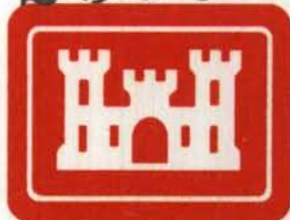


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# US Army Corps of Engineers

Toxic and Hazardous  
Materials Agency

**FINAL**

## SAMPLING DESIGN PLAN

Data Item A004

HAMILTON ARMY AIRFIELD  
Novato, California

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Contract DAAA15-88-D-0006  
Task Order 12

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Prepared for:

Commander  
U.S. Army Toxic and Hazardous Materials Agency  
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by:

E.C. Jordan Co.  
Portland, Maine

November 1990

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ENVIRONMENTAL INVESTIGATION  
SAMPLING DESIGN PLAN

HAMILTON ARMY AIRFIELD  
NOVATO, CALIFORNIA

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Prepared for:

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY  
ABERDEEN PROVING GROUND, MARYLAND

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PORTLAND, MAINE 04112

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

USATHAMA CHEMICAL CODES

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## 1.0 INTRODUCTION

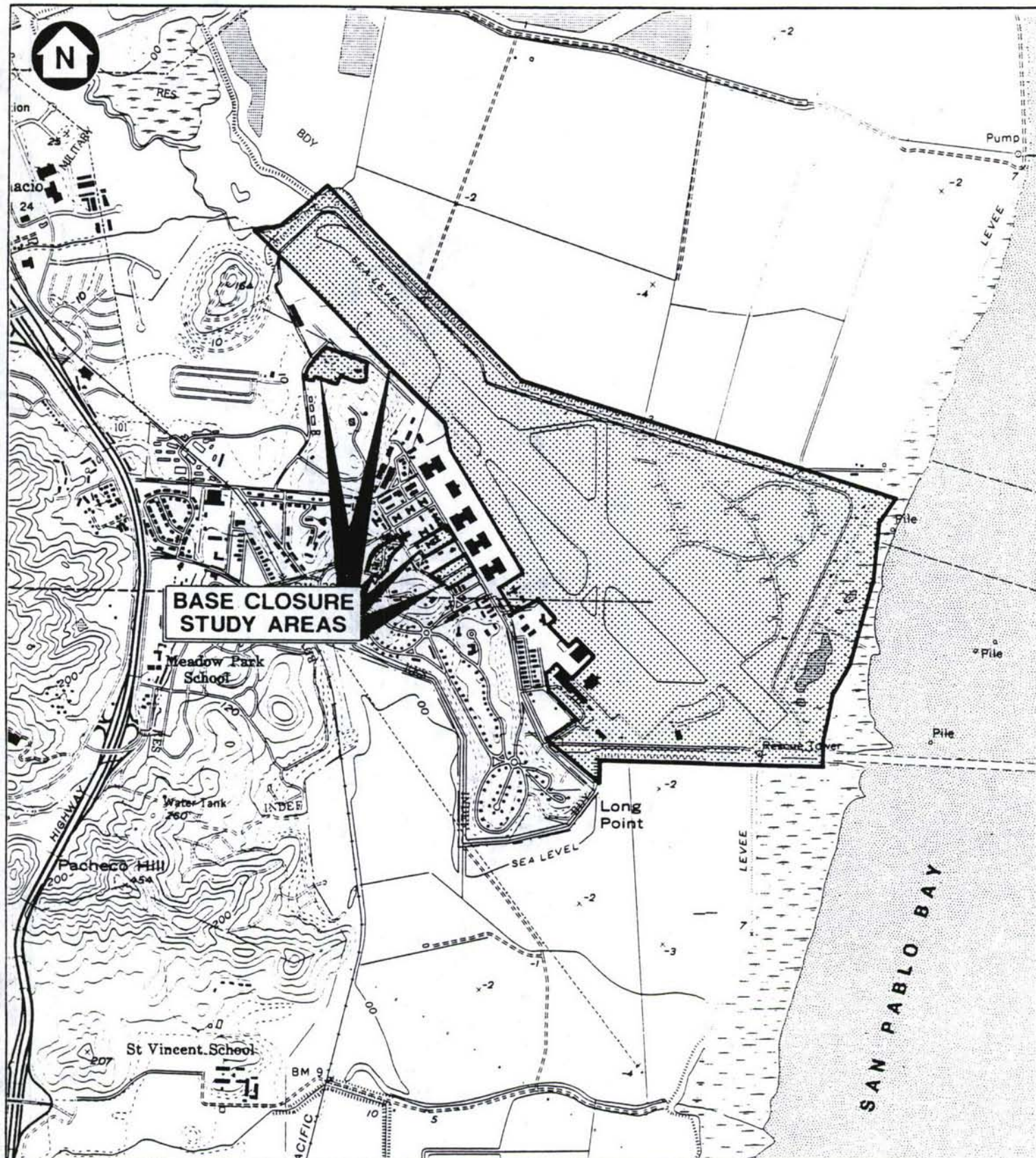
To support the U.S. Army national defense mission, a wide range of manufacturing, storage, testing, and training, as well as research and development operations, has been carried out at various Army installations. As a result of these activities, potential exists for environmental contamination. The U.S. Army Installation Restoration Program (IRP) was designed to identify contamination and control or abate contaminant migration resulting from past operations at Army installations. The IRP is the Army's response authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. As delegated by Executive Order 12580, the Army is responsible for determining response actions, consistent with the National Contingency Plan (NCP) (40 CFR Part 300), necessary for the abatement of contamination resulting from releases of hazardous substances.

