map by name and number and the final adjusted coordinates and elevations (to the closest foot). Each map will include a grid north, a true north, and a magnetic north arrow, with the differences between them in minutes and seconds shown. Grid lines or tic marks at systematic intervals with their grid values will be shown on the edges of the map. A legend showing the standard symbols used for the mapping and a map index showing the Project Site in relationship to all other sites within the boundary lines of the project area will be shown.

The original copies of all field books, layout sheets, computation sheets, abstracts, and computer printouts will be suitably bound and clearly identified. A tabulated list of all control points (e.g., monuments, aerial targets, corners) showing the adjusted coordinates and elevations (in meters and feet) established and/or used for this survey will be developed and maintained.

4.7 ORDNANCE AND EXPLOSIVES SURFACE CLEARANCE

UXO crews will use visual search methods aided by site-tested, hand-held all-metals detectors to clear each grid of any surface OE, OE scrap, or metallic debris. Surface surveys will be conducted using an OE surface clearance walking sweepline within each grid. Sweep personnel will start from the western grid boundary, and systematically sweep the area using a 5-foot separation distance between each sweeper, visually inspecting the ground 2.5 feet to either side of each individual (Figure 4-9). All sweepline personnel will be provided with White Pulse Induction SurfMaster hand-held, all-metals detector. The actual equipment will be determined during equipment performance verification testing. Each sweep team will also be provided with a differentially corrected GPS unit. The GPS

position will be recorded for all discovered OE. Surface clearance will be completed after the 100 foot by 100 foot grids are established beginning with those grids within 200 feet of the project boundary (see Figure 4-8) followed by each sector, as shown on the Project Schedule (Appendix A).

Surface clearance of the wetlands will be accomplished only in the east (narrower) portion of the South Valley wetlands. The west (broader) portion of the South Valley wetlands will not be surface cleared. In order to surface clear the east portion, the area must be dewatered. This will be accomplished through use of temporary dams with the water being pumped around the area to be surface cleared. The west portion will not be surface cleared prior to geophysical mapping, because the instruments will be floated across the wetland; therefore, the ground need not be disturbed.

The hand-held all-metals detector will be used as an aid in locating surface debris and the GPS unit will be used for marking the surface location of OE during the surface clearance. OE scrap encountered during the surface search will be reported to the SUXOS and recorded on the OE Surface Clearance Information Sheet (Appendix H). OE items will be flagged for disposal operations. All OE, recognizable OE scrap, and metallic debris that could impact subsurface detection and mapping of potential OE sources will be removed. OE scrap will be piled at the southwest corner of each grid. OE and OE scrap will be processed in accordance with the Surface and Geophysical Source Process flowchart (Figure 4-10), which is further described in Sections 4.10.4 and 4.10.5. Recorded data will comprise the DGPS track of the sweep team and the characteristics and DGPS location of any discovered OE or recognizable OE scrap.

An OE disposal operations team will remove all OE scrap and metallic materials from the southwest corner of the grids. Disposal operations teams will also remove all "safe to move" items that have been flagged by the surface clearance teams. All OE items that are determined unsafe to move, as determined by the SUXOS, OE SSO, and USACE Safety Specialist in accordance with procedures detailed in Section 4.10.5, will be BIP.

OE disposal operations will be conducted in accordance with Appendices I and J and as described in Section 4.11. All OE scrap and metallic surface debris will be transported to a designated on-site holding area where it will be recorded, certified as inert, segregated, and stored in secure roll-offs or steel drums with locking tops awaiting final disposal to a scrap metal recycler.

A random visual surface clearance QC inspection will be performed over 10 percent of each grid. The 10-percent QC inspections will be conducted by the field investigation QC staff (see Section 6.2.5.1) prior to allowing unescorted personnel access to the grid. Any grids that fail the QC inspection will require another complete surface clearance if OE or OE-like items are found. QC results will be tracked with special attention for recurring QC failures that might be indicative of systemic problems. Each grid QC failure will be jointly reviewed by the Project

Manager, SUXOS, QC Specialist, and the team supervisor to identify and correct root cause(s) of the failure.

4.8 DETECTION PERFORMANCE VERIFICATION

An equipment performance verification test plot will be used to (1) determine the operational limitations of the selected geophysical methods to be used at the Project Site, and (2) define the remedial design depth criteria. The test plot will be used to verify the performance of all geophysical systems deployed to the Project Site. Equipment performance verification will be accomplished as shown in the Project Schedule (Appendix A). Multiple inert OE targets will be laid out at differing depths. The plot will document the reliable depth of detection for the most probable munition (37mm HE projectile); the design criteria are based on the performance limits of the instrumentation. The detection performance verification includes the following steps:

1. Assemble/check out equipment
2. Establish positional survey control point using Optical Total Station Survey System
3. Set corners of the verification plot using Optical Total Station Survey System
4. Perform OE surface clearance over verification plot
5. Collect geophysical background data with each deployed system (data to be collected in two orthogonal directions)
6. Construct Test Plot:
   - Excavate pot holes
   - Set inert OE targets
   - Measure depth to top of each target (below ground surface)
   - Measure position of each target (in relative grid space coordinates)
   - Survey position of each target in CSP using optical Total Station
   - Bury targets and reclaim ground surface to as near as practical the pre-excavation conditions

7. Collect Geophysical Target Response Data with Each Deployed System (data to be collected in two orthogonal directions)

8. Repeat Step 7, twice

9. Process digital geophysical data and identify anomalies of interest

10. Survey test plot in real-time with each system and system operator, flag anomaly locations, survey in anomaly locations with Total Station
11. Repeat Step 9, twice

12. Recover anomaly locations using RTK GPS survey instrument

13. Evaluate detection performance

14. Geophysical Equipment Performance Verification Report.

The plot nominally comprises multiple parallel transects in a 2.0-acre (250 feet by 350 feet) area. The separation between targets and the depths of burial will be as detailed in the following subsections. The test plot will be removed at completion of the sitewide removal action. The test plot will be large enough to accommodate inclusion of targets seeded by USACE in locations not known to either the geophysical subcontractor or the project personnel. This is intended to provide an additional QC check of the target discrimination capabilities of the technology and methodology employed at the Project Site and may be performed at their discretion.

MTADS, MPA MTADS, and hand-held EM instruments and aWhite Pulse Induction SurfMaster will be deployed to determine performance limits from multiple passes over the test bed for each specific system used. The data will be collected in continuous traverses (no stopping and searching) along the designated paths, and spatially referenced via either RTK or DGPS data. The geophysical survey team(s) will have no prior information regarding target location, orientation, depth, or OE type.

4.8.1 Evaluation Plot Design and Development

An accessible 2-acre evaluation plot will be identified for the equipment test site. Ideally, the location will not be in an area of OE concern. However, if the test plot is located within an OE area, all intrusive requirements, as specified in the OE SSHP will be observed. The selected plot will be representative of the vegetation and geology/soils to be encountered within the areas to be remediated during the field activities. The terrain of the evaluation plot be representative of the median relief of the Project Site.

The remediation contractor will seed the area with inert ordnance and ordnance scrap set in the evaluation plot as near as possible to the relative locations

provided by this design. Test items will be buried such that three sets of three like targets will be set at three mutually orthogonal orientations, with additional like targets set both above and below the triplet depth. Targets are buried at shallower and deeper depths than the calculated maximum depth of detection to challenge the detection capabilities of the geophysical equipment. Burial depths were determined using the maximum detection depth criteria for each target item of concern at the Project Site. Seeded target locations will be deviated only to avoid subsurface anomalies already there and disturbance of animal burrows or established plant root systems. The geophysical equipment evaluation plot target inventory is given in Table 4-2. The evaluation plot design is presented as Figure 4-12.

Evaluation Plot Location. Survey control establishing the corners of the evaluation plot will be established in NAD83 CSP coordinates, California, United States survey feet. The corners of the investigative grid will be located in the field to the closest tenth of a foot and marked with an 18- to 24-inch iron pipe or rebar driven into the ground with a 2- to 6-inch stick-up aboveground and witness stakes offset 3 feet from the plot corner. The aboveground stick-up will be painted with a high-visibility orange or pink paint and capped with protective plastic covers. These established corners will be used as the basis for documenting seeded item locations.

Background Characterization. Prior to seeding the targets, background data will be collected using electromagnetic methods. The data will be digitally recorded and processed to produce geophysical isogram contour plots that identify the background characteristics of the evaluation plot.

4.8.2 Excavation and Survey

Vegetation will be removed from the test plot and a surface OE clearance will be performed prior to collecting background data and planting the targets. All seeded items will be situated to the closest tenth of a foot with their CSP coordinates tabulated on the drawings and entered on a Microsoft Excel spreadsheet. Each seeded target will be painted with a high-visibility paint, tagged, identified, and inventoried. Excavations for the targets will be made by hand shovel and power auger. The target locations will be surveyed and tied to the corners of the evaluation plot in CSP coordinates. Surveyed locations will be accurate to 0.1 foot. Target pits will be backfilled and the ground surface compacted and restored to as near pre-excavation conditions as is reasonably practical, including replacement of original topsoil with attached vegetation.

AS-BUILT DESIGN

The remediation contractor will apply the design as a template to the chosen evaluation plot sites and will then provide an as-built design of the evaluation plot site after the targets are emplaced. The as-built will consist of a base map that shows the plot and lane boundaries and any planimetric features such as roads,

buildings and fences with CSP coordinates tick marks and a sheet border and title. Seeded items will be shown with a standard symbol and unique identifier code referenced to a table in the file that shows the item description, depth, coordinates, and any other descriptive information. The table will be placed so that the two files can be plotted to create an as-built composite.

4.8.3 Geophysical Equipment Evaluation

EM instrumentation, comprising the MTADS, MPA MTADS, and hand-held White Pulse Induction SurfMaster metal detectors will be evaluated. Magnetometer systems have been excluded from consideration because the Project Site, like all demolition sites, possesses the potential to contain a significant population of nonferrous OE that cannot be detected with magnetometry systems. However, to demonstrate the relative performance of the EM versus a magnetometer system, magnetometry data will be collected over the test plot. Man-portable and vehicle-towed platform arrays will be deployed. Data will be digitally recorded coincident with CSP coordinates utilizing differential or RTK GPS. The geophysical survey team will continuously track and monitor the position of the instrumentation within the evaluation grid to ensure complete coverage with the systems deployed. Data will be collected over the test grid along contiguous survey lanes. The Standard Operating Procedures for equipment operation, functional checks, data capture, processing, and interpretation are presented in Appendix K.

MTADS Towed Arrays

The MTADS geophysical arrays are towed with a custom designed low ferrous metal vehicle. Data are collected by driving the array over the target area, searching a 2-meter swath with each pass. To obtain total coverage over the test plot, survey line spacing was kept at 5 feet.

Positioning for the MTADS was accomplished with the Trimble 4700 RTK differential global positioning system (GPS). A GPS antenna is mounted on each of the towed geophysical arrays. The 4700 receiver is located within the tow vehicle, and receives data from both the GPS antenna and from the GPS base station. Positional data are recorded in WGS-84 latitude and longitude at a frequency of 5 hertz (Hz).

Positional/navigational data and geophysical sensor data are displayed in real time on the computer screen allowing the operator to monitor position and geophysical data quality. The geophysical and positioning data are sent to a data acquisition computer within the tow vehicle. The data are stored on the hard disk of the computer for downloading at the end of the field day.

MTADS EM Array

The MTADS EM array consists of three pairs of overlapping modified Geonics EM61 coils. The coils measure 40-inches by 40-inches, and are contained in a fiberglass trailer. EM data are collected at a rate of 16 Hz ,and recorded by on-board computers. The array is towed at a speed of between 4-6 miles per hour, resulting in an average data point spacing of 0.5 foot, and a maximum data point spacing of 0.6 foot along survey lines.

MTADS Magnetometer Array

The MTADS magnetometer array uses eight Geometrics 822a fast cycling cesium vapor magnetometers. The magnetometers are spaced 0.25 meters apart in a non-ferrous metal trailer. Data are collected at a 50 Hz sampling rate. The magnetometers measure the total magnetic field while being towed across the survey site at a speed of up to 6 miles per hour.

A base station magnetometer was set up at the site to measure and correct for the diurnal drift of the earth's magnetic field. This consisted of a Geometrics 858 magnetometer set up at a location away from traffic and other geophysical noise. The sensor was oriented vertically with the base of the sensor suspended approximately 40 inches above the ground surface. Data were sampled at a rate of 1 Hz. The base station data was checked periodically, and the battery voltage was monitored.

Dual HP Modified-MTADS EM Array

The dual high-power (HP) MTADS consists of two sets of modified EM61 coils. The coils measure 40-inches by 20-inches, and are mounted on a wheeled cart that is pulled across the survey area by an Argo vehicle. The coils are oriented with the axis of the 40-inch side perpendicular to the direction of travel, such that a two-meter swath is covered with each pass. Sensor data are recorded at a rate of 10 Hz. The array is towed at a speed of approximately three and a half miles per hour resulting in an average data point spacing of 0.5 foot along survey lines.

Positioning for the dual HP system is accomplished with the Trimble 4700 RTK DGPS). A GPS antenna is mounted above the center of the two EM coils. The 4700 receiver is located on the Argo vehicle and receives data from both the GPS antenna and from the GPS base station. Positional data are recorded in WGS-84 latitude and longitude at a frequency of 1 Hz. The geophysical and positioning data are sent to a data acquisition computer and recorded using the MagLog data acquisition software. This is the same software used for the data acquisition in the MTADS vehicle-towed arrays. The data are stored for downloading at the end of the field day.

The dual HP Modified-MTADS system consists of two ganged MPA MTADS. Each of these systems is an MPA MTADS as described in Naval Research Laboratory's report "Man-Portable Adjuncts for the MTADS" dated February 12,

2001. The dual system is an improvement over the single MPA unit due to the increased moment from two transmitter coils. In addition, the use of a PC for data acquisition allows the recording of two sensor streams rather than one which occurs with the standard MPA MTADS data logger (Geometrics G858 console).

In the dual contiguous coil arrangement (demonstrated at the site) the magnetic fields from the currents in adjacent transmitter coil edges cancel out. The resulting magnetic field from this array is equivalent to a single transmitter coil (with the dimensions equal to the perimeter of both coils) with the maximum signal strength in the center of the array. Placing an additional receiver coil at the array center point would allow sensor data to be collected with a tighter line spacing and at the location in the array where the signal strength from deeper targets should be at a maximum.

Dual MK2 EM Array

The dual MK2 system consists of two sets of EM61 MK2 coils. The coils measure 40-inches by 20-inches and are mounted on a wheeled cart that is pulled across the survey area by an all-terrain vehicle (ATV). In areas of steep terrain, the array can be pulled with a winch and pulley system. The coils are oriented with the axis of the 40-inch side perpendicular to the direction of travel, such that a two-meter swath is covered with each pass. Sensor data are recorded at a rate of 6.6 Hz. The array is towed at an average speed of two miles per hour resulting in an average data point spacing of 0.5 foot along survey lines.

Positioning for the dual HP system is accomplished with the Trimble 4700 RTK DGPS). A GPS antenna is mounted above the center of the left side EM coil set. The 4700 receiver is located on the EM array and receives data from both the GPS antenna and from the GPS base station. Positional data are recorded in WGS-84 latitude and longitude at a frequency of 1 Hz. The geophysical and positioning data are sent to the PRO4000, a 486 data acquisition computer that is located on the cart. The data are stored for downloading at the end of the field day.

The first time gate of the MK2 EM system is approximately the same as the MPA MTADS (~200 usec). The coil size (20 by 40 inches) is also the same as the MPA. The use of a dual ganged array results in an increased effective transmitter moment for deeper targets. In developing the MK2 system Geonics incorporated some aspects of the MPA MTADS. This includes the earlier time gate which results in higher signal strengths over metal targets and the 20 by 40-inch coils, which results in better target resolution.

Real-Time MK2 System

The real-time MK2 array consists of a single EM61 MK2 system. As noted above, the first channel of data from this system is essentially equivalent to that obtained with the MPA MTADS. The electronics are located in a backpack that is worn by the equipment operator. When used in real-time mode the geophysical data are not stored in the data logger. The equipment operator

hand-pulls the system across the survey area while monitoring the data display for anomalous readings. A temporary marker is placed on the ground in the vicinity of a detected anomaly. The MK2 is used to pinpoint the location of the anomaly by passing the coils over the anomalous area in multiple directions. A plastic pin flag is placed in the ground over the interpreted anomaly location. After completing the real-time survey with the MK2, the pin flag locations were acquired with the Trimble 4700 RTK differential GPS.

Sensor Positioning

Positional data were recorded with the Trimble 4700 RTK DGPS. With this system, the center points of sensor readings have a location precision of 6 inches for vehicle-towed arrays. Target anomalies are expected to have location precision between 6 and 18 inches due to the geophysical sensor width and line spacing. For real-time surveys, the location precision is expected to be within 5 inches. Positional data are recorded in WGS-84 latitude and longitude for vehicle towed arrays and NAD83 California State Plane coordinates for real-time.

The GPS base station is generally located within one to two miles, line of site, from the survey area. The base station receiver is set up over a known control point and spatial position correction is transmitted in real time to the GPS rover receiver via a radio modem. One control point, labeled PT2000, was utilized during the geophysical survey. This point provided good coverage for the geophysical survey conducted at the test plot.

The standard MTADS EM trailer will be deployed as described elsewhere in this document (specifically, at 5-foot transect spacings, yielding an effective line spacing of 1.65 feet with the three interlaced receivers).

The modified MTADS EM array with dual high-power EM61 systems yields an effective line spacing that alternates between 1.65 and 3.3 feet when traversed over transects separated by 5 feet. The second pass over the survey area yields cumulative line spacings that can reduce this spacing, but does allow some 3.3-foot separations between contiguous lines.

The Dual Mk2 EM array, as deployed at the test plot, also has an effective line spacing that alternates between 1.65 and 3.3 feet on each transect. This system will be deployed only on very steep slopes where safety prohibits the use of the trailered MTADS arrays. The system will be winched up/down the slopes, and will be belayed by an anchoring vehicle. Because of the safety elements involved, it is necessary to minimize bulk (mass and volume), while preserving as much productivity as possible. The expectation is that this system will receive only limited use (deployment over less than 5 percent of the site).

The real-time deployment of the EM systems will be at, or less than, 2.5-foot transect (line) spacings.

During the equipment evaluation, the navigational accuracy of the positional reference instrumentation (DGPS or RTK GPS) will be tested to identify and

quantify temporal and spatial shifts in the data. Prior to commencement of the project, satellite coverage shall be determined for the proposed workday. Period(s) of insufficient satellite coverage shall be identified and integrated into schedule planning.

Digital data will be downloaded to an IBM-compatible PC. EM data will be formatted in x, y, and z ASCII files with the survey values coincident with coordinate locations. A time stamp for the data will be included to assist with evaluating time lags/shifts that may need to be corrected in post-processing.

4.8.4 Performance Objectives

Detection Performance

- The equipment test plot data will be used to generate site-specific detection performance curves. The curves will be used to determine the reliable depth at which the MPM (37mm) will be detected bgs.

- Horizontal Accuracy: 90 percent of all identified anomaly locations must lie within a 1.65-foot radius of their actual location as shown on the "dig-sheet," and 98 percent of all anomaly locations must lie within a 1.3-foot radius circle of the reacquired surface location.

Locational Accuracy. The tolerances for locational accuracy will be identified by comparing the known grid position of targets (±0.1 foot) to the location given by RTK GPS. Geophysical data will be collected coincident with CSP coordinate data with an RTK GPS capable of 8 inches precision; the apparent target (anomaly) location derived from data processing will also be compared to known target position. Lastly, reacquisition of anomaly locations will be compared to grid location of the targets. Locational accuracy error will then be the sum of individual positional errors.

Geophysical Instrument Precision. Instrument standardization responses will vary by no more than ±10 percent of the standard response for each fielded system.. The standard response will be determined by placing a 3-inch carbon steel sphere in a fixed geometry with the instrument sensor receiver and comparing the target response to background response at the same location. The sphere provides a reference target that can be used at any location at the Project Site. Static background readings will be recorded for a minimum of 30 seconds (at a 1 hertz [Hz) sampling rate). The standard target will then be introduced and target data records recorded for 30 seconds (again at 1Hz). The residual, or mathematical difference between the target and background response will be the standard response. A mean deviation from the standard response will be calculated from multiple tests (minimum of three) for each instrument used.

Survey Completeness. Tolerances for completeness will be evaluated by determining the percentage of data drop-outs, unusable, or missed data along

any single pass that can be allowed without compromising the identification of target anomalies. Coincident GPS coordinate and geophysical data will be used to generate a plot of track coverage that will be compared with a theoretical track and anomaly response profile. The initial criterion will be capture of at least 98 percent of the possible data points along a given transect; 100 percent of the area must have been covered after the second, orthogonal survey.

Representativeness. The target sources and anomaly parameters (signal amplitude and width; target shape, depth and orientation) will be evaluated to determine an acceptable range of representative responses for each target.

Anomaly Recovery. Anomaly location reacquisition will be evaluated by navigating to the coordinate of the anomaly with RTK GPS equipment. After the anomaly positions, as identified through computer processing of the geophysical data, have been recovered in the field, an MPA-MTADS will be used to re-define the apparent anomaly centroid and dimensions. Offset distances between the recovered and actual locations will be measured and recorded. Survey tolerances for anomaly recovery and investigation will be extrapolated from these data. If the hand-held instrumentation cannot resolve the identified anomaly (e.g., target is too deep), the CSP coordinates will be taken as the target location.

4.8.5 Sensor Survey Geometry

The configurations and measurement geometrics to be used for the deployed systems will be determined during the equipment evaluation. The equipment will be comprised of components that can be used as an individual system and ganged arrays of multiple detectors. The effective line spacing of the dual high-power EM array exceeds the required 2.5-foot maximum line spacing of the data. To meet this spacing requirement, a third receiver will be interspaced with the two high-power systems prior to deployment of the array to the validation plot and subsequent mapping of the Project Site. The third receiver will yield an effective maximum of 1.65-foot spacings for the modified array. The Dual EM61 Mk2 array will be similarly modified, if possible (adding a third receiver to this array will require some remanufacturing of the system electronics to accommodate the added data stream). As noted previous, this Mk2 system will only be used on the very steepest of slopes of the Project Site. If the system cannot be modified, it will be redeployed as single units before it is used for further mapping. All mapping instruments will have the means of electronically capturing both geophysical response and coincidence measurement locations in a data logger for subsequent processing and analysis. The sensor separation for EM focusing coils will be as specified by the instrument manufacturer. Sensor heights will be optimized to allow as small as possible a standoff height, as dictated by existing terrain and ground surface conditions.

4.8.6 Data Collection

MTADS EM data are to be obtained using standard operating procedures established by the subcontractor (Appendix K). Geophysical data will be collected at no greater than 2.5-foot transect spacings (5-foot for ganged arrays) and measurements made initially at no greater than 0.5-foot station intervals. Potential peak amplitudes will be estimated prior to mapping the evaluation grid by evaluating instrument response over ground surface targets and extrapolating response curve fall-off with depth. Survey speed will be such that the instrument response reaches 90 percent of the potential peak amplitude.

Three sets of data will be obtained for each deployed geophysical system. The data sets for each system will comprise responses from two orthogonal surveys of the test plot.

4.8.7 Data Editing and Formatting

The field data will be checked, corrected, and processed into ASCII files in an ADF file format. All edits and corrections made will be fully documented. Any temporal or spatial shifts between geophysical detection and navigation systems will be quantified and documented. Time/space corrections will be developed as needed. The data will be presented in delineated fields as x, y, and z, where x and y are CSP coordinates in east and north, and z is the instrument reading. Where multiple instrument values are recorded, each channel of the data will be presented as x, y, z_1, and z_2, where z_1 is the value of the top sensor and z_2 is the value of the bottom, collocated, and simultaneously collected sensor. Each field of data, including time stamps, will be recorded in separate columns within the data files. A copy of all digital and electronic data will be appended to the geophysical equipment evaluation report for technical review and evaluation by USACE.

4.8.8 Data Transfer

Data will be digitally recorded and delivered in a format suitable for transmission via telephone modem or other electronic telecommunications media. The procedures and routines for accomplishing this task will be developed and implemented interactively during the equipment evaluations. Data will be processed in the field and the OE contractor will post the processed data to a public web site within 2 working days of completion of the evaluation grid survey. An archive PC-CD ROM containing all field data will be delivered to USACE within 2 days of completion of the field test effort.

4.8.9 Deliverables

- Digital data for EM survey results, as above, in IBM-compatible ASCII x, y, and z format. Data will include preliminary processed (straight conversion to ASCII) and final processed (time or distance lag, position corrected) data and will include digital PDF versions of

the hardcopy maps. Each ASCII file will have headers for each column of data.

- Hard-copy, filled color geophysical image plots of EM response (one for each channel collected).

- Individual survey lane data profiles plotting response amplitude versus distance (one for each channel of data collected).

4.8.10 Equipment Limitations/remedial Design Criteria

The performance of the geophysical system responses will be scored on seeded targets detected. Allowable tolerances for positional accuracy for the geophysical investigation will be extrapolated from the evaluation plot survey, geophysical anomaly maps, and target location maps to be provided through the above tasks.

The geophysical equipment evaluation will test the geophysical instruments and techniques, as well as the methodology of transferring and processing data among the team members. Data will be assembled and formatted in the field to meet the geophysical survey data requirements.

Performance Criteria. Achievable (reliable) depth of detection for each type of geophysical system deployed will be determined from the equipment performance verification test plot, geophysical anomaly profiles, and target location maps to be provided through the previously outlined tasks. The minimum detection depth (e.g., that depth at which each system detected all inert 37mm HE projectiles buried in the test plot) will be taken as the reliable detection depth for that type of equipment. This detection depth will be the design criteria for the remedial action.

Horizontal Accuracy. Only those identified anomalies that are within a 1.65-foot radius of the actual target location, as shown on an as-built diagram, will be considered in the determination of the reliable depth of detection for the selected instrumentation.

Performance Verification. The established, reliable depth detection and the overall quality of the subsurface detection and mapping effort will be verified at a field test site (Sector 10B), in accordance with the process flow detailed in Figure 4-13.

4.8.11 Real-time Surveys

MPA MTADS equipment operators will survey the test plot in a real-time mode, visually and audibly discriminating anomaly locations. Each system will be tested using multiple passes (more than two) over the test plot. Real-time data records consist of "picked" anomaly locations. To keep results as unbiased as possible, no semipermanent or permanent marks will be used to identify the

"picked" positions. The QA/QC derives from the comparison of "flagged" location versus actual position. The operators will mark the locations of these anomalies by passing the MPA MTADS over the suspect position in at least two different directions.

The identified target locations will be landmarked with a differentially (post-processed or RTK) corrected GPS survey system. These target locations will be evaluated to determine the detection depth tolerances for real-time survey operations. The depth for reliable detection of the MPM will be greatest at the depth at which every operator correctly locates the targets.

4.8.12 Geophysical Equipment Evaluation Report

A geophysical equipment evaluation report will be prepared by the project geophysicists following the conclusion of the data collection. The result of this evaluation will be a determination of the reliable depth of detection for the systems tested, positional resolution tolerances, and an estimate of the maximum detection depths for digitally collected data. The report will be submitted to DTSC, USACE, Granite, and the City of Benicia. The report will document all activities performed to create the test plot and establish the criteria for the geophysical survey and quality control applications. It will contain all digital data from the investigations and analysis. Once the design criteria are established, the balance of the site can be remediated. The schedule for these activities is presented in the Project Schedule (Appendix A).

4.9 DETECTION AND MAPPING

Geophysical data will be collected and analyzed to identify locations of subsurface anomalies. Geophysical team(s) will perform continuous tracking, checks, and adjustments of the field data for QC and to establish efficient field procedures. Navigation and instrument position will be tracked and recorded using state-of-the-art RTK DGPS instrumentation. The CSP grid coordinate system will be used and referenced to the National Geodetic Survey NAD83.

The entire surface area (approximately 220 acres) of the Project Site will be geophysically mapped using an MTADS or MPA MTADS. The detailed mapping sequence for each sector is shown on the Project Schedule (Appendix A). EM data will be collected at 10 Hz and correlated with the navigation data. Survey speed will be constrained to ensure measurements are recorded at no more than 1-foot intervals along the survey lanes. The sensor measurements will be mapped out separately for each of the upper and lower coils. Offsets are to be automatically subtracted from each array to correct for a direct current (DC) bias.

The MTADS will use a Trimble 4700 DGPS for positioning. The system will be operated in RTK, On-The-Fly mode, which provides a 2-inch level of accuracy with 5-Hz updates. The DGPS satellite clock time will be used to time-stamp

both position and sensor data information for later correlation. Position dilution of precision calculations will be provided as part of the data stream.

A data acquisition (DAQ) computer will be used to provide real-time guidance displays and information for the driver. Perimeter surveys or point landmarks will be used to define the survey bounds. The maximum tow speed of the MTADS with EM sensors is expected to be 2-3 mph. Limits for station intervals along each transect (function of traverse speed), as well as transect spacings, will be determined during the equipment performance verification tests. Given limitations imposed by terrain, vegetation, and vehicle/MTADS operating requirements, actual survey traverse speed is expected to be 2 mph. Taking into consideration the time to conduct daily operations and safety briefings, equipment standardization tests (before and after surveying, and hourly), mobilizing equipment and crew to the survey line, periods of low satellite coverage for DGPS, downloading data, and conducting daily maintenance, daily productivity for the Tourtelot Project is expected to average 6-8 acres per day per vehicle-towed MTADS.

Where the MTADS cannot be deployed, either because of terrain steepness, vegetation, or other obstacles to coverage with the trailered array, an MPA MTADS instrument will be used. These systems may require some means of belaying the instruments (and operators) as they traverse the steeper terrain, flotation supports, or other site-specific deployment requirements. The actual mechanics and logistics for use of the alternative instruments will be resolved in the field, as specific obstacles and/or problems are encountered. Survey productivity with the MPA MTADS is expected to average 2 acres per day per system deployed.

Geophysical survey setup, data acquisition, and data processing will be carefully controlled to obtain complete, precise, representative, and repeatable data. The processes to be used to obtain high-quality data are outlined below. Appendix K presents the Standard Operating Procedures and QC protocols to be implemented by the geophysical field services subcontractor. These provide a detailed discussion of the data acquisition and processing procedures and steps to be followed. The QC protocols will be specific to the Tourtelot project and will be provided to DTSC and USACE prior to mobilization of subcontractor personnel and equipment.

Complete survey coverage will be obtained by ensuring overlapping of the MTADS (and MPA MTADS) footprint through control of line spacings. Survey precision will be controlled by requiring replication of a standard geophysical response. GPS positional data will also meet a specified tolerance for replication of position over fixed, known points at the Project Site.

The characteristics of anomalies identified during data processing will be compared to the discovered sources to verify that the source is representative of

the anomaly. Data processing to identify the anomalies must be quantifiable and repeatable, and to include:

- Evaluation of QC standard tests
- Evaluation of lag correction
- Evaluation of field notes for cultural features
- Evaluation of sensor data for spikes, gaps, and sensor failure
- Editing or removal of low quality positional data points
- Evaluation of coverage (i.e., data gaps)
- Application of demedian filter to remove sensor drift and level the data to a zero baseline (a 1,000-point average is used for EM data and a 400-point average is used for Mag data).

Following the preprocessing phase, the data analysis will include:

- Plotting the sensor data in gridded and pixel format
- Applying filters to the gridded data (when necessary) to aid in target identification
- Selecting targets utilizing a peak-picking algorithm
- Identifying additional targets that were not selected using the peak-picker
- Reviewing data and removing targets attributed to edge effects and cultural features
- Preliminary modeling to produce estimated size and depth for identified targets
- Generating an output of the final data in XYZ ASCII format
- Plotting a hardcopy map of the data with target locations superimposed
- Producing a final target sheet with location, peak value, estimated size, and estimated depth.

Field data check forms and the specific data processing routines are to be found in the MTADS Standard Operating Procedures (Appendix K).

The wetlands areas will be divided into sections for OE point clearance operations. In areas where the wetlands are narrower (e.g., the eastern part of the valley), temporary wooden structures may be placed across the wetlands area to allow the geophysical crew to use the vehicle-towed MTADS to locate anomalies within the wetlands. The MTADS array will be towed by a small, track-mounted vehicle. In the wider areas of the wetlands (e.g., the western part of the valley) where access by the vehicle-towed MTADS could be problematic, an MPA MTADS (man-towed or raft-mounted) will be used.

In areas of the wetlands where the MPA MTADS will be floated, an in situ test of the MPA MTADS detection capabilities will be conducted.

Table 4-3 summarizes how the geophysical equipment will be used on the Project Site.

4.9.1 Geophysical Data Collection and Data Processing

4.9.1.1 Data Collection.

Each geophysical survey team will consist of an instrument operator and a field assistant to aid in tracking control. Geophysical data will be digitally captured into a file with coordinates recorded relative to the CSP grid coordinate system. A field logbook will be maintained that details pertinent activities, survey lane features, and field conditions encountered in the performance of the geophysical characterization. A field sketch map of mapped survey lanes will be made as or before the geophysical data collection progresses/commences. All activities related to geophysical data collection will be documented in the daily field logbook. Field maps will note date/time of the survey, area covered, and the location and description of noise sources that will affect interpretations.

A safety and work assignment briefing will be conducted prior to the beginning of each day's field activities. The safety briefing will address any known hazards of concern for the particular area(s) to be investigated. Attendees and briefing substance will be recorded in the field logbook. Elements of a survey day include:

- Morning pre-survey checks of instrument and batteries
- Safety and planning briefing
- Identification of traverse segment(s) to be mapped
- Equipment set-up
- Initialization of data logger(s) to record geophysical response
- Performance of instrument standardization

- Traverse of survey lanes to collect data; verification of complete investigation of all segments.

The geophysical survey team will continuously track and monitor the position of the instrumentation array during data collection to assure complete coverage of the areas of interest. This will be accomplished through the use of lane markings and by maintaining alignment of the instrument array relative to transect waypoints.

At the completion of each survey day, field notes, maps, standardization documentation, and digital survey data will be delivered to the remediation contractor's Project Manager on 3.5-inch, IBM-compatible microcomputer diskettes in ASCII format. The diskettes will be labeled with survey lane identifications and date. A copy of the disk will be forwarded to DTSC and USACE, Sacramento District, within 5 days.

4.9.1.2 Standardization.

Proper operation and function of the instruments used will be checked and documented in the field log each day by a standardization process prior to the day's geophysical surveys. The first day on site for geophysical personnel (other than for project orientation) will be used to establish baseline responses over the equipment test plot and standardization acceptance ranges for each mapping system deployed.

Standardization procedures and standard response (for each system) will be established before any geophysical mapping of the survey lanes is performed. This will be accomplished by establishing a target and a background reference geometry and determining the numerical difference between target-anomaly high and background response of each system. Multiple anomaly-versus-background measurements will be made to allow computation of a mean residual (anomaly response) and calculation of a standard deviation specific to the system.

Standardization of each system will be performed periodically each day to ensure proper operation and function of the system, including before any mapping activity and prior to shutting down the equipment for any reason. Standardization will be accomplished using a portable source in a fixed, ground-level geometry with each receiver antenna. The portable source is used to eliminate the need to return to one location several times each day. The portable standard target will be a solid, 3-inch-diameter carbon steel sphere. Standardization consists of comparing the residual anomaly to the acceptance range and recording the values in the daily logs. Acceptance range is specified at ±10 percent of the standard response (calculated mean residual anomaly).

The geophysical equipment positional accuracy will be monitored daily to ensure that chosen tolerances are maintained. Metal stakes will be placed in the ground and their location measured using DGPS. Each piece of geophysical

equipment will measure two of these stakes daily. The offset between the measured anomaly location and the known location of the stakes will be recorded in the daily logs and will not exceed the established tolerances.

The standardization response and acceptance range will be recorded in the field logbooks assigned to each arrayed antenna component receiver. If a system component does not respond within the acceptance range, the standardization measurements will be repeated. Three sequential failures will cause the system to be removed from service. Any failed component must be replaced/repaired and a new standard response (with a new standard deviation and acceptance range as calculated above) calculated before being redeployed to the field.

4.9.1.3 Data Processing.

Geophysical data (amplitude and location) will be downloaded periodically to avoid possible data loss or corruption. The geophysical data will be checked, edited for corrections, and processed into ASCII files using the same procedures and routines as used to verify detection performance. The data will be presented in delineated fields as x, y, and z, where x and y are survey lane coordinates in easting and northing, and z is the instrument reading. Where multiple instrument values are recorded, the data will be presented as x, y, $z_1 \ldots z_n$ in the same ASCII file. An example file header is presented in Appendix K (MTADS Standard Operating Procedure).

The field data will be imported into the processing software, demoded (as necessary), and processed. Data will be corrected for navigation errors, instrument bias, and measurement drift. All corrections, edits, filtering, or normalization of the data used to identify potential OE anomaly locations will be fully documented in a data processing log. A grid mesh corresponding to the survey grid or lane will be generated. This mesh will be the input data for the automatic anomaly discrimination routine used.

Field processing will include a symbol posting of the measurement stations along the survey lanes and generation of simple profiles of the data measured at each of the geophysical receivers of the array. A visual inspection of data will be performed to identify any single-point anomalies, steps in response, or incoherent signal/excessive noise bandwidth. All such events will be noted and described in the field logbooks. This field processing will be performed by the geophysical subcontractor and delivered to the remediation contractor's Project Manager no later than 5 working days after data collection.

4.9.1.4 Anomaly Identification.

Anomaly location is accomplished by identification of discrete response parameters distinct from background response levels. The data processing and QC will be performed using *Geosoft® Oasis montaj* or *Golden Software® SURFER for Windows* software to perform data quality checks, validate data,

and make the required plots. The MTADS DAQ software will be used to select suspect anomalies and print out target lists ("dig sheets") in ASCII format for the reacquisition of sampling locations. Turnaround for anomaly identification will be approximately 5 working days from collection date.

Data resolution will be such that anomaly locations can be identified to within a 1.65-foot radius of the source location. Processing of digital data will include a symbol posting of centerline locations of the sensor array and production of color plots of the data mesh over the survey area. Anomaly symbols and identification numbers will be superimposed on these plots. An ASCII-format tabulation of the anomalies will be generated. The table will include anomaly number, northing and easting (in CSP coordinates), anomaly amplitude, and other anomaly attributes (i.e., depth estimate). No differentiation of target characteristics will be accomplished (all identified anomalies will be investigated).

4.9.2 Review of Field Data

Field data will be reviewed daily by the remediation contractor's site geophysicist. To assess usefulness of the data for detecting and resolving OE anomalies, noise levels in the data will be analyzed to ensure that they are sufficiently low to allow adequate signal-to-noise differentiation of pertinent anomalies. Typically, the root mean square background noise response is approximately 5 mV. For example, at a 5-mV background, those coherent anomalous responses greater than or equal to 7.5 mV would be considered as potential anomalies of interest. At a minimum, responses at signal-to-noise (S/N) levels greater than 1.5:1 will be identified for discrimination from the background matrix. Responses with S/N less than 1.5:1 will be individually considered for inclusion in the final target selection. Unusable or incomplete data delivered for any survey lane will be reacquired. Any variations or results not compatible with prior results or expectations will be reviewed with the geophysicist to determine causative features that may be present. These field contacts will be summarized and included in the weekly QC summary report. Field logbooks will be returned to the field team members prior to commencement of the next work day for continuing documentation of the field effort.

The field review will ensure that precise measurements of the geophysical response were obtained by verifying that instrument performance during standardization fell within the established ±10-percent acceptance range (range established for the baseline/standard response to a known target, as discussed in Section 4.9.1.2). Daily standardization field measurements and results are to be completely documented in the field logbooks. The field logbooks will be reviewed to ensure proper implementation of the quality controls. A mean deviation from the standard response will be calculated for each instrument used. This will be reported in a progressively updated table.

The CSP coordinates recorded for each survey parcel (discrete areas comprising adjacent survey lanes or transects) will be compared with a master listing to ensure that the sampling data are accurately located within the study area. The field logs will also be reviewed each day to verify that data were collected following a continuous progression along the survey lanes. If the survey progression was interrupted for a particular segment because of terrain or other considerations,the reviewer will verify that the causes of the deviation and the actual mode of progression are fully described in the field logbook notes.

The landmarks, fiducials, and anomaly locations represented in the processed geophysical data will be compared to geophysically referenced spatial data (GIS base maps). The features of the GIS that are reflected in the geophysical data should be locationally coincident to within 1.65 foot. Any discrepancies in positional or locational accuracy of the data noted during the field review will be described, including steps taken to correct or resolve any such QC issues.

The field review will ensure that the survey lane characterization was complete by verifying that the data volume for each receiver array is comparable (±1 percent) and that the spatial data density (measurements per unit distance) is representative of the mapping effort described in the field logbook. Field notes will be compared to the downloaded digital file data to assure correspondence between lanes searched and lanes recorded.

The percentage of coverage (by an 18-inch by 12-inch mesh) of each investigated segment will be tabulated. Significant lack of coverage (>2 percent missed) will be flagged and annotated with the steps (to be) taken to resolve the missed coverage. Unavoidable obstacles will have been mapped on the field sketches and should result in direct correspondence with missing data. Data drop-outs or inexplicable data shortages, if not detected during the field review and scheduled for reacquisition, will be evaluated to identify the root problem and steps needed for resolution.

The project GIS will progressively accumulate and incorporate GPS, geophysical, and intrusive investigation results. The GIS will be continually reviewed to provide for continuity between contiguous data blocks.

A table will be developed and progressively updated that presents pertinent anomaly data (e.g., anomaly identity, amplitude, width, apparent source, depth-to-target). The project and field geophysicists will review the intrusive investigation results to verify that the discovered anomaly sources are representative of the detected response. Any anomalies that are not adequately accounted for by the discovered source will be reinvestigated by the field anomaly reacquisition crews.

Data Quality Assurance. A review and verification of 10 percent of the geophysical data will be performed by a third party and will be accomplished in addition to the 100-percent review of the data to be accomplished by field

personnel. Data will be audited by processing discretely bounded survey lane segments using the Geosoft Mapping and Processing System and OE Target Analysis.

Personnel, processing, and interpretive software will not be replicated. Parallel processing in this fashion should result in identification of similar anomalies. QA processing of digital data will include production of representative profiles. The profile images will be used as a QA tool to compare visually discriminated locations with those anomaly locations identified by the automated (digital) target picking routines used to generate the anomaly "dig" lists. QA will comprise the following activities:

- Review of daily field QA documentation (e.g., maps, field notes)
- Review of standardization results (instrument precision)
- Derivation of data statistics and measurement coordinates (location accuracy)
- Posting of data for each segment (survey/coverage completeness)
- Generation of contour/image/profile plots (representativeness/ reasonableness)
- Comparison of field anomaly map, digital data image, and OE sampling results for each area investigated (representativeness).

Additionally, inert 37mm or 30mm projectile rounds will be buried in 25 percent of the 100-foot by 100-foot grids prior to the initial geophysical survey of each data block (nominally 100 100-foot by 100-foot grids). The grids within each sector will be randomly selected using a random number generator. The location of each "seeded" target will also be randomly determined using grid northing and easting with a table of generated random numbers (1-100 for both northings and eastings).

Each inert projectile round will be buried in a horizontal orientation. The pass/fail criteria for these QC targets will be 100-percent detection of all inert OE "seeds" buried at or shallower than the reliable detection depth for each projectile, as determined at the evaluation plot (targets must be detected and the position identified as an anomalous location to be excavated during the point clearance) (see Figure 6-2).

If mapping and detection fails to correctly discriminate the seeded target in any grid, that grid and the eight grids surrounding it will be resurveyed and the data reprocessed. The data will be analyzed to determine why the target item was missed. The results of this analysis will be used to determine corrective measures, as necessary, to ensure subsurface detection of all MPM OE.

The results of the geophysical survey review will be tracked on a master spreadsheet that will tabulate survey area identification, coordinates, and date surveyed. A weekly QC summary will be prepared and submitted to Granite, USACE, and DTSC.

Digital data will be archived to document the geophysical characterization, including thoroughness of the survey, detection efficiency, and locations of identified anomalies; provide a means of quantifying the confidence that can be applied to the OE cleanup results; and preserve and document the extent, precision, accuracy, and quality of the geophysical characterization. The data will be maintained by the OE contractor at the site for Granite and will be available upon request to DTSC and USACE.

4.10 SUBSURFACE ORDNANCE AND EXPLOSIVE CLEARANCE

Prior to the start of intrusive activities, the SUXOS and OE SSO will verify that the area around the operating site is clear of all non-essential personnel and that other UXO supervisors have been notified. MSDs will be established and maintained in the vicinity of the operating site, as specified in Chapter 3.0. A typical MSD and MSA are shown on Figure 3-3. MSDs and VSDs for each sector are shown in Figures 3-8 through 3-17.

Excavation of anomalies will be performed in accordance with the procedures outlined in the following subsections. Subsurface OE and OE scrap will be processed in accordance with the OE process detailed in Figure 4-10. OE located during the subsurface search will be reported to the SUXOS. A description of all OE, OE scrap, and non-OE debris recovered will be recorded digitally utilizing pocket PCs as outlined in Section 4.18.1.3.