The Assistant Chief of Engineers has been designated as the responsible proponent for the Department of the Army Environmental Program. The U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), as a U.S. Army Corps of Engineers (USACE) field operating agency, is responsible for the planning, implementation, and direction of the Department of the Army Environmental Program under the Assistant Chief of Engineers; the IRP is a component of this program.

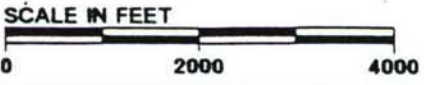
A portion of the Hamilton Army Airfield (HAA) (Figure 1-1) was recommended to the Secretary of Defense for closure by the Commission on Base Realignment and Closure. To support Department of the Army decisions regarding preparation of the property for release, USATHAMA is responsible for implementing environmental standards and, if necessary, restoration activities before property transfer. To minimize the potential for liability, these studies will address necessary IRP elements to comply with CERCLA, SARA, and the NCP; and requirements of the California Department of Health and Regional Water Quality Control Board.

Two previous assessments have been prepared at HAA. The first one was prepared by Environmental Science and Engineering, Inc. (ESE) in 1983 and was included as part of the Installation Assessment (IA) of the Presidio of San Francisco and its subinstallations (McMaster et al. (of ESE), 1983). The second, more recent, assessment was an Enhanced Preliminary Assessment (PA) prepared by Roy F. Weston, Inc. (Weston) in 1990. The IA evaluated the entire historic Hamilton Air Force facility while the PA was restricted to the base closure area. Currently, HAA consists of four separate areas: State of California owned property, base closure property, Government Service Administration (GSA) sale area, and navy housing (Figure 1-2). This Sampling Design Plan (SDP), as requested by USATHAMA, only addresses environmental investigations at Base Closure properties.

Limited potential or actual contamination was identified as part of the IA and PA on base closure property. The IA and PA identified potential or actual contamination related to a landfill; the petroleum, oil, and lubricants (POL) area; aircraft maintenance areas; storage areas; the east levee pump stations; a former sewage treatment plant; underground storage tanks; aboveground storage



SOURCE: U.S.G.S. TOPOGRAPHIC MAP 7.5 MINUTE SERIES  
 NOVATO, CALIFORNIA, 1954 AND PETALUMA POINT,  
 CALIFORNIA, 1959, PHOTOREVISED 1980.