OE anomaly excavation crews will intrusively investigate all anomaly locations identified during the geophysical mapping to verify anomaly source, as described in the following procedures (unless removal of surface metallic debris accounts for the geophysical anomaly). These procedures, specifically referred to as point clearance, entail an OE cleanup approach that locates and removes OE items individually. Table 4-4 includes estimates for vehicle hours and the type of equipment required for OE point clearance activities. The sequence of these activities across the Project Site is shown in the Project Schedule (Appendix A).

Anomaly locations, as identified by the remediation contractor, will be recovered using an RTK GPS capable of submeter accuracy to relocate the coordinates of the center of each identified anomaly. Reacquisition personnel will be escorted by UXO-qualified personnel during this activity. The anomaly reacquisition team will refine the anomaly location using the MPA MTADS and record the peak recovered anomaly value and relative background response in a field logbook.

The location of the recovered anomaly peak will be marked with wood lathes, a plastic pin flag, or a clay pigeon. If the anomaly is not recovered by the

reacquisition team, the anomaly coordinate location will be marked for further investigation. The data for the undiscovered anomalies will be reviewed by the project geophysicist and the OE team supervisor(s). If there are no clear surface sources (e.g., terrain, vegetation, cultural clutter), the locations are to be explored intrusively. The minimum excavation will be 36 inches wide and 18 inches deep, unless a representative source is discovered before the excavation reaches these dimensions.

Data describing the anomaly sources discovered during the intrusive investigation process will be recorded and input into the site GIS (database) for consideration in areawide clearance activities. Recorded data will include, where possible, size, estimated weight, orientation, depth bgs, and description of the item excavated.

Field crews will use portable mapping equipment and survey instruments to reacquire (relocate) the anomalies. These reacquisition crews will be onsite for the duration of the geophysical mapping and for 1 week after mapping is complete to finish reacquisition activities.

Based upon the density of the anomalies within the South Valley wetlands, one of two methods may be used to recover, investigate, and remove anomalies.

The first method may require dewatering segments of the wetlands and would be used in areas with high anomaly density. It is anticipated that this method would be required in the east portion of the wetlands adjacent to Demolition Sites #1, #3, and the Flare Site. This would be accomplished through use of temporary dams with the water being pumped around the area to be point cleared. Dewatering will be completed in such a manner so that no heavily silt-laden water flows into the wetlands. Once the anomalies are recovered, the source will be removed, the area will be remapped, and the process repeated until two complete mapping and anomaly removal cycles have been completed. Segments will be established with a minimum of a 10-foot overlap to assist in complete detection and removal of anomalies.

The second method involves use of a rigid, reusable water and sediment barrier that is approximately 8 feet in diameter. The barrier will be placed around the anomaly location, and the inside would be dewatered. This method will be used in areas with a low density of anomalies; it is anticipated to be used in the west portion of the South Valley wetlands.

4.10.1 Equipment

The equipment requirements for this activity include:

- Instrumentation (hand-held, site-tested metal detectors [e.g., White Pulse Induction SurfMaster]) used to assess proximity to subsurface metallic anomalies and/or OE during progress of excavation

- Miscellaneous common hand tools (e.g., screwdrivers, digging implements)

- Forms and logbooks to record activities

- Backhoe, if necessary

- Pocket Personal Computer (PC).

The actual investigative excavation nominally progresses in 6-inch lifts. To assure a margin of safety for the OE teams, the instruments used to assess the proximity of subsurface metallic anomaly sources must be capable of "outreaching" the penetration of the digging implements. Therefore, instrumentation to be used to ensure personnel safety during intrusive operations will be capable of detecting a 37mm HE projectile at 12 inches bgs. Each instrument will be checked daily at a standard location to ensure proper equipment function and operation.

4.10.2 Near-Surface Anomalies

Near-surface anomaly sources are those that are partially exposed or suspected to be within 1 foot of the surface and that can be excavated using hand tools. These anomalies will be excavated by carefully removing the earth overburden using a hand shovel/trowel or other small digging implement. Throughout the excavation, the UXO Technicians will use site-tested detection instrumentation to check and verify the proximity of the anomaly source.

It is anticipated that a limited amount of soil will be removed from the wetlands during the investigation of near-surface anomalies. Because of the regulations of regarding placement of fill in wetlands, no excavated soils will be intentionally placed back in the wetlands. All excavated material from the wetlands will be removed and placed on the Ridge for later placement and scanning in the bottom of the North Valley.

4.10.3 Subsurface Anomalies

Subsurface anomalies are those caused by sources that are more deeply buried (>1-foot bgs). Some of these may require excavation using heavy equipment (e.g., backhoe). For these excavations, an UXO Supervisor will coordinate equipment requirements with the SUXOS. Prior to the arrival of the heavy

equipment, the UXO Supervisor will ensure that a cleared entrance and egress path is available for the heavy equipment. Heavy equipment or manual digging tools will be used to excavate the earth overburden in 6-inch lifts. After each lift, the anomaly location will be redefined with a site-tested metal detector and the anomaly source exploratively sought using hand tools. This process will continue until the source of the anomaly has been uncovered and identified.

When a technician is checking backhoe excavations for suspected OE source proximity, the backhoe bucket will be placed on the ground, away from the excavation, and the operator will keep his/her hands clear of the operating controls. The backhoe operator will resume excavation operations only after the UXO Technician is clear of the excavation and outside of the bucket swing area.

It is not anticipated that the use of heavy equipment will be necessary in the South Valley wetlands.

4.10.4 Identification of Non-OE Debris, OE Scrap, OE-like Item, Potential OE, and OE

OE clearance crews will identify recovered anomaly type as non-OE debris, OE scrap, OE-like item, potential OE, or OE. The crews will record anomaly source type, depth, dimensions, and condition on the pocket PC.

An item will be identified as potential OE if it cannot be determined whether explosives are present. Potential OE items will be handled as OE by the OE removal crew, and potential OE and OE items will be left in place and flagged for further inspection by the demolition team. Excavated non-OE, OE-like items, and OE scrap items will be collected and placed in the southwest corner of each grid section that will be laid out on the Project Site.

All non-OE scrap and OE scrap, to include inert OE items, will be inspected by two UXO IIs from the OE clearance crew prior to being placed in the southwest corner of the clearance grid. All non-OE scrap, OE scrap, and inert OE items will be segregated as it is placed in the southwest corner of the grid.

Prior to moving the OE scrap to the central collection area, it will be reinspected by at least two UXO IIs from the demolition team. After completing their inspection, the demolition team will transport the OE scrap directly to the central collection point.

After the OE clearance crew has collected the non-OE debris, OE-like items, and OE scrap items and flagged potential OE and OE items, the demolition team will further inspect all flagged items to make a final determination if an item is OE or OE scrap. OE scrap items will be handled as previously described. The demolition crew will also further inspect the non-OE debris and OE scrap items collected by the OE clearance crew to certify that these items are not OE. Once certified as not OE, the non-OE debris and OE scrap items will be moved

to a central on-site location for storage in a locked container to ensure scrap inventory remains segregated from any potential OE (see Figure 4-10).

4.10.5 Considerations for Movement of OE

The demolition team will inspect each OE item to determine if it is safe to move (i.e., the item can be moved with minimal risk). The inspection will be directed by the SUXOS in conjunction with the OE SSO and USACE Safety Specialist. Their determination will be based on available Ordnance Technical Manual data, training, and professional knowledge, using the following criteria in conjunction with the OE Process Flowchart (see Figure 4-10).

Each OE item will be inspected to determine if it is armed or unarmed, and if it is unsafe to move due to damage. An item is considered armed if it has been fired or used for its intended purpose. The determination that it is armed or unarmed is in part based on the following criteria:

- Proper identification of ordnance item and fuzing. Utilizing the applicable technical manuals, the item will be identified based on size, shape, and any visible markings. Items unable to be positively identified will not be moved and will be BIP.

- Determination whether item is armed or unarmed. Item will be examined for indications of arming. For example, projectile rotating bands would be scored if fired. Mortars would have an impinged percussion primer.

- Projectiles - Check the rotating band. If it has been scored by the rifling in the gun tube, it has been fired, and if fuzed, it must be considered armed.

- Mortars - Check the ignition cartridge and percussion primer. If the primer is impinged, it must be considered fired, and if fuzed, it must be considered armed.

- Hand Grenades - Check the safety pin and spoon. If the safety pin and/or spoon are missing, it is armed.

An item, either armed or unarmed, may have been rendered unsafe to move due to damage. Types of damage that may render an item unsafe could include, but are not limited to, the following:

- Dents in the body or fuzing systems.
- Holes or rips in the body or fuzing systems.
- Burned. If there is visible scorching and/or soot present.

The results of this determination will be recorded in the SUXOS's field log. Data will include grid identifier and an inventory of the OE (or identifiable OE scrap). OE items that are armed or determined unsafe due to damage, or whose status cannot be safely evaluated due to deterioration or positioning, will not be considered safe to move. OE items that are unarmed and not rendered unsafe due to damage may be considered safe to move. In some cases, OE items that are damaged may be moved if OE Technical Manual data indicate that the items are safe to move.

4.11 ORDNANCE AND EXPLOSIVES DISPOSAL

Items determined to be safe to move will be relocated by the demolition team to one of the two Bureau of Alcohol, Tobacco, and Firearms (BATF) Type II, explosives storage magazines on the Project Site (Figure 4-14). These items will be stored until they are either explosively or mechanically expended. Percussion primers that have not been impinged on cartridge cases and mortar fin assemblies that have been otherwise completely expended due to past demolition procedures will be mechanically impinged prior to off-site disposal. The duration for which OE items will be stored is dependent upon the accumulated explosive weight of the OE recovered, the explosive weight storage limit of the on-site magazine as established by required permits, and Resource Conservation and Recovery Act (RCRA) storage requirements, which regulate the length of time OE items can be stored.

To ensure that the permitted magazine explosive weight limit is not exceeded, an inventory of all recovered OE items will be maintained on Magazine Data Cards, and a running total of accumulated explosive weights will be maintained. The following procedures will be accomplished to complete the inventory.

- Once the space has been entered, a thorough inspection of the magazine contents will be conducted to positively identify any OE or OE-related materials that may be present.

- OE will be disposed of as delineated in the following paragraphs.

4.11.1 Demolition Operations

4.11.1.1 Ordnance and Explosives Demolition Procedures.

UXO personnel will dispose of OE that cannot be moved on a daily basis. If demolition operations can not be conducted for whatever reason, the item will be secured with sandbags and security will be provided 24 hours a day until the item has been disposed of. Demolition operations will begin at a work site after all nonessential personnel are out of the MSD of the ordnance being detonated. OE that is safe to move will be consolidated in magazines and will be disposed of at the end of each work week, or as necessary in the event on-site magazines will exceed regulated Net Explosive Weight (N.E.W.). At a minimum, the OE

disposal operations team will consist of three UXO-qualified individuals, including the OE SSO, UXO Supervisor, and a UXO Technician. The SUXOS and OE SSO will be on site at all times during demolition operations. These operations will be performed under the direction and supervision of the SUXOS, who is charged with the responsibility of ensuring that procedures contained in this OE RDD and referenced documents are followed. The OE SSO and USACE Safety Specialist will monitor compliance with the safety measures contained in the OE SSHP. In the event of noncompliance, the OE SSO will stop or suspend operations until the operations are in compliance. Demolition activities are inherently hazardous and require strict adherence to approved safety and operational procedures. Violations of procedures may result in immediate removal of the violating party from this project.

4.11.1.2 Ordnance and Explosives Disposal Site Control.

Prior to initiation of demolition operations, all personnel will be withdrawn to a distance outside the MSD of the OE being detonated. Prior to priming of the demolition charges, all avenues of ingress will be physically blocked by UXO personnel. Radio communications will be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the OE SSO. A constant state of vigilance will be maintained by all personnel to detect any intrusion into the MSD.

All demolition operations will be conducted by safely detonating OE items using Standard Operating Procedures for OE Demolition/Disposal Operations (Appendix I) and USACE-approved engineering controls, as specified in HNC-ED-CS-S-98-7, August 1998, to control/minimize hazards of blast and fragmentation (see Appendix J). The OE SSO will monitor compliance with safety measures contained in the OE SSHP and will stop or suspend operations in the event of noncompliance. In all cases, disposal operations will be performed between the hours of 9:00 a.m. and 3:00 p.m. Monday through Friday, and will not be conducted during days of low cloud cover or temperature inversions, which could amplify noise associated with detonations and adversely affect local residences.

Air monitoring will be performed as specified in Section 3.2.1 at two PM_{10} monitoring stations downwind and one PM_{10} monitoring station upwind during all OE detonations.

4.11.1.3 On-Site Blast Chamber.

The Donovan T-10 self-contained blast chamber will be deployed and set up on the Project Site for the disposal of OE items that can be safely moved. The on-site blast chamber will be situated within an area of the Project Site that satisfies the 670-foot RCRA setback requirement (see Figure 4-14). Operation of the chamber will be IAW DDESB approval documentation and DEMIL Standard Ordnance Procedures (Appendix N). If OE items exceed the capacity

of the on-site blast chamber, an open detonation will be accomplished in accordance with USACE design criteria (Appendix J) and Section 4.11.1.5 of this OE RDD.

4.11.1.4 "Not Safe to Move" OE Items.

If an OE item cannot be moved, it will be BIP after authorization has been received to conduct the procedure from DTSC and USACE (Appendix I and Appendix J). BIP operations will be performed under the direction and supervision of the SUXOS. The USACE Safety Specialist will provide safety and QA oversight for all BIP operations.

To identify if the item to be detonated is in direct contact with a secondary OE item, which could add to the total explosive weight if it should it sympathetically detonated during a BIP operation, the OE item will be investigated using a mine probe. Should the item be found to be in direct contact with another OE item, appropriate engineering controls will be employed to either eliminate the direct item-to-item contact, which will in turn eliminate the possibility of a sympathetic detonation, or to compensate for the potential detonation of the second item during the intentional demolition of the first item.

Mitigation in the freshwater marsh/riparian areas of the South Valley due to BIP demolition of identified OE will be accomplished through controlling surface water runoff and minimization of sediment transport. Surface water runoff will be controlled as specified in the SWPPP (see Section 3.2.3). Swales, sand bag check dams, or earthen dikes will be used to control or minimize channelized runoff. Sediment transport will be further controlled, if necessary, through use of straw bales, silt fences, or sand bag barriers.

4.11.1.5 On-Site Open Blast/Open Detonation.

A contingency to conduct OB/OD operations for on-site detonation of safe-to-move OE items that are too large to be destroyed in the blast chamber is available. The designated demolition site will be cleared of any potential OE prior to construction. The open burn/open demolition site would be constructed at the site of the former Howitzer Test Facility (see Figure 4-14). Construction of the demolition site will include a pliable liner under 3 feet of native soil. A berm will be constructed around the area. A hose will be placed at the bottom of the demolition site, leading out of the demolition area, and capped. This hose will be used to pump any water that may collect in the demolition area into 55-gallon drums (Figure 4-15). A cover will be placed over the demolition area to reduce fugitive dust and to prevent rain water from entering the area.

4.11.1.6 Demolition Site Testing/Treatment.

The open demolition site used for disposal of OE where explosives are used as the disposal method will be tested and treated for toxic substances in

accordance with the non-OE RDD. The sites used for BIP demolition of OE will be left unearthed and positively marked for follow-on testing in accordance with the non-OE RDD.

After the follow-on testing for the BIP sites is completed, the area will be backfilled to match surrounding topography. In the freshwater marsh/riparian areas, seed-impregnated fiber mats will be placed over the disturbed area.

4.11.1.7 Ordnance and Explosives Demolition Shots.

Prior to priming of demolition shots, the demolition team supervisor will direct all nonessential personnel to withdraw outside the MSD. Upon priming of demolition shots and prior to detonation of demolition shots, all remaining personnel will withdraw outside the MSD.

Authority to initiate demolition shot setup and detonation will rest solely with the SUXOS. Prior to authorizing the detonation of explosive charges, the SUXOS is responsible for ensuring that all personnel have been evacuated from the MSD, all personnel have been accounted for, all pertinent parties have been notified of an impending demolition shot, and the area is secure. The SUXOS will notify the local fire department of the location and approximate times prior to detonation.

Upon completion of demolition operations, the demolition team will visually inspect each demolition shot. Upon completion of this inspection, and assuming there are no residual hazards, the SUXOS will authorize the resumption of site operations.

4.11.2 Removal and Disposal of Scrap Metal

The SUXOS will establish temporary collection points for any OE scrap recovered at each demolition shot location. Only items that are free of explosives but considered OE scrap will be placed into these collection points. The material in these temporary collection points will be transported to the pre-designated central scrap collection point (Figure 4-16). As the material is being loaded, the SUXOS will perform an inspection of the material to ensure that it is free of explosives and other hazardous materials. All inert/empty ordnance items will be vented such that a hole is punched through the items to allow visual inspection of the interior of the item.

The SUXOS will perform a final inspection of the scrap at the central collection point that was either recovered in the field or collected during demolition operations. The SUXOS will certify the scrap to be free of any explosive hazard. The SUXOS and UXO QC Supervisor will sign and annotate a Release/Receipt Document with the following statement: "I certify that the property listed hereon has been inspected by me and, to the best of my knowledge and belief, contains no items of a dangerous nature."

The OE scrap collected during field activities will be stored in a lockable storage shelter that will be locked at the close of each business day. Prior to shipment of metal scrap to a local scrap dealer, the scrap will be visually inspected on all sides (inside and outside) to ensure that no HE or explosive materials are present and, if necessary, that the item will be rendered such as not to resemble an OE item. The scrap will then be picked up and delivered to a local scrap dealer for recycling.

4.12 TNT-AFFECTED SOILS

Earthwork activities addressed in this section include the operations associated with homogenizing, excavating, and stockpiling soil from the TNT Strips with TNT concentrations of 10 percent or more by weight. The sequence of field activities are shown on the Project Schedule (Appendix A).

4.12.1 Site Safety

Due to the explosive potential of soils containing TNT at concentrations of 10 percent or greater, the following protective measures will be employed on the Project Site whenever remediating soil within the TNT Strips. All work will be conducted in strict accordance with the OE SSHP.

- During the homogenization of TNT-affected soil, all mobile equipment will be rubber tired.
- Equipment utilized during homogenization, excavating, and material handling will have smooth-lipped buckets
- Equipment used to homogenize and excavate explosives-affected soil will have sealed bearings and shielded electrical junction boxes. Equipment will also be decontaminated routinely to prevent the buildup of dust.
- Spray water for dust control and reducing potential for ignition or detonation will be applied at TNT-affected soil handling points. The amount of water applied to soil will be adjusted such that runoff is minimized, equipment can operate efficiently, and maximum content is maintained. The criteria for success of the dust control efforts shall be the absence of visible airborne dust and the confirmation that the quantity of dust at the perimeter of the Project Site is below action levels. Pre-wetting of excavation areas will be of primary concern, followed by additional wetting at other locations, such as the staging area, as required. A full-time water truck will be dedicated to the TNT Strips area.
- All vehicles (trucks) utilized to transport TNT-affected soil will use bottom dump gate tarps or equal, to negate soil spillage.

- Stationary equipment in close contact with TNT-affected soils (e.g., high-pressure steam cleaners, trailers) will be grounded.

- Fuel will be stored outside the MSD. Fuel trucks will not enter the MSD. Fuel will either be provided in OSHA-approved 5-gallon fuel containers or by a hose that will be passed across the MSD boundary to refuel heavy equipment as necessary. During refueling operations, any equipment that will be moved outside the MSD (including fuel containers and fuel hoses) will be decontaminated if it comes in contact with the ground.

4.12.2 Site Preparation

4.12.2.1 Minimum Separation Distance for Soil Homogenization Operations.

The MSD for the TNT Strips is 412 feet (Figure 4-17), measured from the outside edge of the unvegetated area of each TNT strip.

4.12.2.2 Preparation of the TNT Strips.

The excavation zone will be based upon a review of the existing analytical data from site investigation actions, ground cover, and site topography that indicate the presence of the TNT. The initial excavation zone shall be laid out by land survey techniques using stationing and grid boundaries. In addition, offset stations shall be set for the grid and soil sampling locations in order to be able to accurately re-establish the primary excavation zone and sampling locations for any subsequent lifts of material. Soil sampling location stations shall include grid and side-wall stations as well as locations of previous known areas of elevated surface TNT concentrations. All offsets shall be set in a semipermanent fashion (rebar pins or wooden hubs) and appropriately flagged and protected. Once grid boundary stations have been set, the initial excavation limit shall be indicated for equipment operators through the use of boundary flagging or sprayed chalk lines.

Field personnel will establish equipment entry and exit routes. The final configuration of these routes will include consideration for truck loading operations in order to minimize truck decontamination requirements, for easy access to station offset stakes for recovery of sampling points and grid boundaries, and for dust control needs and water truck access.

Air monitoring will be performed at two PM_{10} monitoring stations downwind and one PM_{10} monitoring station upwind of all homogenization and excavation activities as described in Section 3.2.1. Air monitoring will also be performed downwind, just outside the MSD that has been established for the affected area during soil working or soil movement activities.

In addition to worker safety requirements dictated by the OE SSHP, the tractor planned to pull the plow and disc implements will have a fully enclosed cab that is air conditioned. The tractor doors and windows will be closed and latched during the homogenization operations. The back window of the tractor or other windows in a direct path of potential soil particles will be equipped with a 4-ply Lexan plate (Underwriters Laboratory listed 752PSA [Level 3]) of an approximate 1.3-inch thickness. The side and front windows not in a direct path of potential fragments will be equipped with Lexan CTG plate (in accordance with ANSI Z87.1989) of approximate 1/8-inch thickness. In addition, air monitoring instrumentation required for personal safety will be maintained inside the cab and monitored by the OE Contractor.

4.12.2.3 Storm Water Control.

As excavation proceeds, conditions will be monitored and runon/runoff (soil mounding and/or interceptor trenches) will be controlled, as necessary. Storm water will be controlled as specified in the SWPPP (see Section 3.2.3).

4.12.3 Methods for Homogenization of TNT-Affected Soils

Some surface soil within the TNT Strips in the top 2-1/2 feet is potentially explosive because it contains 10 percent or more explosives by weight. The methods for homogenizing TNT-affected soil for safe handling are described in the following subsections.

4.12.3.1 Soil Homogenization.

The homogenization process will be accomplished within the portion of each strip devoid of vegetation. The area to be homogenized will be pre-wetted using a water truck.

Homogenization will be a two-step process. If there is no evidence of metallic OE or OE scrap in the TNT Strips and after the strip has been adequately watered, the first step will be for a 2-foot layer to be completely turned using a narrow-width deep plow pulled behind a 4-wheel drive, rubber-tired tractor. If the conceptual site model indicates that OE/OE scrap may be present, the thickness of the first layer will be 6 inches less than the reliable detection depth of the instrumentation used to clear the site. The goal of this plowing step is to bring the soil at the bottom of the layer to the top surface. The total number of passes of this plowing process for any homogenization zone will be dependent on the actual subsurface conditions encountered in the field, but will likely require multiple passes. If OE/OE scrap might have been present, the soils remaining after soils containing 10 percent or more TNT have been removed will be subject to areawide clearance protocols.

Only essential personnel required to operate the equipment will be inside the MSD during the homogenization operations. The equipment operators will wear protective vests and helmets during all homogenization operations.

A water truck and water spray operator will not be within the 412-foot MSD during homogenization operations. Initial wetting operations will occur prior to the start of homogenization operations, and subsequent wetting will be accomplished to reduce the explosive potential and to ensure suppression of visible dust. Homogenization operations will be suspended during wetting operations. Radio communication will be used for contact between the equipment operator, the water truck operator, and the SUXOS. The SUXOS will oversee the homogenization process and will be available during homogenization activities.

The second homogenization step will utilize a narrow-width farm disc attachment in lieu of the deep plow. The application of the disc attachment will result in de-clumping and full homogenization of the soil layer. Patterns of disc operation will be the same as for the plowing operation, and will be controlled to mix the full homogenization zone.

4.12.3.1.1 Soil Sampling during Homogenization.

After the two-disc homogenization of the first layer is complete, field screening tests will be performed for the 2-foot soil layer (or a large layer 6 inches less than the reliable depth) at 50-foot intervals along each strip. These field screening tests will be used to evaluate if TNT-affected soil has been adequately homogenized. Two full depth samples (2 feet in depth) will be collected at each test location within 3 feet of each other. The soil sample will be homogenized and composited in the field. A representative sample of the composite sample will be tested. If the field screening tests indicate concentrations of TNT are below the 10-percent threshold, one sample will be collected in the same manner as the field screening sample every 50 feet along each TNT Strip and will be sent for off-site laboratory analysis to verify that final concentrations of total explosives are below the 10-percent threshold. If concentrations of TNT greater than 10 percent are located, further homogenization will be completed. All samples will be homogenized prior to testing. In addition to the above samples, samples will be collected at the former locations where concentrations of TNT exceeded 10 percent.

4.12.3.1.2 TNT Strip Confirmation.

After the initial homogenization activity is completed and the field and laboratory sampling results are below 10 percent TNT concentration by weight, confirmation samples will be obtained. One confirmation soil sample will be collected from each side wall and one from the bottom of the excavation at each 50-foot interval following excavation of the first lift. In addition, bottom samples will be taken in the location previously identified as having TNT concentrations in excess of

10 percent. These samples will be homogenized and screened for TNT by field screening methods and, if less than the excavation action level for TNT (10 percent by weight), sent off site for explosives analysis using EPA Method 8330. If the TNT concentrations in the side wall confirmation and/or bottom samples are below 10 percent, the homogenization process will be halted. Further excavation will be as described in the non-OE RDD for excavation of TNT soil to below the anticipated post-excavation risk assessment clean up levels.

Confirmation samples will be collected in accordance with methods detailed in the non-OE RDD. The procedures for sample collection are summarized as follows:

- Homogenization confirmation samples will be collected using a hand auger. A 0- to 2-foot sample will be collected for field screening and off-site analysis.

- Excavation side wall and bottom samples will be collected using a long-handled sampler from the top of the excavation.

4.12.3.2 Soil Excavation and Loading.

Soil excavation and loading in TNT strip locations will be conducted in a methodical manner to maintain safe conditions and allow the collection of defensible confirmation sampling. Air quality monitoring, as outlined in Section 3.2.1 and the OE SSHP (Appendix F), will be accomplished to verify that health protection action levels for dust are not exceeded.

Excavation will be coordinated based on the availability of the construction personnel (i.e., 8 a.m. to 5:30 p.m.) and soil excavation confirmation sampling turnaround times. Excavation will be considered complete based on field test samples and laboratory analytical results and the absence of TNT soil concentrations exceeding 10 percent. Once TNT concentrations are confirmed to be less than 10 percent, the soil will be characterized for off-site disposal.

The following landfills with the capability to accept soil containing TNT have been identified:

- Kettlemen Hills, California (Class I)
- ECDC Facility, East Carbon, Utah (Class I)
- Altamont Pass, Livermore, California (Class II)
- Keller Canyon, Pittsburgh, California (Class II).

Each landfill specifies their own profiling requirements, including the number of samples that need to be collected and the types of analyses that are required. Data collected during the RI/FS will be used for general characterization of the TNT Strip soil. After the homogenization process, all soils to be excavated will be non-reactive (i.e., explosives levels in the soil will be less than 10 percent by

weight). The following criteria will be used to determine if the soil will go to a Class I or Class II landfill.

- Does the soil exhibit characteristics of toxicity as specified in 22 California Code of Regulations (CCR) 66261.24 (i.e., acute aquatic 96-hour LC50 less than 500 milligrams per liter)?

- Are 2,4-dinitrotoluene (DNT) concentrations greater than 0.13 milligrams per liter using the Toxicity Characteristic Leaching Procedure?

If either of the above criteria are exceeded, the soil would be considered a Class I waste and must be disposed of at either Kettlemen Hills Landfill or the ECDC facility. The soil would be classified as a Class II waste if it does not exceed the above criteria and, therefore, may be disposed of at a Class II landfill. The sampling protocols specified below have been designed to satisfy the landfill's waste characterization guidelines in order to properly classify TNT Strip spoils following the homogenization process.

The following considerations will be incorporated into the excavation methods:

- Water spraying will be implemented during excavation, as necessary, to control the presence of visible dust.

- Slopes associated with greater than 5 feet in height excavations are not expected. If slopes are created that are greater than 5 feet in height, they will warrant special excavation safety requirements.

- Soil management options will include placing excavated soil onto a 20-mil polyethylene liner adjacent to the excavation or in the bottom of the North Valley, and installing an additional 20-mil (minimum) cover for protection from precipitation and wind or direct loading and shipment to an off-site landfill based on landfill acceptance criteria. If the option to place the soil on a liner adjacent to the excavation or in the bottom of the North Valley is chosen, the soil and the liner will be disposed of at a suitable landfill. The soil beneath the liner will be sampled on a frequency consistent with the side wall sampling frequency associated with the soil from its undisturbed location. Excavated soil will only be temporarily stored on liners until waste characterization requirements are completed.

- Completed excavation areas will be isolated by stake and ribbon boundaries to prevent entry or cross-contamination.

- Site conditions that create excessively dusty conditions (i.e., wind) will be monitored in the field, and appropriate actions will be taken. Actions may include applying additional dust control water or applying a dust suppressing agent.

4.12.3.3 Equipment Decontamination.

All equipment will be fully decontaminated after the homogenization is completed, as well as if buildups of dust become visible on the equipment surfaces. This intermediate decontamination step will be accomplished primarily through the use of dry removal techniques. These decontamination steps are for equipment change-out or maintenance only, and will be confirmed based on visual absence of soil residue from equipment surfaces.

The purpose of decontamination procedures during soil sampling is to prevent foreign contamination of samples and cross-contamination between sampling locations. Before use, all sampling equipment will be decontaminated by steam-cleaning, or alternatively by washing with a nonphosphate detergent such as Liquinox® or Alconox™ (or equivalent). Equipment washed with a nonphosphate detergent will be double rinsed using potable water and deionized (or Type II) reagent-grade water. The decontamination procedure for sampling equipment will incorporate a detergent wash, potable water rinse, rinse with pesticide-grade methanol, rinse with deionized water, and a final rinse with Type II reagent-grade water. As an alternative to the use of reagent-grade water, analytical data may be collected to indicate that deionized water to be used for the final rinse is free of the substances of interest for this project above the level of detection for the relevant analyses.

Sampling equipment that is not readily decontaminated will be discarded after each use. Discarded materials, including decontamination solutions, will be accumulated and stored in appropriate containers pending proper disposal. Decontamination procedures will be performed by all field personnel who have been in contact with contaminated or potentially contaminated materials.

The decontamination facility for heavy equipment will be situated adjacent to, and just west of, the current position of Stockpile #3 (see Figure 4-17). The decontamination facility will be constructed by first removing all brush and performing a surface clearance of the locations. The facility will be approximately 20 feet wide and 30 feet long. A sandbag berm will be placed at all sides of the location. The sandbags and bottom of the facility will be covered with two layers of high-density polyethylene sheeting (HDPE) or five layers of 10-mil polyethylene sheeting. This will form a water and debris containment for decontamination of the heavy equipment. A water pump will be placed into the HDPE containment to transfer decontamination effluent to drums placed outside the facility area.

The heavy equipment will be driven into the facility. Loose soil and material will be removed with a brush; steam cleaned with high-pressure water or portable high-pressure steam spray. All exposed surfaces will be brushed with soap and water. The final step will be to rinse all surfaces with clean water. Prior to driving the heavy equipment out of the facility, all water and debris will be removed from the facility. As the heavy equipment leaves the facility, a final

rinse of the equipment will be performed so that all residual debris is removed from the equipment and is captured within the facility.

Once the homogenization process is complete, and equipment or materials are ready for release from the Project Site, the final decontamination will be verified through the use of surface wipe sampling utilizing Webster's Reagent (solution of 5-percent potassium hydroxide in ethanol). The reagent becomes pink or red if the surface tested is contaminated with TNT and/or break-down derivatives.

Samples will be collected from selected containers of wastewater derived from the decontamination rinsate. If more than one container contains water from the same source, only one of the containers will be sampled. Water samples will be handled and shipped to the analytical laboratory in accordance with the QA Project Plan in the non-OE RDD. Additional sampling and analysis of the water may also be required in order to satisfy the requirements of a licensed disposal facility. If no contaminants are detected in the samples collected from the wastewater containers, the water may be discharged directly to the ground surface, on a portion of the Project Site that is not chemically affected and in a manner to prevent surface ponding and runoff. DTSC will be consulted prior to any such discharge. Water containing chemicals above concentrations found in the site's upgradient monitoring well will be transported by a licensed hazardous waste hauler and disposed of at a licensed disposal facility.

4.13 POINT CLEARANCE GRADING

4.13.1 Unit D-1 Fill Areas

The Unit D-1 fill area (Sector 2) will be excavated in lifts (6 inches less than the reliable scan depth) and the excavated surface will be scanned using real-time detection procedures. An MSD will be established during excavation and intrusive investigations (Figure 4-18). If anomalies are found, they will be point cleared. This procedure will be repeated until the excavation encounters bedrock or reaches the bottom of the fill. If colluvial and/or alluvial material is encountered below the fill, the colluvial and/or alluvial material will be scanned using real-time detection procedures. If anomalies are found, they will be point cleared. The soil that is removed will be temporarily stockpiled in Sector 10A or 10B, and then subsequently placed and scanned in the North Valley as engineered fill. The sequencing of this activity is shown on the Project Schedule (Appendix A).

4.13.2 North Valley Fill Areas

Pre-existing fill material (Figure 4-19) in the bottom of the North Valley will be excavated to 6 inches less than the reliable scan depth (as determined in Section 4.8.11). The excavation surface will be scanned using the procedures for real-time detection. If anomalies are found, they will be intrusively investigated (see Section 4.10). The areas will again be excavated to 6 inches

less than the reliable scan depth. The process of excavation scanning and intrusive investigation will continue until the excavation encounters alluvial/colluvial material or bedrock. The exposed surface will be scanned using the procedures for real-time surveys. If anomalies are found, they will be intrusively investigated. The sequencing of this activity is shown on the Project Schedule (Appendix A). All fill material will be temporarily stockpiled.

4.13.3 Demolition Sites #1 and #3

Demolition Sites #1 and #3 will be excavated in lifts 6 inches less than the reliable scan depth, geophysically scanned using real-time detection procedures, and the anomalies will be removed. If the reliable depth of the geophysical instruments is greater than 18 inches, the soil will be removed in 12-inch lifts. An MSD will be established during excavation and intrusive investigations. The excavated soil will be stockpiled and samples will be taken and tested to characterize the stockpiled soil. The excavation in lifts, real-time scanning, and intrusive investigation will be repeated until native soil or bedrock is encountered (estimated depth of approximately 8 to 12 feet bgs) at Demolition Site #3. The mercury impacted soils around Demolition Site #3, will be excavated in lifts until all impacted soil is removed to below the cleanup goals, and confirmed with appropriate sampling as detailed in the non-OE RDD. All soils with chemical concentrations exceeding cleanup goals will be removed and disposed of off site at a suitable landfill (see non-OE RDD for details regarding the characterization, reuse, and/or off-site disposal of these soils). If the chemical concentrations in the stockpiled soil do not exceed cleanup levels, the soil will be used as fill in the demolition sites. If additional soil is required to backfill the excavation, clean crushed bedrock from the Ridge will be used. The detailed steps to point clear Demolition Sites #1 and #3 and the mercury-impacted soils around Demolition Site #3 are shown in the Project Schedule (Appendix A).

4.13.4 Flare Site

The Flare Site will be excavated in lifts as described in Section 4.13.3, geophysically scanned, and anomalies removed. An MSD will be established during excavation and intrusive investigations. The excavated soil will be stockpiled, and samples will be taken and tested to characterize the stockpiled soil. The excavation in lifts, scanning, and intrusive investigation will be repeated until no further anomalies are found and confirmation sampling and testing confirms that soils with chemical concentrations exceeding cleanup goals are removed. All soils with chemical concentrations exceeding cleanup goals will be removed and disposed of off site at a suitable landfill. Details of the characterization, reuse, and/or off-site disposal of these soils are presented in the non-OE RDD. If the chemical concentrations in the stockpiled soil do not exceed cleanup levels, they will be used as fill in the Flare Site. If additional soil is required to backfill the excavation, clean crushed bedrock from the Ridge will

be used. The Project Schedule (Appendix A) shows the sequence of activities to point clear the Flare Site.

4.14 AREAWIDE CLEARANCE GRADING

During areawide clearance, the sitewide grid system will be preserved to assure that the occurrence of OE and OE scrap discovered during areawide clearance is documented.

Areawide clearance will be performed along the south slope of the South Valley, which is within the future residential area of Unit D-1 (Figure 4-20). Approximately 4 feet of alluvial/colluvial material above the bedrock will be removed by excavating the material in lifts no greater than 6 inches less than the clearance depth established for digital geophysical surveys (see Section 4.8). After the first lift is removed, the excavated surface will be scanned using the procedures for real-time surveys (see Section 4.8.11), and any anomalies will be intrusively investigated (see Section 4.10). The excavated soil will be stockpiled in Sector 10B.

The area that will be subject to areawide clearance grading on the remainder of the Project Site will be determined by the evaluation of the point clearance data and development of the final site conceptual model. The details of the OE point clearance data evaluation are described in Section 3.4.4.2. Areawide clearance will not begin until the chemically affected soils on the Project Site have been remediated and the post- remediation risk assessment has been approved, except for a narrow strip in Unit D-1 on the south slope of the South Valley. Remediation of the chemically affected soils are fully described in the non-OE RDD. Areawide clearance and preparation of the North Valley will be added to the Project Schedule (Appendix A) when the scope of these activities has been defined.

Based on the results of the evaluation of the distribution of OE and OE scrap, areawide clearance, if required, will be completed in the bottom of the North Valley. Soil within the grids in the bottom of the North Valley requiring areawide clearance will be excavated in lifts no greater than 6 inches less than the reliable depth established for digital geophysical surveys (see Section 4.8). After the first lift is removed, the excavated surface will be scanned using the procedures for real-time surveys (see Section 4.8.11), and any anomalies will be intrusively investigated (see Section 4.10). The excavated soil will be temporarily stockpiled. This process will be continued until two clear lifts are found.

Following completion of areawide clearance, if applicable on the bottom of the North Valley, the North Valley will be prepared for acceptance of fill soils. This will require the use of heavy equipment to remove existing compressible alluvial materials from the bottom of the North Valley until competent (not compressible) alluvial material is encountered, if recommended by Granite's geotechnical

consultant. These soils will be held in a temporary staging area until fill operations begin in the North Valley.

Subdrains (subsurface drains designed to remove water that may percolate through the fill) will be placed in the lowest parts of the North Valley, as detailed by an approved grading plan.

Granite proposes the subdrain be constructed using a blanket drain concept. The blanket drain would be constructed over any reworked fill in the valley and would be constructed of Class 2 permeable material meeting Caltrans Standard Specifications. The blanket drain would be a minimum of 2 feet thick and 10 feet wide. The drain would be placed in the bottom of the valley and would have branches that extend up any side canyons and would collect any seeps that are identified prior to or during grading. No pipes would be installed within the Class 2 permeable material.

The stockpiled fill soils and the compressible alluvial soils held in a temporary staging area will be placed back in the North Valley as engineered fill. If scanning of the soil in lifts was required, the fill soils will be placed in the North Valley and scanned in 8-inch lifts using the procedures for real-time surveys (see Section 4.8.11).

If OE or OE-like items are located while scanning the 8-inch lifts, the source will be removed. The real-time methods and procedures used to scan the stockpiled fill soils would be reviewed by the Project Manager, SUXOS, geophysicist, and the scanning team leader to identify the root cause(s), such as operator error or equipment limitations (see Figure 3-7).

Soils temporarily stored in Sectors 7, 10A, and 10B will then be placed in the North Valley. These soils will be scanned in 8-inch lifts as they are being placed following the same real-time anomaly detection and disposal methods described for stockpiled soils in Section 4.4.

Areawide clearance will then be conducted on the remainder of the area identified for areawide clearance by the final site conceptual model. Soils from the grids requiring areawide clearance will be excavated and placed in the North Valley as engineered fill. Soil will be excavated in lifts no greater than 6 inches less than the clearance depth established for digital geophysical surveys (see Section 4.8). After the first lift is removed, the excavated surface will be scanned using the procedures for real-time surveys (see Section 4.8.11), and any anomalies will be intrusively investigated (see Section 4.10). The excavated soil will be scanned in 8-inch lifts as it is being placed as engineered fill in the North Valley. In order to track where soils are to be removed and placed as fill in the North Valley, the grid system established for the OE point clearance will be preserved. The area to be excavated on a daily basis will be clearly marked. If OE or OE scrap are found under the excavated surface or within the soil as it is placed in the North Valley, each subsequent surface will be scanned, and the

soil will be scanned as it is placed in the North Valley. If OE or OE-like items are located while scanning the 8-inch lift, the source will be removed and the real-time methods and procedures used to scan the excavated soil will be reviewed as discussed above. If two clear lifts are found (see Section 3.4.4.3), the remaining soil will be removed by grading and deposited in the North Valley as engineered fill without scanning.

4.15 GRADING IN AREAS NOT MEETING AREAWIDE CLEARANCE CRITERIA

Depending on the results of the evaluation of the point clearance data , one outcome may be the identification of grids that are not thought to have contained OE. If any of these grids in future residential areas require grading to create the 14 feet of crushed bedrock below final site grade, then this grading work will be accomplished using conventional grading techniques; no scanning is anticipated. OE personnel will be on site during the grading operations to identify any potential OE or OE scrap items observed in fill soils. Grading will be completed by providing a minimum of 14 feet of clean crushed bedrock from the Ridge over all soils in future residential areas of the Project Site. These grading activities will be added to the Project Schedule (Appendix A) after the scope has been fully defined.

4.16 ENVIRONMENTAL RESTORATION

As soon as is feasible, vegetation will be reestablished on all graded sloping areas subject to erosion throughout the Project Site using a hydroseed mix that meets the City of Benicia requirements. Mitigation of the loss of vegetation in the freshwater marsh/riparian areas of the South Valley will be accomplished as described in the Mitigation Monitoring Plan (Earth Tech, 2001).

4.17 EXPLOSIVES MATERIALS MANAGEMENT AND HANDLING

The Project Manager has overall responsibility for the management of explosives on site. The Project Manager, in conjunction with the SUXOS, is also responsible for the initial quantity and type of demolition material ordered. The SUXOS will be responsible for all subsequent requisitions for demolition materials.

The explosives will be managed in accordance with the references listed in Table 4-5. Explosives will be delivered by the vendor on an as-needed basis to detonate OE encountered on site. Storage of explosives on site is not anticipated.

4.17.1 License and Permits

The remediation contractor will maintain a valid BATF license/permit and an Explosives Purchase/Receipt Authorization List for the receipt of explosives. These documents will be on file and a copy provided to the explosives supplier prior to the purchase of explosives. A copy of all required licenses/permits and an authorization list for the Project Site will be maintained at the site Command Post using the Earth Tech Explosives Purchase/Receipt/Transportation Authorization List (see Appendix H).

At least one UXO Technician on the Project Site will possess a California State Blaster's License.

A county permit to conduct demolition operations will be obtained through the County Fire Department prior to OE demolition operations.

4.17.2 Receipt Procedures

Only those individuals named on the authorization list maintained on site by the OE contractor may sign for explosives received from the explosives vendor. To ensure the quantity delivered is the same as the quantity listed on the delivery documents, two UXO Technicians will inventory the delivery prior to signing for any demolition materials.

Explosives deliveries will be accompanied by the explosive supplier's bill of lading. The initial inventory will include reconciling the document with the actual delivery received. One copy of the bill of lading document will be attached to a copy of the purchase requisition (PR) and the purchase order. One copy of each of these three documents will be kept on file at the site Command Post, and one complete copy will be forwarded to the remediation contractor's contracting office.

4.17.3 Magazine Siting

There are two approved BATF Type 2 outdoor storage magazines at the Project Site. These will be used by the remediation contractor during this project to store OE items that are found to be safe to move. The remediation contractor will ensure that the proper permitting is maintained throughout the project, and that magazine criteria and quantity distance requirements established in DOD 6055.9 STD, DOD Ammunition and Explosive Safety Standards, and USACE, EP 1110-1-10, Ordnance and Explosive Response Procedures are maintained. The on-site magazines are unbarricaded, have a separation distance from each other of more than 200 feet, and are over 600 feet from the closest inhabited building. The remediation contractor will enforce a limit of not more than 25 pounds per magazine and no more than 50 pounds total explosive N.E.W. on site at any given time. The magazines are inside a fenced area and are patrolled by a professional security force 24 hours per day, 7 days per week. An

annotated location of both magazines is provided on an explosives siting map (see Figure 4-14).

4.17.3.1 Placard Requirements.

BATF and DOD require that all magazines be appropriately posted for content, hazard class, fire fighting hazard, and an emergency notification list. Magazines will be placarded in accordance with DA PAM 385-64. This will require a Fire Division Class 1 placard for each OE magazine. All local emergency response personnel will be briefed on DOD magazine placards prior to any magazine usage at the site.

4.17.3.2 Emergency Notification.

An emergency notification list containing the names, telephone numbers, and local addresses of the individuals to be notified in the event of an emergency will be posted on the outside and inside of the magazine door. These individuals will be the same individuals authorized to sign for explosives.

4.17.3.3 Explosive Compatibility.

Table 4-6 lists the various storage compatibility groups, and Table 4-7 is the compatibility chart. In certain instances, it may be necessary to store incompatible items in the same magazine. If this should occur, the incompatible items will be physically separated by a barricade, such as sandbags, within the magazine. This situation is to be short-term in nature and should be avoided if at all possible.

Magazines will remain locked except when receipts, issues, and inventories are being conducted. The two locks on the magazines will require two different keys. One key will be kept by the SUXOS, and the second key will be kept by a designated Ordnance Accountability Officer (OAO), who will be one of the UXO supervisors on site (a UXO Technician III). This procedure ensures that the magazines cannot be accessed without both keys, and that no one individual can gain access to the magazines.

4.17.4 Transportation Requirements

Transportation of OE and explosives will be conducted in accordance with the federal Department of Transportation (DOT) requirements in 40 CFR for the transport of hazardous substances and other applicable federal, state, and local regulations. Permits for on-site transportation of explosives/OE are not required.

Explosives will be transported onto the site as shown in Figure 4-21. Primary access to the site from Interstate 680 will be via West Channel Road. Alternative access to the site from Interstate 680 will be via Lake Herman Road, East Second Street, and Rose Drive to the site access point at McAllister Drive.

The primary route minimizes transport through residential areas. Transportation of explosives and OE on site will meet the following criteria:

- Vehicles will be inspected using the Weekly Vehicle Inspection Checklist (Appendix H)and will be properly placarded.
- Explosives will be transported in closed vehicles whenever possible. When an open vehicle is used, explosives will be covered with a flame-resistant tarpaulin (except when loading/unloading).
- Vehicle engine will not be running and wheel chocks and brakes will be set when loading/unloading explosives.
- Beds of vehicles will have either a plastic bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings.
- Vehicles transporting explosives will have a first aid kit, two 10-pound-rated fire extinguishers, and communications capabilities.
- Initiating explosives, such as detonators, will remain separated at all times.
- Compatibility requirements will be observed.
- Operators transporting explosives will have a valid driver's license.
- Drivers will comply with posted speed limits, but will not exceed a safe and reasonable speed for conditions. Vehicles transporting explosives off-road will not exceed 25 mph.

4.17.5 Explosives Management Audit Criteria

Explosives will be delivered to the site by the vendor on a per shot basis; explosives for demolition activities will not be stored on-site. The following items related to explosives acquisition, accountability, and transport will be audited to ensure compliance with this OE RDD:

- Earth Tech Demolition Shot Record (Appendix H)
- The Site Daily Operational and Safety Logs
- The OE Operations Daily/Weekly Report
- The Safety Training Attendance Forms for the initial site hazard training

- The Safety Training Attendance Forms for the Daily Tailgate Safety Briefings (Appendix H)

- Magazine inspection records

- The Daily Safety Inspection and Audit Log.

4.18 DATA MANAGEMENT

The responsibility for data and records management and the details of the procedures and requirements for organizing, filing, storing, collecting, and controlling remediation data and records are presented below. The types of data and records included in this plan include:

- Field documentation
- Geophysical data
- GIS data
- Population database.

4.18.1 Field Documentation

Field documentation comprises a permanent record of the field activities associated with the site investigation. All activities at the site will be recorded in the site project logbook. Field logbooks will be used to record specific information and activities related to collection, reduction, and/or interpretation of data in the field.

The following guidelines will be used to maintain field documentation:

- Entries will be completed in permanent black or dark blue ink.

- All entries will be legible.

- Corrections will be made by crossing out the entry to be revised with a single line, initialing, and dating the change.

- Serialized documents or data files will be preserved and maintained on site and referenced in the logbooks, as needed.

- Portions of any page that are not completely filled will have a single diagonal line drawn through the unused portion of the page. The individual lining out the unused portion of the page will sign and date the line.

- The field team leader will sign and date each page of daily entries to the field logbooks.

- The logbooks will be periodically reviewed by the Project Manager (or designee) to ensure that the field effort is being properly and completely documented. This individual will sign and date the bottom of each page to signify his/her review and acceptance.

4.18.1.1 Project Logbook.

The project logbook is the master field investigation document. Its primary purpose is to preserve, within one document, the actual field data or references to other field documents that contain a specific description of every activity and/or event that has occurred in the field on a given day. The project logbook will also contain administrative occurrences, conditions, or activities that have affected the fieldwork for any given day or task.

4.18.1.2 Field Logbooks.

Field personnel will use bound field logbooks with sequentially numbered pages for maintenance of field records. The front cover of the logbook will list project name, project task, book number, and start/end dates. The inside cover will replicate these data, in addition to listing the personnel performing the fieldwork, with their assigned responsibilities. Each field investigation team will possess and maintain a field logbook series. These logbooks will be used to record the specific field information collected during the progress of the field investigation.

At a minimum, the following information will be recorded each day in the field logbook:

- Name and affiliation of the personnel performing work
- Date, start time, and signature of the individual providing entry
- Significant weather conditions (i.e., conditions that could affect the interpretation of the collected data, or that could affect the progress of work
- Notes of conversations with visitors to the work sites
- Identification numbers of instruments used
- Results of equipment standardization measurements
- Documentation of investigative activities, any abnormal procedures used, digital file names, and narrative morphological description of each area investigated

- Summary of field activities, events affecting the progress of the work, and results for each area (e.g., number of anomalies, any noted anomaly trends, OE identification).

4.18.1.3 Digital Field Data.

In addition to logbooks, field crews will utilize pocket personal computers to electronically collect information during anomaly reacquisition and investigation. Collection of data in this manner will help to ensure proper content and formatting while decreasing the potential for errors during the transfer of data to the database. This electronically collected information will include, but is not limited to:

- Verification of anomaly reacquisition
- Size (in millivolts) of reacquired anomaly
- Source of anomaly (e.g., non-OE, OE scrap)
- Depth and orientation (in eight cardinal directions)
- Location, evidence of demolition, and whether the area is disturbed
- Description of anomaly source including size, weight, and composition.

Anomaly reacquisition and dig lists will be distributed to the field teams on the pocket computers. At the end of each day, the work completed and the data collected will be downloaded to a temporary database file and printed. Each field team leader will verify the accuracy and completeness of the information and sign the printed copy. These copies will be maintained on site for reference and QC purposes. After the electronically collected field data have been checked for completeness and accuracy, they will be appended to a master database.

4.18.2 Geophysical Data

During the OE remediation process, different types of geophysical information will be collected. These include:

- Geophysical data
- Anomaly picks
- Data processing log.

All geophysical data will be delivered in a processed ASCII file format whose file name contains the date and area surveyed. The files will contain delineated

fields that correspond to the easting, northing, and instrument reading. They will be maintained in folders named for the area surveyed.

The anomaly picks will be delivered in a comma delineated format. These files will contain anomaly identification, location, size, and expected depth. The anomaly pick files will be named based on the area and date surveyed and maintained in folders named for the area surveyed.

The data processing logs will be named based on the area and date surveyed. They will be Word Perfect files that contain all corrections, edits, filtering, or normalization of the data. They will also be maintained in folders named for the area surveyed.

4.18.3 Geographic Information System Data

The GIS will use ArcInfo® to monitor the remediation efforts. The GIS will be used to review the geophysical data, plot OE information, and track progress of the field efforts. Each project file will have metadata (name of project file, location, data created, author, content of project, and client). All files will be archived to a CD weekly to prevent any loss of data.

4.18.4 Population Database

A database containing the names of local residents and businesses will be provided to the remediation contractor. This database will be maintained by the provider. It will be delivered in or converted to Microsoft Access format and used for public withdrawal notification.

Table 4-1. Field OE Personnel Workforce

Task	Number of Crews	Number of Persons per Crew	Estimated Production Rate
Vegetation Removal (Manual)	1	7	2 acres/day
Vegetation Removal by Tractor	1	2	8 acres/day
Remove/dispose of construction debris		3	500 tons/day
Installation of Grid Markers	2	2	125 grids/day
OE Surface Clearance	2	5	50 grids/day
Geophysical Mapping (MTADS)	1	3	6 acres/day
Geophysical Mapping (MPA MTADS)	4	2	4 acres/day
Anomaly Reacquisition	2	2	640 numbers/day
Anomaly Excavation	6	7	720 numbers/day
Point Clearance	1	7	1,200 SF/day
Areawide Clearance/Grading	1	4	250 cy/day
OE Scanning of soils placed in North Valley	4	4	2,000 cy/day
Disposal Operations	1	4	2

cy = cubic yard
MPA = Man-portable Array
MTADS = Multisensor Towed Array Detection System
SF = square foot

Table 4-2. Tourtelot Equipment Test Plan

Grid East	Grid North	Object	Depth	Orientation
0	0	GC		
250	0	GC		
0	350	GC		
250	350	GC		
25	75	TG		
225	75	TG		
25	275	TG		
225	275	TG		
41	257	60mm	24	Parallel
45	221	60mm	24	Transverse
65	198	60mm	36	Vertical
73	241	60mm	24	Vertical
97	260	60mm	36	Parallel
109	157	60mm	18	Transverse
125	99	60mm	18	Parallel
129	249	60mm	30	Transverse
146	162	60mm	24	Vertical
163	255	60mm	30	Parallel
165	115	60mm	18	Vertical
192	93	60mm	12	Vertical
192	165	60mm	24	Parallel
196	241	60mm	30	Vertical
198	124	60mm	12	Parallel
207	210	60mm	24	Transverse
35	86	37mm	30	Vertical
36	197	37mm	18	Parallel
42	110	37mm	30	Parallel
56	134	37mm	18	Transverse
58	169	37mm	18	Transverse
60	88	37mm	24	Vertical
68	151	37mm	18	Parallel
74	110	37mm	24	Parallel
80	133	37mm	24	Transverse
84	168	37mm	18	Vertical
95	98	37mm	12	Transverse
111	124	37mm	6	Parallel
155	90	37mm	18	Vertical
170	149	37mm	12	Vertical
212	262	37mm	12	Parallel
216	103	37mm	6	Vertical
30	238	OE Scrap	9	Flat Lying
33	176	OE Scrap	9	Flat Lying
39	143	OE Scrap	12	Flat Lying
41	164	OE Scrap	12	Flat Lying
106	239	OE Scrap	9	Flat Lying
119	267	OE Scrap	6	Flat Lying

Table 4-2. Tourtelot Equipment Test Plan

Grid East	Grid North	Object	Depth	Orientation
131	137	OE Scrap	15	Flat Lying
142	267	OE Scrap	6	Flat Lying
185	261	OE Scrap	6	Flat Lying
197	190	OE Scrap	3	Flat Lying
197	267	OE Scrap	12	Flat Lying
206	148	OE Scrap	15	Flat Lying
212	186	OE Scrap	3	Flat Lying
218	235	OE Scrap	3	Flat Lying
79	220	37mm	24	Vertical
89	159	37mm	24	Transverse
92	205	37mm	24	Parallel
102	223	37mm	6	Vertical
116	192	37mm	18	Transverse
121	210	37mm	18	Parallel
130	226	37mm	6	Parallel
130	178	37mm	18	Vertical
142	206	37mm	12	Transverse
145	194	37mm	12	Parallel
153	233	37mm	6	Transverse
157	217	37mm	12	Parallel
170	199	37mm	12	Vertical
177	178	37mm	12	Transverse
181	217	37mm	12	Vertical

Table 4-3. Geophysical Instrument Applications

Activity	Vehicle-Towed MTADS EM	Digital MPA MTADS EM	Realtime MPA MTADS EM	Hand-held All Metals Detectors
Geophysical Equipment Tests	X	X	X	X
Unit D-1 Fill			X	
Unit D-1and North Valley Stockpiles			X	
Ridge Stockpiles	X	X		
Geophysical Detection and Mapping for Point Clearance Activities	X	X	X	
Geophysical QC Surveys	X	X	X	
Anomaly Location Reacquisition			X	
Areawide Clearance Geophysical Scanning			X	
Safety Instrumentation for Grid Placement and Intrusive Investigations				X

Table 4-4. Estimated Equipment Hours for Subsurface Clearance

Type of Equipment	Quantity	Operation Hours/Day	Number of Work Days	Total Equipment Hours
Tractor	1	8	60	600
D-4 Dozer	1	8	15	150
Excavator	1	8	132	1,320

Table 4-5. Explosives Regulatory References

OSHA General Industry Standards, 29 CFR 1910
OSHA Construction Standards, 29 CFR 1926
CEHNC Safety Concepts and Basic Considerations for Unexploded Ordnance
USACE EM 385-1-1, Safety and Health Requirements Manual
DOD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives
DOD 4160.21-M, Defense Reutilization and Marketing Manual
DOD 6055.9-STD, DOD Ammunition and Explosives Safety Standards
AR 385-64, Ammunition and Explosive Safety
AR 385-10, Army Safety Program
DA PAM 385-64, Ammunition and Explosives Safety Standards
TM 9-1300-206, Ammunition and Explosive Standards
TM 9-1300-200, Ammunition General
TM 9-1300-214, Military Explosives
TM 60A-1-1-31, EOD Disposal Procedures
AR 190-11, Physical Security of Arms, Ammunition and Explosives
ATF 5400.7, Alcohol Tobacco and Firearms Explosives Laws and Regulations
Applicable sections of DOT, 49 CFR 100 to 199

Table 4-6. Storage Compatibility Groups for Explosives and Ammunition

Group A	
Cyclonite (RDX), dry	Mercury fulminate, wet
HMX, dry	PETN, dry
Lead azide, wet	RDX (cyclonite), dry
Lead styphnate, wet	Tetracene, wet
Group B	
Fuses (except chemically actuated fuses containing ampules that may initiate, directly or indirectly, explosives and explosives-loaded components that are conventionally assembled to form the finished explosive fuse).	Detonators Mines, practice, AP, M17 Percussion elements Primer detonators
Group C	
Ammunition, blank and saluting, cannon	Cartridge, 90mm, canister, AP
Ammunition, .50 caliber, except API/incendiary	Cartridges, practice, over 40mm
Ammunition, 20mm, practice and high-pressure test	Catapults, aircraft ejection seat, M3A1, M4A1, M5
Ammunition, 25mm, with inert projectile	Charge, propelling, not assembled to projectiles EC powder
Ammunition, 27mm, caseless	Detonating cord (primacord)
Ammunition, 30mm, ball and high pressure test	Nitrocellulose
Ammunition, 30mm, practice and training	Fuel (solid), emergency power unit
Ammunition, 37mm and 40mm, TP and AP	Propellant
Ammunition, 40mm, practice, M407A1, M382, and M385	Rockets, practice, 3.5-inch
Benite Baron potassium nitrate	Rocket motors, M3, M5, M6, M10, M13, M26, M30, M37, M42, M53, M66; Pershing 1st and 2nd stages; Spartan 1st, 2nd, and 3rd stages
Group D	
Adapter booster	Explosive D
Ammonium nitrate, except in original shipping container or equivalent	Explosives, cratering
Ammonium perchlorate, except when particle size is greater than 15 microns and in original shipping container or equivalent	Grenades, rifle, AT (except pentolite loaded)
Ammonium picrate (Explosive D)	HMX, wet
Bangalore torpedoes	Mine, APERS, MN, M14 (w/integral fuse)
Baratol	Mines, antipersonnel (bounding type

Table 4-6. Storage Compatibility Groups for Explosives and Ammunition

Black powder, bulk	Mines, antipersonnel (cast iron block)
Bombs, demolition	Mines, HEAT Nitrocellulose wet 8-30% water exposed to detonation hazards at less than intra-line distance
Bombs, fragmentation	Nitroguanidine
Bombs, general purpose	Nitrostarch Octol
Boosters	PBX
Boosters, auxiliary	pentolite
Bursters	PETN, wet
Charge, demolition, snake	Picratol
Charge, springing earth rod, blast driven	Picric acid
Charge, supplementary, HE	Projectiles, HE, fuzed or unfused
Compositions A, A-2, A-3, A-4, B, B-3, C, C-2, C-3, and C-4	RDX (Cyclonite), wet
Cutter, cable M1	Rocket heads, HE and HEAT (except pentolite loaded) w/o motors
Cyclonite (RDX), wet	Shaped charges
Cyclotol	Tetranitrocarbazole (TNC)
Demolition Blocks	Tetryl
Destructor, HE, M10	Tetrytol
Detonating cord (primacord) exposed to detonation hazard at less than intra line distance	TNT
Dynamite	Tritonal
Ednatol	Torpex
Group E	
Ammunition, HEP	Ammunition, fixed and semifixed, 90mm through 106mm, loaded with ammonal, amatol, Explosive D, composition B or TNT
Ammunition, 20mm, HE, HEI and functional packs containing HE and HEI	Cartridge, heavy mortar, over 81mm (including 81mm M56), except chemical loaded
Ammunition, 30mm, HEDP	Cartridge, light mortar, 81mm or less (excluding 81mm M56), except chemical loaded
Ammunition, 37mm, HE	Redeye guided missiles, packaged 3 complete rounds w/launcher
Ammunition, 40mm, HE, RDX loaded	

Table 4-6. Storage Compatibility Groups for Explosives and Ammunition

Ammunition, 40mm, HE, M406, M386, M441, and M463	Rockets, HEAT, 3.5-inch, complete round
Ammunition, 57mm through 81mm, except WP smoke, HEP, and blank	Rockets, HE, 2.75-inch (in LAU-3/A rocket launcher)
Group F	
Grenades, hand offensive	Grenades, fragmentation
Group G	
Ammunition, .50 caliber API and incendiary	Grenades, hand, CN1, ABC, M25A1, w/fuse C12
Ammunition, 20mm, API	Grenades, hand, CM1, ABC, M25A2, w/fuse C12
Ammunition, 20mm, incendiary and functional packs containing incendiary, except those containing HE or HEI	Grenades, illuminating and incendiary
Ammunition, 40mm, riot control and pyrotechnic loaded, except WP smoke	Grenades, practice, w/spotting charge
Bombs, photoflash	Grenades, rifle, smoke, XM48E1 and M22 and M23
Cartridge, igniter, M2	Grenades, smoke (except WP and PWP)
Cartridge, illuminating	Grenades, riot control, CS1, M25A2
Cartridge, photoflash	Igniter, spotting charge
Cartridge cases, primer (w/o propellant)	Igniters for rocket motors (e.g., M12, M18, M20 and M29)
Charge, igniter assembly, for practice hand grenades	Ignition cartridge for trench mortar ammunition
Charge, spotting, APR practice, M8	Illuminating compositions (consolidated in final press operations)
Chemical ammunition, Group B, tear or smoke producing, w/explosive components, over 40mm	Mines, practice, w/spotting charge and/or fuse
Chemical ammunition, Group B, tear or smoke producing, w/o explosive components	Nuclear fire marker device 11-F2
Chemical ammunition, Group D, containing flammable solids, except for TEA or TPA, w/o explosive components	Photoflash powder
Chemical ammunition, Group D, fixed or semi-fixed rounds, containing flammable solids, except for TEA or TPA	Primers, artillery and cannon, percussion and electric
Clusters, incendiary bomb, M31 and M32 (w/o fuzing components)	Projectiles, illuminating
Destroyer, file, M4	Rocket, riot agent, CS, 2.75-inch FFAR, MX99
Detonation, simulator, explosive M80	Simulators, M110, M115, M116, M117, M118, M119 and XM142

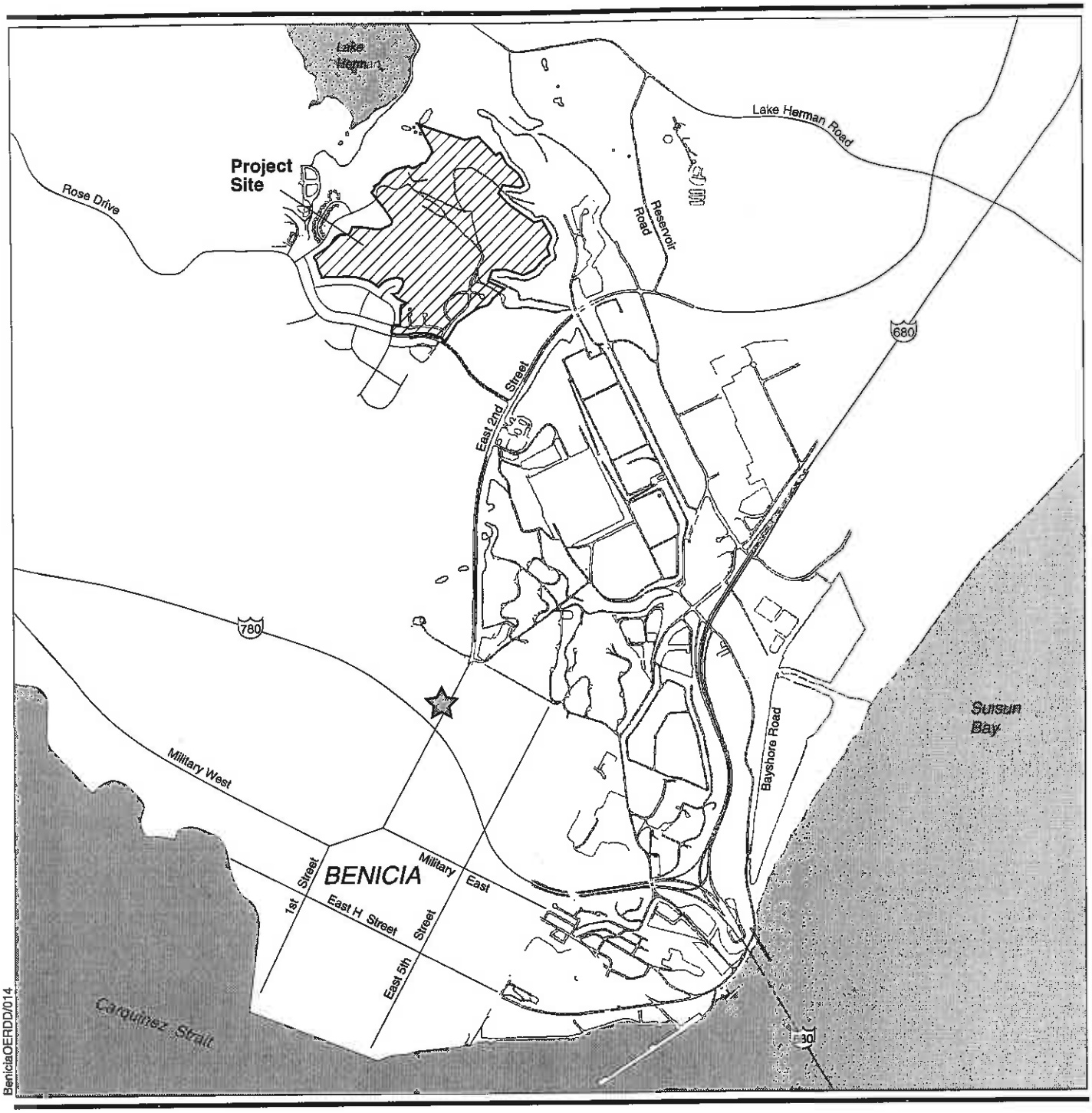
Table 4-6. Storage Compatibility Groups for Explosives and Ammunition

Grenade, hand, smoke, HC, M8	Smoke pots
Grenades, hand, CN, M7A1, w/fuse M201A1	Spotting charges (cartridge for miniature practice bombs)
Grenades, hand, CS, M7A3, w/fuse M210A1	
Group H	
Chemical ammunition, Group C	Grenade rifle, WP, M19
Grenades, WP	
Group J	
Chemical ammunition, Group D, containing flammable liquids or gels, with or w/o explosive components	Chemical ammunition, Group D, fixed and semifixed rounds, containing flammable liquids or gels with or without explosive components
Group K	
Chemical ammunition, Group A, with or without explosive components Rockets, toxic chemical agents, complete rounds	Chemical ammunition, Group B, with or without explosive components, designed for toxic or incapacitating effects greater than lachrymation
Group L	
Aluminum powder Ammonium nitrate	Fuzes, chemically actuated, containing ampoules which may initiate directly or indirectly, explosives and explosives loaded components which are assembled in the conventional manner to form the finished explosive fuse
Ammonium perchlorate	Magnesium powder
Ammunition, pentolite loaded	Grenades, rifle, AT (pentolite loaded)
Chemical Ammunition, Group A, without explosive components	Nitrates (inorganic), except ammonium nitrate (in original shipping container or equivalent)
Chemical ammunition, Group B, without explosive components, designed for toxic or incapacitating effects more severe than lachrymation	Perchlorates
Chemical ammunition, Group D, TEA or TPA components	Peroxides, solid
Chlorates	Rocket heads, pentolite loaded, w/o motors
DNT	Zirconium (types I and II, spec. FED 1665)
Group S	
Ammunition, 40mm, canister and multiple projectile	Fuse lighters
Ammunition, small arms, less than .50 caliber	Fuse safety
Explosive bellows	Squibs commercial
Firing devices	

Table 4-7. Storage Compatibility Chart

Groups	A	B	C	D	E	F	G	H	J	K	L	S
A	X	Z										Z
B	Z	X										X
C			X	Z	Z		Z					X
D			Z	X	X							X
E			Z	X	X							X
F						X						X
G			Z				X					X
H								X				X
J									X			X
K										X	U	
L										U		
S	Z	X	X	X	X	X	X	X	X			X

Note: "X" indicates that these groups may be combined in storage. Otherwise, mixing is either prohibited or restricted per the following statement: "Z" indicates that, when warranted by operational considerations or magazine nonavailability, and when safety is not sacrificed, these groups may be combined in storage. Equal numbers of separately packaged components of complete rounds of any single type of ammunition may be stored together. When so stored, compatibility is that of the assembled rounds (i.e., WP Filler in Group H, HE Filler in Groups D, E, or F, as appropriate). Group K required not only separate storage from other groups, but also requires that munitions having different toxic chemical agent fillers be stored separately from each other. "U" indicates that leaking toxic chemical munitions of one agent type (i.e., GB, with or without explosive components) may be stored together in one magazine specifically designated for storage of leakers of that agent type. Ammunition designated "PRACTICE" by NSN and nomenclature may be stored with the fully loaded ammunition it simulates.



EXPLANATION

- 680 Interstate Highway
- Project Site
- Hospitality Center Best Western

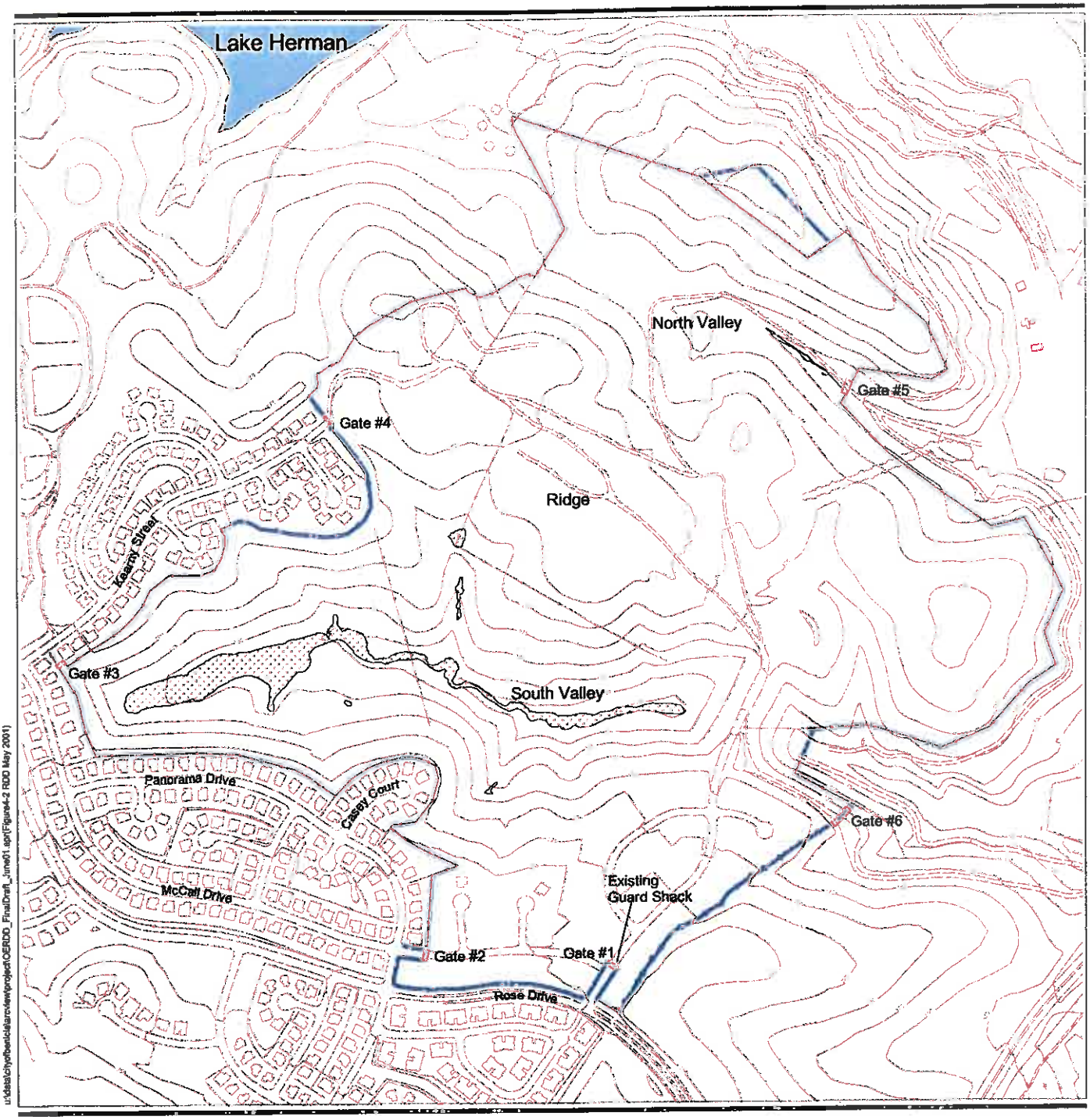
0 .125 .25 .5 Mile

Hospitality Center

Best Western
1955 E. Second Street
Benicia, CA 94510-2201

Final

Figure 4-1



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EXPLANATION

Wetlands

Perimeter Fence

Gates

Planimetric features

Buildings

Fence

Foundations

Roads/Trails

25 Foot Contour

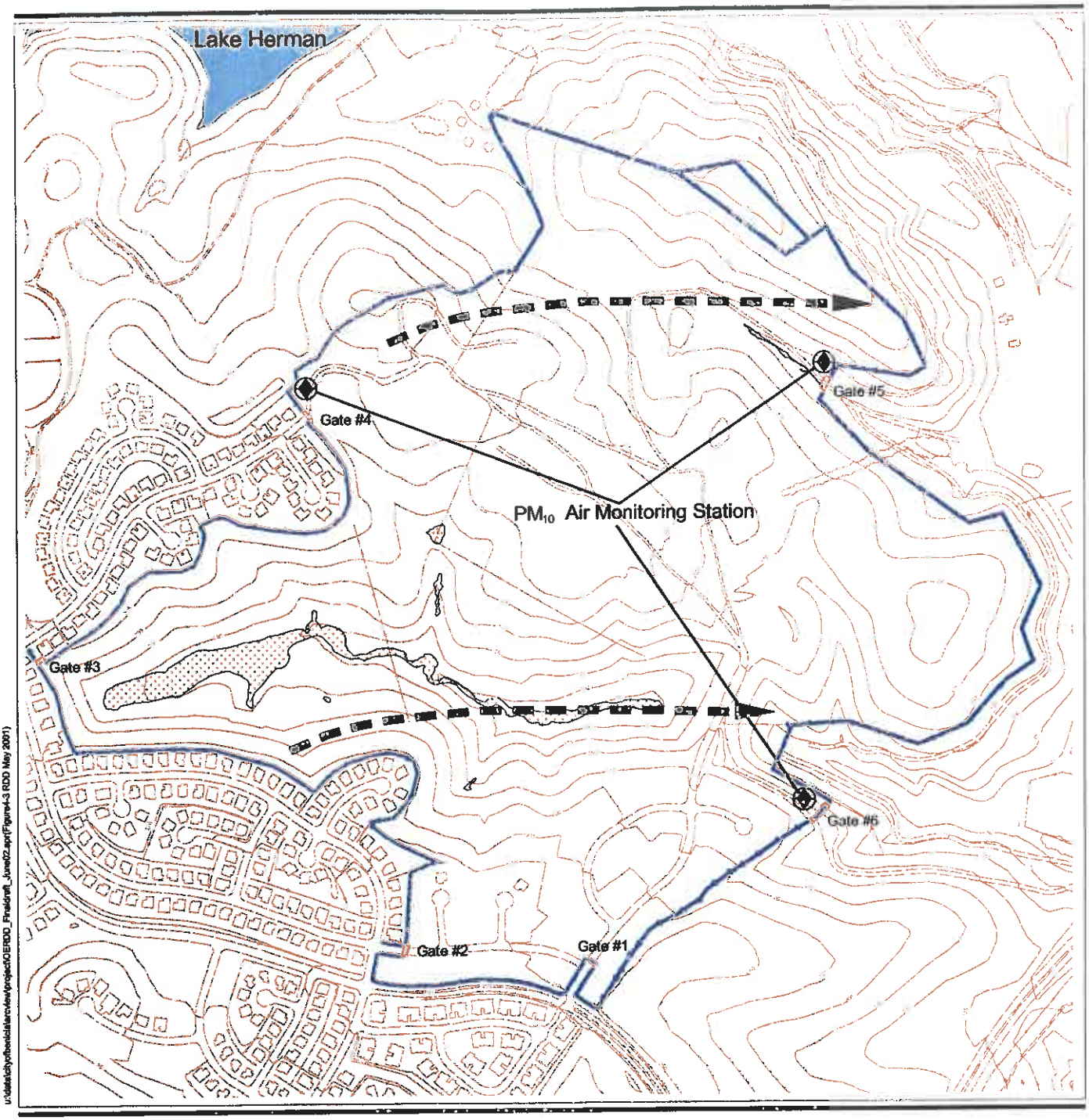
Intermittent Stream

350 0 350 700 Feet

Tourtelot Cleanup Project
Perimeter Security Fences

Final

Figure 4-2



EXPLANATION

- Wetlands
- Perimeter Fence
- Gates
- PM_{10} Air Monitoring Stations

Planimetric features

- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream
- Prevailing Wind Direction

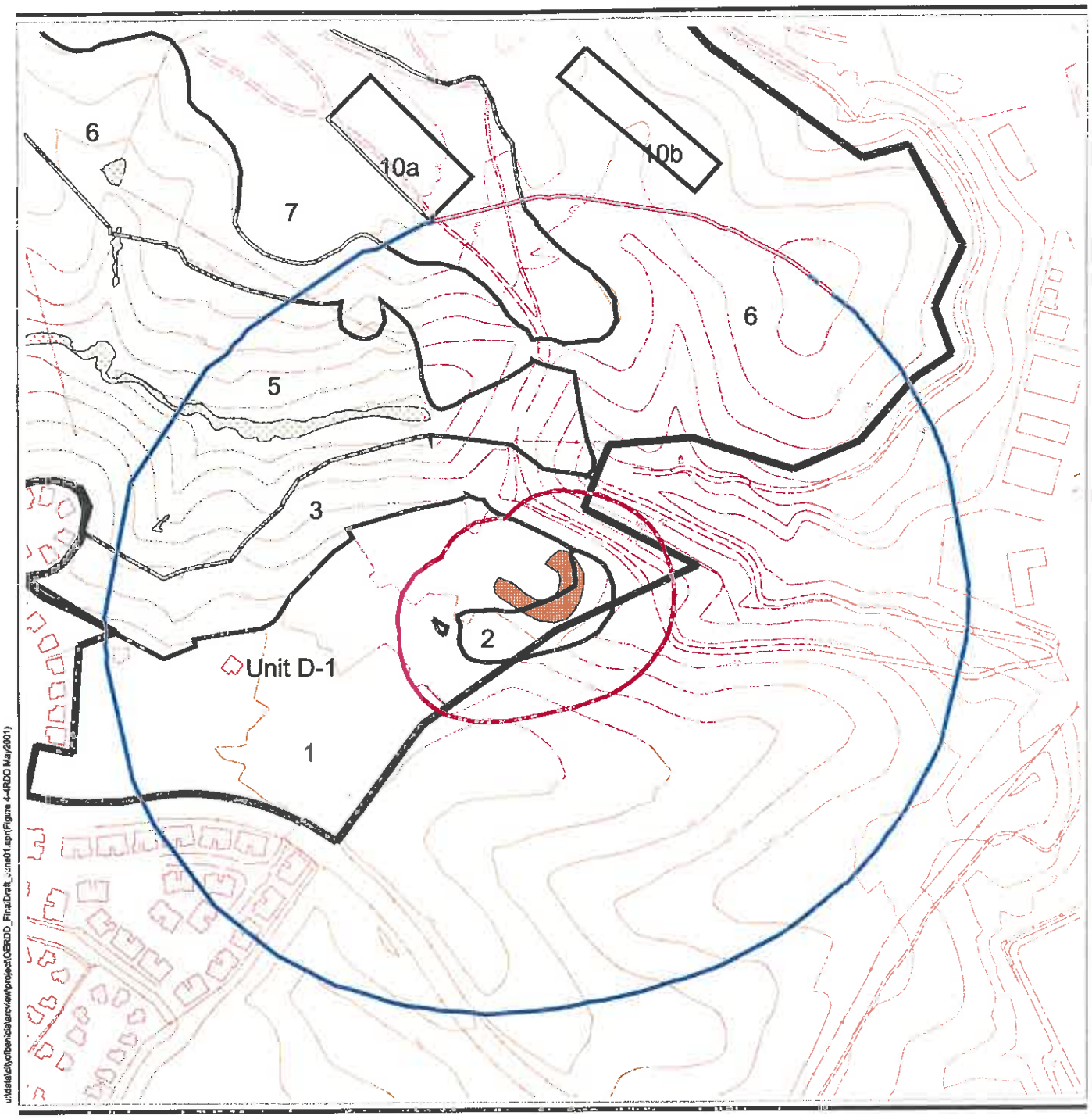
350 0 350 700 Feet

Data Source:
Field Observation of Wind Patterns

Tourtelot Cleanup Project
PM_{10} Air Monitoring Stations

Final

Figure 4-3



EXPLANATION

- Project Site Boundary
- Sector Boundaries
- Wetlands
- Stockpiles
- 200 Foot MSD Buffer
- 1181 Foot VSD Buffer

250 0 250 Feet

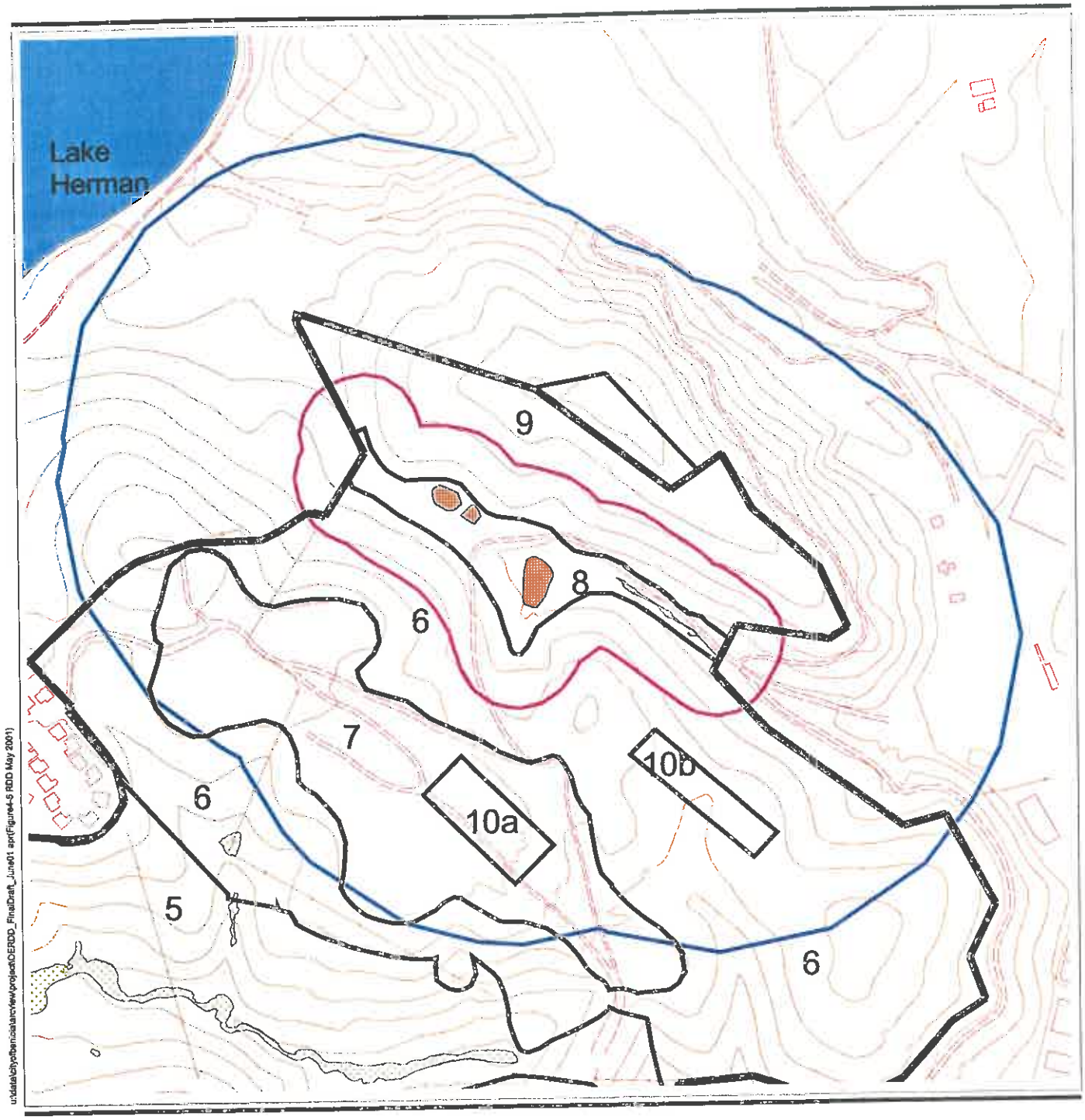
Planimetric features

- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

Unit D-1 Stockpile MSD and VSD

Final

Figure 4-4



EXPLANATION

- Project Site Boundary
- Sector Boundaries
- Wetlands
- Stockpiles
- 200 Foot MSD Buffer
- 1080 Foot VSD Buffer

Planimetric features

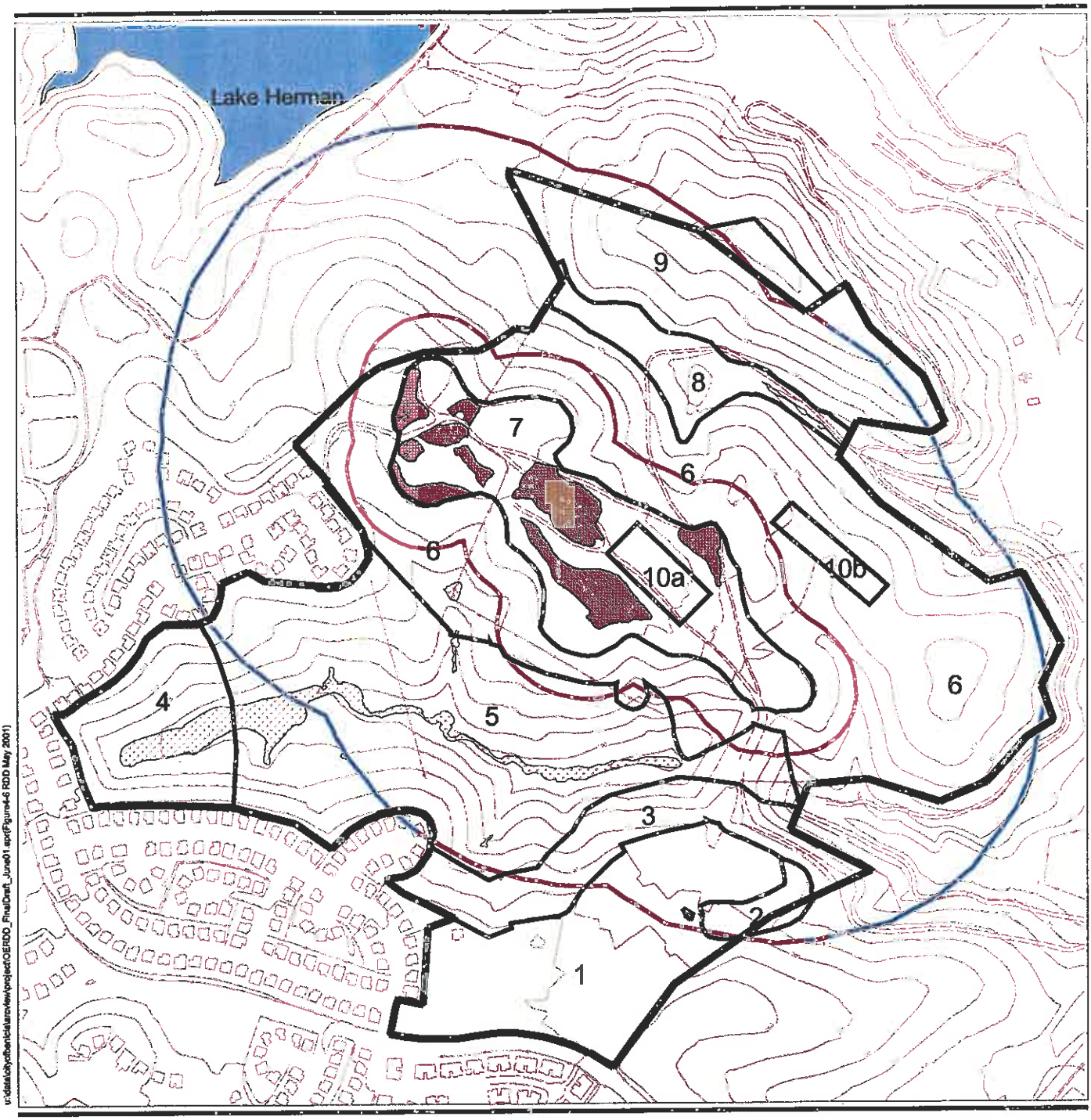
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