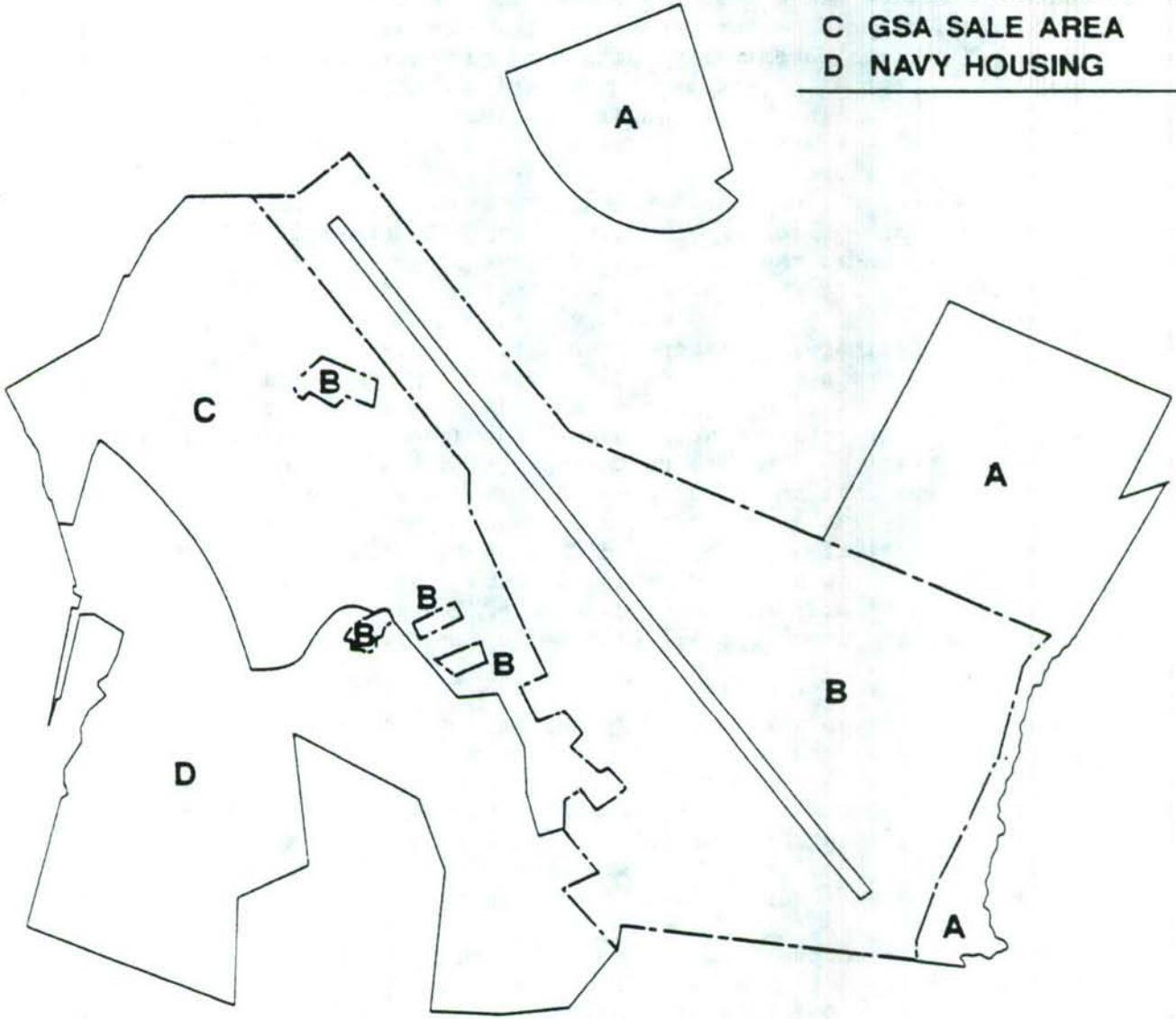


**FIGURE 1-1**  
**SITE LOCATION MAP**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

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- A STATE OF CALIFORNIA
- B ARMY PROPERTY
- C GSA SALE AREA
- D NAVY HOUSING



BASE MAP OBTAINED FROM HAMILTON ARMY AIRFIELD  
 "ENHANCED PRELIMINARY ASSESSMENT" PREPARED BY  
 ROY F. WESTON, INC., WESTCHESTER, PENNSYLVANIA,  
 DATED JANUARY 1990.



**FIGURE 1-2**  
**AREA LAND OWNERSHIP**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

EC.JORDANCO

tanks; a reported practice bombing range; a radiological disposal site; asbestos containing materials; transformer dielectric fluids containing polychlorinated biphenyls (PCBs); buildings potentially containing radon; and a burn pit. These areas of identified potential or actual contamination are justification for conducting an Environmental Investigation/Alternatives Assessment (EI/AA) to verify and quantify the nature and extent of contamination, perform public health and environmental risks assessments, and evaluate remedial action alternatives leading to individual site remedial actions, if necessary. Although HAA is not on the National Priorities List (NPL) under CERCLA, the EI/AA will be conducted under the approach and terminology of a Remedial Investigation/Feasibility Study (RI/FS).