275 0 275 Feet

Tourtelot Cleanup Project
North Valley
Stockpiles MSD and VSD

Final

Figure 4-5



EXPLANATION

- Project Site Boundary
- Sector Boundaries
- Wetlands
- Stockpiles
- 200 Foot MSD Buffer
- 1080 Foot VSD Buffer

Planimetric features

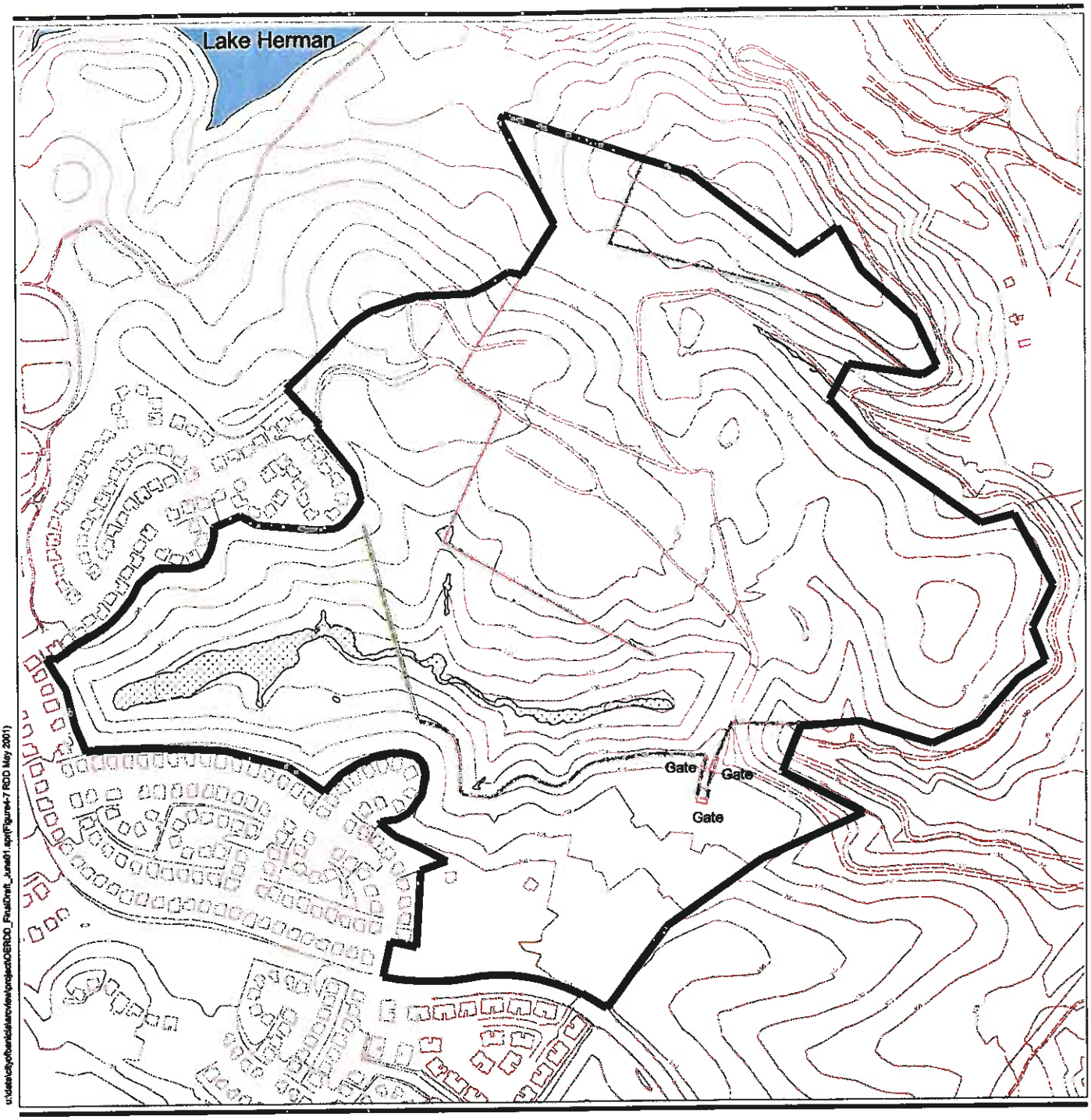
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

350 0 350 700 Feet

Tourtelot Cleanup Project
Ridge Stockpiles
MSD and VSD

Final

Figure 4-6



EXPLANATION

- Project Site Boundary
- Wetlands
- Fence to be Removed
- Gates

Planimetric features

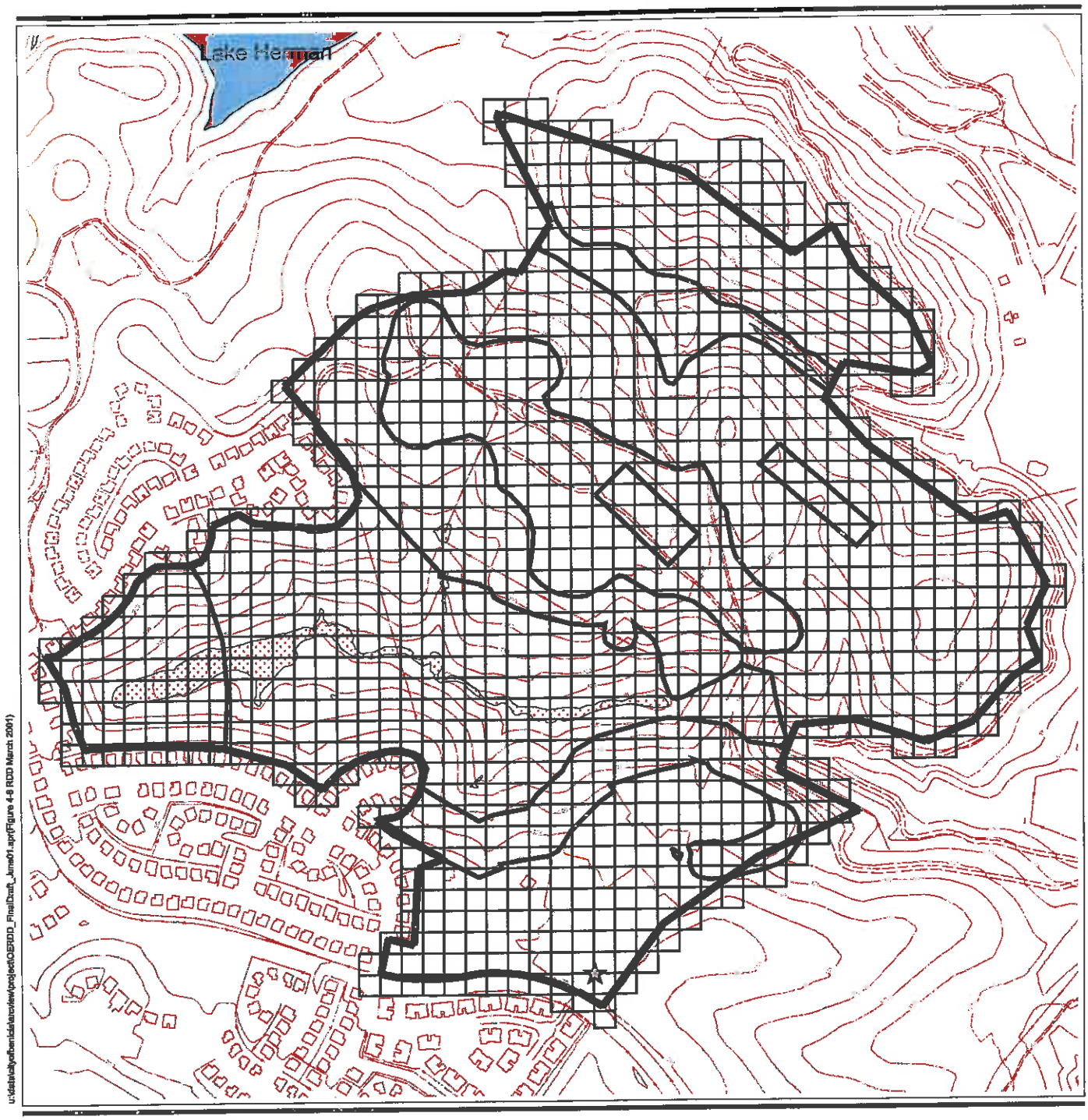
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

350 0 350 700 Feet

Tourtelot Cleanup Project
Fences to be Removed

Final

Figure 4-7



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EXPLANATION

- Project Site Boundary
- Sector Boundaries
- Wetlands
- 100' x 100' Foot Grids
- Base Coordinate for Grid Measurements

Planimetric features

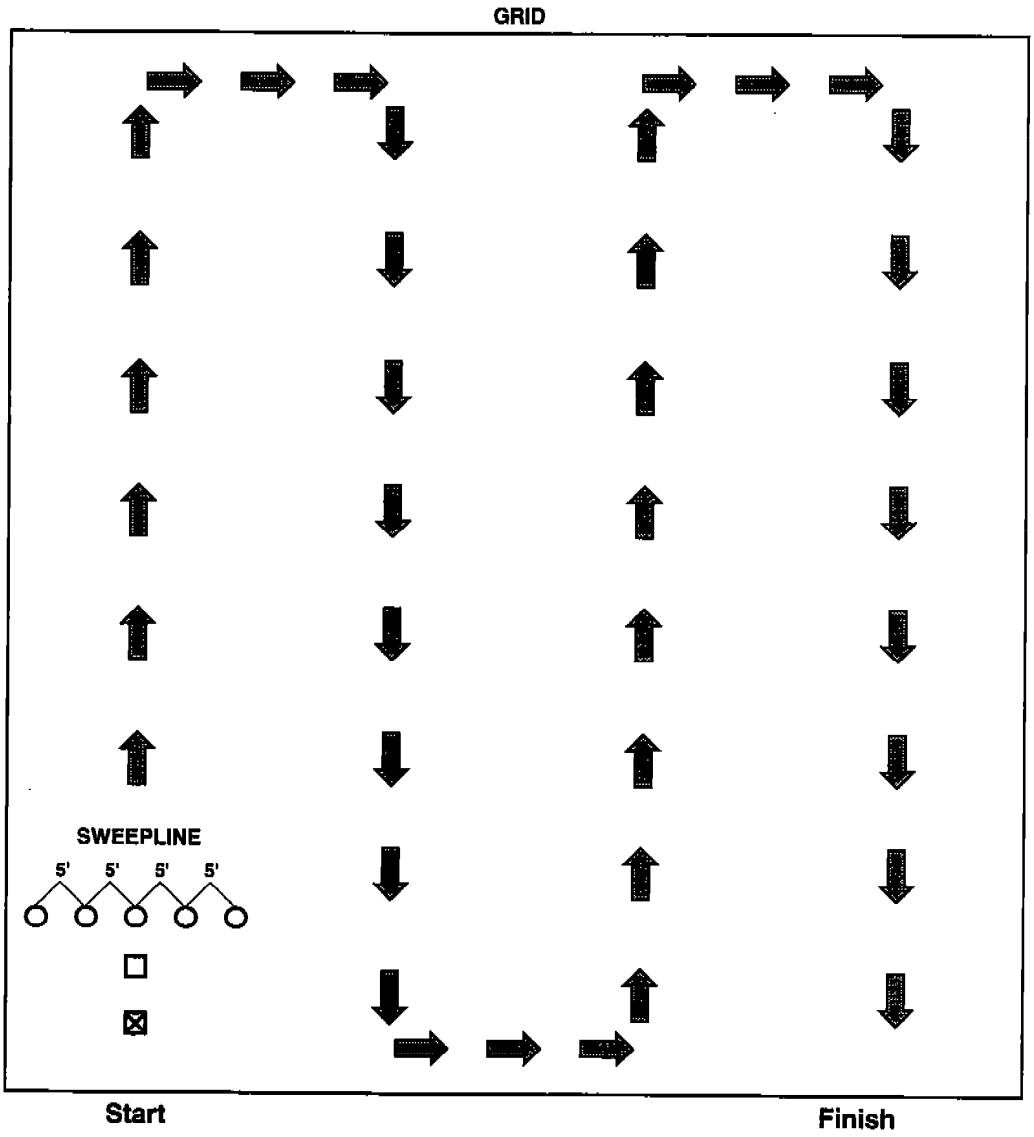
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

350 0 350 700 Feet

Tourtelot Cleanup Project Site Grid Map

Final

Figure 4-8



BenicieOERDD/011

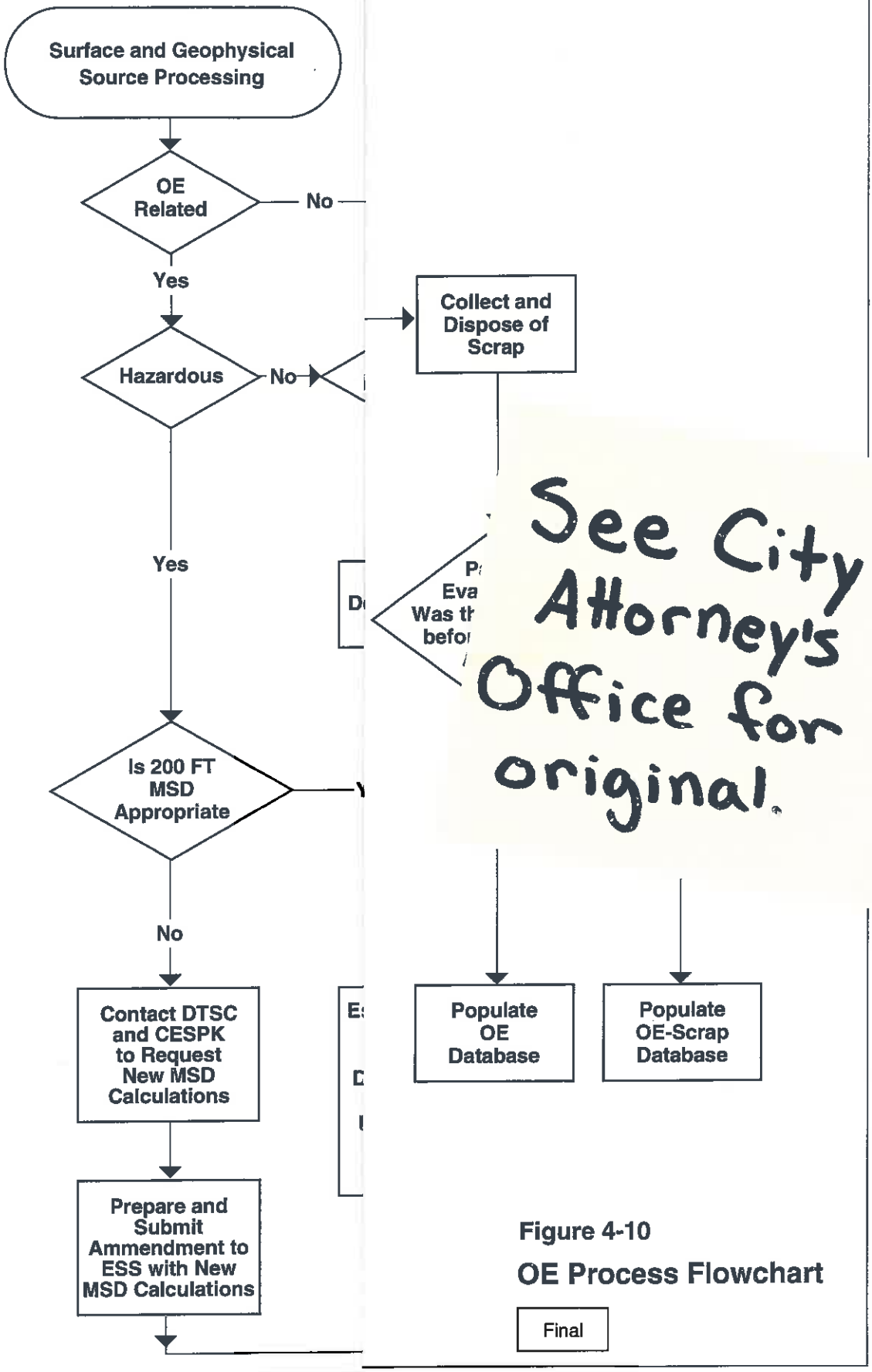
EXPLANATION

- ○ UXO Tech
- □ UXO Supervisor
- ⊠ Support Vehicle

OE Surface Clearance Walking Sweepline (Conceptual)

Final

Figure 4-9



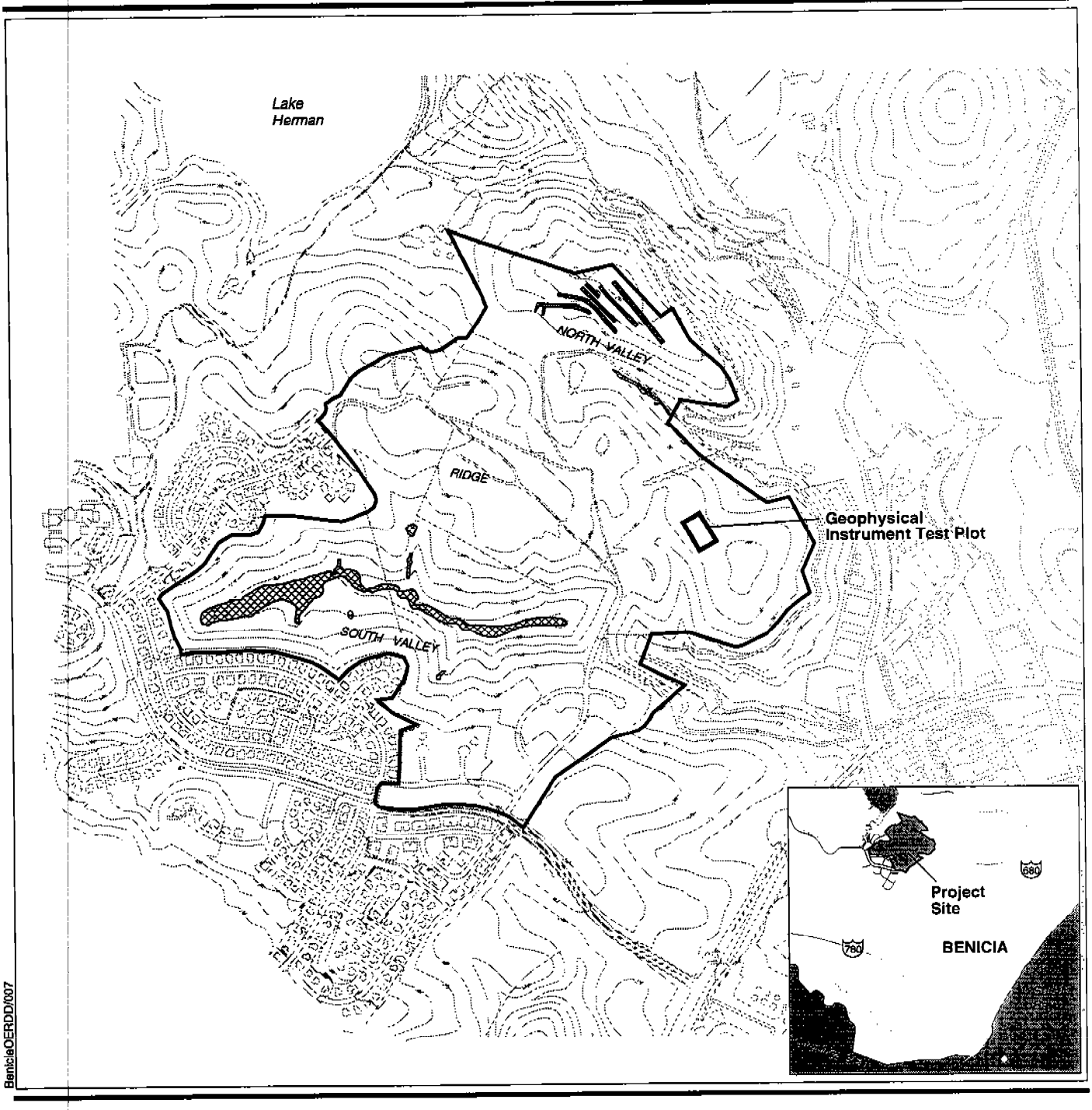
See City Attorney's Office for original.

Figure 4-10

OE Process Flowchart

Final

BeniciaOERDD/022



BeniciaOERDD/007

EXPLANATION

- Project Site Boundary
- Wetlands
- Geophysical Instrument Test Plot

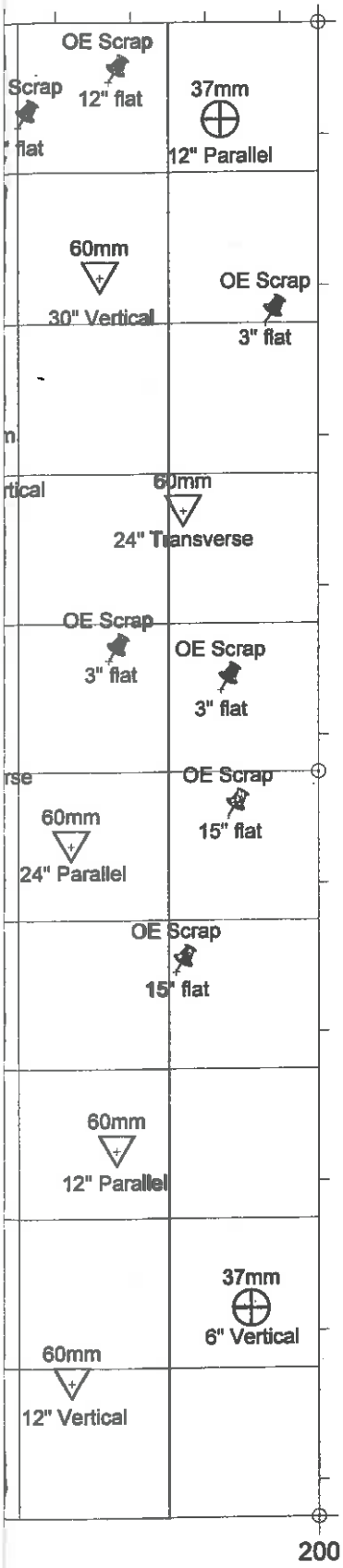
0 250 500 1000 Feet

Note: Contour interval equals 25 feet.

Location of Geophysical Instrument Test Plot

Final

Figure 4-11



See City Attorney's Office for original.

× 30mm p

▽ 60mm mortar rocket

⊕ 37mm projectile

OE Scrap

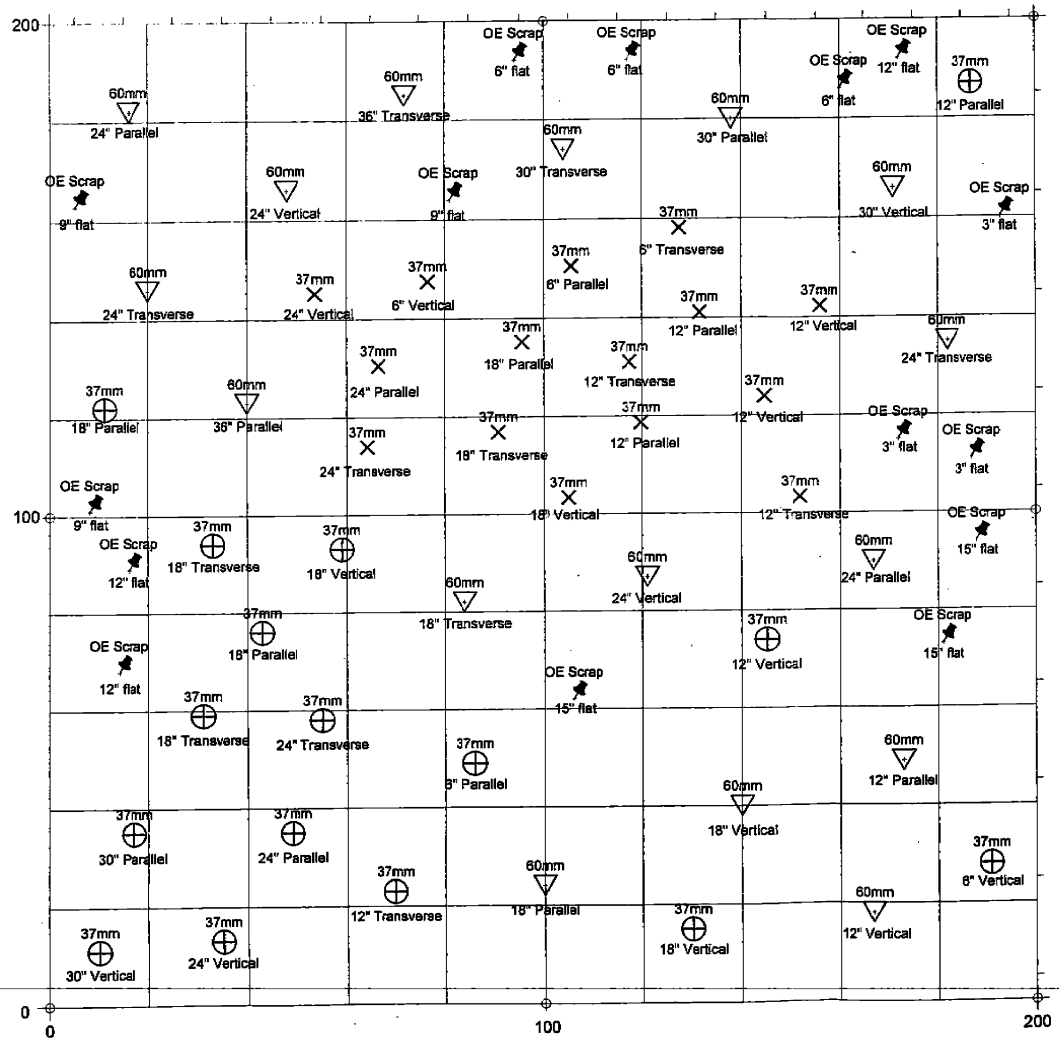
⊙ rebar

Final

Figure 4-12

Tourtelot Cleanup Project Geophysical Equipment Evaluation Plot (25-foot buffer on west and east, 75-foot on north and south not shown)

0 5 10 20 Feet



× 30mm projectile

▽ 60mm mortar rocket

⊕ 37mm projectile

OE Scrap

rebar

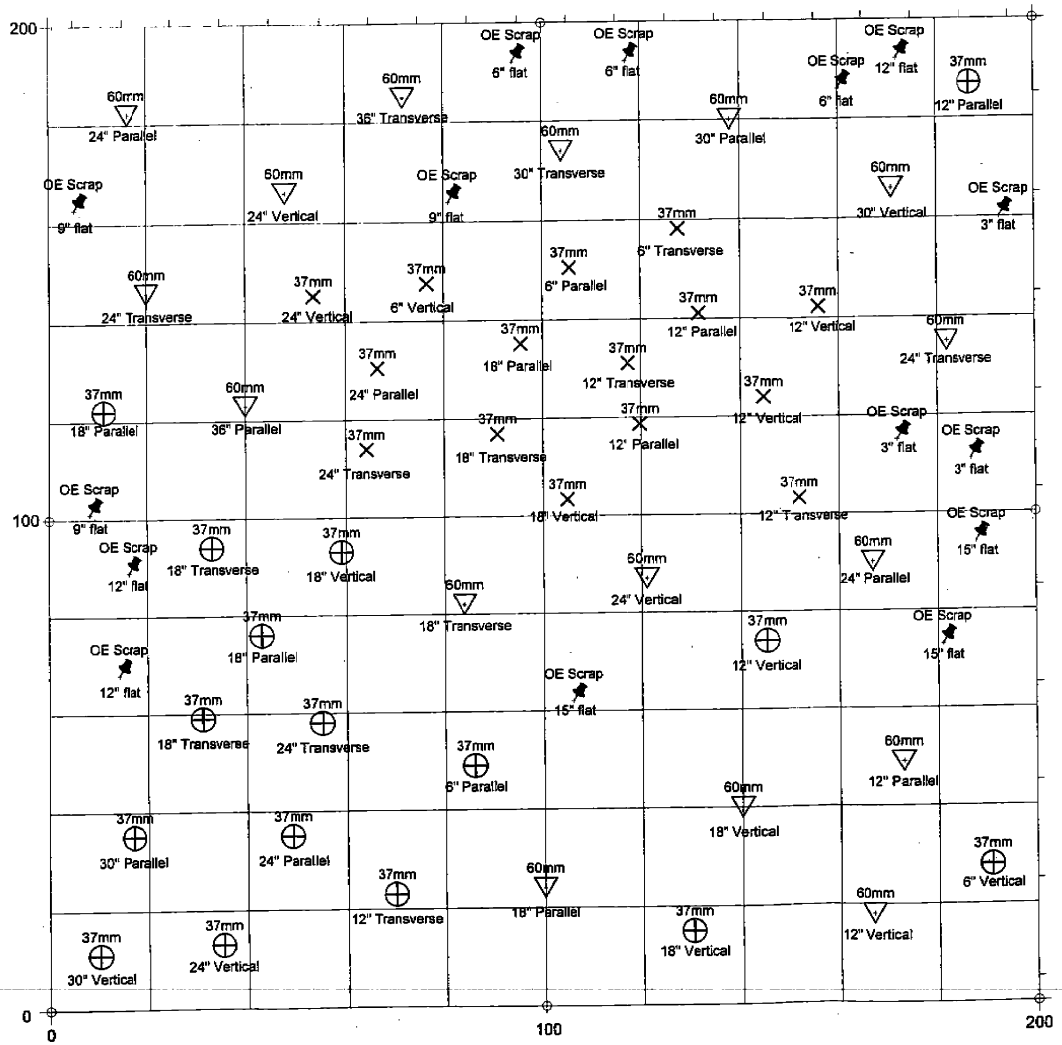
Final

Figure 4-12

Tourtelot Cleanup Project Geophysical Equipment Evaluation Plot (25-foot buffer on west and east, 75-foot on north and south not shown)

0 5 10 20 Feet

Berkale/OEPlot.dwg



× 30mm projectile

▽ 60mm mortar rocket

⊕ 37mm projectile

OE Scrap

rebar

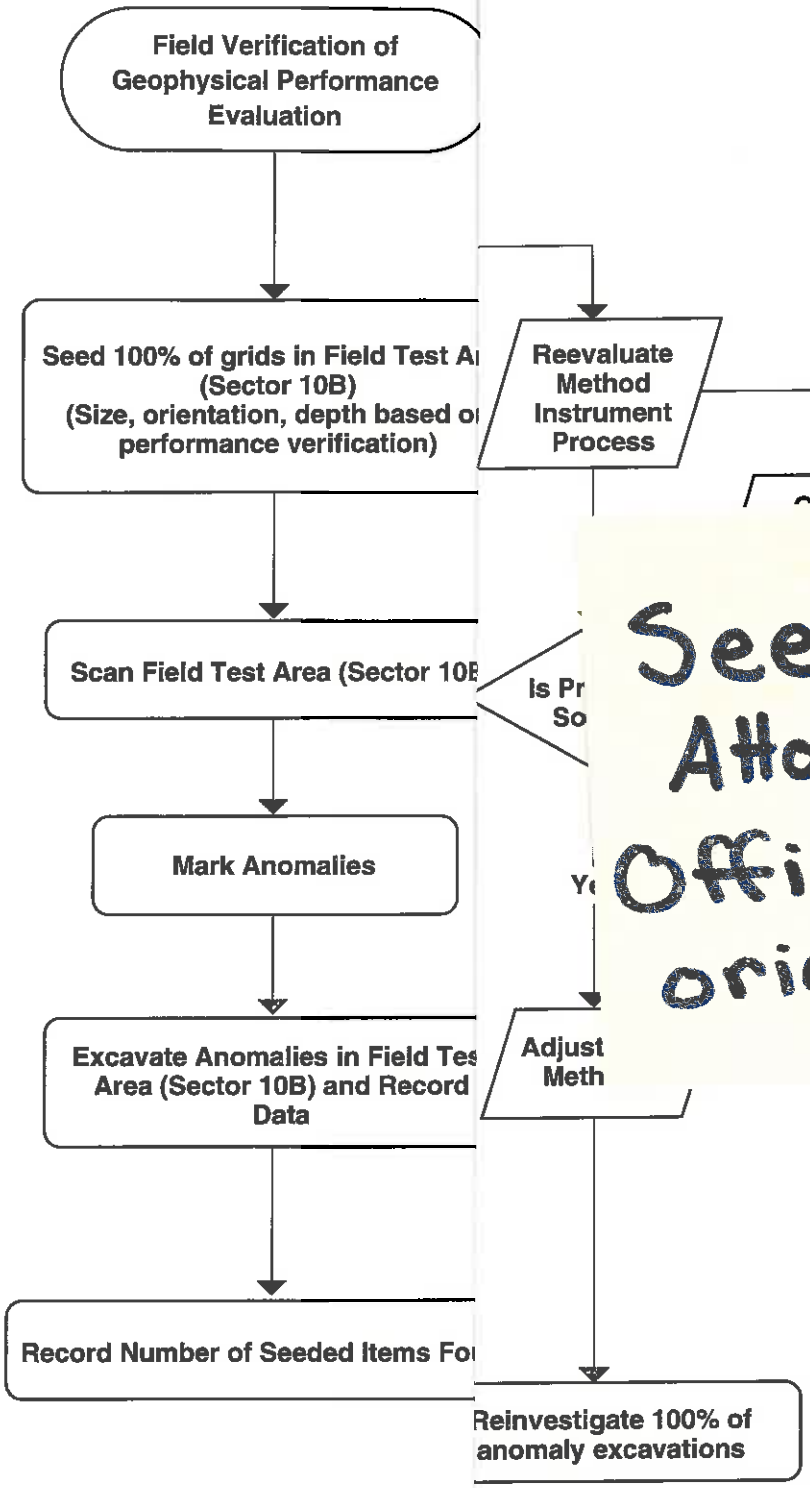
Final

Figure 4-12

Tourtelot Cleanup Project Geophysical Equipment Evaluation Plot (25-foot buffer on west and east, 75-foot on north and south not shown)

0 5 10 20 Feet

BenicaOER00/034



See City Attorney's Office for original.

Figure 4-13
Equipment Performance Verification Quality Control

Final

EXPLANATION

OE Ordnance and Explosives

BanktaOERDD/021

Final

See City Attorney's Office for original.

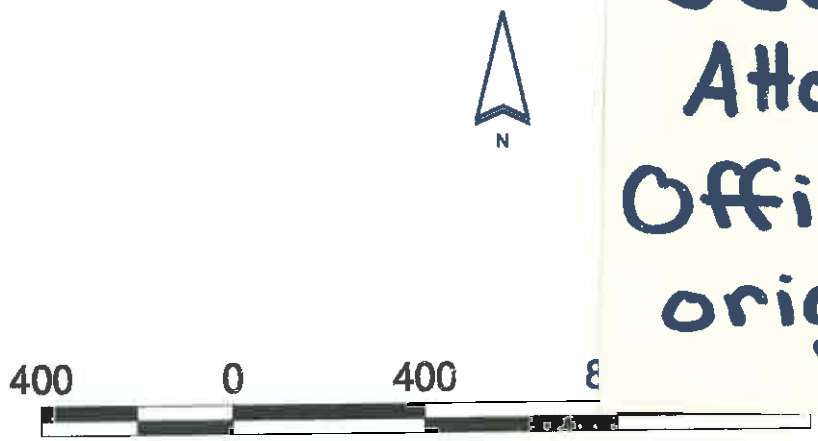
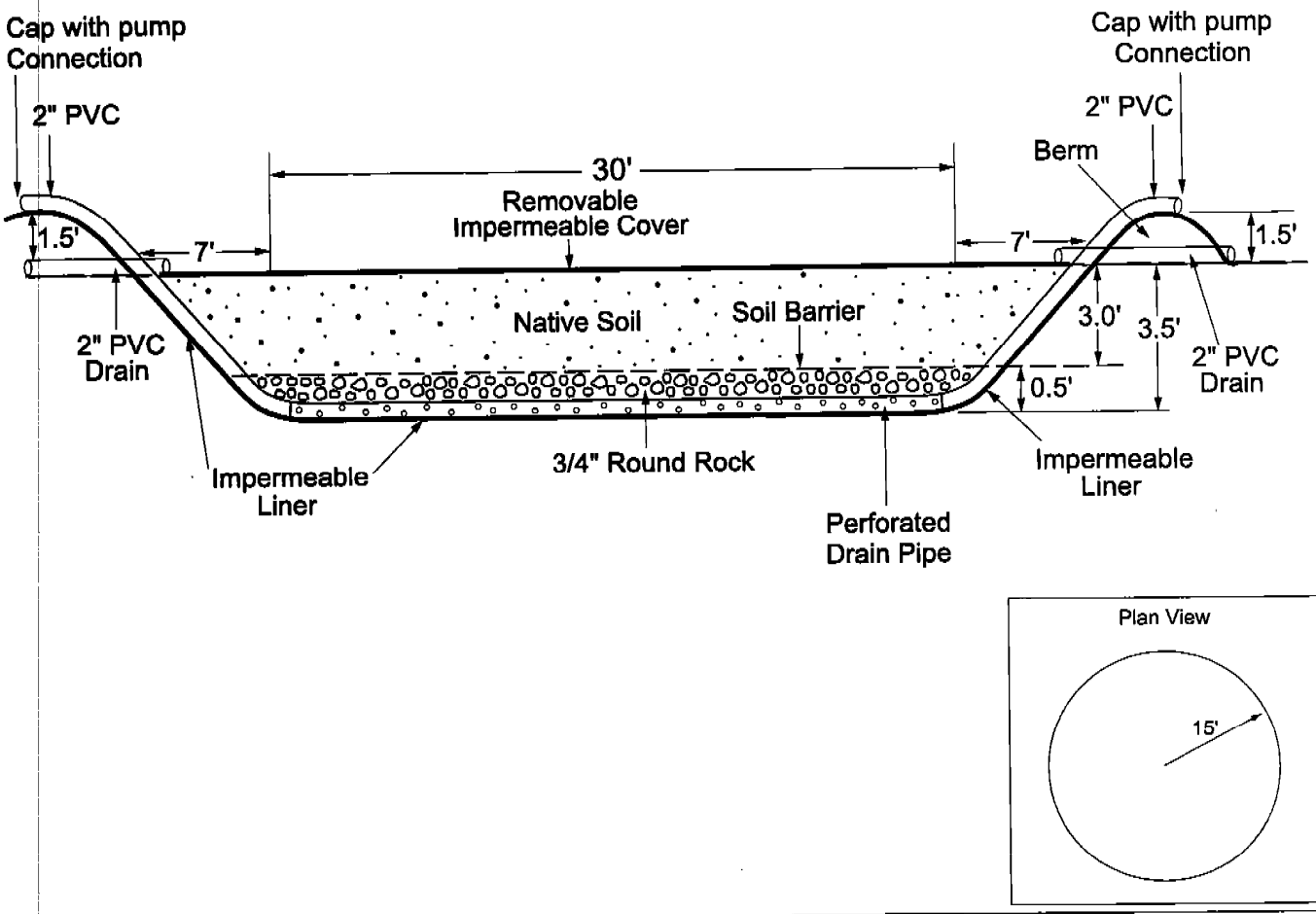


FIGURE 4-14

Q-D Map

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002



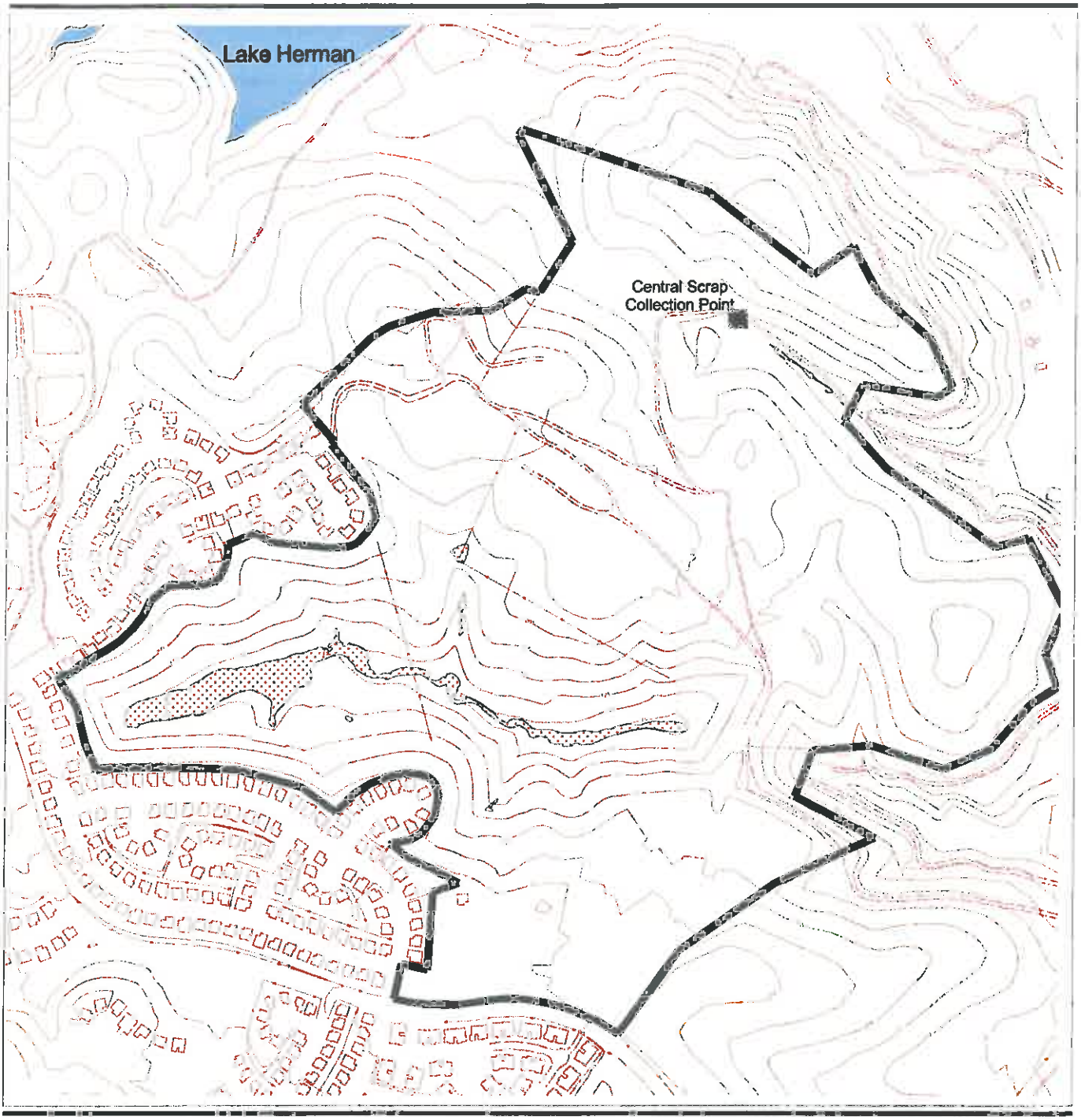
BaniciaOERDD/006

On-Site Open Blast/ Open Demolition Pit

Final

Note: All open detonation will be done in accordance CEHNC document use of Sand Bags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions HNC-ED-CS-S 98-7, February 23, 1999.