The Draft Enhanced Preliminary Assessment identified approximately 12 environmentally significant operations (ESOs) (Weston, 1990) or study areas. One additional study area was added based on E.C. Jordan Co.'s (Jordan's) site visit (Jordan, 1990a). These sites were identified based on past records, interviews with base personnel, aerial photographs, and a site visit. In the HAA Technical Plan, available information on the study areas was evaluated and those requiring investigation as part of the EI were identified. For the SDP, the study areas to be investigated have been divided into eleven study areas: 1) Property-wide Investigations, 2) POL Area, 3) Pump Station Area, 4) Former Sewage Treatment Plant, 5) Aircraft Maintenance Area/Storage Areas, 6) Burn Pit, 7) JP-4 Pipe Line, 8) Revetment Area, 9) East Levee Landfill, 10) PCB Drum Site, and 11) Building 442 Site.

At the HAA, the EI objectives are to acquire the data necessary to define the distribution, types, and concentrations of contaminants, and to assess associated risks to public health and the environment. Data collected in the EI are designed to support the AA and decision documents that address mitigation of environmental contamination at each site. The EI will support a no-action decision at appropriate identified potential sites with sufficient data to demonstrate a lack of significant residual contamination.

The EI program will be conducted in accordance with the U.S. Environmental Protection Agency (USEPA) EI/AA Draft Guidance Manual (USEPA, 1989a) and USATHAMA Quality Assurance (QA) Program, January 1990. As such, the EI program is implemented in accordance with this site-specific SDP (Data Item A004), which is supported by two other documents: (1) the Technical Plan (TP; Data Item A005); and (2) Health and Safety Plan (HASP; Data Item A009). These documents correspond directly to the Field Sampling Plan (AAP), Work Plan, and Health and Safety Plan, respectively, called for in the USEPA Guidance Manual.

This SDP presents the rationale, approach, and proposed program for conducting the field activities at the HAA. The plan is presented in the following four sections;

Section 1.0 - Introduction;

Section 2.0 - Site Management;

Section 3.0 - Remedial Investigation Data Collection;

## Section 4.0 - Site-Specific Technical Programs

Section 1.0 presents the project overview and describes the purpose of the program. Site Management (Section 2.0) summarizes the support activities necessary for data collection and includes mobilization, site access consideration, instrumentation, documentation, field instrumentation, decontamination, and control and disposal of contaminated materials. Remedial Investigation Data Collection (Section 3.0) describes the methods employed to gather information required to meet data quality objectives (DQOs). Among these methods are exploratory geophysics programs; subsurface explorations; headspace screening; monitoring well installation and development; hydraulic conductivity testing; groundwater, soil, surface water, and sediment sampling; the laboratory analytical program; and topographic survey. Finally, the Site Specific Explorations (Section 4.0) proposed for HAA are presented for each of the 11 identified study areas.

### 1.1 SITE BACKGROUND

The majority of the information in the rest of this section is summarized and condensed from existing documents that contain additional detail and background information concerning the HAA (i.e., Bonaparte and Mitchell, 1979; U.S. Army Corps of Engineers, 1989; Jordan, 1990a and b; Weston, 1990; Woodward Clyde Consultants (WCC), 1985, 1987).

#### 1.1.1 Population And Land Use Characteristics

The HAA is located at the southern end of the City of Novato, on the western shore of the San Pablo Bay. San Pablo Bay is contiguous to San Francisco Bay and is the northernmost saltwater body in the San Francisco Bay area. Novato, located in Marin County, had a recorded population of 51,209 in 1980. Population projections forecast a continued increase in the number of city residents with an estimated population of 73,100 in 2005, which would make Novato the largest city in Marin County. This increase is reflective of a general county-wide increase in population and is due both to the migration of San Francisco residents to the suburbs and San Francisco's confined area, which has not changed in more than 100 years. San Francisco is approximately 22 miles south of HAA.

Existing land use in the HAA vicinity is divided into industrial, small business, and residential. Industrial land use includes Hamilton Industrial Park, Bel Marin Commerce Industrial Park, and Ignacio Industrial Park; all are located north of the base. Small business land use includes a bowling alley and shopping center northwest of the base, motels and a restaurant west of Highway 101, and assorted small businesses (theatre, offices, and restaurants, etc.) next to the southwestern corner of the site. Residential land use includes Los Robles Mobile Home Park adjacent to the Ignacio Highway 101 interchange, Bel Marin Keys north of the site runway, Rafael Village on the west side of Highway 101, and single family homes south of the site.

Land adjacent to the site consists mainly of the remainder of what was considered part of the HAA. South of the site is the Navy-operated housing (see Figure 1-2). Southwest of the site and surrounding the four noncontiguous parcels is the GSA sale property. North of the Revetment Area and east of the east levee is State-owned land. Bel Marin Keys is located north and northwest of the runway; however, the area north of the runway is currently used for farming activities.