Figure 4-15



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EXPLANATION

Project Site Boundary

Wetlands

Central Scrap Collection Point

Planimetric features

Buildings

Fence

Foundations

Roads/Trails

25 Foot Contour

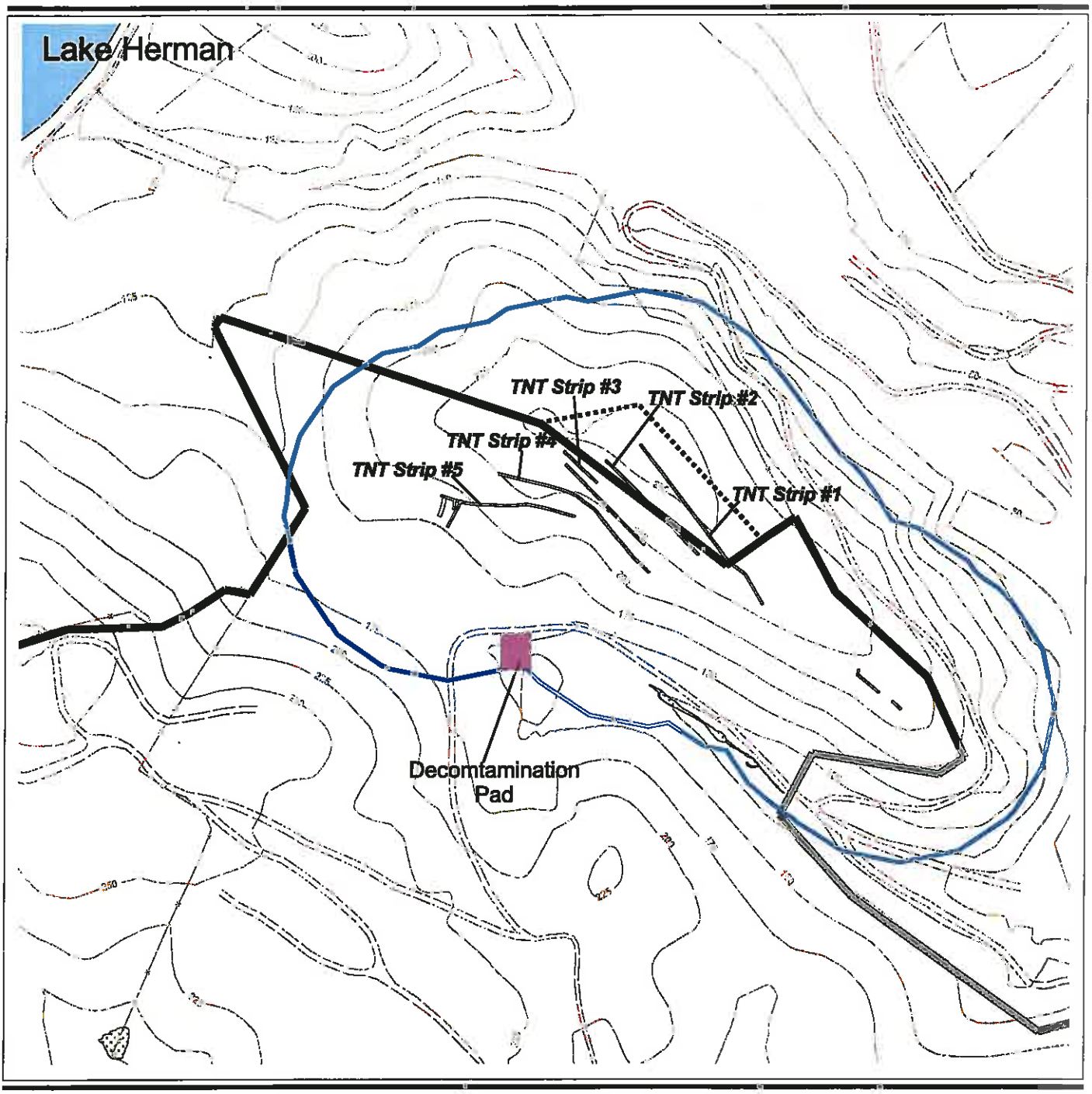
Intermittent Stream

350 0 350 700 Feet

Central Scrap Collection Point

Final

Figure 4-16



EXPLANATION

- Project Site Boundary
- Wetlands
- TNT Strips
- 412 Foot MSD/VSD
- Fence Around TNT Strips

Planimetric features

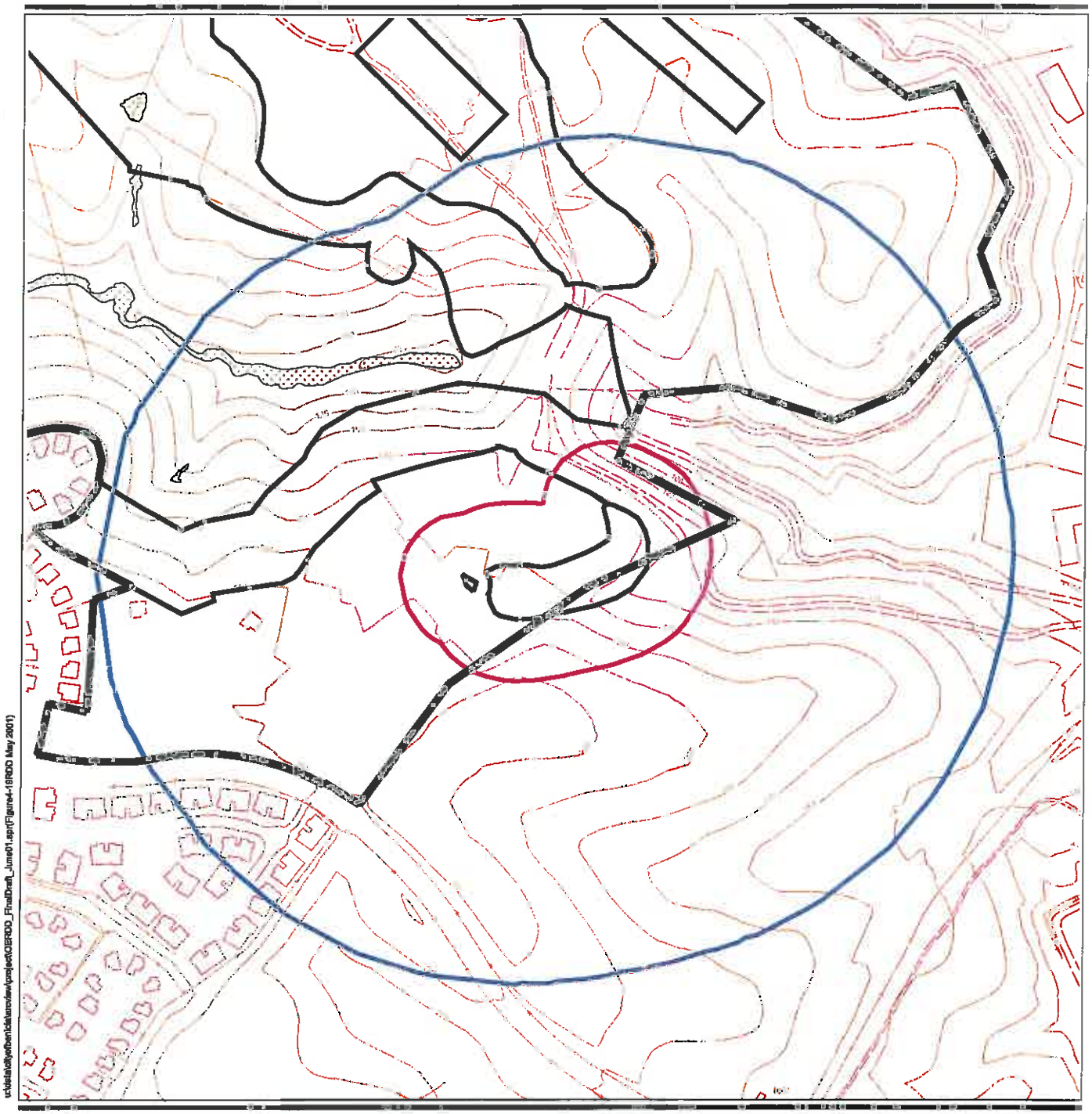
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour

200 0 200 400 Feet

TNT MSD and Equipment Decontamination Pad Location

Final

Figure 4-17



EXPLANATION

- Project Site Boundary
- Sector Boundaries
- Wetlands
- 200 Foot MSD Buffer
- 1181 Foot VSD Buffer

Planimetric features

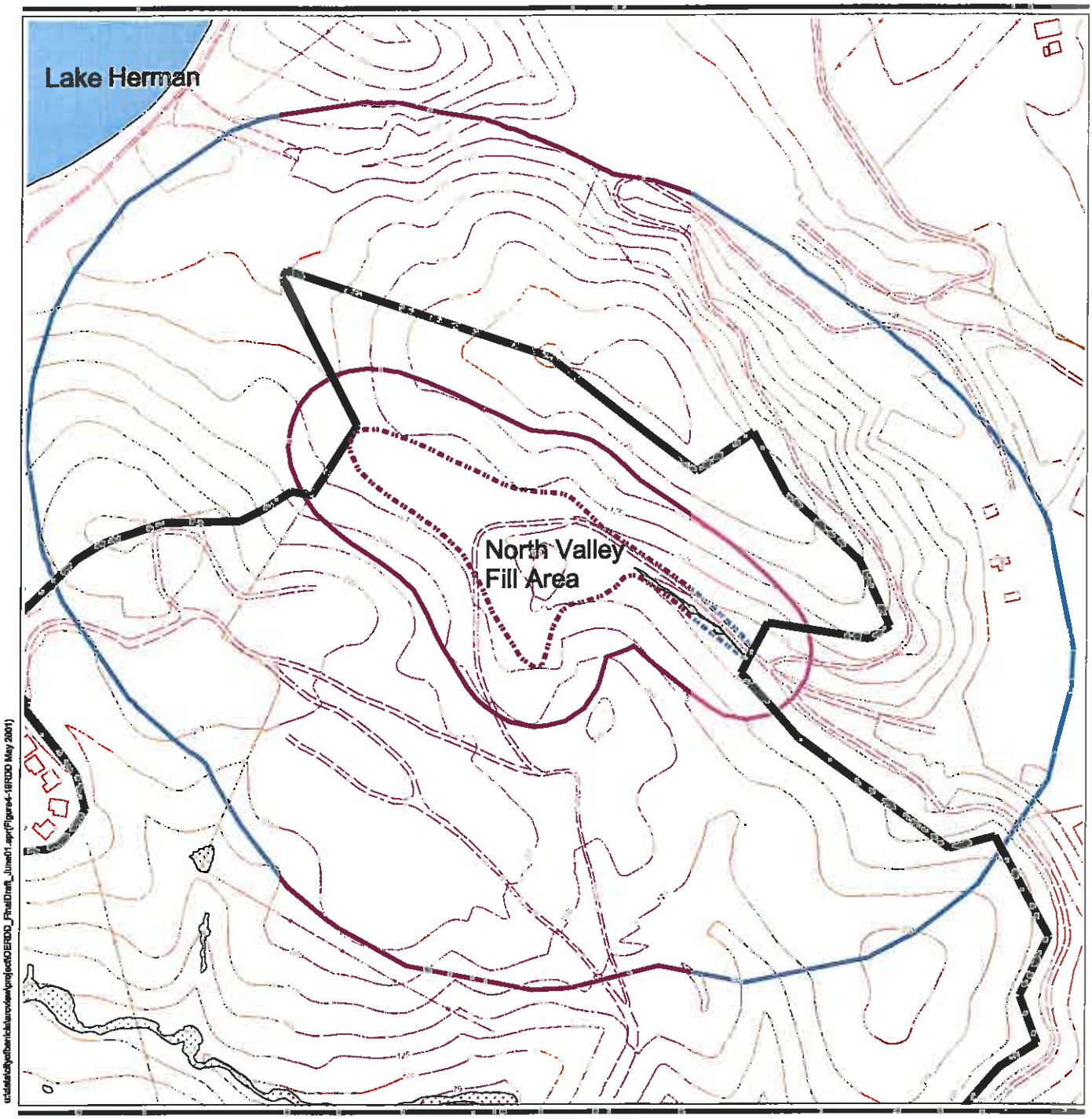
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

200 0 200 400 600 Feet

Tourtelot Cleanup Project
Sector 2 MSD and VSD

Final

Figure 4-18



EXPLANATION

- Project Site Boundary
- Wetlands
- Existing Fill Material in North Valley
- 200 Foot MSD Buffer
- 1080 Foot VSD Buffer

Planimetric features

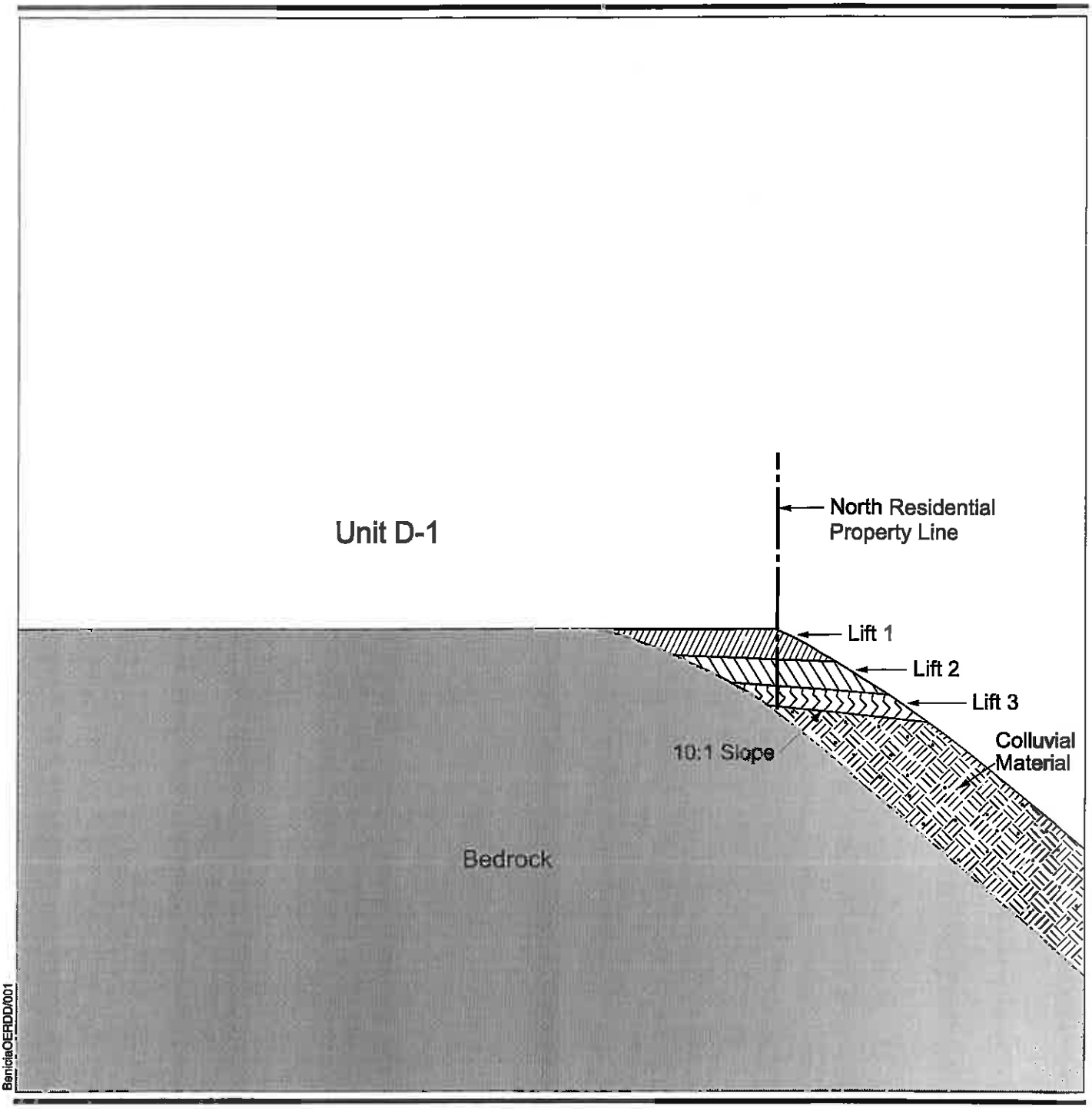
- Buildings
- Fence
- Foundations
- Roads/Trails
- 25 Foot Contour
- Intermittent Stream

250 0 250 500 Feet

Tourtelot Cleanup Project
Estimated Extent of Existing Fill Material in North Valley MSD and VSD

Final

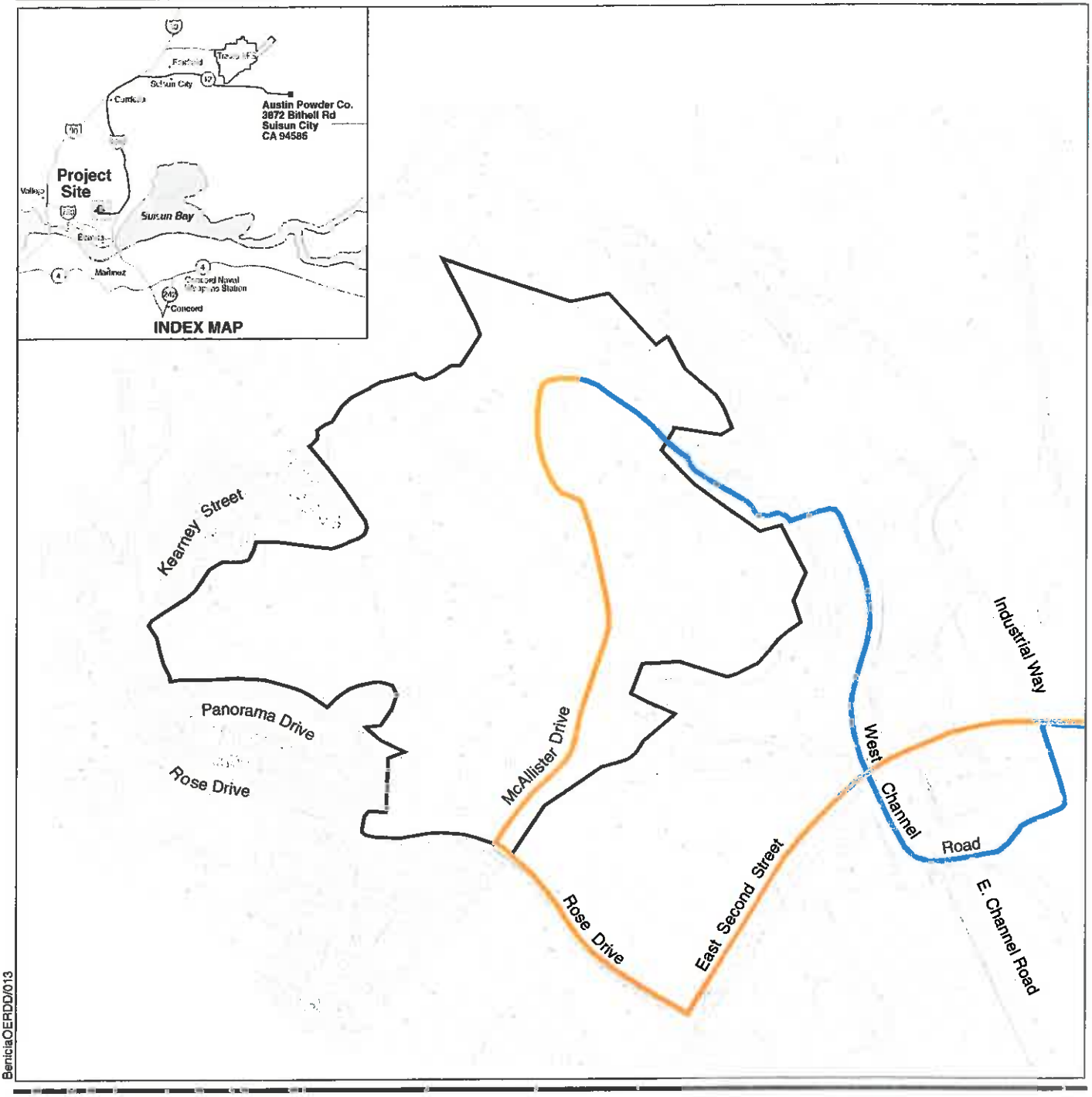
Figure 4-19



Cross Sectional View
South Slope of South Valley
Clearance Unit D-1

Final

Figure 4-20



EXPLANATION

- Project Site Boundary
- Route for Explosives Transport
- Alternate Route for Explosives Transport

0 250 500 1000 Feet

Route for Explosives Transport

Final

Figure 4-21

5.0 PROJECT CLOSURE

5.1 DEMOBILIZATION

Vegetation will be reestablished on all filled or graded slopes throughout the Project Site to reduce soil erosion as specified in the Mitigation Monitoring Plan (Appendix N). Temporary construction roads, equipment areas, and temporary field offices will be removed from the site and these areas will be restored in accordance with mitigation monitoring plan . Demobilization is anticipated to take 5 working days and will be conducted by the Project Manager, SUXOS, and either the OE SSO or the QC Supervisor.

Demobilization activities will include, but not be limited to:

- Removal of all personnel and equipment from the Project Site (including the Command Post)
- Close-out of files and records.

5.2 TECHNICAL MEMORANDA AND CLOSURE REPORTS

Two technical memoranda and a project closure report will be prepared covering all operations and activities addressed by this OE RDD. The first technical memorandum will document that the remedial actions outlined in the RAP and detailed in this OE RDD has been completed for Unit D-1 and the adjacent buffer area. The second technical memorandum documents completion of the OE remediation of the remainder of the Project Site.

The areas of the Project Site to be covered by each technical memorandum are shown on Figure 5-1. Draft and final reports will be prepared as indicated on the Project Schedule in Appendix A. Each technical memorandum will include the following:

- Documentation of all drawings, geophysical surveys, and field logs
- Tests conducted and test results including QA/QC
- Description and locations of all OE and identifiable OE scrap anomaly sources identified during the point clearance
- Results of QC sweeps or additional sweeps
- Maps showing the boundaries of actual removal activities.

OE and identifiable OE scrap found (dig sheet data) will be tabulated by grid number, type, and quantity. A separate list will be included that identifies all OE,

OE scrap, and non-OE debris recovered during the remedial action. The list, which will be arranged by grid numbers, will identify OE by military designation number, type and condition, ordnance scrap in pounds (including types of any fragmentation not represented in the list of OE items), and pounds of other material (non-OE debris) found at the Project Site. The state plane coordinates and depth to the top of each OE item recovered will be reported on the list.

Color photographs of major activities and OE discoveries will be included in each report and included in both draft and final submittals.

5.2.1 Unit D-1 Technical Memorandum

The remediation contractor will prepare a technical memorandum that describes the work performed at Unit D-1. The memorandum will address:

- Subsurface clearance of Unit D-1 and a 200-foot buffer area in the South Valley
- Point clearance and excavation of fill soil from eight lots on Unit D-1
- Backfill soil to eight lots on Unit D-1
- 100-percent QA/QC of point clearance of Unit D-1
- Areawide activities at Unit D-1.

5.2.2 Technical Memorandum 2

The remediation contractor will prepare a technical memorandum that will describe work performed under the OE RDD in each sector and identify sectors where work is complete or in progress before new homes are occupied. The technical memorandum will assess the need for access controls and will recommend appropriate access controls, if needed. The technical memorandum will address:

- Status and progress of OE remediation of the remainder of the South Valley, Ridge, and North Valley
- Summary of post-remediation risk assessment for the South Valley or entire site, depending on when remediation is complete.
- Cleanup of TNT Strips.

5.2.3 Ordnance and Explosives Project Closure Report

The project closure report will document completion of all OE phases of the Tourtelot Remediation Project (OE point clearance, 100-percent QA/QC, and areawide clearance). The project closure report will also include the following:

- Documentation of point and areawide clearance of the Project Site
- Remediation of TNT-affected soils containing 10 percent or more of explosives
- Descriptions and locations of all OE or significant OE-scrap identified during the OE clearance activities
- Restoration/preservation of wetlands
- Agency review and approval of the Unit D-1 technical memoranda.

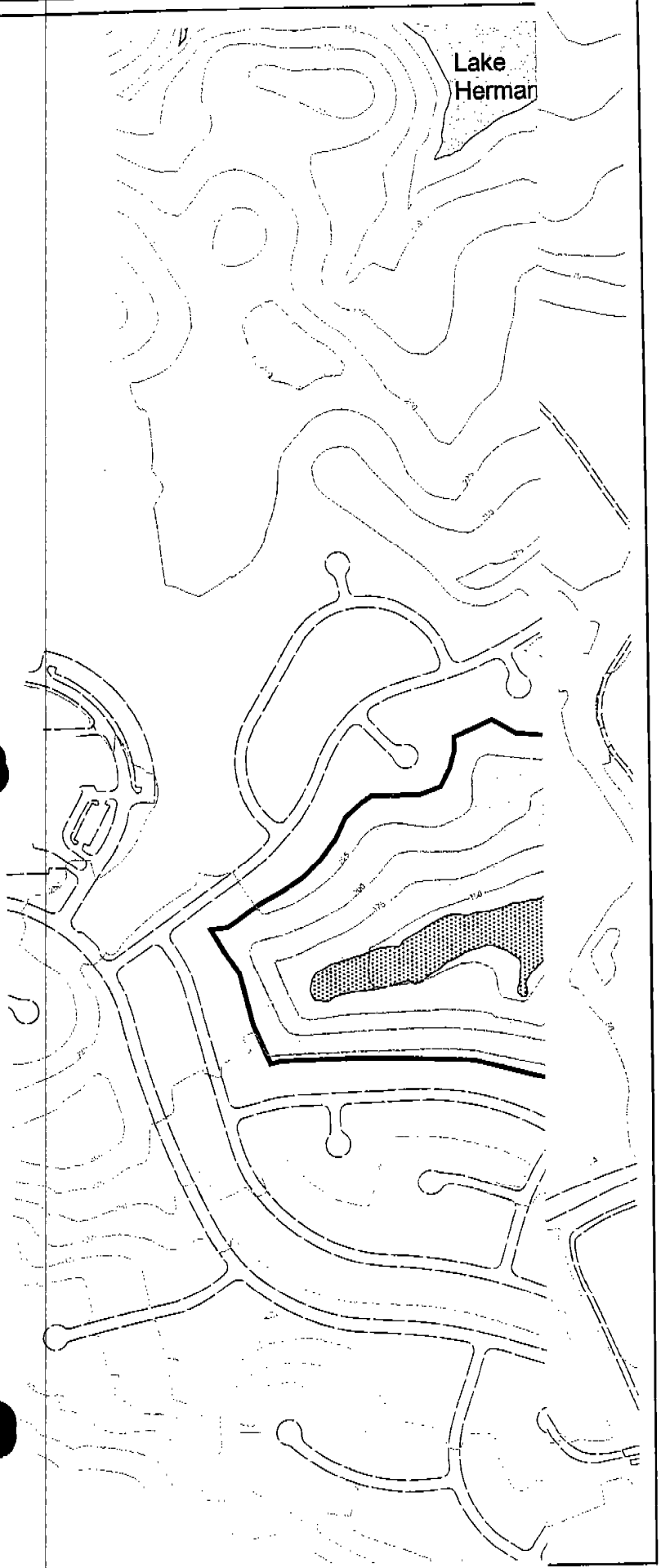
The project closure report will be prepared in accordance with the Data Item Description (DID), Site-Specific Removal Report (DID OT-030), as provided by the U.S. Army Engineering and Support Center, Huntsville.

5.2.4 Operation and Maintenance Plan

Following completion of the OE remediation activities, operation and maintenance (O&M) activities will be performed to monitor and maintain the effectiveness of the remedial actions at the site. The O&M activities include groundwater, surface water, subdrain, and seep monitoring; wetlands mitigation monitoring; erosion control; and slope stability monitoring. An overview of the O&M activities is provided in Chapter 6.0 of the non-OE RDD. Wetlands mitigation and slope stability monitoring are detailed in Appendix E and Appendix F of the non-OE RDD.

color picture

-to be scanned-



Planimetric features

Buildings

Roads/Trails

25 Foot Contour

/2714/data/cityofbenicia/arcview/projects/sectors-sep-dist-maps.apr (View_Figure5-1)

Final

N

300 0 300 600 900 Feet

FIGURE 5-1

Site Areas Addressed By Technical Memorandums

Tourtelot Cleanup Project
Benicia, California

FEBRUARY 2002

6.0 QUALITY CONTROL PLAN

6.1 INTRODUCTION

6.1.1 Purpose

The purpose of this QC Plan is to document the roles, responsibilities, and procedures that will be used to ensure quality throughout the OE remediation of the Project Site. It is based on the USACE DID for a QC Plan (DID OE-005-11).

6.1.2 Scope

This plan includes a designated QA/QC organization with the authority to enforce all provisions. The plan governs all operations, both on and off site, associated with this OE remedial action. It covers audit procedures, nonconformance corrective action procedures, data management, anomaly acquisition and reacquisition, field operations, equipment calibration maintenance requirements, and pass-fail criteria for audits and records. The QC Plan is designed to follow the sequence of field operations.

6.2 QUALITY ASSURANCE/QUALITY CONTROL ROLES AND RESPONSIBILITIES

6.2.1 California Environmental Protection Agency, Department of Toxic Substances Control

DTSC is the lead regulatory agency for the project. As such, they are responsible for the final review and approval of this QC Plan.

6.2.2 U.S. Army Corps of Engineers

USACE will provide technical oversight of the project, including:

- Review this OE RDD and the ESS (Appendix C).
- Provide a site geophysicist to review all aspects of the geophysical mapping, data processing, and anomaly reacquisition.
- Provide a Site Safety Specialist to observe all field operations. The Site Safety Specialist will ensure that the remediation contractor establishes the appropriate daily safety routines as specified in this OE RDD and the OE SSHP (Appendix F).

6.2.3 Granite Management Corporation

Granite is responsible for coordinating with DTSC and USACE on the project approach and technical issues. Granite's Project Coordinator will ensure all parties are kept informed of QC issues and progress of operations.

6.2.4 Quality Assurance Contractor

The QA Contractor will be responsible for oversight of all OE operations for field activities to be implemented by the Remediation Contractor. The QA Contractor will check conformance to this QC plan by performing audits, surveillance, document reviews, and QA functions. The QA Contractor will report to Granite's Project Coordinator and has the authority to require corrective actions and stop work, as needed, to ensure compliance with the Remediation Contractor's QC Plan.

6.2.5 Remediation Contractor

The remediation contractor will be responsible for implementation of this QC Plan. Key QC positions are listed below:

- QC Manager
- OE Safety Manager
- OE SSO
- Project Engineer
- Project Manager
- Geophysical Technical Manager (GTM)
- Field QC Staff.

An organization chart showing the lines of authority for implementation of a three-phase control system for monitoring QC activities is shown in Figure 6-1.

These key QC personnel will not be replaced without the concurrence of DTSC. The QC Manager will provide the names, qualifications, duties, and responsibilities of each proposed replacement to DTSC, USACE, and Granite.

The responsibilities, duties, and authorities of key QC personnel are discussed in the following sections. Rèsumès of the Earth Tech staff personnel proposed for the positions if Earth Tech serves as the remediation contractor are provided in Appendix L.

6.2.5.1 Quality Control Manager

The QC Manager will be principally responsible for oversight of all OE operations for field activities to be implemented by the SUXOS and for implementing this plan. The QC manager will have knowledge of all requirements mandated by OSHA,

USACE, U.S. EPA, Title 8 CCR, and the Remediation Contractor's Corporate Health and Safety Program. The QC Manager will hold a college degree in engineering, geology, or related field. The QC Manager will have a minimum of 10 years of experience in managing or auditing environmental field activities. The QC Manager, or designee, performs audits, surveillance, document reviews, and QC functions as required to determine the continued effectiveness of the QC Plan. The QC Manager will, as necessary, audit compliance with the QC Plan and perform OE safety reviews of selected project tasks. The QC Manager has the authority to require corrective actions and to stop work, as needed, to ensure compliance with this plan.

6.2.5.2 Ordnance and Explosives Safety Manager (OESM).

The OESM will be principally responsible for oversight of all OE operations for field activities to be implemented by the SUXOS. The OESM will have knowledge of all requirements mandated by OSHA, USACE, U.S. EPA, Title 8 CCR, and the remediation contractor's Corporate Health and Safety Program. The OESM will be a United States citizen and a graduate of either the U.S. Army Bomb Disposal School or the U.S. Naval Explosive Ordnance Disposal School. The OESM will have at least 15 years of UXO experience, which may be a combination of active-duty military EOD and contractor UXO experience, including 10 years in supervisory positions. The OESM will be directly responsible to the Project Manager.

The OESM, or his/her designee, will interface with the OE staff, the SUXOS, and the OE SSO on OE safety functions of the project and will coordinate activities with the Project Manager. In addition, they will, as necessary, perform audits, surveillance, document reviews, and other OE safety functions as required to determine the continued effectiveness of the OE SSHP. The OESM will, as necessary, audit compliance with the OE SSHP, and will perform OE safety reviews of selected project tasks. Other responsibilities will include, but not be limited to:

- Performing and documenting regular and frequent OE site hazard inspections and observing employees at work
- Stopping work when necessary to prevent injury or illness associated with OE and to ensure human and environmental health and safety
- Investigating all injuries and illnesses resulting from OE-related incidents
- Performing random health and safety assessments in the field, implementing corrective measures for site-specific health and safety deficiencies, and verifying resolution of any resulting corrective actions

- Overseeing the SUXOS, who will be responsible for all OE operations to be implemented. The SUXOS will report directly to the Project Manager.

6.2.5.3 Ordnance and Explosives Site Safety Officer.

The OE SSO is responsible for implementation of the OE SSHP and will provide overall direction of the health and safety function for field activities. The OE SSO will have knowledge of all requirements mandated by OSHA, USACE, U.S. EPA, Title 8 CCR, and the Remediation Contractor's Corporate Health and Safety Program. The OE SSO will be a graduate of either the U.S. Army Bomb Disposal School or the U.S. Naval Explosive Ordnance Disposal School. The OE SSO will have documented site safety experience and a minimum of 10 years of experience in ordnance remediation or disposal operations. The OE SSO will perform audits, surveillances, document reviews, and other health and safety functions as required to determine the continued effectiveness of the OE SSHP. Other responsibilities include, but are not limited to:

- Ensuring regulatory and operational compliance with OSHA requirements, the OE SSHP, and the remediation contractor's corporate health and safety requirements.

- Reviewing health and safety training and medical monitoring.

- Monitoring the labeling, shipping, and control of hazardous or potentially hazardous samples and materials, and briefing all field personnel concerning health and safety requirements.

The OE SSO has the authority to require corrective actions and to stop work, as needed, to ensure compliance with the OE SSHP.

6.2.5.4 Project Engineer.

The Project Engineer, who is responsible for the overall direction, coordination, technical consistency, and review of the OE RDD, will monitor the performance of all project staff through the Project Manager.

The Project Engineer will have the authority to select or dismiss staff, select or terminate major remediation contractors and subcontractors, approve or disapprove budgets and schedules, stop work, and communicate with the Granite Project Coordinator, as necessary, to evaluate the progress on any task and ensure the early resolution of any problem.

The Project Engineer may delegate authority to appropriate personnel to ensure activities are conducted in a compliant, cost-effective, and timely manner. However, responsibility for the project will remain with the Project Engineer.

6.2.5.5 Project Manager

The Project Manager, who will report directly to the Project Engineer, will be fully responsible and accountable for all project activities and will serve as the focal point and main channel of communication between the Granite Project Coordinator and the Project Team regarding technical and scheduling matters. The Project Manager will be responsible for:

- Reviewing and approving sampling, testing, and field investigation methods and QC Plan, including designs, schedules, and labor allocations
- Reporting any significant conditions adverse to quality and obtaining concurrence by the Granite Project Coordinator on proposed resolutions
- Reviewing QA audit reports and any resulting corrective action disposition.

6.2.5.6 Geophysical Technical Manager.

The GTM will be responsible for oversight and direction of all geophysical activities for the investigation.

The GTM will interface with the Granite Project Coordinator and regulatory agencies regarding the quality of the geophysical data collected. The GTM will also track all QA/QC results of the geophysical survey on a spreadsheet that will tabulate the survey area identified, coordinates, and date surveyed. A QA summary will be prepared and submitted to the proponent's Project Coordinators, DTSC, and Project Manager.

The GTM has the authority to require corrective actions and to stop work, as needed, to ensure compliance with the remedial design.

6.2.5.7 Field QC Staff.

The Field QC staff will be maintained under the direction of the QC Manager (or designee) during all phases of the remediation work. The Field QC staff will have knowledge of all requirements mandated by OSHA, USACE, U.S. EPA, Title 8 CCR, and the Remediation Contractor's Corporate Health and Safety Program. In addition, each Field QC staff member will have a minimum of 5 years of experience in performing environmental field activities related to the specific discipline for which they are assigned field investigation QC responsibility (i.e., UXO Technician, geophysicist). Field QC staff members will be responsible for implementation of the QC Plan. Field QC staff are responsible for:

- QC of sampling, testing, field investigation, and remediation activities
- Ensuring that OE remediation activities conform to this QC Plan, including enforcement up to and including work stoppage
- Evaluating the job performance of field crews. This work will be completed daily by each Field QC staff member at the job site. The Field QC staff will review the markups daily to ensure they are complete and correct.

The Field QC staff members have the authority to require corrective actions and to stop work, as needed, to ensure compliance with the QC Plan.

6.3 DEFINABLE FEATURES OF WORK AND PHASE MEETINGS

6.3.1 Definable Features of Work

The definable features of work (DFW) for this project include site preparation (vegetation removal, removal and disposal of construction debris, removal and disposal of interior fencing), surveying and marking of grids, surface clearance, detection and mapping, intrusive investigation, disposal of OE and OE scrap, remediation of TNT-affected soils, areawide clearance, surveillance of grading activities and site restoration.

6.3.2 Phases of Control

For each of the DFW, field QC will be ensured through four audit phases: (1) readiness review (preparatory phase), (2) the initial phase, (3) the follow-on phase, and (4) the final phase. The QA/QC Manager will be responsible for performance of the QC phases as follows:

6.3.2.1 Readiness Review (preparatory phase).

This phase will be performed prior to mobilization to the site and will include:

- A review of guidance documents
- A review to verify that all equipment has been tested and calibrated
- A check to ensure that provisions have been made to provide required control inspection and testing
- An examination of the work area to ensure that all required preliminary work has been completed

- A physical examination of required equipment and sample work to ensure that they are on hand, conform to approved or submitted data, and are properly stored

- A review of the OE SSHP to ensure safety requirements are met

- A discussion of procedures for performing the work, including repetitive deficiencies, documentation of OE operation procedures, and standards for that phase of work

- A check to ensure that all pertinent documents have been accepted by DTSC

- A check to ensure that all required permits have been obtained and are posted at the job site, as necessary

- A check that all required health and safety equipment and supplies, field notebooks, data sheets, and other activity documentation record forms are available

- A review to ensure that all procurement documents (for materials, equipment, and subcontractors) are in order

- A check to ensure that all procedures and facilities for handling, holding, or disposing of OE and OE-related scrap are in place

- A review of all emergency procedures

- An assessment of anticipated weather conditions and potential affects it may have on production/quality.

The readiness review will be documented for each DFW on the preparatory-phase checklist (Appendix H) and signed by the Project Manager and the QC Manager.

6.3.2.2 Initial Phase.

The initial phase consists of a review of the work practices and procedures.

This phase will be accomplished in the field at the beginning of each DFW and will include:

- A verification of work plan compliance, including required control inspection and testing

- Establishment of level of workmanship and verification to meet minimum acceptable workmanship standards

- Resolution of all differences

- Safety check to include compliance with and upgrading of the OE SSHP; review of the OE SSHP with each worker.

The initial phase will be repeated for each new crew to work on site, or whenever acceptable specified quality standards are not being met.

6.3.2.3 Daily Inspection (follow-up phase).

The followup phase is the continued inspection of practices and procedures for the remainder of site activities for each DFW.

The QC Manager or designee will perform daily inspections/surveillances of job site activities to ensure continuing compliance with contract requirements, including control testing until completion of the DFW. Appropriate technical assistance will be provided to perform the inspections/surveillances as necessary for the specific field activities being performed. The inspections/surveillances will include, but not be limited to, the following:

- Examination of the quality of workmanship

- Compliance with required submittals

- Verification that all required equipment calibration has been performed and that inspection and standardization results comply with this OE RDD

- Check for defective, damaged, or out-of-calibration equipment

- Verification, inspection, and documentation of delivery, and storage of material and equipment to the site

- Performance of follow-up checks and correction of all deficiencies prior to the start of additional features of work that may be affected by the deficient work

- Documentation of the daily inspections of field activities on Daily QC Report Form (Appendix H).

6.3.2.4 Final Inspection.

The QC Manager will conduct a complete inspection of the work and develop a list of any items that do not conform to the OE RDD at the completion of each DFW. This list will be included in the QC documentation and will identify the projected date the deficiencies will be corrected. The Project Manager and the QC Manager

will make a second completion inspection to ascertain that all deficiencies have been corrected and notify the DTSC, USACE, and Granite of their findings. The completion inspection and any required deficiency corrections will be accomplished within the time specified for completion of the work.

6.3.2.5 Control Documentation.

All inspection/surveillance documentation will be maintained in the project files and will include:

- All equipment standardization results and equipment maintenance results
- Preparatory-phase checklist
- QC-related meeting minutes
- All audit documentation and nonconformance and corrective action documents
- Corrective action acceptance documentation
- Daily QC Report Forms detailing the following information:
  - Remediation contractor/subcontractor personnel and their area of responsibility (trades)
  - Weather conditions
  - Work performed each day including location, description, and worker(s)
  - Test and/or control activities performed with results and references to the OE RDD requirements; deficiencies should be noted along with the corrective action
  - Quantity of materials received at the site with statement as to acceptability and storage
  - Job safety evaluations stating what was checked, results, and instructions or corrective actions.

The Daily QC Report will be the primary document, with all other applicable reports attached to it. The Daily QC Reports will be kept on site. All calendar days will be accounted for throughout the length of the field effort. Reports will be signed

and dated by the QC Manager. The report from the QC Manager will include copies of reports prepared by the Field QC staff. Copies of daily QC Reports will be provided to the USACE Site Safety Specialist.

6.4 AUDITS

6.4.1 Purpose

The purpose of this procedure is to establish methods of planning, conducting, and documenting a formal and comprehensive audit program to verify implementation of the QC Plan.

An audit is an examination and evaluation performed to determine whether applicable elements of the site-specific QC Plan have been performed, documented, and effectively implemented in accordance with specified requirements.

6.4.2 Scope

This procedure applies to all audits performed on remediation contractor or subcontractor personnel activities affecting quality for the Tourtelot OE Remediation Project.

6.4.3 Responsibilities

The QC Manager is responsible for:

- Implementing and conducting an audit program of the remediation contractor and subcontractors' activities in accordance with the requirements of this procedure
- Reporting quality deficiencies to management
- Reviewing and evaluating audit reports to determine if quality deficiency trends are developing
- Evaluating the implementation and effectiveness of the QC Plan on a regular basis.

The Project Manager is responsible for:

- Reviewing audit results
- Attending pre-audit and post-audit meetings

- Implementing corrective action in response to Quality Deficiency Notices (QDNs) (Appendix H)

- Responding to QDNs within 30 days, or as stipulated in the audit report.

The remediation contractor's consultants, outside laboratories, and/or subcontractors are responsible for:

- Reviewing the remediation contractor's audit reports, including any QDNs

- Implementing corrective action, as required

- Replying to QDNs within 30 days of receipt, or as stipulated in the audit report.

6.4.4 Procedure

6.4.4.1 Objectives.

Audit objectives are as follows:

- To verify that the QC Plan is being implemented by evaluating objective evidence

- To assess the adequacy, effectiveness, and thoroughness of the QC Plan

- To verify conformance with approved procedures, work plans, and drawings and specifications

- To identify quality deficiencies

- To verify correction of previously identified quality deficiencies.

6.4.4.2 Scheduling Requirements.

The QC Manager will audit program and project-related activities at least once during the field effort. The QC Manager will perform audits of consultants, outside laboratories, and subcontractors. Reauditing to verify implementation and satisfactory completion of recommended corrective actions will be performed, as deemed necessary.

6.4.4.3 Scheduling of Audits.

The QC Manager will prepare a tentative schedule of audits in a manner that provides effective coverage and coordination with ongoing program activities. The audit schedule will be periodically reviewed and revised, as necessary, to ensure that coverage is maintained.

6.4.4.4 Unscheduled Audits.

Unscheduled audits will be performed if any of the following occurs:

- Significant changes are made in functional areas of the QC Plan, such as significant reorganization or procedure revisions
- There is evidence of a serious breakdown in the implementation of the QC Plan
- A systematic, independent assessment of program effectiveness is necessary
- It is necessary to verify implementation of recommended corrective actions.

6.4.4.5 Implementation.

Individual audits will be performed by audit personnel in conformance with the following procedures:

Preparation

Written Plan. An individual audit plan will be developed and documented. This plan will identify the audit purpose and scope, activities to be audited, applicable documents, and schedule of the audits. A checklist will be filled out for all audits to verify conformance.