HAA is generally situated on low lying lands with elevations below mean sea level. It is surrounded by three levees: the San Pablo Bay Levee to the east, a northern levee separating HAA from the neighboring farmlands and state-owned property, and a western levee separating HAA from an existing reservoir. Higher elevated land (i.e., land above mean sea level) is located to the south where the majority of the HAA buildings are located (Figure 1-3). A 2,575 linear foot gap exists in the northern levee and subjects the HAA to the same flooding as the neighboring farmlands and state lands.

The current mission of HAA is to operate as a subinstallation of the Presidio of San Francisco (PSF). Operations are primarily associated with Army Reserve activities. On the approximately 700 acres of base closure property existing at HAA, there are a number of buildings that have been used for a variety of purposes. Based on visual observations, most of the buildings appear to have been used for offices and related uses. In addition, several of the buildings have been used as health care facilities, including a hospital with an operating room. Several buildings are related to aircraft maintenance and storage activities; other buildings are related to the stormwater runoff control system.

#### 1.1.2 History of the Hamilton Army Airfield

The property for HAA was acquired from Marin County and private landowners in 1932. The original property was over 2,000 acres in size. HAA was opened in 1934 as an Army Air Corps facility to train fighter and bomber pilots and was known as Hamilton Field. Hamilton Field was used extensively during World War II. In 1947, the base was transferred to the U.S. Air Force (USAF) as part of the transfer of aircraft responsibilities from the Army to the USAF and was renamed Hamilton Air Force Base (AFB). Hamilton AFB functioned until 1974, when it was listed as excess property. In 1975, base command by military personnel ceased and civilian managers commenced operation. However, shortly thereafter the Department of Defense changed the housing area portion to the responsibility of the U.S. Navy. In 1976, the Army received permission from the USAF to use the runway and other ancillary facilities for aircraft operation. Also in 1976, the State of California determined that lands subject to tidal action belong to the State. Consequently, the State of California claimed a portion of the land outside the levees that partially encircle the site (referred to as "State" properties in Figure 1-2).

From 1976 to 1983, a number of potential uses of the site were proposed by government agencies and private developers. Some plans called for the resumption of air traffic in a civilian capacity; for example, a regional airport. Other plans called for inundating the area and creating an artificial wetland. In 1983, the State courts accepted a plan that allowed for the

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NOVATO, CALIFORNIA

DRAFT FINAL

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TASK ORDER 12

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U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY  
ABERDEEN PROVING GROUND, MARYLAND

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SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