Notification. Involved organizations will be notified of a scheduled audit within a reasonable time before it is to be performed (usually 2 to 4 weeks ahead of time). This notification may be in writing and should include the scope of the audit. Unannounced audits may be performed as required (Section 6.4.4.4).

Performance

Pre-audit Discussion. A brief conference will be conducted at the Project Site with cognizant organization/project management. The purpose of the conference

will be to confirm the scope, present the audit plan, introduce auditors, meet counterparts, discuss audit sequence, and establish channels of communication.

Audit

- Checklists will be used to maintain the depth and continuity of audits
- Objective evidence will be examined for compliance with applicable requirements
- If a quality deficiency is found during an audit, the auditor will complete the QDN (Appendix H).

Post-audit Conference. At the conclusion of the audit, a conference will be held with the management of the audited organization/project. If any quality deficiencies have been noted during the audit, the responsible management will be advised of the deficiency in sufficient detail to ensure that the problem is clearly understood.

6.4.4.6 Report.

An audit report will be prepared and signed by the QC Manager and will include the following information:

- Audit number
- Audit scope
- Audit date
- Auditor identification
- Controlling documents
- Personnel contacted
- Audit result summary, including an evaluation statement of elements audited
- Identification of any QDNs.

The report, with attached QDNs, will be distributed to the responsible management. The formal audit report will be distributed within 30 days (preferably within 2 weeks) of the audit.

The QC Manager will log the performed audits on the Audit Status Form (Appendix H, along with the number of QDNs, and track the responses, or close the audit if no QDNs were issued.

6.4.4.7 Follow-Up

By Audited Organization

The management of the audit organization will review the audit report and any QDNs. If a QDN has been issued, the management of the audited organization will determine and schedule the appropriate corrective action, including action to prevent recurrence. The audited organization will describe the corrective action taken on the QDN and submit the notice to the auditor within the designated time frame, which should not be more than 30 days after receipt of the audit report.

By Auditor

The QC Manager will:

- Verify that the audited organization completes the appropriate sections of the QDNs and submits the form within the designated time.
- Review the response and determine whether the response is satisfactory.
- Evaluate evidence of completion of corrective action to determine whether the action taken is satisfactory.
- Request an additional response if the response and/or corrective action is unsatisfactory.
- Close the QDN, if the response and/or corrective action is satisfactory. Annotate on the Audit Status form.
- Complete the Audit Closure blocks.

6.4.4.8 General Requirements for Auditors.

Personnel selected for QC auditing assignments by the QC Manager will have experience or training commensurate with the scope, complexity, or special nature of the activities to be audited. Personnel selected for QC auditing assignments will have, or be given, appropriate training or orientation to develop their competence to perform required audits. The QC Manager will determine auditor qualifications and the type of additional audit training required of auditors.

Lead auditors will have the experience or training necessary to ensure their competence in auditing skills, including:

- Knowledge and understanding of the standards and regulations applicable to field projects
- General structure of field investigation QC and applicable elements
- Auditing techniques of examining, questioning, evaluating, and reporting; methods for identification and follow-up of corrective action items, and close-out of quality deficiencies
- Audit planning in quality-related functions
- On-the-job training to include applicable elements of the audit program.

6.4.5 Records

Records pertaining to audits will include:

- Forms
- Audit Plans (notification and checklist)
- Audit Reports.

6.5 NONCONFORMANCE CORRECTIVE ACTION

6.5.1 Purpose

The purpose of this section is to:

- Verify that conditions adverse to quality (nonconformances) are identified and reported to appropriate management levels in an expedient manner.
- Verify that nonconforming items (e.g., test data, analyses) are appropriately marked and/or segregated and not used until corrective action has been completed.
- Verify that appropriate corrective actions or dispositions (accept, reject, repairs, or rework) have been recommended, approved, and implemented.
- Provide a system for the review and analysis of significant conditions adverse to quality (significant nonconformance) to determine their

causes and trends, and to verify that corrective actions will preclude recurrence.

6.5.2 Scope

This procedure will be implemented whenever a condition adverse to quality is identified.

6.5.3 Responsibility

All remediation contractor Project Team personnel will be responsible for identifying and reporting nonconformances.

The Project Manager is responsible for :

- Evaluating nonconformances to determine if the work should be stopped
- Proposing corrective action
- Implementing corrective action
- Evaluating nonconformance impact on prior work or on previously obtained data (if any), and notifying the Granite Project Coordinator.

The QC Manager is responsible for reviewing nonconformances to determine if trends adverse to quality are developing, and for proposing and implementing long-term corrective action to prevent recurrence of any identified material nonconformance and nonconformance trends.

6.5.4 Procedure

65..4.1 Identification and Reporting of Nonconformances.

A nonconformance exists if there is a deviation from or noncompliance with the QC Plan, approved procedures, OE RDD, or other project requirements. Nonconformances also include major errors in documented analysis, data or results, and deficiencies in documentation or any other aspect of the project that may materially affect quality. Personnel who identify a nonconformance will report the condition by:

- Completing Part A of the Nonconformance Report (NCR) (Appendix H)
- Requesting an NCR number from the QC Manager, who will enter the NCR into the Non Conformance Report Log (Appendix H)

- Distributing the NCR to the Project Manager and QC Manager.

6.5.4.2 Evaluation of Nonconformance Report.

The QC Manager and Project Manager will review the NCR to determine if:

- Ongoing work should be stopped. If work stoppage is required, procedures delineated in Section 6.5.4.5 will be followed.

- The nonconformance constitutes a condition materially adverse to quality. In such a case, they will determine the cause of the condition. Examples of conditions that may be materially adverse to quality are potentially material failure to implement the QC Plan, potentially material errors in data or analyses that had previously been approved, potentially material deviation from the approved OE RDD and other work plans, and conditions that may materially affect the schedule of the work. Nonconformances that may constitute conditions materially adverse to quality will be reported to the Project Manager per Section 6.5.4.1.

- The nonconformance has any impact on previously obtained data or potentially material reports. If there is an impact, the Project Manager will note the potentially material impact in the "Remarks" section of the NCR, and notify the Granite Project Coordinator.

The evaluation will be documented through completion of Part B of the NCR.

6.5.4.3 Recommendation of Corrective Action or Disposition.

Persons determining corrective action or disposition will have demonstrated competence, an adequate understanding of the requirement, and access to pertinent background information. The QC Manager will recommend corrective action or disposition to resolve the nonconformance by completing Part C of the NCR.

6.5.4.4 Corrective Action Implementation and Verification.

The approved corrective action or disposition will be implemented by appropriate personnel. When completed, Part D of the NCR will be signed and dated by personnel performing the corrective action.

Corrective action, disposition implementation, and NCR closeout will be reviewed and approved by the Project Manager and the QC Manager.

The identification, cause, and corrective action for a nonconformance, which is a condition materially adverse to quality, will be reported to the QC Manager.

The completed NCR will be given to the QC Manager for logging into the NCR Log and filing in the QC records.

6.5.4.5 Work Stoppage.

If it is determined that work will be stopped, it will be noted in Part B of the NCR; the conditions necessary for work to resume will be noted in the Remarks section of Part B of the NCR.

The QC Manager will direct project personnel to stop all affected work. Work will not be restarted until the conditions required to restart work have been satisfied and written approval has been received from the QC Manager.

All work stoppages will be reported to the Project Manager, DTSC, USACE, and Granite Project Coordinator per Section 6.5.4.6.

6.5.4.6 Notification of Granite Project Coordinator.

If client notification is required, the Project Manager will submit a written report of the nonconformance to the Granite Project Coordinator. The Granite Project Coordinator will notify DTSC and USACE. The Project Manager will obtain concurrence from the Granite Project Coordinator for the proposed corrective action or disposition.

6.5.4.7 Tracking of Nonconformance Reports.

The QC Manager will monitor nonconformance reports to determine if trends adverse to quality are developing. If such trends are developing (e.g., repetitive NCRs-related to a particular activity, organization), the QC Manager will issue a written report identifying the problem to the Project Manager.

The Project Manager will evaluate the identified problem, propose, and implement a written corrective action program to prevent recurrence of the nonconformance.

6.5.5 Records

Records pertaining to Nonconformance/Corrective Action will include:

- NCR
- NCR Log

- Documentation of Notification to the Project Manager of Nonconformance
- Evaluation of NCR Trends
- Corrective Action Report for NCR Trends.

6.6 DATA MANAGEMENT

Data management guidance describing how project data and information will be collected, evaluated, and maintained is contained in Section 4.18 . The Data Management Plan designates responsibility for data and record management and details procedures and requirements for organizing, filing, storing, and controlling project data and records. All data and records will be maintained and preserved in the project files for final delivery/disposition, as directed by Granite, USACE, and DTSC. All QC records and documentation will be kept on site and made available for USACE and DTSC inspection.

6.7 FIELD OPERATIONS

Inspection and surveillance will be performed by the remediation contractor to maintain controls over all field activities identified in this OE RDD. The QC audit process for the OE remediation activities is shown on Figure 6-2. These controls will ensure that all personnel are qualified for the jobs they are performing and are using approved procedures and equipment. Controls will also ensure that specified process parameters and environmental conditions are maintained as required by this OE RDD. The pass/fail criteria for OE surface and subsurface clearance is specified in Figure 6-2.

6.7.1 Control Duties and Responsibilities

The QC Manager designee will conduct all phases of control and will be on site during all field activities. If the QC Manager alone cannot conduct an entire phase of control for a feature of work, or when multiple features of work may be concurrently ongoing, the QC Manager may be supported by qualified staff members.

6.7.2 Project Field Documentation

Field documentation is a permanent record of all activities associated with the site remediation project. All activities at the site will be recorded in the site Project Logbook(s). Field logbooks will be used to record specific information and activities related to collection, reduction, and/or interpretation of data (geophysical surveying or OE removal) in the field or Project Site.

Project field documentation will be maintained in accordance with the procedures discussed in Chapter 4.0.

6.8 PROJECT CONFORMANCE AUDIT SCHEDULE

The Project Conformance Audit Schedule (PCAS) (Appendix H) will be implemented at project start-up and will remain in effect throughout the life of the project. The PCAS will be used by the Field QC Staff as a working tool during all project audits/inspections and will be maintained in the project QC files.

The PCAS schedule will, at a minimum, provide the auditor/inspector with the schedule, checklist for audit/inspection area, reference for the check to be conducted, and a comment block to be filled in by the auditor/inspector for later documentation, used to generate QC Reports, QDNs, and NCRs, if required.

6.9 FIELD CHANGE CONTROL

6.9.1 Scope

The purpose of this section is to ensure that a thorough review of field changes is performed by qualified personnel.

6.9.2 Responsibilities

6.9.2.1 General.

Any individual, including the Project Manager, who is assigned to perform or supervise a task and recognizes the necessity for a field change, is responsible for developing the appropriate field change. They are required to complete and submit the Field Change Request Form (Appendix H) for review and approval.

6.9.2.2 Project Manager.

The Project Manager or a designated representative (e.g., QC Manager) is responsible for:

- Evaluating validity and acceptability of the field change request
- Evaluating and documenting the effect of the field change on the overall effort and schedule
- Accepting, qualifying, or rejecting the field change
- Soliciting and obtaining approval of any changes from the Granite Project Coordinator, who will interact with DTSC and USACE.

6.9.2.3 QC Manager.

The QC Manager is responsible for evaluating the changes to ensure that all QC requirements are met, that all changes to the OE RDD are properly reviewed and approved by the responsible personnel. The QC Manager will maintain the Field Change Request Log (Appendix H) to track all field changes.

6.9.3 Procedure

6.9.3.1 Recognition of Necessity for Field Changes.

During the course of field activities, the approved OE RDD technical procedures, and design documents will be followed. This document has been developed to cover all contingencies that may be encountered during the field activities. In the event that a situation arises that has not been addressed in the OE RDD Report, the team performing the task will determine the best approach toward satisfactory completion of the task. The team will inform the Project Manager or QC Manager of the situation, and the following actions will occur:

- If warranted, affected activities will be stopped until the Project Manager or QC Manager evaluates the situation.
- Field changes will be drafted for approval by DTSC.

6.9.3.2 Instigation of Field Changes and Definition of Minor and Major Changes and Major Project Impact.

Field changes and minor and major project impacts will be defined as follows:

- A Minor Change is defined as a field change that would not adversely affect the quality of the data or product, or the rationale for the field procedures. Examples of minor changes are as follows:
  - Changing the sequence of the field activities
  - Changing any of the administrative requirements relative to a remedial effort with the exception of those requirements mandated by federal or state regulations (e.g., chain-of-custody procedures).
- A Major Change is defined as a field change that may adversely affect the quality of field activities or a major change in the scope of the activity. Examples of major changes are as follows:

- Significantly changing the area to be geophysically surveyed.

- Significantly changing the methods used to detect OE.

- A change with Major Project Impact is defined as a change that has a major impact on the scope of the activity and/or technical performance. Some changes defined as major changes may have major project impact.

- Field changes will be documented by completing the Field Change Request Form (Appendix H) and describing the reasons for the change, the recommended disposition, cost impact, impact on previous work, and the type of change (Minor, Major, Major Project Impact). The signed and dated form will immediately be provided to the Project Manager and QC Manager for review.

Minor changes may be implemented prior to approval by the Project Manager and the QC Manager.

Major changes will require the approval of DTSC.

6.9.3.3 Project Review and Approval of Field Changes.

All field change requests will be routed to the Project Manager for review and approval.

The Project Manager will:

- Appraise the changes in technical performance

- Appraise the effect of the change on project level of effort and schedule

- Check the appropriate box for acceptance or rejection of the field change

- Sign and date the form

- Provide form to the Granite Project Coordinator for interaction with USACE and DTSC.

The QC Manager will:

- Appraise conformance to the OE RDD specifications and the QC Plan

- Check the appropriate block for acceptance or rejection

- Sign and date the form

- Assist the Project Manager in negotiation of the changes

- Give the field change request a consecutive number from the project Field Change Request Log and log the request.

6.9.3.4 Final Disposition.

After the review and approval process has been completed, the Field Change Request Form will be forwarded by the Project Manager to the personnel responsible for the work and the QC Manager, with the following action requested:

- If approved, the personnel responsible for the work will implement the change.

- The QC Manager will note final disposition of field change request (e.g., change incorporated and work completed, change rejected, and work performed per original requirements) on the Field Change Request Form and the Field Change Request Log.

- The QC Manager will verify that all changes to the OE RDD are marked on all copies in use in the field and on file.

- The completed Field Change Request Form will be submitted to the project file.

If an implemented minor field change is not approved, it will be deemed a nonconforming condition and, as such, will be treated by the procedures for Nonconformance/Corrective Action.

6.9.4 Records

Records pertaining to Field Change Control will include:

- Field Change Request Form
- Field Change Request Log.

6.10 PERSONNEL QUALIFICATION AND TRAINING PLAN

6.10.1 Qualifications of On-site Personnel

The Project Manager and QC Manager will ensure that all personnel meet the qualification requirements to perform the duties of the job to which they were assigned. All OE Safety Specialists and UXO contractor personnel must meet minimum standards for education and experience as detailed in USACE EP 1110-1-18.

6.10.2 Site-Specific Training

As part of the mobilization process, the remediation contractor will perform site-specific OE training for all personnel assigned to this project. The purpose of the training is to ensure that all personnel fully understand the procedures and methods that will be used to perform operations at the Project Site, their individual duties and responsibilities, and all safety and environmental practices/procedures associated with the operations. All personnel will be trained as they arrive and will not be allowed onto the Project Site until they have received site-specific training. Training topics/issues and responsibilities are as follows:

- The OE Supervisors and Specialists will receive operations briefings and training on their duties and responsibilities. All project personnel will receive ordnance recognition and OE safety precautions briefings. The SUXOS or OE SSO will perform this training.

- All personnel will receive additional training on the individual equipment they will operate on site.

All OE personnel will receive detailed training on the OE RDD and the OE SSHP. All training activities will be documented utilizing appropriate forms (e.g., training and field logbooks).

Prior to mobilization, all project personnel will receive HAZWOPER 40-hour/ 24-hour (or 8-hour refresher) training, as required. Additionally, all on-site personnel must be participating in a medical surveillance program and must have completed a pre-placement or annual physical examination that complies with the requirements of 29 CFR Part 1910.120. Project personnel must have been certified as fit to work by an Occupational Physician certified in Occupational Medicine by the American Board of Preventive Medicine, or one who is board-eligible. Documentation of the medical personnel will be filed on site.

6.10.3 Safety Training/Briefings

All on-site Project Team personnel will routinely participate in two types of safety briefings: a daily general briefing and a daily tailgate safety briefing. Additionally,

the SUXOS may hold a safety stand-down when any degradation of OE safety is noted.

6.10.3.1 Daily General Briefing.

The daily general briefing will be conducted for all on-site Project Team personnel at the Command Post prior to beginning work. The briefing will cover general hazards for the project and any new safety issues or hazards that have been identified since the last briefing. The Project Manager will conduct the briefing, with input from the SUXOS and OE SSO.

6.10.3.2 Daily Tailgate Briefing.

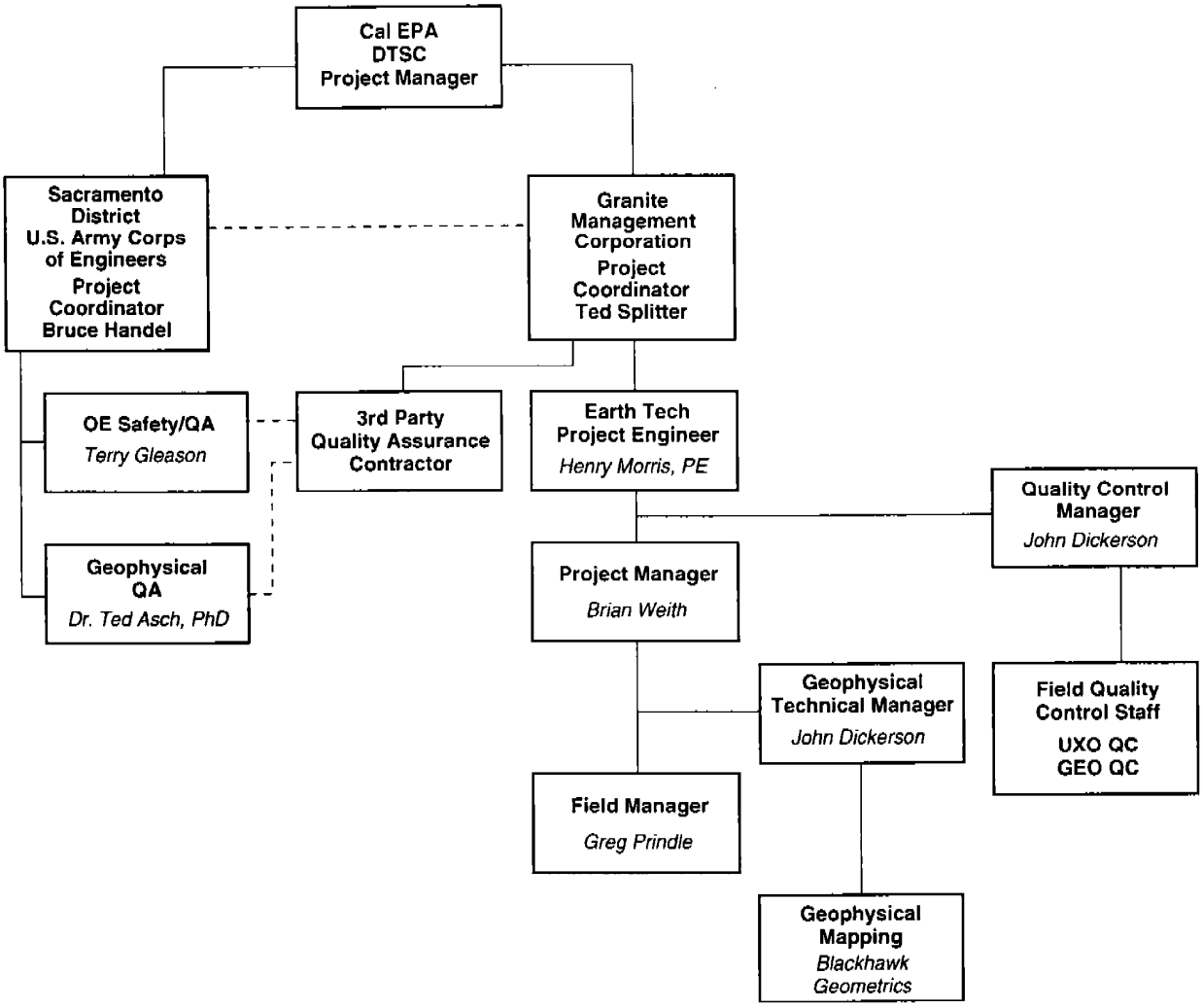
The SUXOS and OE SSO will conduct daily tailgate safety briefings focusing on the specific hazards anticipated for each work site during that day's operation, as well as the safety measures that will be used to eliminate or mitigate those hazards. It will also refer to other ongoing operations within the area whose proximity may have safety ramifications. As work progresses and the teams' locations change from grid to grid, this tailgate briefing will be used to review any corresponding changes in ingress/egress and emergency evacuation routes. Written records of these briefings and the signatures of personnel attending the briefings will be maintained.

6.10.3.3 Visitor Safety Briefings.

Site visitors must receive a safety briefing prior to entering the operating area and must be escorted at all times by an OE-qualified individual. All visitors entering the project area must first sign in at the Command Post.

6.11 SITE ACCESS CONTROL

The remediation contractor will control access into operating areas and will limit access to those personnel necessary to accomplish the specific operations, or to those with a specific purpose and authorization to be on site. No hazardous operations will be conducted when unauthorized personnel are in the vicinity of the investigation and clearance areas. If at any time an unauthorized person is sighted within the defined MSA, operations will be immediately halted. Operations will not resume until the person has been safely escorted from the area. Site security personnel will perform perimeter inspections daily to ensure fencing remains intact.



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EXPLANATION

OE Ordnance and Explosives

DTSC Department of Toxic Substances Control

QA Quality Assurance

QC Quality Control

Project QA/QC Organizational Chart

Final

Figure 6-1

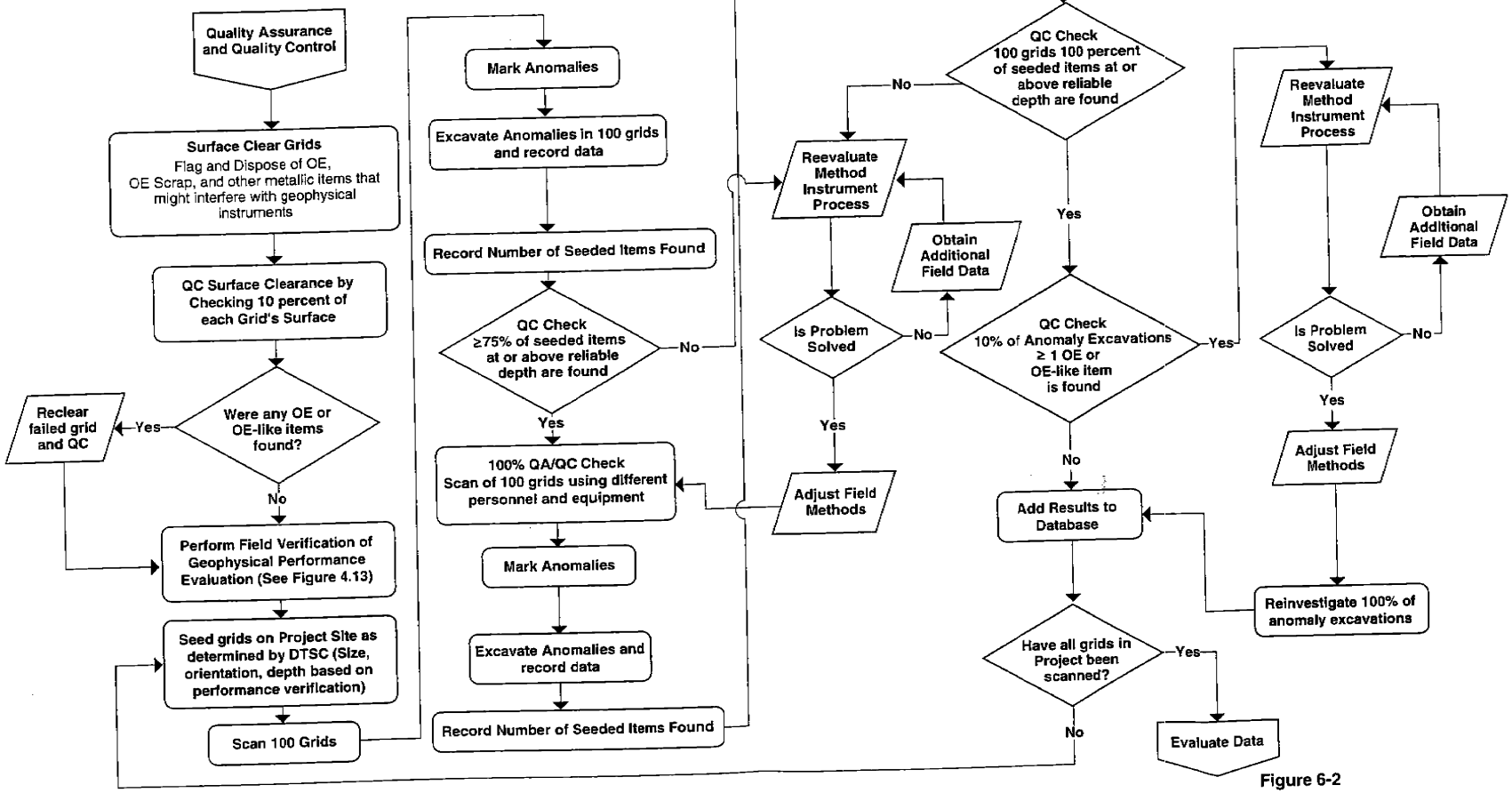

Figure 6-2
Quality Assurance & Quality Control

Final

EXPLANATION

OE Ordnance and Explosives

Note: 3rd Party QA will follow this chart.

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7.0 REMEDIAL DESIGN MANAGEMENT PLAN

7.1 INTRODUCTION

The Remedial Design Management Plan defines the delegation of authority to, and the responsibilities of, the personnel and organizations involved in the execution of the project. The Remedial Design Management Plan will be used to manage all aspects of implementing the OE RDD.

7.2 PROJECT MANAGEMENT ORGANIZATION

This project organization is designed to provide a clear line of management responsibility and authority to facilitate delegation of authority to the management level responsible for completing the OE removal activities described in this OE RDD. The organization reflects strong technical and management leadership and provides a direct line of communication between OE the remediation contractor and Granite's Project Coordinator. Lines of communication from the OE remediation contractor to DTSC and USACE, Sacramento District, are through the Granite Project Coordinator. The OE remediation contractor lines of authority flow from the Project Engineer to the support staff.

It is the responsibility of all management personnel who may affect the quality of the data collected, studies, operations, or other quality-related functions to be aware of and implement the policies and practices set forth in this document. The organizational structure for this project is shown on Figure 7-1.

7.2.1 California Environmental Protection Agency, Department of Toxic Substances Control

It is the role of DTSC to review and approve all related documents necessary to complete the actions described herein. All notices, comments, approval, and other communication from DTSC will be sent to the respondents' project coordinators; USACE, Sacramento District; and Granite. DTSC is the lead regulatory agency for the project and reviews and approves all documents related to the investigation and remediation of the Project Site.

7.2.2 Granite Management Corporation

Granite coordinates closely with DTSC and USACE on the project approach and technical issues through their Granite Project Coordinator.

7.2.3 Granite Project Coordinator Responsibilities

The Granite Project Coordinator's primary responsibility is for the overall coordination of the project with DTSC and USACE. Additional responsibilities include receiving all notices, comments, approvals, and other communication from

DTSC. The Granite Project Coordinator works closely with the Project Engineer and Project Manager and all other team members to ensure that project goals and objectives, including project schedule, are met. Lines of authority for the Granite Project Coordinator flow directly from the respondents named in the Order. The Granite Project Coordinator serves as the primary point of contact for the Project Engineer.

7.2.4 Qualified OE Remediation Contractor

The OE remediation contractor will provide site personnel and technical staff to support the OE remediation of the Project Site. The Project Engineer is the primary point of contact for the OE remediation contractor. The Project Engineer may delegate authority to appropriate personnel to ensure activities are conducted in a compliant, cost-effective, and timely manner. However, responsibility for the project will remain with the Project Engineer.

7.2.4.1 Project Engineer.

The Project Engineer, who is responsible for the overall direction, coordination, technical consistency, and review of the OE remediation, will monitor the performance of all project staff through the Project Manager. The Project Engineer will have the authority to select or dismiss staff; select or terminate major subcontractors; approve or disapprove budgets and schedules; stop work; and communicate with the Granite Project Coordinator, as necessary, to evaluate progress on any task and ensure the early resolution of any problem. Communication with DTSC and USACE, Sacramento District, will be coordinated by the Granite Project Coordinator. The Project Engineer's specific responsibilities include:

- Performing final approval and review of project plans, all project deliverables, schedules, and manpower allocations for each task.
- Designating of a Project Manager.
- Ensuring availability of key personnel assigned to the project for the duration of the project.
- Overseeing coordination among management, field teams, and support personnel to ensure consistency of performance.
- Communicating, as necessary, with the Granite Project Coordinator to evaluate the progress of the program and to facilitate the early resolution of any potential problems.

7.2.4.2 Project Manager.

The Project Manager will establish and interpret project policies; monitor schedule; coordinate all reporting and other forms of communications; ensure necessary resources are made available; prepare plans; identify and resolve potential problems or conflicts; and provide for safe performance and quality of the work. Other duties, as appropriate, will include:

- Allocating work assignment and schedules to members of the Project Team, and orienting the staff to the objective of the OE RDD.
- Evaluating the qualifications of project staff and critical subcontractor personnel, and identifying individuals who need additional training.
- Assigning project field managers to direct specific field activities and providing them with the necessary resources.
- Tracking the performance of the investigation.
- Reviewing, approving, and consistently implementing the project planning documents (e.g., OE RDD) and procedures, including approval of geophysical techniques, schedules, and manpower allocations.
- Addressing specific tasks for compliance with federal, state, and local regulations/laws, and directives.
- Providing overall technical, quality, and performance consistency throughout the investigation.
- Identifying procurement needs (e.g., materials, services, subcontracts) and coordinating project procurements.
- Identifying, documenting, and notifying the Project Engineer; and the GTM, HSO, OESM, and project staff of changes in project scope.
- Reviewing the final report.
- Interacting with regulatory or public agencies at the request of the Granite Project Coordinator, and preparing progress reports.
- Disseminating project-related information from the Granite Project Coordinator and USACE.

- Preparing the OE RDD and related presentations at progress meetings between the Project Team and the Granite Project Coordinator.

7.2.4.3 Geophysical Technical Manager.

The GTM will be responsible for oversight and direction of all geophysical activities for the investigation. The GTM will have a degree in geophysics, geology, geological engineering, or a closely related field and a minimum of 5 years of directly related geophysical experience. The GTM will also have knowledge of various geophysical instrumentation detection capabilities and experience in the collection, analysis, and interpretation of geophysical data as it pertains to ordnance and landfill detection. The GTM will be directly responsible to the Project Manager.

The GTM is responsible for overall direction of geophysical operations. The GTM, or his/her designee, will interface with the Granite Project Coordinator, USACE Tech Manager, and regulatory agencies regarding the quality of the geophysical data collected. The GTM, or his/her designee, will track all QA/QC results of the geophysical survey on a spreadsheet that will tabulate survey area identified, coordinates, and date surveyed.

7.2.4.4 Ordnance and Explosives Safety Manager.

The OESM will be principally responsible for oversight of all OE operations for field activities to be implemented by the SUXOS. The OESM will have knowledge of all requirements mandated by OSHA, USACE, U.S. EPA, Title 8 CCR, and the remediation contractor's Corporate Health and Safety Program. The OESM will be a United States citizen and a graduate of either the U.S. Army Bomb Disposal School or the U.S. Naval Explosive Ordnance Disposal School. The OESM will have at least 15 years of UXO experience, which may be a combination of active duty military EOD and contractor UXO experience, and include 10 years in supervisory positions. The OESM will be directly responsible to the Project Manager.

The OESM, or his/her designee, will interface with the Project Manager, the SUXOS, SSO, and USACE Site Safety Specialist on OE safety functions of the project and will coordinate activities with the Project Manager. In addition, they will, as necessary, perform audits, surveillance, document reviews, and other OE safety functions as required to determine the continued effectiveness of the OE SSHP. The OESM will, as necessary, audit compliance with the OE SSHP, and will perform OE safety reviews of selected project tasks. Other responsibilities will include, but not necessarily be limited to:

- Performing and documenting regular and frequent OE site hazard inspections and observing employees at work.

- Stopping work when necessary to prevent injury or illness associated with OE and to ensure human and environmental health and safety.

- Investigating all injuries and illnesses resulting from OE-related incidents.

Performing random health and safety assessments in the field, implementing corrective measures for site-specific health and safety deficiencies, and verifying resolution of any resulting corrective actions.

- Overseeing the SUXOS, who will be responsible for all OE operations to be implemented. The SUXOS will report directly to the Project Manager.

7.2.4.5 OE Site Safety Officer.

The OE SSO will be principally responsible for execution of all health and safety operations for field activities, and will have knowledge of the OSHA requirements and corporate health and safety requirements specific to the Project Site.

The OE SSO is responsible for the implementation of the OE SSHP and will provide overall direction of the health and safety function for field activities. The OE SSO will be a United States citizen and a graduate of either the U.S. Army Bomb Disposal School or the U.S. Naval Explosive Ordnance Disposal School. The OE SSO will have at least 10 years of UXO experience, which may be a combination of active duty military EOD and contractor UXO experience. The OE SSO will be directly responsible to the Project Engineer. The OE SSO, or her/his designee, will administer health and safety functions of the project and will coordinate activities with the Project Manager. In addition, the OE SSO will perform any necessary audits, surveillance, document reviews, and other health and safety functions as required to determine the continued effectiveness of the OE SSHP. Other responsibilities include, but are not limited to:

- Ensuring regulatory and operational compliance with OSHA requirements, the OE SSHP, and the remediation contractor's corporate health and safety requirements.

- Reviewing health and safety training and medical monitoring.

- Working with the Project Manager, the SUXOS and the HSO to ensure that all health and safety requirements outlined in the OE SSHP are implemented in the field.

- Performing document reviews, and other health and safety functions as required, to determine the continued effectiveness of the OE SSHP.

- Performing random health and safety assessments in the field, implementing corrective measures for site-specific health and safety deficiencies, and verifying resolution of any resulting corrective actions.

- Monitoring the labeling, shipping, and control of hazardous or potentially hazardous samples and materials, and briefing all field personnel concerning health and safety requirements.

- Stopping work when necessary and requiring corrective actions to be taken to ensure compliance with the QC Plan.

7.2.4.6 Senior Unexploded Ordnance Supervisor.

The SUXOS reports to the Project Manager and is responsible for project setup in the field, including identifying and scheduling personnel resources, materials, and equipment. The SUXOS is assigned to oversee and control all field activities, and is responsible for field cost tracking through administrators and project billing. The SUXOS will also conduct project control assessments and provide purchasing support for small purchases necessary to initiate the project.

The SUXOS will provide site-level implementation of environmental protection, fire protection, occupational safety and health requirements, and permitting for this project. The SUXOS will coordinate activities with the Project Manager and other project personnel as appropriate. Duties of the SUXOS include, but are not limited to:

- Initiating OE remediation field activities with the required resources, materials, and equipment.

- Directing all field activities, supervising field staff and any subcontractors, and ensuring that field procedures described in the OE RDD are implemented.

- Maintaining daily records of work performed, personnel on site, and any work stoppages or communications with other agencies pertaining to the project.

- Managing equipment, preventive maintenance, decontamination, and calibration programs.

- Implementing a tracking system to ensure documentation of required corrective actions in the field.

7.2.5 City of Benicia

The City of Benicia, through the Memorandum of Agreement (MOA) with USACE (Support for Others Program), requested that USACE provide oversight of the OE QA and site safety at the Project Site. The City will prepare a task order for a qualified OE remediation contractor requiring them to take direction from USACE as defined in this plan. These actions will allow USACE to have a direct line of communication and authority over the OE remediation contractor as it relates to the QA and site safety for the OE remediation of the Project Site.

7.2.6 U.S. Army Corps of Engineers, Sacramento District

The primary role of USACE, Sacramento District, will be to provide technical oversight of the QA and site safety of all activities associated with the remediation of OE at the Project Site. USACE oversight will include, but not be limited to, the following: (1) review and approval of the OE RDD for the project. The OE RDD will contain all procedures for the OE remediation of the Project Site; (2) provide an on-site Site Safety Specialist to observe all field operations. The Site Safety Specialist will directly supervise OE operations, ensuring that the work is being performed safely and in accordance with USACE standards. The Site Safety Specialist officer has the authority to stop work if unsafe actions could harm workers on site or the public; and (3) provide a Site Geophysicist to review all aspects of the geophysical mapping, data processing, and anomaly reacquisition to ensure that the geophysical methods used at the site are in accordance with USACE standards.

The USACE will be responsible for providing safety and QA oversight and technical support to the OE USACE Site Safety Specialist. USACE will have knowledge of the OSHA requirements and corporate health and safety requirements.

The USACE Technical Manager will be responsible for providing OE and project technical oversight and support as requested by the Site Safety Specialist and the Project Manager.

The Site Safety Specialist will work closely with the USACE Technical Manager, and the Project Manager, and is responsible for project safety and QA programs for the on-site remediation process. The Site Safety Specialist will meet the prerequisites as identified in ER 835-1-92, as well as OSHA requirements. Responsibilities include:

- Ensure the remediation contractor establishes the required daily safety routines and procedures as described in this OE RDD at project start-up
- Stop work, when necessary, for safety and health concerns
- Monitor all OE-related project safety requirements

- Advise the remediation contractor on OE procedures
- Verify employee UXO qualifications
- Perform QA oversight for the OE remediation process.

The USACE HSO will review the OE SSHP to ensure compliance with USACE and OSHA safety standards. Also, the USACE HSO will provide health and safety technical support to USACE Site Safety Specialist, and the Project Manager.

7.3 COMMUNITY OUTREACH

An information repository has been established by the City of Benicia, Granite, and the USACE at the Benicia Public Library, 150 East L Street, Benicia, California. The repository is maintained by Granite. The repository provides local access to the various reports, fact sheets, and other significant documents generated during the continuing investigation and remediation of the Project Site. Project close-out documents, described in Chapter 5.0, will be placed in the information repository as they become available.

Granite, in concert with the City of Benicia and\ USACE, has established and will continue to maintain a mailing list of all persons who have expressed interest in the Tourtelot Remediation Project. The mailing list includes key contacts, as well as residents and businesses near the Project Site. A publicly accessible Internet Web page is currently available to the public and will be periodically updated to keep the public informed on the status of the Tourtelot Remediation Project.

DTSC and the City of Benicia have formed a Community Advisory Group for the Tourtelot Remediation Project. The Community Advisory Group reviews and comments on the primary project documents. Information contacts have been established by DTSC, the USACE, the City of Benicia, and Granite. These information contacts can respond directly to citizen inquiries regarding the Tourtelot Remediation Project. Information contacts are provided in Table 7-1. Information contact names and telephone numbers are also published in fact sheets and are available in the information repository.

7.3.1 Entity Responsibilities

Granite Project Coordinator

- Overall responsibility and control of withdrawal and relocation of residents, including briefing and notification requirements

- Identification of the MSA, and dissemination of information to the City of Benicia, the Benicia Fire Department, and the Benicia Police Department regarding planned field activities, addresses within the MSA, and recommended road closures at least 72 hours prior to scheduled withdrawal.

The Benicia Police Department

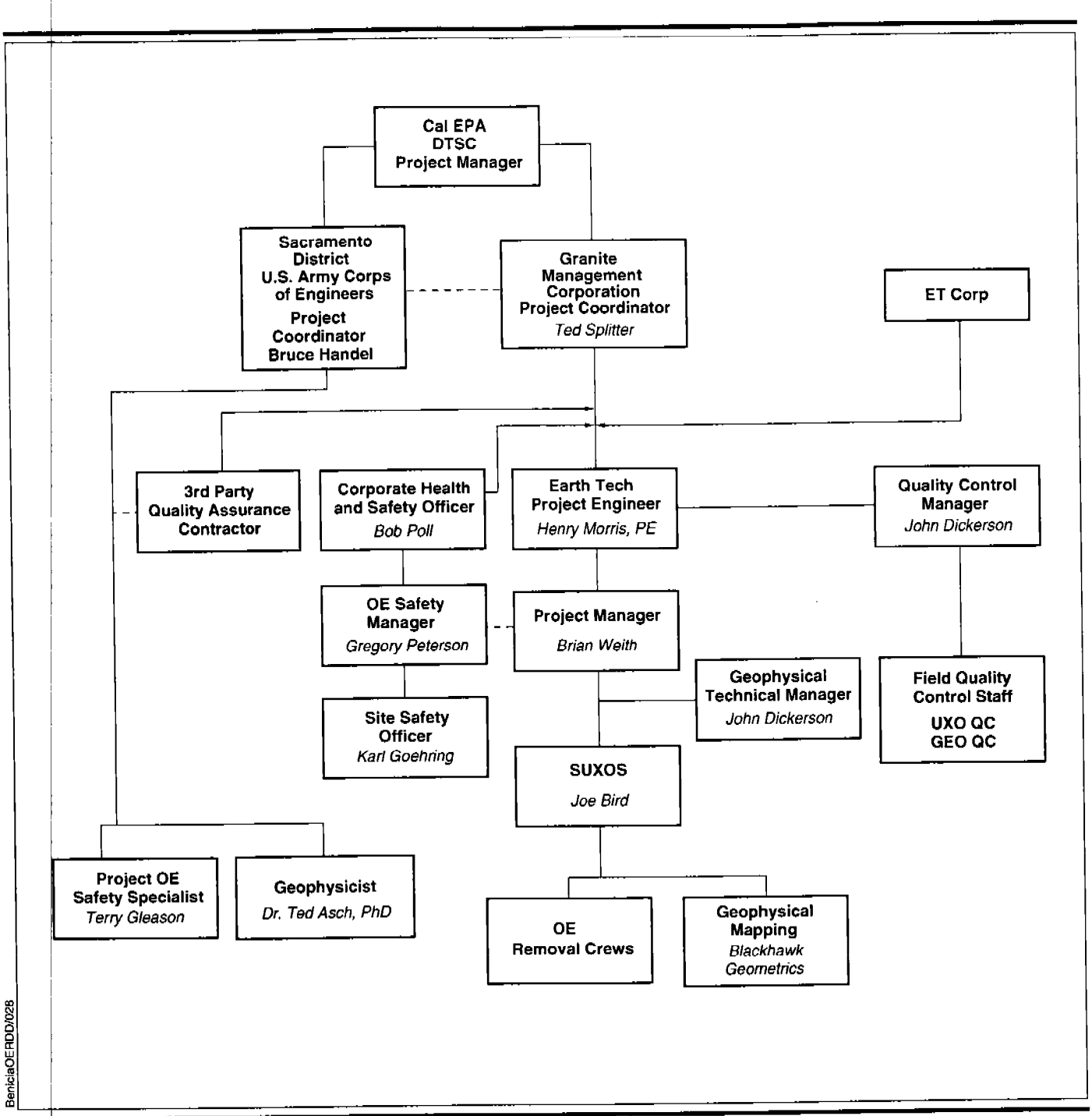
- Enforce the City of Benicia ordinance related to public withdrawal as necessary.

The Benicia Fire Department

- Provide support as necessary.

Table 7-1. Information Contacts

Organization	Name of Contact	Address of Contact	Telephone Number of Contact
Granite Management Corporation	Jason Keadjian	701 Southhampton Suite 209 Benicia, CA 94510	Voice: (707) 745-2112 Fax: (707) 745-3675
U.S. Army Corps of Engineers	Bruce Handel	1325 J Street Sacramento, CA 95814	Voice: (916) 577-7906 Fax: (916) 577-7865
City of Benicia	Heather McLaughlin	250 East L Street Benicia, CA 94510	Voice: (707) 745-2112 Fax: (707) 745-1196
Department of Toxic Substances Control (DTSC)	Jim Austreng	10151 Croydon Way Suite 3 Sacramento, CA 95827	Voice: (916)n 255-3702 Fax: (916) 255-3794



BeniciaOERDD/028

EXPLANATION

OE Ordnance and Explosives

DTSC Department of Toxic Substances Control

QA Quality Assurance

QC Quality Control

Project Organizational Chart

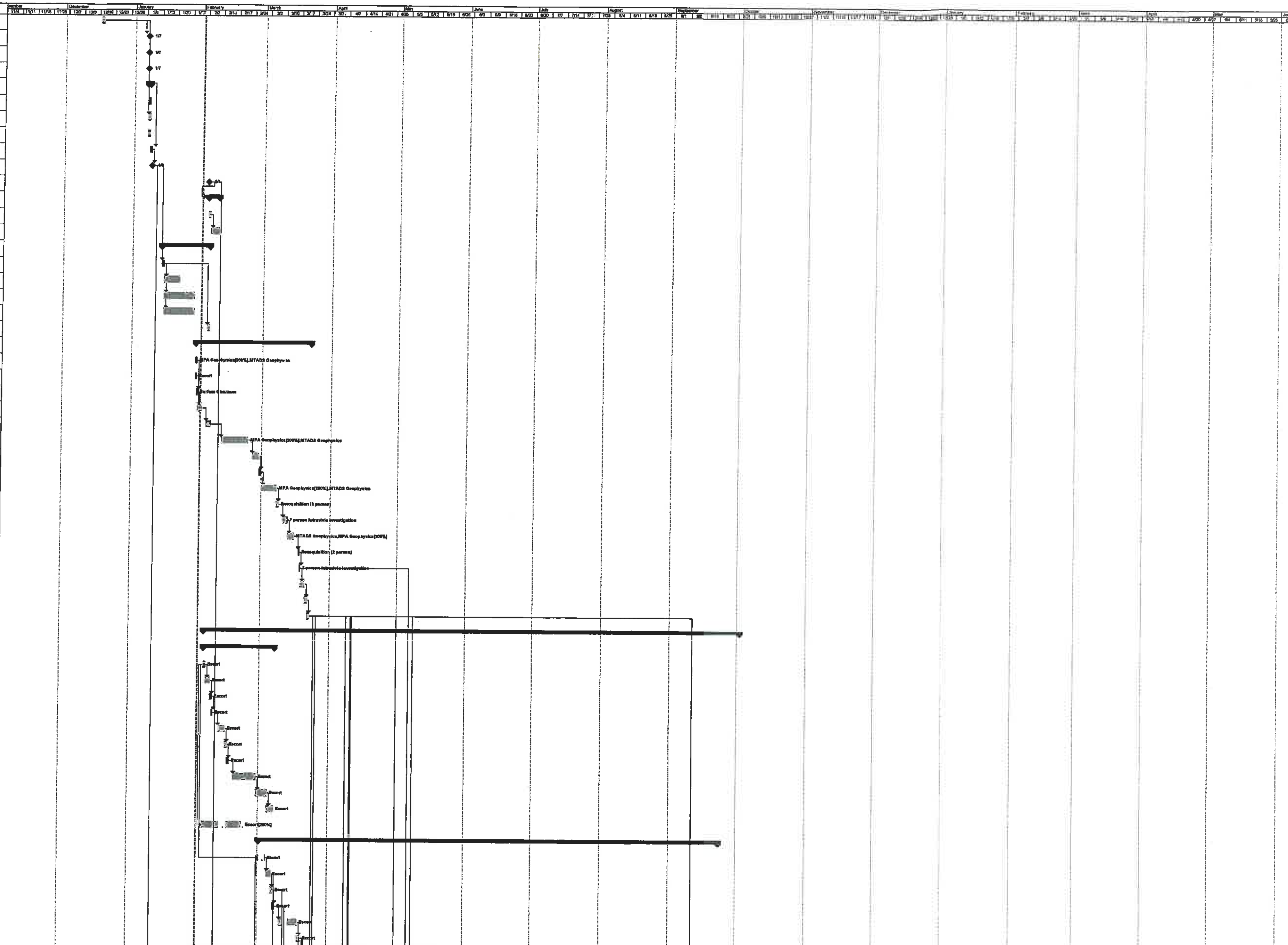
Final

Figure 7-1

APPENDIX A

PROJECT SCHEDULE

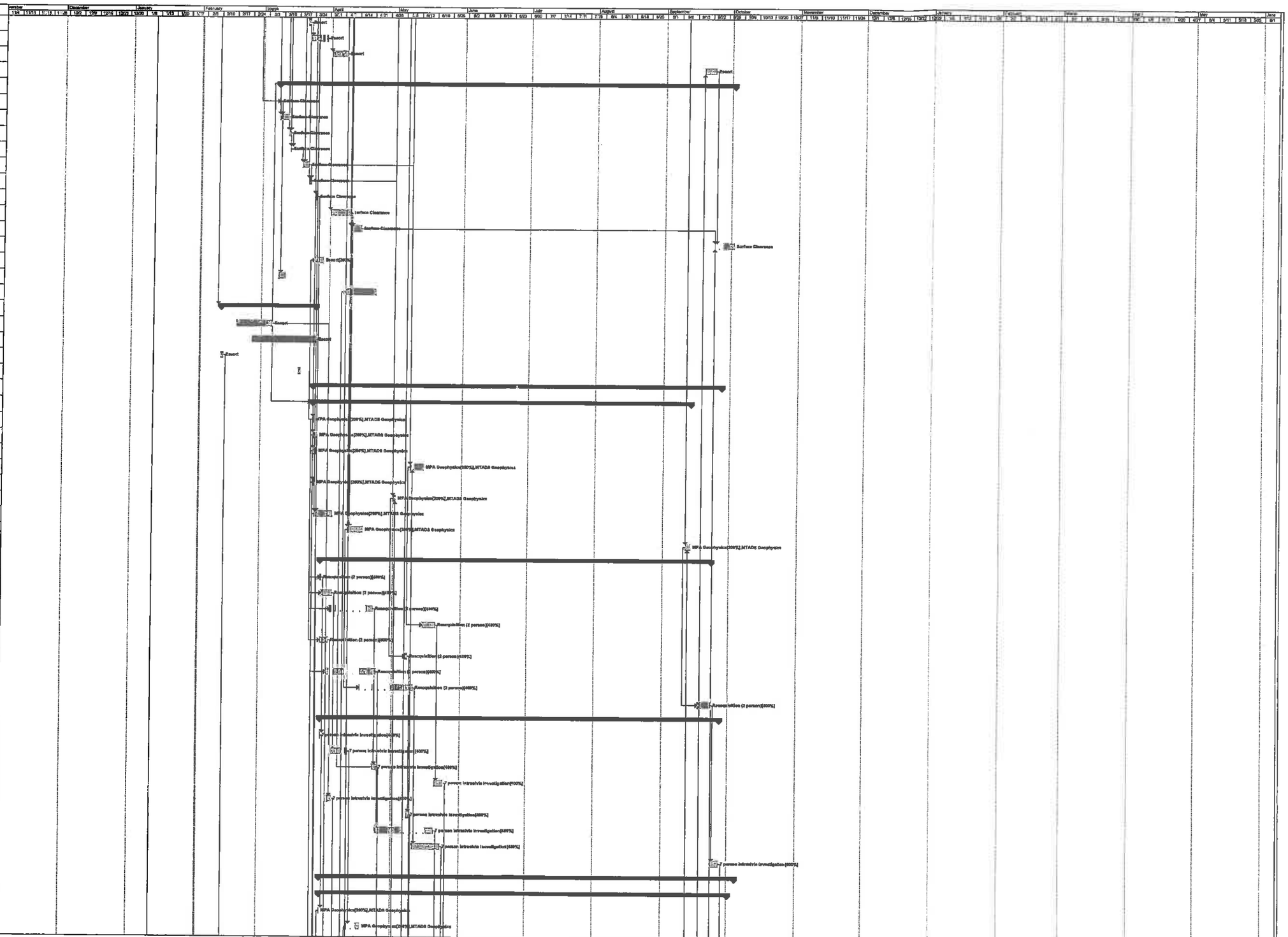
ID		Task Name	Duration	Start	Finish	Predecessors
1		Notice of Award (Spec. A-9)	1 day	Mon 12/17/01	Mon 12/17/01	
2		Execution of Contract and Bonds (Spec. A-10)	0 days	Mon 1/7/02	Mon 1/7/02	1
3		Claims Bond	0 days	Mon 1/7/02	Mon 1/7/02	
4		Performance Bond	0 days	Mon 1/7/02	Mon 1/7/02	
		Pre-Mobilization (Spec. B-3)	1 day	Mon 1/7/02	Mon 1/7/02	
		Proposed Health and Safety Plan (Final Draft OE RDD, Appendix F)	1 day	Mon 1/7/02	Mon 1/7/02	
7		BATF License	1 day	Mon 1/7/02	Mon 1/7/02	1
8		State of California Class E Blaster's License	1 day	Mon 1/7/02	Mon 1/7/02	
9		Engineer Approval of Pre Mobilization Submittals	1 day	Tue 1/8/02	Tue 1/8/02	6
10		Notice to Proceed (Spec. A-11)	0 days	Tue 1/8/02	Tue 1/8/02	9
11		Agency Approval of OE RDD	0 days	Mon 2/4/02	Mon 2/4/02	
12		Site Biological Survey (Other Contractor)	5 days	Mon 2/4/02	Fri 2/8/02	11
13		Biological Survey of Sector 10A/B	1 day	Mon 2/4/02	Mon 2/4/02	
14		Biological Survey of Sectors 1, 2, 3, 4, 5, 6, 7, 8, and 9	4 days	Tue 2/5/02	Fri 2/8/02	13
15		Site Mobilization (Spec. Div. 1.2)	16 days	Mon 1/14/02	Mon 2/4/02	
16		Set up Temporary Office	1 day	Mon 1/14/02	Mon 1/14/02	10
17		Utility Connections (Water, Electric)	5 days	Tue 1/15/02	Mon 1/21/02	16
18		Communications, Telephones	10 days	Tue 1/15/02	Mon 1/28/02	16
19		Communications, Data Tie Lines	10 days	Tue 1/15/02	Mon 1/28/02	16
20		Communications, Radio	1 day	Mon 2/4/02	Mon 2/4/02	16
21		Geophysics Equipment Performance Tests (Spec. Div. 2.3)	38 days	Wed 1/30/02	Fri 3/22/02	
22		Equipment Setup/Function Tests	0.67 days	Wed 1/30/02	Wed 1/30/02	
23		Clear Vegetation (Test grid)	0.5 days	Wed 1/30/02	Wed 1/30/02	
24		Surface Clear (Test)	0.5 days	Wed 1/30/02	Wed 1/30/02	23
25		Geophysically Map Background	2 days	Thu 1/31/02	Fri 2/1/02	22,24
26		Seed Test Plot	2 days	Mon 2/4/02	Tue 2/5/02	25
27		Geophysical Equipment Performance Verification	10 days	Mon 2/11/02	Fri 2/22/02	26
28		Prepare Letter Report	3 days	Mon 2/25/02	Wed 2/27/02	27
29		Prepare Sector 10B (Third Party Seed)	1 day	Thu 2/28/02	Thu 2/28/02	28
30		Geophysically Map Sector 10B	5 days	Fri 3/1/02	Thu 3/7/02	29
		Reacquire Anomalies in Sector 10B	1 day	Fri 3/8/02	Fri 3/8/02	30
		Intrusive Investigation of Sector 10B	2 days	Mon 3/11/02	Tue 3/12/02	31
33		QC Scan of Sector 10B	3 days	Wed 3/13/02	Fri 3/15/02	32
34		Reacquire Anomalies detected during QC Scan	0.5 days	Mon 3/18/02	Mon 3/18/02	33
35		Intrusive investigation of Anomalies Detected during QC Scan	0.5 days	Mon 3/18/02	Mon 3/18/02	34
36		Prepare Final Verification Report	2 days	Tue 3/19/02	Wed 3/20/02	35
37		Regulatory Review	1 day	Thu 3/21/02	Thu 3/21/02	36
38		Approve Verification Report	1 day	Fri 3/22/02	Fri 3/22/02	37
39		Site/Surface Preparation	189.12 days	Mon 2/4/02	Wed 10/9/02	
40		Vegetation Clearance of Project Site (Spec. Div. 2.2)	24 days	Mon 2/4/02	Thu 3/7/02	
41		Sector 10	1 day	Mon 2/4/02	Mon 2/4/02	
42		Sector 9	2 days	Tue 2/5/02	Wed 2/6/02	41
43		Sector 4	1 day	Thu 2/7/02	Thu 2/7/02	42
44		Sector 2	0.25 days	Fri 2/8/02	Fri 2/8/02	43
45		Sector 1	3 days	Mon 2/11/02	Wed 2/13/02	44
46		Sector 3	1 day	Thu 2/14/02	Thu 2/14/02	45
47		Sector 8	1 day	Fri 2/15/02	Fri 2/15/02	46
48		Sector 6	5 days	Mon 2/18/02	Wed 2/27/02	47
49		Sector 5	3 days	Thu 2/28/02	Mon 3/4/02	48
50		Sector 7	3 days	Tue 3/5/02	Thu 3/7/02	49
51		Remove and Dispose of Interior Fencing	10 days	Mon 2/4/02	Fri 2/22/02	41SS
52		Placement of Grids on Project Site	143.28 days	Fri 3/1/02	Mon 9/23/02	
53		Sector 10A	0.25 days	Fri 3/1/02	Mon 3/4/02	41SS+15 days
54		Sector 9	2 days	Tue 3/5/02	Wed 3/6/02	53
55		Sector 4	1 day	Thu 3/7/02	Thu 3/7/02	54
56		Sector 2	1 day	Fri 3/8/02	Fri 3/8/02	55
		Sector 1	5 days	Mon 3/11/02	Mon 3/18/02	56
		Sector 3	1 day	Tue 3/19/02	Wed 3/20/02	57



Project: OE Remediation
Date: Fri 2/1/02

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

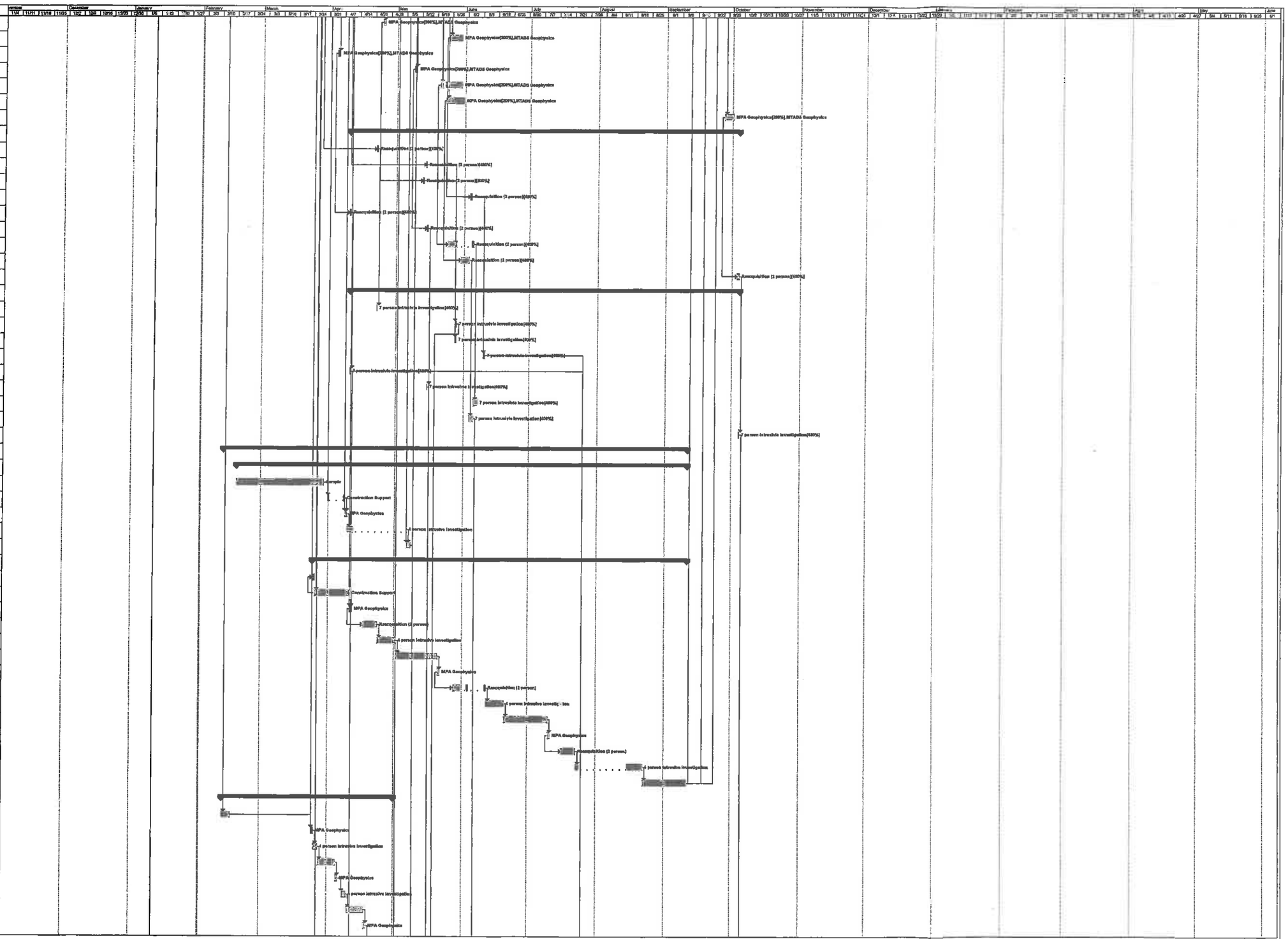
ID	Task Name	Duration	Start	Finish	Predecessors
59	Sector 8	1 day	Thu 3/21/02	Thu 3/21/02	69
60	Sector 6	6 days	Fri 3/22/02	Fri 3/29/02	59
61	Sector 5	5 days	Mon 4/1/02	Mon 4/8/02	60
62	Sector 7	3 days	Wed 3/15/02	Mon 3/23/02	195FS+2 days
	Surface Clearance of Project Site	144.79 days	Fri 3/8/02	Wed 10/2/02	
	Sector 10A	0.25 days	Fri 3/8/02	Fri 3/8/02	63SS+5 days
65	Sector 9	2 days	Fri 3/8/02	Tue 3/12/02	64,64
66	Sector 4	1 day	Tue 3/12/02	Wed 3/13/02	65,65
67	Sector 2	0.25 days	Wed 3/13/02	Wed 3/13/02	66,66
68	Sector 1	3 days	Tue 3/19/02	Thu 3/21/02	67,67
69	Sector 3	1 day	Fri 3/22/02	Fri 3/22/02	68,68
70	Sector 8	1 day	Mon 3/25/02	Mon 3/25/02	69,59
71	Sector 6	7.5 days	Mon 4/1/02	Wed 4/10/02	70,60
72	Sector 5	3 days	Wed 4/10/02	Mon 4/15/02	71,61
73	Sector 7	3 days	Mon 3/23/02	Wed 10/2/02	72,62,168
74	Remove Exterior Fencing and Replace with Temporary Fence	4 days	Mon 3/25/02	Thu 3/28/02	64SS+4 days
75	Preparation of Donovan Blast Chamber	1 day	Fri 3/8/02	Mon 3/11/02	64
76	Preparation of Open Front Bathhouse	10 days	Mon 4/8/02	Mon 4/22/02	105SS-10 days
77	Segregate Construction Debris From Stockpiles and Dispose (Others)	31 days	Mon 3/11/02	Mon 3/25/02	11
78	Lost D-1 Stockpile (Other Contractor)	12 day	Mon 2/18/02	Tue 3/5/02	
79	Ridge Stockpile (Other Contractor)	21 days	Mon 2/25/02	Mon 3/25/02	
80	North Valley Stockpile 1,2,3 (Other Contractor)	1 day	Mon 3/11/02	Mon 3/11/02	
81	Construction of Dense Aqueous Portion of TNT Bulk (Explosive)	1 day	Mon 3/18/02	Mon 3/18/02	
82	Site Point Clearance	126.38 days	Mon 3/25/02	Fri 9/27/02	
83	Declaration and Mapping Sectors 1,2,3,4,5,6,7,8,9, and 10A	121.63 days	Mon 3/25/02	Fri 9/13/02	63,64+2 days
84	Sector 10A	0.25 days	Mon 3/25/02	Mon 3/25/02	64,38
85	Sector 9	2 days	Mon 3/25/02	Tue 3/26/02	65,39
86	Sector 4	1 day	Mon 3/25/02	Tue 3/26/02	66,38
87	Sector 1	2.25 days	Wed 5/8/02	Tue 5/14/02	36,150,[illegible]
88	Sector 3	1 day	Mon 3/25/02	Mon 3/25/02	68,39
	Sector 8	1 day	Wed 5/1/02	Wed 5/1/02	89,170,38
	Sector 6	6 days	Tue 3/26/02	Wed 4/3/02	70,38
91	Sector 5	5 days	Wed 4/10/02	Wed 4/17/02	71,38
92	Sector 7	3.25 days	Wed 9/11/02	Fri 9/13/02	72,105,38
93	Reconnaissance of Anomalies Sectors 1,2,4,5,6,7,8,9,and 10A	133.38 days	Fri 3/29/02	Mon 9/23/02	
94	Sector 10A	0.3 days	Fri 3/29/02	Fri 3/29/02	84SS+4 days
95	Sector 9	3.5 days	Fri 3/29/02	Wed 4/3/02	85SS+4 days
96	Sector 4	2 days	Tue 4/2/02	Mon 4/22/02	8[illegible]+4 days
97	Sector 1	4 days	Tue 5/14/02	Mon 5/20/02	87SS+4 days
98	Sector 3	2 days	Fri 3/29/02	Mon 4/1/02	88SS+4 days
99	Sector 8	1 day	Tue 5/7/02	Tue 5/7/02	89SS+4 days
100	Sector 6	10 days	Mon 4/1/02	Tue 4/23/02	90SS+4 days
101	Sector 5	8.5 days	Tue 4/16/02	Fri 5/10/02	9[illegible]+4 days
102	Sector 7	4 days	Tue 9/17/02	Mon 9/23/02	92SS+4 days
103	Intrusive Investigation of Sectors 1,2,4,5,6,7,8,9, and 10A	126.50 days	Fri 3/29/02	Fri 9/27/02	
104	Sector 10A	0.3 days	Fri 3/29/02	Fri 3/29/02	94
105	Sector 9	3.5 days	Wed 4/3/02	Tue 4/11/02	95
106	Sector 4	2 days	Mon 4/22/02	Wed 4/24/02	96
107	Sector 1	4 days	Mon 5/20/02	Fri 5/24/02	97
108	Sector 3	2 days	Tue 4/2/02	Wed 4/3/02	98
109	Sector 8	1 day	Wed 5/8/02	Wed 5/8/02	99
110	Sector 6	10 days	Wed 4/24/02	Mon 5/20/02	100
111	Sector 5	8.5 days	Fri 5/10/02	Thu 5/23/02	101
112	Sector 7	4 days	Mon 9/23/02	Fri 9/27/02	102
113	QC Site Point Clearance	132.33 days	Fri 3/29/02	Fri 10/4/02	
114	Declaration and Mapping Sectors 1,2,4,5,6,7,8,9, and 10A	126.50 days	Fri 3/29/02	Thu 10/3/02	
	Sector 10A	0.25 days	Fri 3/29/02	Fri 3/29/02	104
	Sector 9	2 days	Thu 4/11/02	Wed 4/17/02	105



Project: DE Remediation
Date: Fri 2/1/02

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

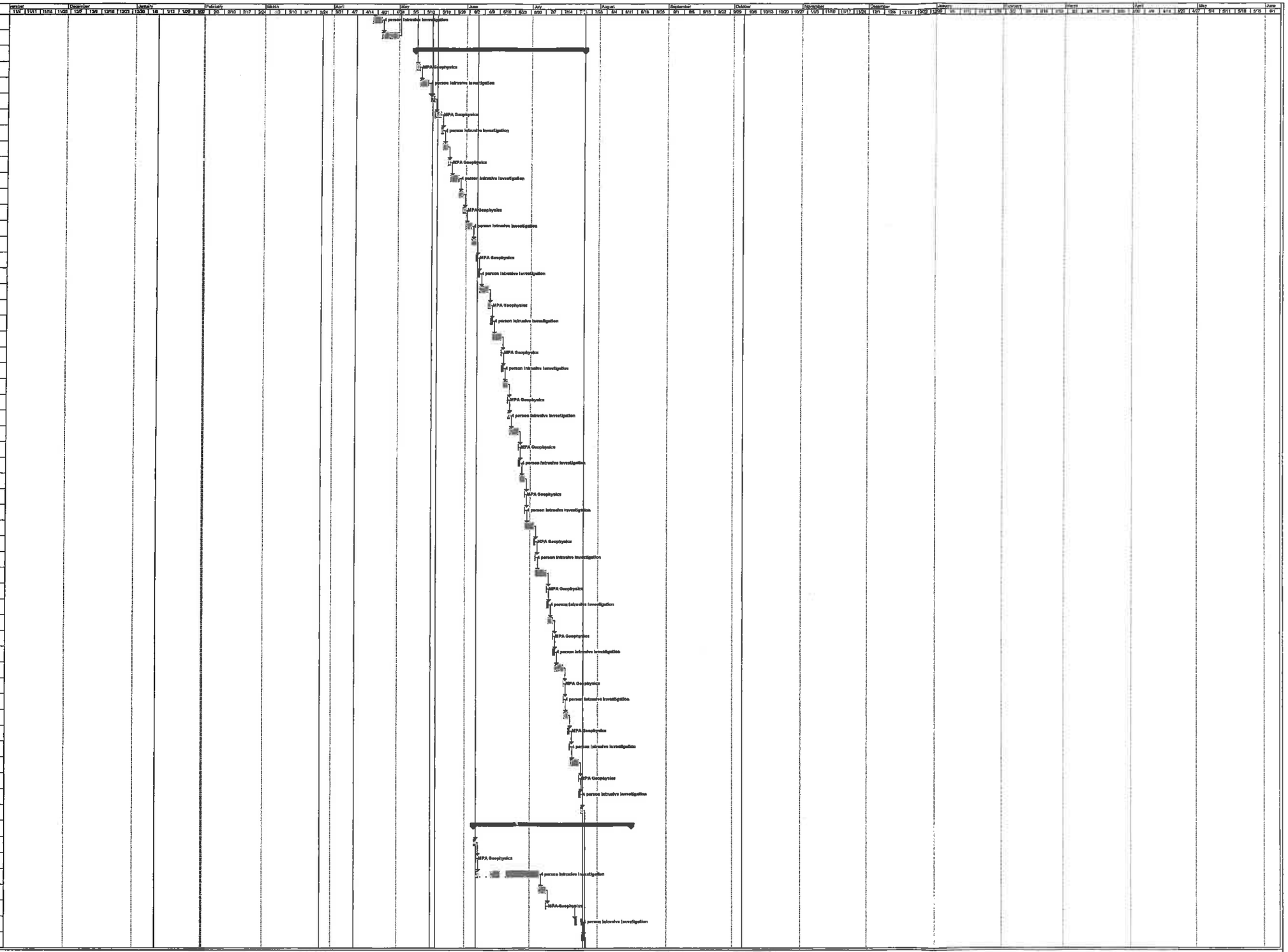
ID	Task Name	Duration	Start	Finish	Predecessors
117	Sector 4	1 day	Wed 4/24/02	Thu 4/25/02	106
118	Sector 1	2.25 days	Fri 5/24/02	Thu 5/30/02	107
119	Sector 2	1 day	Thu 4/4/02	Thu 4/4/02	108
120	Sector 3	1 day	Thu 5/9/02	Thu 5/9/02	109
	Sector 4	6 days	Mon 5/20/02	Thu 5/30/02	110
	Sector 5	5 days	Thu 5/23/02	Fri 5/31/02	111
1.5	Sector 7	2.25 days	Fri 6/27/02	Tue 10/1/02	112
124	Reacquisition of Anomalies Sectors 1,2,4,5,6,7,8,9,and 10A	134.88 days	Wed 4/10/02	Fri 10/4/02	
125	Sector 10A	0.25 days	Mon 4/22/02	Mon 4/22/02	118SS+4 days
126	Sector 9	0.7 days	Tue 5/14/02	Tue 5/14/02	118SS+4 days
127	Sector 4	0.4 days	Mon 5/13/02	Mon 5/13/02	117SS+4 days
128	Sector 1	0.3 days	Mon 6/17/02	Tue 6/4/02	118SS+4 days
129	Sector 3	0.4 days	Wed 4/10/02	Wed 4/10/02	118SS+4 days
130	Sector 6	0.3 days	Wed 5/15/02	Wed 5/15/02	120SS+4 days
131	Sector 8	2 days	Fri 5/24/02	Wed 6/5/02	121SS+4 days
132	Sector 5	2 days	Thu 5/30/02	Mon 6/3/02	122SS+4 days
133	Sector 7	0.8 days	Thu 10/3/02	Fri 10/4/02	123SS+4 days
134	Intrusive Investigation of Sectors 1,2,4,5,6,7,8,9, and 10A	134.88 days	Wed 4/10/02	Fri 10/4/02	
135	Sector 10A	0.25 days	Mon 4/22/02	Mon 4/22/02	125
136	Sector 9	0.7 days	Tue 5/28/02	Tue 5/28/02	126
137	Sector 4	0.4 days	Tue 5/28/02	Tue 5/28/02	127
138	Sector 1	0.8 days	Mon 6/10/02	Mon 6/10/02	128
139	Sector 3	0.4 days	Wed 4/10/02	Wed 4/10/02	129
140	Sector 6	0.2 days	Wed 5/15/02	Wed 5/15/02	130
141	Sector 8	2 days	Wed 6/5/02	Fri 6/7/02	131
142	Sector 5	2 days	Mon 6/3/02	Wed 6/5/02	132
143	Sector 7	0.8 days	Fri 10/4/02	Fri 10/4/02	133
144	OE Clearance of Stockpiles	148.38 days	Tue 2/12/02	Wed 9/11/02	
145	Unit D-1 Stockpiles	144.38 days	Mon 2/18/02	Wed 9/11/02	
146	Confirmation Sampling of D-1 Stockpiles (Chemical Remediation Contractor)	30 days	Mon 2/18/02	Fri 3/29/02	
	Level Unit D-1 Stockpiles into Sector 2 (Grading Contractor)	1 day	Mon 4/1/02	Mon 4/8/02	146,78
	Detection of Anomalies in Unit D-1 Stockpile	1 day	Mon 4/8/02	Tue 4/9/02	147,36
149	Intrusive Investigation of Anomalies in Unit D-1 Stockpiles	3 days	Tue 4/9/02	Mon 5/6/02	148
150	Excavate and Haul Unit D-1 Stockpiles	2 days	Mon 5/6/02	Wed 5/8/02	149,36
151	Ridge Stockpiles	119.25 days	Mon 3/25/02	Wed 9/11/02	
152	Sample Ridge Stockpiles	1 day	Mon 3/25/02	Mon 3/25/02	153SS-1 day
153	Level Ridge Stockpiles (Grading Contractor)	12 days	Tue 3/26/02	Wed 4/10/02	79
154	Detection of Anomalies in Ridge Stockpiles (Lift 1)	1 day	Thu 4/11/02	Thu 4/11/02	153,36
155	Reacquisition of Anomalies in Ridge Stockpiles (Lift 1)	4.8 days	Wed 4/17/02	Tue 4/23/02	154SS+4 days
156	Intrusive Investigation of Anomalies in Ridge Stockpiles (Lift 1)	8.2 days	Tue 4/23/02	Wed 5/1/02	155
157	Excavate Lift 1 and Temporarily Stockpile on Site (Grading Contractor)	13 days	Thu 5/2/02	Mon 5/20/02	156
158	Detection of Anomalies in Ridge Stockpiles (Lift 2)	1 day	Tue 5/21/02	Tue 5/21/02	157
159	Reacquisition of Anomalies in Ridge Stockpiles (Lift 2)	4.8 days	Tue 5/28/02	Tue 6/4/02	158SS+4 days
160	Intrusive Investigation of Anomalies in Ridge Stockpiles (Lift 2)	8.2 days	Wed 6/12/02	Thu 6/20/02	159
161	Excavate Lift 2 and Temporarily Stockpile on Site (Grading Contractor)	13 days	Thu 6/20/02	Wed 7/10/02	160
162	Detection of Anomalies in Ridge Stockpiles (Lift 3)	1 day	Wed 7/10/02	Thu 7/11/02	161
163	Reacquisition of Anomalies in Ridge Stockpiles (Lift 3)	4.8 days	Tue 7/16/02	Mon 7/22/02	162SS+4 days
164	Intrusive Investigation of Anomalies in Ridge Stockpiles (Lift 3)	8.2 days	Tue 7/23/02	Thu 8/22/02	163
165	Excavate Lift 3 and Temporarily Stockpile on Site (Grading Contractor)	13 days	Thu 8/22/02	Wed 9/11/02	164
166	North Valley Stockpiles	58 days	Tue 3/12/02	Tue 4/30/02	
167	Level North Valley Stockpiles (Grading Contractor)	4 days	Tue 3/12/02	Fri 3/15/02	80
168	Detection of Anomalies in North Valley Stockpiles (lift 1)	1 day	Mon 3/25/02	Mon 3/25/02	167,38
169	Intrusive Investigation of Anomalies in North Valley Stockpiles (lift 1)	2 days	Tue 3/26/02	Wed 3/27/02	168
170	Excavate and Haul Lift 1 (Grading Contractor)	8 days	Thu 3/28/02	Thu 4/4/02	169
171	Detection of Anomalies in North Valley Stockpiles (lift 2)	1 day	Fri 4/5/02	Fri 4/5/02	170
172	Intrusive Investigation of Anomalies in North Valley Stockpiles (lift 2)	2 days	Mon 4/8/02	Tue 4/9/02	171
	Excavate and Haul Lift 2 (Grading Contractor)	6 days	Wed 4/10/02	Wed 4/17/02	172
	Detection of Anomalies in North Valley Stockpiles (Lift 3)	1 day	Thu 4/18/02	Thu 4/18/02	173



Project: OE Reconnaissance
Date: Fri 2/1/02

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

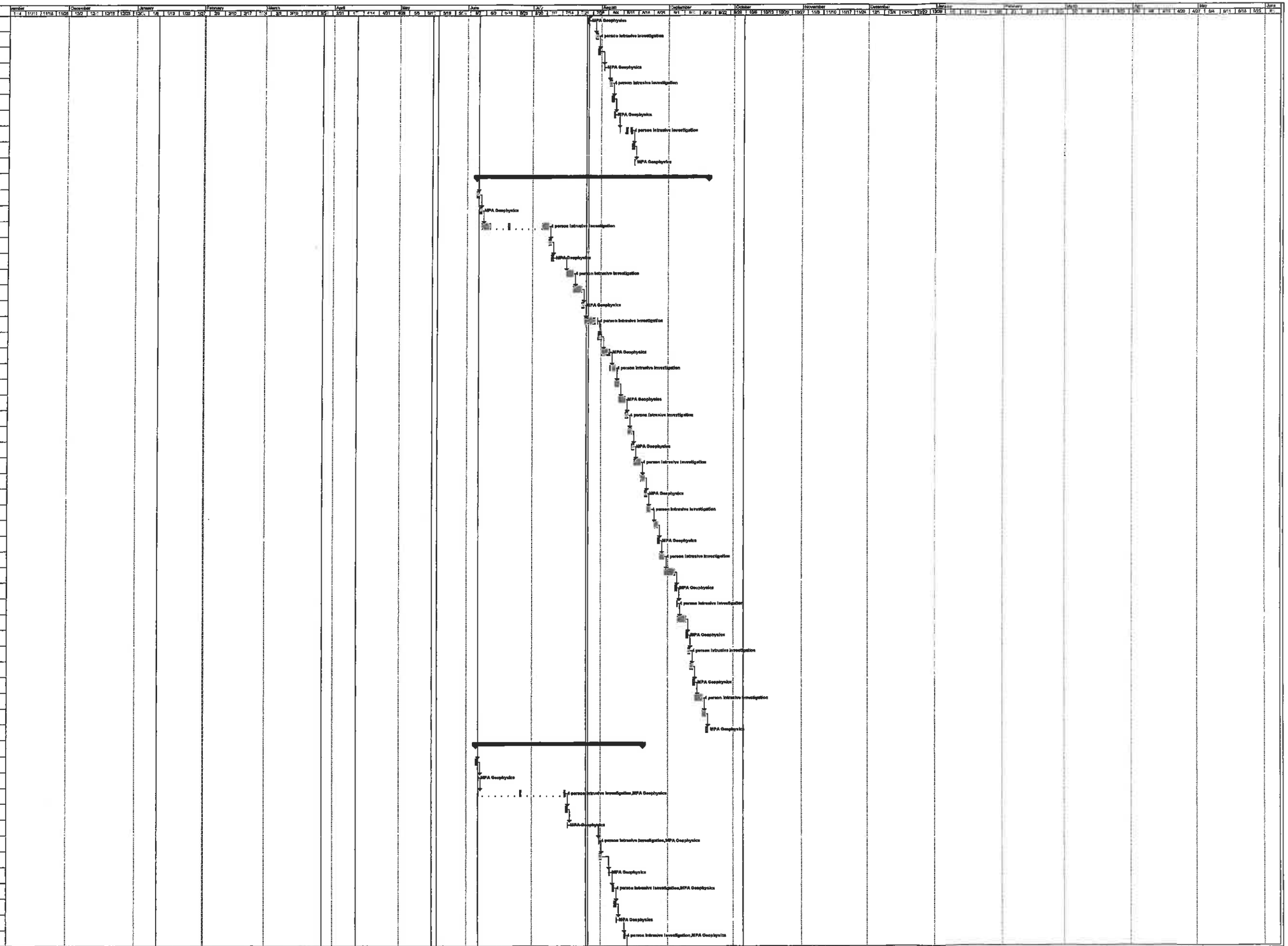
ID		Task Name	Duration	Start	Finish	Predecessors
176		INTRUSIVE Investigation of Anomalies in North Valley Stockpiles (SR 3)	2 days	Fri 4/19/02	Mon 4/22/02	174
178		Excavate and Haul Lift 3 (Grading Contractor)	8 days	Tue 4/23/02	Tue 4/30/02	175
177		GE Point Clearance of Sector 2	63.75 days	Wed 6/5/02	Thu 7/25/02	
178		Detection of Anomalies in Sector 2 Fill Soils (Lift 1)	2 days	Wed 5/8/02	Fri 5/10/02	150
		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 1)	2 days	Fri 5/10/02	Tue 5/14/02	178
		Excavate and Haul Lift 1 Soil (Grading Contractor)	2 days	Wed 5/15/02	Fri 5/17/02	179,130
181		Detection of Anomalies in Sector 2 Fill Soils (Lift 2)	1 day	Fri 5/17/02	Mon 5/20/02	180
182		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 2)	1 day	Mon 5/20/02	Tue 5/21/02	181
183		Excavate and Haul Lift 2 Soil (Grading Contractor)	2 days	Tue 5/21/02	Thu 5/23/02	182
184		Detection of Anomalies in Sector 2 Fill Soils (Lift 3)	1 day	Thu 5/23/02	Fri 5/24/02	183
185		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 3)	1 day	Fri 5/24/02	Tue 5/28/02	184
186		Excavate and Haul Lift 3 Soil (Grading Contractor)	2 days	Tue 5/28/02	Thu 5/30/02	185
187		Detection of Anomalies in Sector 2 Fill Soils (Lift 4)	1 day	Thu 5/30/02	Fri 5/31/02	186
188		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 4)	1 day	Fri 5/31/02	Mon 6/3/02	187
189		Excavate and Haul Lift 4 Soil (Grading Contractor)	2 days	Mon 6/3/02	Wed 6/5/02	188
190		Detection of Anomalies in Sector 2 Fill Soils (Lift 5)	0.5 days	Wed 6/5/02	Thu 6/6/02	189
191		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 5)	1 day	Thu 6/6/02	Fri 6/7/02	190
192		Excavate and Haul Lift 5 Soil (Grading Contractor)	2 days	Fri 6/7/02	Tue 6/11/02	191
193		Detection of Anomalies in Sector 2 Fill Soils (Lift 6)	0.5 days	Tue 6/11/02	Wed 6/12/02	192
194		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 6)	1 day	Wed 6/12/02	Thu 6/13/02	193
195		Excavate and Haul Lift 6 Soil (Grading Contractor)	2 days	Thu 6/13/02	Mon 6/17/02	194
196		Detection of Anomalies in Sector 2 Fill Soils (Lift 7)	0.5 days	Mon 6/17/02	Mon 6/17/02	195
197		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 7)	0.5 days	Mon 6/17/02	Tue 6/18/02	196
198		Excavate and Haul Lift 7 Soil (Grading Contractor)	2 days	Tue 6/18/02	Thu 6/20/02	197
199		Detection of Anomalies in Sector 2 Fill Soils (Lift 8)	0.5 days	Thu 6/20/02	Thu 6/20/02	198
200		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 8)	0.5 days	Thu 6/20/02	Fri 6/21/02	199
201		Excavate and Haul Lift 8 Soil (Grading Contractor)	2 days	Fri 6/21/02	Tue 6/25/02	200
202		Detection of Anomalies in Sector 2 Fill Soils (Lift 9)	0.25 days	Tue 6/25/02	Tue 6/25/02	201
203		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 9)	0.5 days	Tue 6/25/02	Wed 6/26/02	202
204		Excavate and Haul Lift 9 Soil (Grading Contractor)	2 days	Wed 6/26/02	Fri 6/28/02	203
205		Detection of Anomalies in Sector 2 Fill Soils (Lift 10)	0.25 days	Fri 6/28/02	Fri 6/28/02	204
206		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 10)	0.5 days	Fri 6/28/02	Fri 6/28/02	205
207		Excavate and Haul Lift 10 Soil (Grading Contractor)	2 days	Fri 6/28/02	Tue 7/2/02	206
208		Detection of Anomalies in Sector 2 Fill Soils (Lift 11)	0.25 days	Tue 7/2/02	Wed 7/3/02	207
209		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 11)	0.5 days	Wed 7/3/02	Wed 7/3/02	208
210		Excavate and Haul Lift 11 Soil (Grading Contractor)	2 days	Wed 7/3/02	Mon 7/8/02	209
211		Detection of Anomalies in Sector 2 Fill Soils (Lift 12)	0.25 days	Mon 7/8/02	Mon 7/8/02	210
212		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 12)	0.5 days	Mon 7/8/02	Tue 7/9/02	211
213		Excavate and Haul Lift 12 Soil (Grading Contractor)	2 days	Tue 7/9/02	Thu 7/11/02	212
214		Detection of Anomalies in Sector 2 Fill Soils (Lift 13)	0.25 days	Thu 7/11/02	Thu 7/11/02	213
215		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 13)	0.5 days	Thu 7/11/02	Fri 7/12/02	214
216		Excavate and Haul Lift 13 Soil (Grading Contractor)	2 days	Fri 7/12/02	Tue 7/16/02	215
217		Detection of Anomalies in Sector 2 Fill Soils (Lift 14)	0.25 days	Tue 7/16/02	Tue 7/16/02	216
218		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 14)	0.5 days	Tue 7/16/02	Tue 7/16/02	217
219		Excavate and Haul Lift 14 Soil (Grading Contractor)	2 days	Tue 7/16/02	Thu 7/18/02	218
220		Detection of Anomalies in Sector 2 Fill Soils (Lift 15)	0.25 days	Thu 7/18/02	Fri 7/18/02	219
221		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 15)	0.5 days	Fri 7/18/02	Fri 7/18/02	220
222		Excavate and Haul Lift 15 Soil (Grading Contractor)	2 days	Fri 7/18/02	Tue 7/23/02	221
223		Detection of Anomalies in Sector 2 Fill Soils (Lift 16)	0.25 days	Tue 7/23/02	Tue 7/23/02	222
224		Intrusive Investigation of Anomalies in Sector 2 Fill Soils (Lift 16)	0.5 days	Tue 7/23/02	Wed 7/24/02	223
225		Excavate and Haul Lift 16 Soil (Grading Contractor)	1 day	Wed 7/24/02	Thu 7/25/02	224
226		GE Point Clearance of Demolition Site 1	91.3 days	Wed 6/5/02	Fri 9/16/02	
227		Excavate and Remove Lift 1 (Grading Contractor)	1 day	Wed 6/5/02	Thu 6/6/02	143
228		Detection of Anomalies in Demolition Site 1 (Lift 2)	0.5 days	Thu 6/6/02	Thu 6/6/02	227
229		Intrusive Investigation of Anomalies in Demolition Site 1 (Lift 2)	13 days	Thu 6/6/02	Fri 7/5/02	228
230		Excavate and Remove Lift 2 (Grading Contractor)	1 day	Fri 7/5/02	Mon 7/8/02	229
		Detection of Anomalies in Demolition Site 1 (Lift 3)	0.5 days	Mon 7/8/02	Mon 7/8/02	230
		Intrusive Investigation of Anomalies in Demolition Site 1 (Lift 3)	1 day	Mon 7/22/02	Wed 7/24/02	231
233		Excavate and Remove Lift 3 (Grading Contractor)	1 day	Thu 7/25/02	Thu 7/25/02	232