USATHAMA CHEMICAL CODES

REFERENCES

APPENDICES

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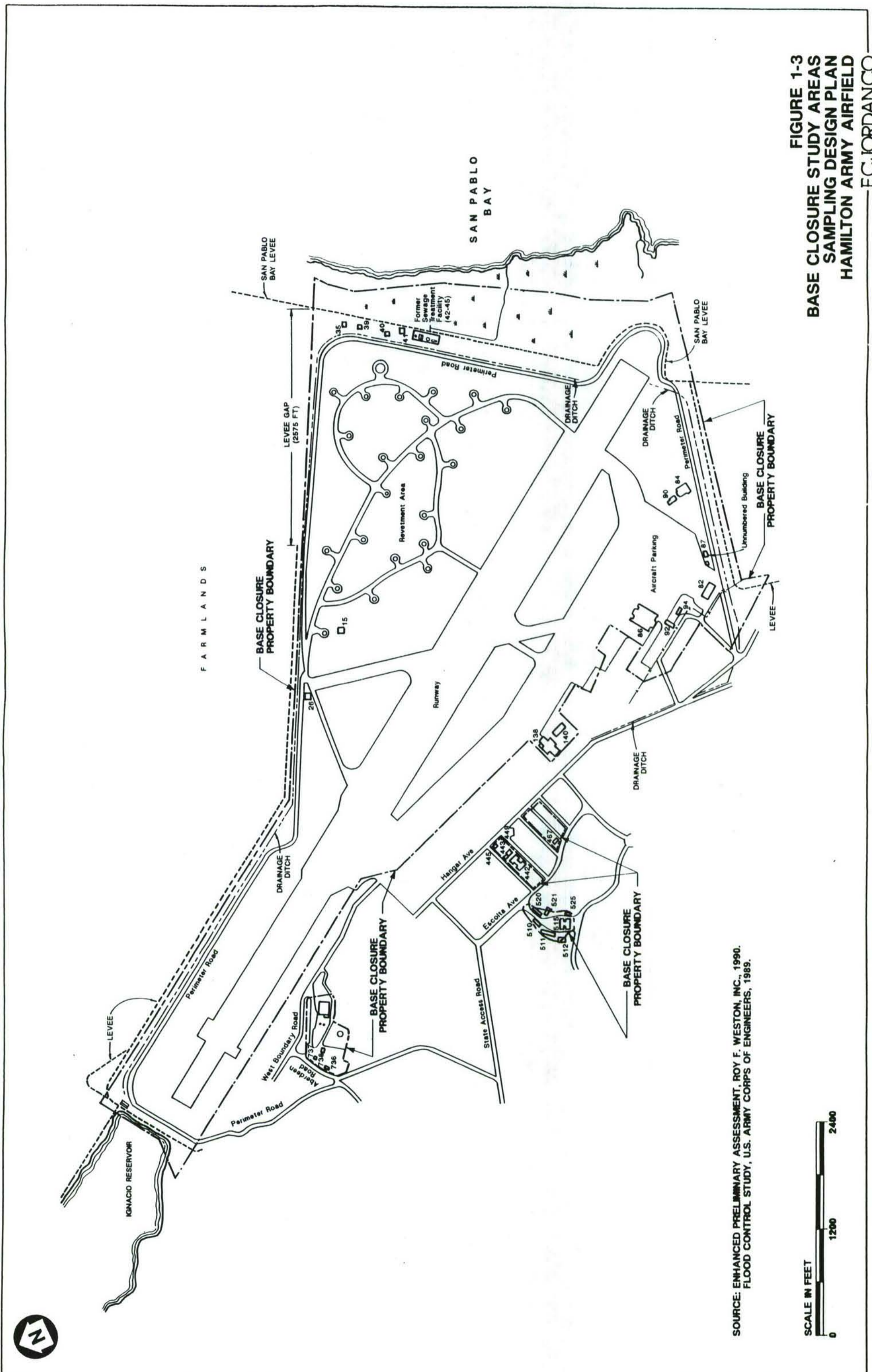
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SOURCE: ENHANCED PRELIMINARY ASSESSMENT, ROY F. WESTON, INC., 1990.  
 FLOOD CONTROL STUDY, U.S. ARMY CORPS OF ENGINEERS, 1989.



FIGURE 1-3  
 BASE CLOSURE STUDY AREAS  
 SAMPLING DESIGN PLAN  
 HAMILTON ARMY AIRFIELD  
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division of the site. The first property was given the installation number 6160 and included the airfield, a noncontiguous POL area, and other miscellaneous area. Installation 6160 was transferred to the Army in 1984. The second property, designated Installation 6200, was transferred to the Army in 1976 and consisted of three noncontiguous parcels. The three parcels are used primarily for Army Reserve activities. The scope of the Base Closure Program originally included only Installation 6160. Installation 6200 was added to the base closure process at the request of USATHAMA. Installation 6160 and 6200, collectively, are the portions of Hamilton that are to be closed under Base Closure and total approximately 700 acres, herein referred to as HAA.

The remaining property (not included in this report) consists of approximately 400 acres under the control of the U.S. Army and will be sold by the GSA. This property includes buffer zones that currently belong to the State and small parcels that belong to the Novato School District, U.S. Navy, and Coast Guard.

In March 1985, the GSA conducted an auction that resulted in a successful bid by a private developer who wanted to develop light industry and residential housing on the site. However, a landfill (known as Landfill 26) is located on the GSA site, which presented the potential for hazardous waste. Therefore, the USACE decided that the sale should be halted pending further investigation. Landfill 26, along with its buffer zone consisting of approximately 47 acres of land, was subsequently removed from the sale property. A RI/FS has been completed and a recommendation has been made to cap the landfill and install a groundwater monitoring system. Plans are underway to remediate this site. A subsequent interagency agreement between the USAF and the USACE split the responsibility for resolving the hazardous waste issue. The USAF is responsible for payment for the investigations at the site, and the USACE is responsible for ensuring that any investigations or subsequent field efforts are properly executed.

In addition, several sites in, around, and on HAA were found to contain hazardous waste. However, with the exception of the POL Area, none is on the property currently owned by the Army.

As stated in Section 1.0, there have been two preliminary assessments conducted at HAA. The 1983 IA, conducted by ESE, summarized data concerning hazardous waste sites on the entire Hamilton Air Force Base facility. The Enhanced PA, conducted by Weston (1990) included a site walkover, record review, and interviews with past and present HAA personnel. No environmental sampling was conducted as part of that assessment. Weston identified 12 study areas and made recommendations for sampling or survey activities at most of the study areas. The study areas where Weston recommended action are: asbestos on and within buildings, underground storage tanks (USTs), aboveground storage tanks (ASTs), transformers, aircraft maintenance/storage areas, burn pit, former sewage treatment facility, JP-4 line, revetment area, landfill, and bombing range (see Figure 1-3). No action was recommended for the former radiological disposal site because the buried wastes were removed and transported to an appropriate waste disposal facility for low level radioactive wastes.

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## 1.2 PHYSICAL SETTING

This subsection discusses the climate and physiography of the HAA.

### 1.2.1 Climate

HAA has a Mediterranean-type climate which is characterized by hot, dry summers and cool, wet winters. The temperature is moderated by San Pablo Bay and the Pacific Ocean. The average maximum temperature is 72°F and the average minimum is 47°F, although 100°F+ days are common in late summer. The rainy season extends from November through March and rainfall averages between four and seven inches per month during this period. During summer months, rainfall averages less than 0.1 inches per month. Annual rainfall averages 26 inches per year at HAA. Winds originate from the northwest and southeast with an average velocity of seven miles per hour. Summer months result in extensive evaporation of shallow surface waters and evaporation of moisture from shallow soil depths. Desiccation features such as cracks and fissures are common for soils during middle and late summer months. Fog occurs commonly during all times of the year, but typically "burns off" by 12:00 noon each day. From 1981 to 1989, the region has been subjected to 100-year storm events and unusually high tides. The combination of these two factors resulted in extensive surface flooding of lowland areas within HAA. Recent HAA rainfall records show that a major storm deposited 7.8 inches of rain over a six day period in February, 1986. However, severe winter storms with gale winds and heavy rains occur only occasionally. Thunderstorms seldom affect the area, but may occur in any month.

### 1.2.2 Physiography

This subsection describes the geology, hydrogeology, soils, and biota at the HAA site. The discussions of site geology and hydrogeology have been adapted from WCC (1985).

1.2.2.1 Geology. HAA lies within the San Francisco-Marín structural block of the northern Coast Range geomorphic province of California. The Coast Range province is characterized by a series of nearly parallel mountain ranges and intermontane alluviated valleys that trend obliquely to the coast line in a northwesterly direction. Geologic units within the Coast Range province range in age probably from early Jurassic to Recent and are composed of a heterogeneous mixture of intrusive, extrusive, metamorphic, and sedimentary rock types. Nearly all geologic units have been subjected to structural disruption and displacement by inactive and active fault systems. Today, geologic units and structures, and major fault zones emphasize the northwestern structural grain of the Coast Range geomorphic province.

The geology of the site is characterized by two distinct units. The Franciscan Complex of Jurassic to Cretaceous age forms the basement complex of the site and comprises the areas of topographic relief. Surrounding and unconformably overlying the Franciscan Complex rocks are a host of Quaternary age sedimentary deposits.