Project: GE Remediation
Date: Fri 2/1/02

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

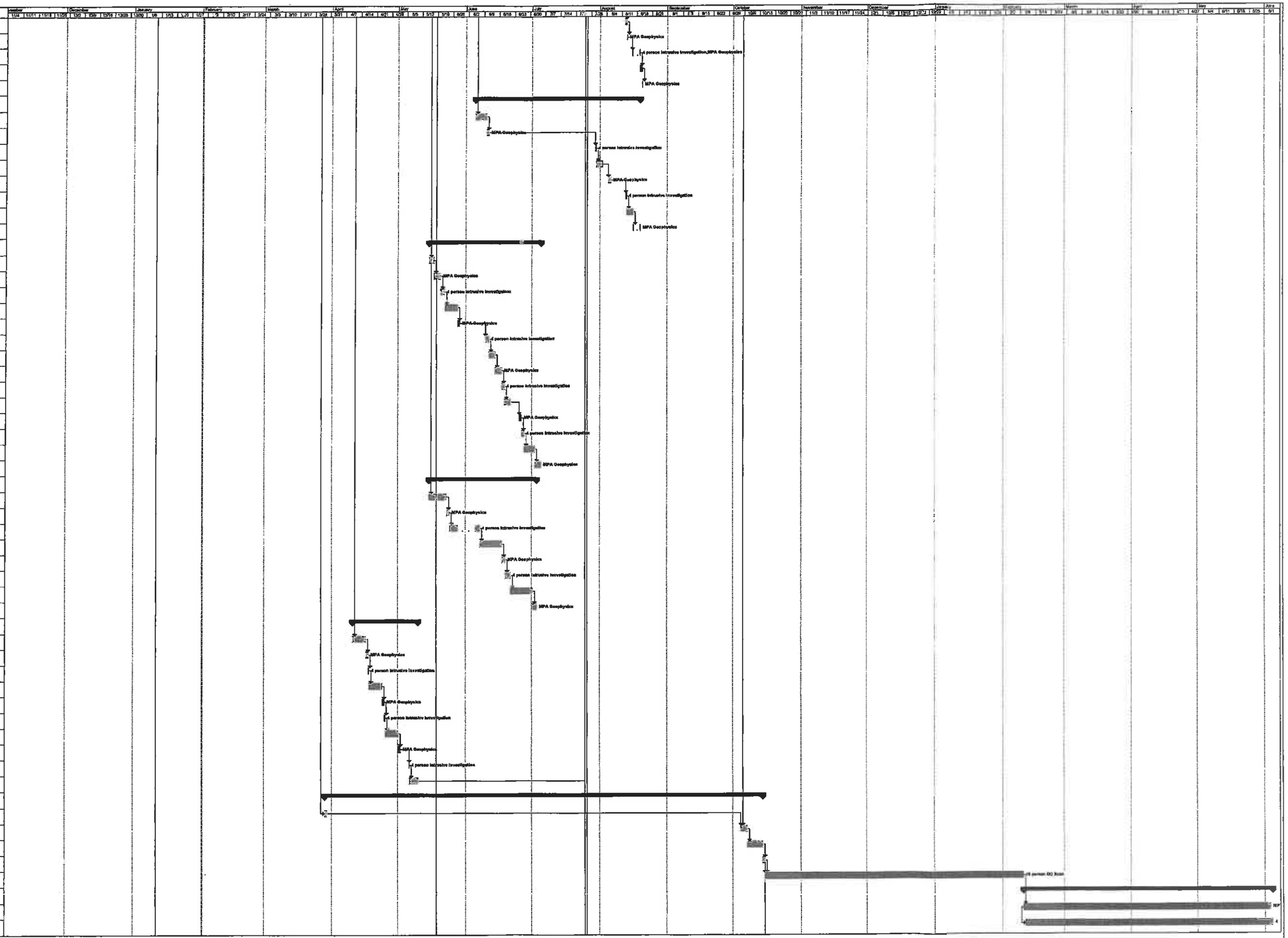
ID		Task Name	Duration	Start	Finish	Predecessors
234		Detection of Anomalies in Demolition Site 1 (Rt 4)	0.5 days	Fri 7/26/02	Fri 7/26/02	233
235		Intrusive Investigation of Anomalies in Demolition Site 1 (Rt 4)	1 day	Mon 7/29/02	Tue 7/30/02	234
236		Excavate and Remove Lift 4 (Grading Contractor)	1 day	Tue 7/30/02	Wed 7/31/02	235
237		Detection of Anomalies in Demolition Site 1 (Rt 5)	0.5 days	Fri 8/2/02	Fri 8/2/02	236
238		Intrusive Investigation of Anomalies in Demolition Site 1 (Rt 5)	1 day	Mon 8/5/02	Mon 8/5/02	237
239		Excavate and Remove Lift 5 (Grading Contractor)	1 day	Tue 8/6/02	Tue 8/6/02	238
240		Detection of Anomalies in Demolition Site 1 (Rt 6)	0.5 days	Wed 8/7/02	Wed 8/7/02	239
241		Intrusive Investigation of Anomalies in Demolition Site 1 (Rt 6)	1 day	Fri 8/9/02	Thu 8/15/02	240
242		Excavate and Remove Lift 6 (Grading Contractor)	1 day	Thu 8/15/02	Fri 8/16/02	241
243		QC Scan/Intrusive Investigation (Excavated Surface)	0.5 days	Fri 8/16/02	Fri 8/16/02	242
244		Oil Point Clearance of Demolition Site 3	74.5 days	Wed 6/5/02	Thu 9/19/02	
245		Excavate and Remove Lift 1 (Grading Contractor)	1.5 days	Wed 6/5/02	Thu 6/6/02	142
246		Detection of Anomalies in Demolition Site 3 (Rt 2)	1 day	Thu 6/6/02	Fri 6/7/02	245
247		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 2)	3.2 days	Fri 6/7/02	Mon 7/8/02	246
248		Excavate and Remove Lift 2 (Grading Contractor)	1.5 days	Mon 7/8/02	Tue 7/9/02	247
249		Detection of Anomalies in Demolition Site 3 (Rt 3)	1 day	Tue 7/9/02	Wed 7/10/02	248
250		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 3)	3.2 days	Tue 7/16/02	Fri 7/19/02	249
251		Excavate and Remove Lift 3 (Grading Contractor)	1.5 days	Fri 7/19/02	Tue 7/23/02	250
252		Detection of Anomalies in Demolition Site 3 (Rt 4)	1 day	Tue 7/23/02	Wed 7/24/02	251
253		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 4)	3.2 days	Wed 7/24/02	Tue 7/30/02	252
254		Excavate and Remove Lift 4 (Grading Contractor)	1.5 days	Tue 7/30/02	Thu 8/1/02	253
255		Detection of Anomalies in Demolition Site 3 (Rt 5)	1 day	Thu 8/1/02	Mon 8/5/02	254
256		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 5)	1.6 days	Mon 8/5/02	Wed 8/7/02	255
257		Excavate and Remove Lift 5 (Grading Contractor)	1.5 days	Wed 8/7/02	Fri 8/9/02	256
258		Detection of Anomalies in Demolition Site 3 (Rt 6)	1 day	Fri 8/9/02	Mon 8/12/02	257
259		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 6)	1.6 days	Mon 8/12/02	Tue 8/13/02	258
260		Excavate and Remove Lift 6 (Grading Contractor)	1.5 days	Tue 8/13/02	Thu 8/15/02	259
261		Detection of Anomalies in Demolition Site 3 (Rt 7)	1 day	Thu 8/15/02	Fri 8/16/02	260
262		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 7)	1.6 days	Fri 8/16/02	Mon 8/18/02	261
263		Excavate and Remove Lift 7 (Grading Contractor)	1.5 days	Mon 8/18/02	Wed 8/21/02	262
264		Detection of Anomalies in Demolition Site 3 (Rt 8)	1 day	Wed 8/21/02	Thu 8/22/02	263
265		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 8)	1.6 days	Thu 8/22/02	Fri 8/23/02	264
266		Excavate and Remove Lift 8 (Grading Contractor)	1.5 days	Mon 8/26/02	Tue 8/27/02	265
267		Detection of Anomalies in Demolition Site 3 (Rt 9)	1 day	Tue 8/27/02	Wed 8/28/02	266
268		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 9)	1.6 days	Wed 8/28/02	Fri 8/30/02	267
269		Excavate and Remove Lift 9 (Grading Contractor)	1.5 days	Fri 8/30/02	Wed 9/4/02	268
270		Detection of Anomalies in Demolition Site 3 (Rt 10)	1 day	Wed 9/4/02	Thu 9/5/02	269
271		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 10)	0.8 days	Thu 9/5/02	Thu 9/5/02	270
272		Excavate and Remove Lift 10 (Grading Contractor)	1.5 days	Thu 9/5/02	Mon 9/9/02	271
273		Detection of Anomalies in Demolition Site 3 (Rt 11)	1 day	Mon 9/9/02	Tue 9/10/02	272
274		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 11)	0.8 days	Tue 9/10/02	Wed 9/11/02	273
275		Excavate and Remove Lift 11 (Grading Contractor)	1.5 days	Wed 9/11/02	Thu 9/12/02	274
276		Detection of Anomalies in Demolition Site 3 (Rt 12)	1 day	Thu 9/12/02	Fri 9/13/02	275
277		Intrusive Investigation of Anomalies in Demolition Site 3 (Rt 12)	0.8 days	Fri 9/13/02	Mon 9/16/02	276
278		Excavate and Remove Lift 12 (Grading Contractor)	1.5 days	Tue 9/17/02	Wed 9/18/02	277
279		QC Scan/Intrusive Investigation (Excavated Surface)	1 day	Wed 9/18/02	Thu 9/19/02	278
280		Oil Point Clearance of Flare Site	63.45 days	Wed 6/5/02	Tue 8/20/02	
281		Excavate and Remove Lift 1 (Grading Contractor)	1 day	Wed 6/5/02	Thu 6/6/02	142
282		Detection of Anomalies in Flare Site (Rt 2)	0.25 days	Thu 6/6/02	Thu 6/6/02	281
283		Intrusive Investigation of Anomalies in Flare Site (Rt 2)	0.75 days	Thu 6/6/02	Tue 7/16/02	282
284		Excavate and Remove Lift 2 (Grading Contractor)	1 day	Tue 7/16/02	Wed 7/17/02	283
285		Detection of Anomalies in Flare Site (Rt 3)	0.25 days	Wed 7/17/02	Wed 7/17/02	284
286		Intrusive Investigation of Anomalies in Flare Site (Rt 3)	0.5 days	Wed 7/31/02	Wed 7/31/02	285
287		Excavate and Remove Lift 3 (Grading Contractor)	1 day	Wed 7/31/02	Thu 8/1/02	286
288		Detection of Anomalies in Flare Site (Rt 4)	0.25 days	Mon 8/5/02	Mon 8/5/02	287
289		Intrusive Investigation of Anomalies in Flare Site (Rt 4)	0.5 days	Tue 8/6/02	Wed 8/7/02	288
290		Excavate and Remove Lift 4 (Grading Contractor)	1 day	Wed 8/7/02	Thu 8/8/02	289
291		Detection of Anomalies in Flare Site (Rt 5)	0.25 days	Thu 8/8/02	Thu 8/8/02	290
292		Intrusive Investigation of Anomalies in Flare Site (Rt 5)	0.5 days	Mon 8/12/02	Mon 8/12/02	291



Project: OE Remediation
Date: Fri 2/1/02

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

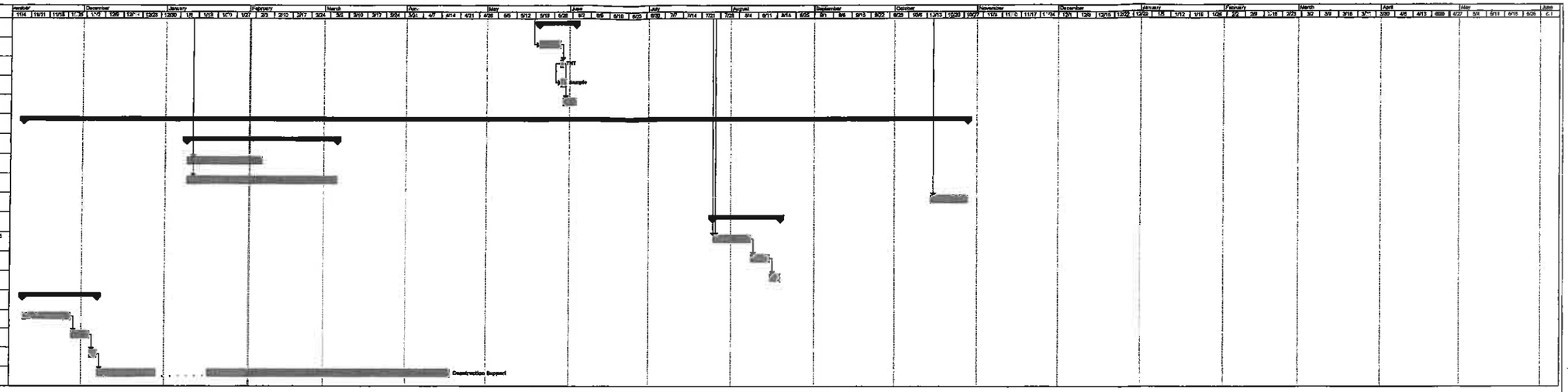
ID	Task Name	Duration	Start	Finish	Predecessors
293	Excavate and Remove Lift 5 (Grading Contractor)	1 day	Mon 7/1/02	Tue 8/13/02	292
294	Detection of Anomalies in Flare Site (Sft 6)	0.25 days	Tue 8/13/02	Tue 8/13/02	293
295	Intrusive Investigation of Anomalies in Flare Site (Sft 6)	0.5 days	Fri 8/16/02	Mon 8/19/02	294
296	Excavate and Remove Lift 6 (Grading Contractor)	1 day	Mon 8/19/02	Tue 8/20/02	295
297	QC Scan/Intrusive Investigation (Excavated Surface)	0.25 days	Tue 8/20/02	Tue 8/20/02	296
	OE Point Clearance of Mercury Impacted Soil	62.61 days	Wed 6/5/02	Mon 8/19/02	
299	Excavate and Remove Lift 1 (Grading Contractor)	3 days	Wed 6/5/02	Mon 6/10/02	142
300	Detection of Anomalies in Mercury Impacted Soil (Sft 2)	1 day	Mon 6/10/02	Tue 6/11/02	299
301	Intrusive Investigation of Anomalies in Mercury Impacted Soil (Sft 2)	0.33 days	Tue 7/9/02	Tue 7/9/02	300
302	Excavate and Remove Lift 2 (Grading Contractor)	3 days	Tue 7/9/02	Fri 7/12/02	301
303	Detection of Anomalies in Mercury Impacted Soil (Sft 3)	1 day	Mon 8/5/02	Mon 8/5/02	302
304	Intrusive Investigation of Anomalies in Mercury Impacted Soil (Sft 3)	0.33 days	Tue 8/13/02	Tue 8/13/02	303
305	Excavate and Remove Lift 3 (Grading Contractor)	3 days	Tue 8/13/02	Fri 8/16/02	304
306	QC Scan/Intrusive Investigation (Excavated Surface)	1 day	Fri 8/16/02	Mon 8/19/02	305
307	OEPoint Clearance of North Valley Landfill	34.74 days	Wed 5/15/02	Fri 7/5/02	
308	Excavate and Remove Lift 1 (Grading Contractor)	2.5 days	Wed 5/15/02	Fri 5/17/02	140
309	Detection of Anomalies in North Valley Landfill (Sft 2)	1 day	Fri 5/17/02	Mon 5/20/02	308
310	Intrusive Investigation of Anomalies in North Valley Landfill (Sft 2)	1.67 days	Mon 5/20/02	Wed 5/22/02	309
311	Excavate and Remove Lift 2 (Grading Contractor)	2.5 days	Wed 5/22/02	Tue 5/28/02	310
312	Detection of Anomalies in North Valley Landfill (Sft 3)	1 day	Tue 5/28/02	Wed 5/29/02	311
313	Intrusive Investigation of Anomalies in North Valley Landfill (Sft 3)	1.67 days	Mon 6/10/02	Tue 6/11/02	312
314	Excavate and Remove Lift 3 (Grading Contractor)	2.5 days	Tue 6/11/02	Fri 6/14/02	313
315	Detection of Anomalies in North Valley Landfill (Sft 4)	1 day	Fri 6/14/02	Mon 6/17/02	314
316	Intrusive Investigation of Anomalies in North Valley Landfill (Sft 4)	1.67 days	Mon 6/17/02	Tue 6/18/02	315
317	Excavate and Remove Lift 4 (Grading Contractor)	2.5 days	Tue 6/18/02	Fri 6/21/02	316
318	Detection of Anomalies in North Valley Landfill (Sft 5)	1 day	Tue 6/25/02	Wed 6/26/02	317
319	Intrusive Investigation of Anomalies in North Valley Landfill (Sft 5)	1.67 days	Wed 6/26/02	Thu 6/27/02	318
320	Excavate and Remove Lift 5 (Grading Contractor)	2.5 days	Thu 6/27/02	Tue 7/2/02	319
321	QC Scan/Intrusive Investigation (Excavated Surface)	1 day	Tue 7/2/02	Fri 7/5/02	320
322	OE Point Clearance of North Valley Fill Areas	33.76 days	Wed 5/15/02	Wed 7/31/02	
323	Excavate and Remove Lift 1 (Grading Contractor)	6 days	Wed 5/15/02	Thu 5/23/02	140
324	Detection of Anomalies in North Valley Fill Area (Sft 2)	1.5 days	Thu 5/23/02	Fri 5/24/02	323
325	Intrusive Investigation of Anomalies in North Valley Fill Area (Sft 2)	2.4 days	Fri 5/24/02	Fri 6/7/02	324
326	Excavate and Remove Lift 2 (Grading Contractor)	6 days	Fri 6/7/02	Mon 6/17/02	325
327	Detection of Anomalies in North Valley Fill Area (Sft 3)	1.5 days	Mon 6/17/02	Tue 6/18/02	326
328	Intrusive Investigation of Anomalies in North Valley Fill Area (Sft 3)	2.4 days	Wed 6/19/02	Fri 6/21/02	327
329	Excavate and Remove Lift 3 (Grading Contractor)	6 days	Fri 6/21/02	Mon 7/1/02	328
330	QC Scan/Intrusive Investigation (Excavated Surface)	1.5 days	Mon 7/1/02	Wed 7/3/02	329
331	OE Anomalies Clearance at South Steps of South Valley	21.58 days	Wed 4/10/02	Fri 5/10/02	
332	Excavate and Remove Lift 1 (Grading Contractor)	4 days	Wed 4/10/02	Tue 4/16/02	136
333	Detection of Anomalies (Sft 2)	1 day	Tue 4/16/02	Wed 4/17/02	332
334	Intrusive Investigation of Anomalies (Sft 2)	0.2 days	Wed 4/17/02	Wed 4/17/02	333
335	Excavate and Remove Lift 2 (Grading Contractor)	4 days	Thu 4/18/02	Tue 4/23/02	334
336	Detection of Anomalies (Sft 3)	1 day	Wed 4/24/02	Wed 4/24/02	335
337	Intrusive Investigation of Anomalies (Sft 3)	0.2 days	Thu 4/25/02	Thu 4/25/02	336
338	Excavate and Remove Lift 3 (Grading Contractor)	4 days	Thu 4/25/02	Wed 5/1/02	337
339	Detection of Anomalies (Sft 4)	1 day	Wed 5/1/02	Thu 5/2/02	338
340	Intrusive Investigation of Anomalies (Sft 4)	0.2 days	Mon 5/6/02	Mon 5/6/02	339
341	Excavate and Remove Lift 4 (Grading Contractor)	4 days	Mon 5/6/02	Fri 5/10/02	340
342	Analysis of Point Clearance Data	138.[illegible] days	Fri 3/28/03	Mon 10/14/02	
343	Start Population of GIS	1 day	Fri 9/26/02	Fri 3/28/03	6480
344	Complete Population of GIS Data	1 day	Fri 10/4/02	Mon 10/7/02	343,143
345	QC of GIS	5 days	Mon 10/7/02	Mon 10/14/02	344
346	Preparation of North Valley (Grading Contractor)	1 day	Mon 10/14/02	Tue 10/15/02	345
347	QC Scan/Intrusive Investigation of Previously Stockpiled Soils being placed in North Valley	80 days	Tue 10/15/02	Mon 2/10/03	345,346
348	OE Anomalies Clearance	81 days	Mon 2/10/03	Wed 6/4/03	
	Detection of Anomalies During Removal of Soil in Lifts	80 days	Mon 2/10/03	Tue 6/3/03	347
	Intrusive Investigation of Anomalies During Removal of Soil in Lifts	80 days	Tue 2/11/03	Wed 6/4/03	349SS+1 day



Project: OE Remediation
Date: Fri 3/7/03

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

ID		Task Name	Duration	Start	Finish	Predecessors
351		TNT Soils Potentially Contributing 15 pounds or More Explosives	9 days	Mon 5/20/02	Mon 6/3/02	
352		Notify Bay Area Air Quality Control Board	5 days	Mon 5/20/02	Tue 5/28/02	126FS-5 days
353		Homogenize TNT Soils	1 day	Tue 5/28/02	Wed 5/29/02	352
354		Support Collection of Samples	2.25 days	Tue 5/28/02	Thu 5/30/02	353SS
		Excavate, Load, Haul, and Dispose of TNT Impacted Soil	3 days	Wed 5/29/02	Mon 6/3/02	353
		DE Remediation Project Submittals	344.25 days	Fri 11/9/01	Mon 10/28/02	
357		Project Schedules (Spec. Div. 1.5)	48 days	Wed 1/9/02	Tue 3/5/02	
358		Preliminary Project Schedule	20 days	Wed 1/9/02	Tue 2/5/02	10
359		Initial Project Schedule	40 days	Wed 1/9/02	Tue 3/5/02	10
360		Site Conceptual Model	10 days	Mon 10/14/02	Mon 10/28/02	345
361		DE Project Closeout Report (Unit D-1)	17 days	Thu 7/25/02	Mon 8/19/02	
362		Administrative Draft	10 days	Thu 7/25/02	Thu 8/1/02	341,338,339,225
363		Draft	5 days	Thu 8/1/02	Thu 8/15/02	362
364		Final	2 days	Thu 8/15/02	Mon 8/19/02	363
365		DE Project Closeure Report (Site Wide)	18 days	Fri 11/9/01	Thu 12/6/01	
366		Administrative Draft	10 days	Fri 11/9/01	Mon 11/26/01	
367		Draft	5 days	Tue 11/27/01	Mon 12/3/01	366
368		Final	3 days	Tue 12/4/01	Thu 12/6/01	367
369		Construction Support During B-3 Wide Grading	80 days	Fri 12/7/01	Wed 4/17/02	368



Project: DE Remediation
Date: Fri 2/1/02

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

91 Reacquire Anomalies in Sector 18B
Assumes 2.2 acres, 214 anomalies 97 anomalies per acre, 2 person team at 160 per day
93 Intrusive Investigation of Sector 18B
Assumes 1, 6 person dig crew
92 Placement of Grids on Project Site
Assumes one Survey Crew
63 Surface Clearance of Project Site
Assumes 8 acres per day per 6 person crew plus supervisor
94 Sector 18A
4 teams, 160 per team. 100 percent of anomaly count, 97 per acre
95 Sector 8
4 teams
96 Sector 4
4 teams
... Sector 1
4 teams
Sector 3
4 teams
Sector 5
4 teams
100 Sector 6
4 teams
101 Sector 8
4 teams
102 Sector 7
4 teams
104 Sector 10A
7 person crew, 1 supervisor, 40 per shovel, 4 shovels, 2 data recorders (3 Tech II and 3 Tech I)
145 Detection of Anomalies in Unit D-1 Stockpile
Assumes 2, real time systems
148 Intrusive Investigation of Anomalies in Unit D-1 Stockpiles
Assumes 97 anomalies per acre, 3.7 acres, 4 person team [1 supervisor, 3 shovels, (1 UXO II and 2 UXO 1)
152 Resupplies of Anomalies in Ridge Stockpiles (LIR 1)
Assumes 7.7 acres of 97 anomalies, 5 teams
156 Intrusive Investigation of Anomalies in Ridge Stockpiles (LIR 1)
Assumes 97 anomalies per acre, 7.7 acres, 4 person team [1 supervisor, 3 shovels, (1 UXO II and 3 UXO 1)]
168 Detection of Anomalies in North Valley Stockpiles (IIR 1)
1 MPA System
169 Intrusive Investigation of Anomalies in North Valley Stockpiles (IIR 1)
Assumes 97 anomalies per acre, 1.45 acres, 4 person team [1 supervisor, 3 shovels, (1 UXO II and 2 UXO 1)]
176 Detection of Anomalies in Sector 2 Fill Soils (LIR 1)
1 MPA MTAD System
179 Intrusive Investigation of Anomalies in Sector 2 Fill Soils (LIR 1)
Assumes 4 person crew (1 Supervisor, (UXO II, 2 UXO 1), 3 shovels
225 Detection of Anomalies in Demolition Site 1 (IIR 3)
1 MPA MTAD System
228 Intrusive Investigation of Anomalies in Demolition Site 1 (IIR 3)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels
246 Detection of Anomalies in Demolition Site 3 (IIR 2)
1 MPA MTAD System
247 Intrusive Investigation of Anomalies in Demolition Site 3 (IIR 2)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels, 513 anomalies per acre, 0.6 acres
266 Intrusive Investigation of Anomalies in Demolition Site 3 (IIR 6)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels, 232 anomalies per acre, 0.9 acres
271 Intrusive Investigation of Anomalies in Demolition Site 3 (IIR 16)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels, 145 anomalies per acre, 0.6 acre
282 Detection of Anomalies in Pine Site (IIR 2)
1 MPA MTAD System
283 Intrusive Investigation of Anomalies in Pine Site (IIR 2)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels
300 Detection of Anomalies in Mercury Impacted Soil (IIR 2)
1 MPA MTAD System
301 Intrusive Investigation of Anomalies in Mercury Impacted Soil (IIR 2)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels, 20 percent of 97 per acre or 20 per acre, 1.8 acres
309 Detection of Anomalies in North Valley Landfill (IIR 2)
1 MPA MTAD System
310 Intrusive Investigation of Anomalies in North Valley Landfill (IIR 2)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels, 200 anomalies per acre (Same as Demolition Site 3)
324 Detection of Anomalies in North Valley Fill Area (IIR 2)
1 MPA MTAD System
325 Intrusive Investigation of Anomalies in North Valley Fill Area (IIR 2)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels, 97 anomalies per acre
333 Detection of Anomalies (IIR 2)
1 MPA MTAD System
334 Intrusive Investigation of Anomalies (IIR 2)
Assumes 4 Person Crew (1 supervisor, 1 UXO II and 2 UXO 1), 3 shovels at 30 percent of 97 (per acre)
358 Intrusive Investigation of Anomalies During Removal of Soil in Lifts
Old Schedule space 27 days. Send Question.
354 Suppport Collection of Samples
72 acres of samples. 4 samples per hour, 2 person crew, 1 excon
355 Excavate, Load, Haul, and Dispose of Hot Impacted Soil
Chris Moses/Eden McKelvey to determine timeframe

APPENDIX B

MINIMUM SEPARATION AREA NOTIFICATION AND IMPLEMENTATION PLAN

MINIMUM SEPARATION AREA NOTIFICATION AND IMPLEMENTATION PLAN (MSAP)

Introduction and Purpose

The Tourtelot Cleanup Project entails the safe location, investigation and removal of ordnance and explosives (OE), OE scrap and other metallic items. Trained OE safety specialist teams will conduct this process according to U.S. Army Corps of Engineers' (Corps) ordnance clearance procedures. The California Department of Toxic Substances Control (DTSC) has approved these procedures.

The Corps has performed calculations to establish a Minimum Separation Distance (MSD) that must be maintained between clearance operations and the public. For the Tourtelot Cleanup Project, the MSD has been determined to be 200 feet. The MSD distance will remain constant unless ordnance is found during remediation that would require a recalculation of the MSD to comply with the Corps' established clearance procedures.

An MSD is measured from the outer limits of an OE clearance operation as a radius. This radial distance is applied 360 degrees and forms an area that is controlled and restricted to project personnel during clearance work periods. For purposes of this plan, this area will be known as the Minimum Separation Area (MSA).

Minimum Separation Area (MSA)

A portion of the MSA includes private and public properties that lay outside the project site. This Minimum Separation Area Notification and Implementation Plan (MSAP) addresses the scheduled/pre-planned temporary withdrawal of residents who reside in the MSA when intrusive OE clearance operations are underway. For example, when such work is scheduled to occur in a project area with a MSD of 200 feet, preplanned temporary withdrawal from homes within that MSD will take effect. It is anticipated that affected residents will be required to withdraw from their homes during the daytime (from 8:30 a.m. to 5:00 p.m.) on the scheduled dates. Typically, clearance work will occur only Monday through Friday.

In addition to persons who live within the MSA, the establishment of the MSA may affect other residents in the area, such as residents whose homes aren't affected by the MSA, but whose ability to travel to and from their residences may be impeded by the closure of streets within the MSA. These residents will be addressed as part of this MSAP.

MSA Notification

The project proponents will undertake a numbers of actions to ensure residents within or affected by the MSA are informed of the temporary withdrawal and have an opportunity to have their questions answered and special needs addressed. Residents whose homes do not fall within the MSA, but whose ability to travel to and from their residences may be impeded by the closure of streets within the MSA, will be included in the MSA notification. This notification will be provided on the time schedule described below. The notices will include a telephone point of contact that can be used in the event an emergency requires a resident whose ability to travel to and from their residents is impeded by the closure of streets within the MSA to leave their home while a MSA is in effect. In an emergency, residents would be

able to call this number to temporarily halt clearance activities so that they could depart safely. Communications will also be established with public agencies in Benicia. These actions are as follows:

1. Approximately 60 days prior to clearance activities and temporary withdrawal, the proponents will distribute a newsletter to residents within or affected by the MSA. The newsletter will provide an overview of the Tourtelot Cleanup Project, describe the requirements for public withdrawal from the MSA and notify residents of the potential hazards associated with clearance activities. It will also provide answers to frequently asked questions, a project map and anticipated schedule and contact information, including a 24-hour information phone line and website address. The newsletter will include a point of contact that residents can use if they need assistance to address such special needs as transportation; child care coordination; boarding of pets; assistance with frail, ill or disabled household members; or temporary accommodations for residents who normally conduct business from home offices.

2. Approximately 30 days prior to clearance activities and temporary withdrawal, the proponents will:

i) brief the Community Advisory Group, the City of Benicia, the Benicia Fire Department and the Benicia Police Department regarding the designated MSA, the anticipated dates of withdrawal, the addresses falling within or affected by the MSA, and withdrawal procedures;

ii) hold a workshop to provide area residents with information regarding clearance activities and the temporary withdrawal. Residents can also use this opportunity to ask questions, provide the project proponents with input, and request assistance with special needs associated with withdrawal;

iii) distribute notices with information about the specific anticipated dates and times of the required withdrawal to each address within or affected by the MSA. The notice will include a point of contact and form for reporting special needs.

3. Approximately 10 days and 72 hours prior to clearance activities and temporary withdrawal, the proponents will distribute reminder notices to each address within or affected by the applicable MSA. The notices will include the point of contact information to address special needs associated with the temporary withdrawals.

4. In the event changes to the schedule are necessary following the 72-hour reminder, residents will be encouraged to call the 24-hour information phone line or check the project website to make sure the planned withdrawal is still on schedule.

5. Throughout the period that clearance activities are being conducted, the proponents will regularly update the City of Benicia, Benicia Police Department and Benicia Fire

Department of the specific areas scheduled to be within the MSA in upcoming activities and of any roads or other public facilities that would be closed during the clearance activities.

6. On the evening before the planned withdrawal, representatives for the project proponents will go door-to-door in the MSA to remind residents about the next day's activities and to address any special needs.

Broader Notification

In addition to the 200 foot MSD recommended by the Corps, DTSC is requiring residents, businesses and schools within the Voluntary Separation Distance (VSD) to be notified of the potential hazards associated with an accidental detonation. The VSD is based upon the Maximum Fragmentation Distance (MFD) for the most probable munition (either 1080 feet or 1181 feet depending on the specific area of the project site and the applicable most probable munition). These distances will remain constant unless ordnance is found during remediation that would require a recalculation of the MSD and MFD distances to comply with the Corps' established clearance procedures. Persons within the area between the MSD and VSD (between 200 feet and 1080 or 1181 feet) will not be required to withdraw, but may voluntarily do so. Persons choosing to withdraw from the VSD will be offered the same support services as persons within or affected by the MSD.

The proponents will inform persons who live in the area between the MSD and VSD of special considerations that may affect them. This includes residents whose homes aren't affected by the MSA, but whose ability to travel to and from their residences may be impeded by the closure of streets within the MSA.

The notifications to residents residing within the broader area will include the following actions:

1. Approximately 60 days prior to clearance activities the proponents will distribute a newsletter to addresses within this broader area. The newsletter will provide an overview of the Tourtelot Cleanup Project, describe the requirements for public withdrawal from the MSA, the option of voluntary withdrawal from the MFD, and notify residents of the potential hazards associated with OE clearance activities. It will also provide answers to frequently asked questions, a project map and anticipated schedule and contact information, including a 24-hour information phone line and website address.

2. Approximately 10 days prior to clearance activities the proponents will distribute a reminder notice to addresses in the greater area surrounding the MSD. This notice will remind the recipients of the pending clearance work and encourage them to check the 24-hour information phone line and the website for additional information.

3. A workshop will be held to provide area residents with information regarding clearance activities and the voluntary withdrawal. Residents can also use this opportunity to ask questions, provide the project proponents with input, and request assistance with special needs associated with withdrawal.

Matthew Turner Elementary School does not fall within the 200 foot MSD. The school will be included in the broader notification area. The geophysical mapping of the portions of the Project Site nearest the school will help to determine the steps necessary to minimize affects on school operation. The proponents will work with school officials to be sure they are adequately informed about the Tourtelot Cleanup Project, the MSA and the issues affecting the broader notification area, so that they may determine the appropriate response and communicate with parents. The proponents will address any other issues related to the clearance activities that the school officials identify.

Proponents will also contact City of Benicia officials to discuss any issues related to public areas or facilities that are affected by the broader notification area including the community park, walking path and Lake Herman, so that they may determine the appropriate response.

If ordnance were to be found during remediation that requires a recalculation of the MSD distances to comply with Corps' established clearance procedures, a determination will be made as to whether the revised area affects the school or other public areas. If the school were affected by the revised MSD, the proponents would coordinate with school officials to establish a procedure for notifying parents of the activities affecting the school. If other public areas are affected, the proponents will coordinate with City of Benicia officials regarding appropriate actions and notifications.

MSA Security

The proponents' site clearance contractor will employ trained safety personnel to oversee the withdrawal from the MSA and restrict re-entry during clearance work hours. At the beginning of each workday, the assigned personnel will visit each affected residence within the MSA, look for signs of anyone being present and knock on doors. If any unauthorized persons are determined to be within the MSA, they will be asked to depart and clearance work will not begin until they have left the MSA. The safety personnel will also post signs or erect barriers to close affected streets and walkways to restrict unauthorized entry to the MSA. Personnel will be stationed in appropriate locations outside the MSA to monitor activities continuously during the clearance workday. In the event that unauthorized persons enter or are found within the MSA, clearance activities will be halted until the area is cleared.

If unauthorized persons fail to leave the MSA, the Benicia Police Department will be contacted for assistance in clearing the area in accordance with City of Benicia Ordinance #01-02.

Hospitality Services During Work Hours

Residents within the MSA who are required to temporarily withdraw from their residences or residents within the VSD whose choose to voluntarily withdraw during the day may use the services provided by the proponents' Hospitality Center located at the Best Western Heritage Inn. These services will include refreshments and meals, telephones, television and other amenities. In the highly unlikely event that residents are prevented from returning to their homes for the evening, suitable overnight accommodations will be made available to them at the Hospitality Center.

Special Needs

The proponents will establish a point of contact (community liaison) to address special needs such as transportation; child care coordination; boarding of pets; assistance with frail, ill or disabled household members; temporary accommodations for residents who normally conduct business from residence offices; damage to property caused by a detonation at the project site; and other specials needs identified through the proponents' community notification efforts. Special needs will be addressed on a case-by-case basis.

APPENDIX C

EXPLOSIVES SAFETY SUBMISSION

EXPLOSIVES SAFETY SUBMISSION
TOURTELOT PROJECT SITE

Tourtelot Remediation
Solano County
Benicia, California

February 2002

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EXPLOSIVES SAFETY SUBMISSION
TOURTELOT PROJECT SITE
SOLANO COUNTY
BENICIA, CALIFORNIA

1.0 INTRODUCTION

This Explosives Safety Submission (ESS) describes the methods and procedures to be used to locate and remove ordnance and explosives (OE). Location and removal of OE is one of the actions in response to the Order.

An engineering evaluation/cost analysis (EE/CA) for the former Benicia Arsenal, which includes the Project Site, was completed by the U.S. Army Corps of Engineers (USACE) in March 2000.

The former Benicia Arsenal EE/CA investigation divided the arsenal into five sectors for purposes of evaluation. These sectors are shown on Figure C-3. The Tourtelot Project Remediation, addressed by this submission, includes Sectors 3A and 3B, as well as areas to the west and south (see Figure C-3). Sectors 3A and 3B were determined during the EE/CA investigation to require a clearance to depth and were determined as deserving of removal actions by the Action Memorandum. This submission does not address Sectors 1, 2, 3C, 4, and 5. For purposes of this remediation, the Project Site has been divided into two sectors (Figure C-4) similar to Sectors 3A and3B. An Action Memorandum was signed on March 30, 2000, by the Commander of USACE, Sacramento District.

An Imminent and/or Substantial Endangerment Determination and Remedial Action Order (Docket No. I/SE 98/99-011), signed June 1, 1999 (the "Order"), was issued for the Tourtelot Remediation Project Site (Project Site), Benicia, California, by the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC).

A final draft remedial investigation/feasibility study (RI/FS) report (June 2001) was prepared. Based on the results of the RI and analysis of alternatives in the FS, the report recommended Alternative 5A as the preferred remedial action. Alternative 5A is composed of three remedial steps, point clearance of OE, OE scrap, and metallic anomalies of the entire Project Site, remediation of chemically affected soils, and areawide OE clearance. OE point clearance includes surface clearance, geophysical investigation and mapping, removal and disposal of all detected anomalies, and a quality control (QC) scan of the entire site that includes the removal of any additional anomalies detected. The QC scan would be conducted over the entire Project Site. OE point clearance would be followed by remediation of chemically affected soils. Affected areas include the TNT Strips; the Flare Site; Demolition Site #3; and Stockpiles #1, #2,and #3 in the North Valley. TNT Strips soils would be treated prior to removal to ensure that TNT concentrations are less than 10 percent. The final remedial step would be areawide OE clearance.

Areawide clearance is the removal of soil that is suspected of containing OE below the depth of the previous OE cleanup activity or that is associated with an outlier

and is within a future residential area. The areawide clearance will continue until two consecutive lifts of soil that do not contain OE or OE scrap are removed and no deeper anomalies are detected. A lift of soil ranges from 12 to 18 inches in thickness.

1.1 Site Location

The Project Site is approximately 220 acres in size and much of this site is situated within the former Benicia Arsenal. Figure C-1 presents a regional map of the area with the general location of the former Benicia Arsenal and the Project Site.

The Project Site is bordered by the Southampton residential development to the west and south, industrial and commercial facilities to the east and south, and open space to the north. Figure C-2 presents a site map of the Project Site and illustrates the proximity of the site to residential, commercial, and recreational areas.

1.2 Site Description

The Project Site is situated in a hilly area dominated by a central, east/west-trending ridge (referred to in this ESS as the "Ridge"), which acts as a drainage divide between a major drainage swale to the south, referred to as the South Valley, and a smaller drainage swale to the north, referred to as the North Valley. Project Site elevations range from approximately 60 feet to 300 feet above mean sea level (MSL) in the South Valley and 110 feet to 260 feet above MSL in the North Valley. The top of the Ridge, which was excavated as part of previous grading activities, is approximately 230 feet above MSL toward the east end and approximately 300 feet above MSL toward the west end.

1.3 Site History

The former Benicia Arsenal began as the Benicia Barracks in 1849. During its existence, the former Benicia arsenal supplied arms and serviced weaponry during the Civil War, the Spanish-American War, World Wars I and II, and the Korean Conflict. The former Benicia Arsenal manufactured targets for seacoast, field, and mobile artillery firing practice. Testing of 155-millimeter (mm) howitzers was performed on the former Benicia Arsenal using two large concrete test tunnels. In addition, the arsenal assembled powder charges and rapid-fire ammunition and filled armor-piercing projectiles with high explosives (HEs). As part of the Cold War build-up, the former Benicia arsenal reconditioned NIKE guided missiles.

The previous military uses of the Project Site are depicted in Figure C-5. 2,4,6-TNT was laid out in strips (TNT Strips) along the hillside and may have been burned. Approximately 3.5 acres in the North Valley were developed with roads and structures where the accuracy of howitzer gun barrels was checked (Howitzer Test Facility). Ordnance was inspected and renovated, and primers were destroyed in a "squirrel cage" (Ammunition Renovation/Primer Destruction Site). There was also a disposal area referred to as the "North Valley Military Landfill" in

the North Valley. Part of the Ridge was reportedly used to dispose of aged, out-of-service dynamite (Dynamite Burn Site).

In the South Valley, there was a Flare Site and three suspected demolition sites (Demolition Sites #1, #2, and #3) (Demolition Site #2 is no longer considered to have been used as a demolition site). The Flare Site was used to burn old, out-of-service flares. Demolition activities generally consisted of placing various amounts of out-of-service munitions in a "pit," placing a countercharge on top of the items, and detonating them.

All structures within the North Valley have been dismantled. Most of the building construction debris and inert OE scrap was removed from the Project Site during these activities. A large number of concrete-filled howitzer shells were unearthed during the dismantling activities in 1996, particularly in the vicinity of the test tunnels.

USACE conducted historical investigations of the former Benicia Arsenal, including the Project Site, in 1994, 1996, and 1999 (the results of these historical investigations are contained in the March 1994 Archives Search Reports, the May 1997 Supplemental Archives Search Report, and the 1999 Records Research Report). In addition, USACE performed an EE/CA investigation to evaluate potential OE and assess safety risks at the former Benicia Arsenal. The property owner conducted a geophysical survey in 1996 over the Project Site, excluding the cut portion of the Ridge, the western portion of the South Valley, and the wetland area in the South Valley to assess the distribution of metallic anomalies. An additional geophysical survey of select areas throughout the Project Site was conducted by USACE in 1999.

The geophysical surveys conducted identified anomalies at the Project Site. The data collected from these surveys were used to perform OE clearances in August and December 1996 and to support a USACE OE investigation of the former Benicia Arsenal, including the Project Site and adjacent property, in March 1999. In May 2000, an investigation of the North Valley Military Landfill was conducted utilizing construction support for OE. Approximately one half of the geophysical anomalies identified were OE-related scrap. No OE was encountered.

As a result of previous clearances and investigations, a total of nine OE items related to site activities have been recovered from the Project Site. Table C-1 lists the type and depth of the OE and the recovery date. Figure C-5 depicts the location of each OE encountered. All nine items have been recovered from the South Valley and from the south portion of the Ridge. No OE items have been recovered from the North Valley or on the slopes of the North Valley. All OE and OE scrap recovered from the Project Site, outside the demolition sites in the South Valley, were recovered at depths less than 2 feet below ground surface (bgs), except in two areas disturbed by previous grading activities. The absence of OE and OE scrap at depths greater than 2 feet bgs indicates that any OE at the Project Site is likely be buried at a shallow depth that is consistent with the historical use of the Project Site.

Table C-1. Summary of OE Found on the Tourtelot Property

Grid	Easting[a]	Northing[a]	Type	Description	Depth (inches)	Disposition	Date Found
NA[b]	6518714	1792353	OE	37mm HE projectile	unknown	Destroyed by Travis AFB EOD Unit	11/12/96
NA[b]	6518717	1792344	OE	76mm APHE round	unknown	Destroyed by Travis AFB EOD Unit	11/12/96
NA	6519242	1792111	OE	37mm HE projectile	unknown	Destroyed by Travis AFB EOD Unit	12/96
I-14	6519030	1792468	OE	40mm AA HE	12	Destroyed by Travis AFB EOD Unit	12/02/96
O-15	6520319	1792264	OE	60mm mortar, fuzed	2	Destroyed by Travis AFB EOD Unit	12/05/96
P-15	6520425	1792250	OE	40mm AA, unfired	8	Destroyed by Travis AFB EOD Unit	12/06/96
0312	6518714	1792342	OE	37mm HE projectile, fuzed	24	Destroyed on-site	02/23/99
0312	6518710	1792352	OE	75mm shrapnel HE projectile, unfuzed	6	Destroyed on-site	02/23/99
NA	6519085	1792150	OE	Expelling charge	surface	Destroyed by Travis AFB EOD Unit	05/06/99

Notes: (a) Easting and northing coordinates are estimated based on the location of the item within the sampling grid.
(b) Item found in EE/CA grid 0312, prior to the 1999 EE/CA investigation.

AA = anti-aircraft
AFB = air force base
APHE = armor-piercing, high explosive
EOD = explosives and ordnance disposal
HE = high explosive
NA = not applicable
OE = ordnance and explosives