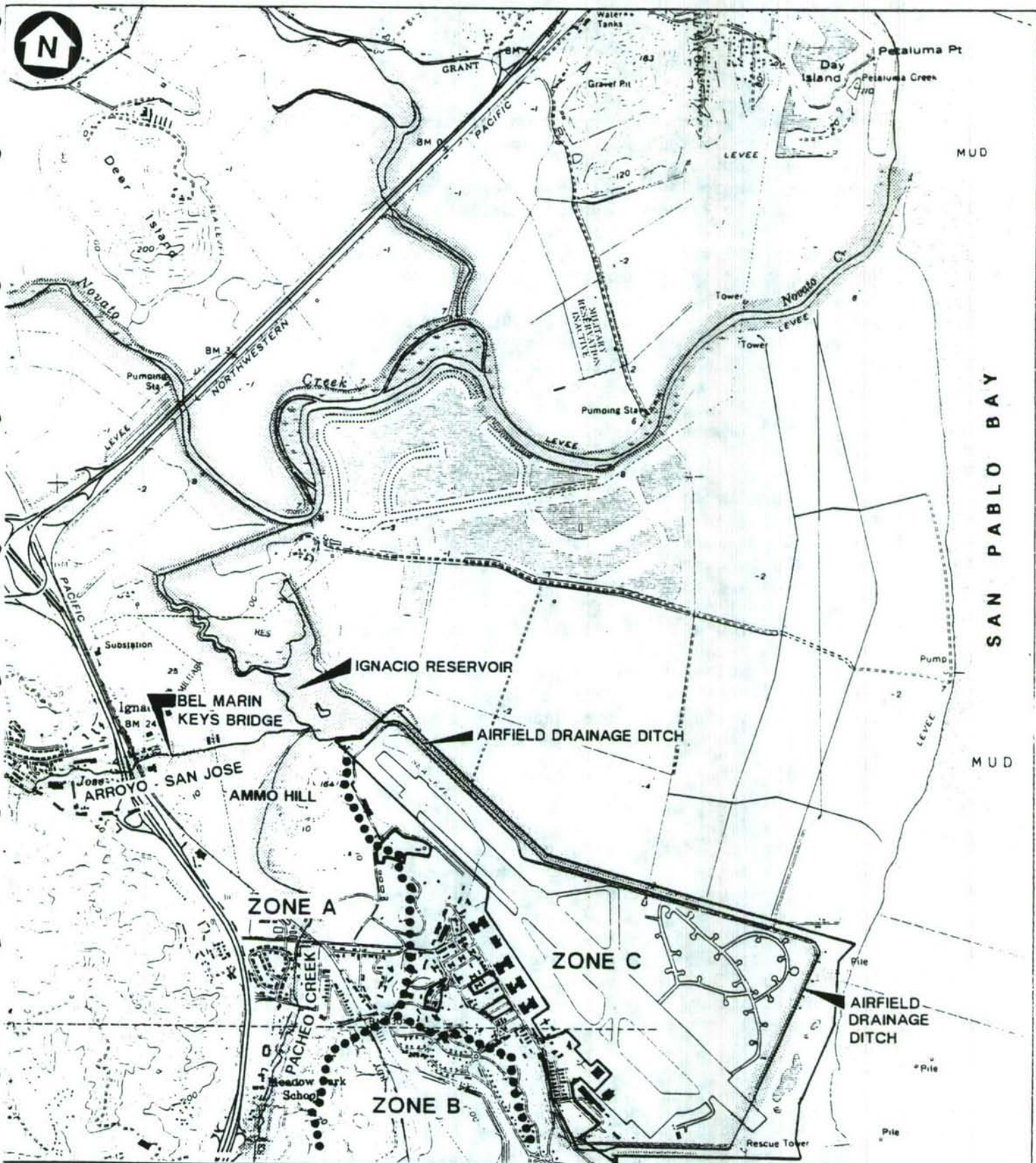
The Franciscan Complex rocks have been subjected to several episodes of tectonic disruption, faulting, and erosion. The erosional unconformity between the older Franciscan Complex rocks and the younger Quaternary sediments shows considerable relief implying that the thickness of the Quaternary sediments varies considerably.

The upland areas are generally steep, highly eroded monadnocks of light colored, pale buff, very hard, arkosic sandstone. This Franciscan sandstone is blue-grey when fresh but weathers to a yellow-brown. The sandstone is fine- to coarse-grained, contains subangular to angular grains of quartz and feldspar, and may contain a minor matrix component of silty-clayey material. This unit is generally massive, well cemented, partially recrystallized, locally bedded, and highly fractured. Although fine-grained matrix material is virtually absent, fracture planes and joints are common. These apertures may or may not be filled with secondary calcite.

The competent Franciscan sandstone has been partially buried in lowland areas by coalescing channel deposits and by bay plain and marshland deposits. These depositional materials are derived from the physical and chemical weathering of regional bedrock components and their transport to the San Francisco Bay basin. Periodic fluctuations in sea level over the past 50,000 years has resulted in the deposition of extensive sedimentary sequences within the Bay proper.

The stream and channel deposits occur as fine to medium-grained, discontinuous lenses of silt, sand, and minor gravels. These units coalesce and interfinger with extensive sequences of very fine-grained argillaceous mud. The argillaceous materials are progradational bayward and may exceed 100 feet in thickness. These bay plain and marshland deposits are semi to unconsolidated, dark blue-grey to black, highly plastic, soft to very stiff, impermeable, water-saturated, silty clays, commonly known as Bay Mud. Organic plant debris and shell fragments are common. Typically the Bay Mud is soft, sticky, and plastic when wet but tends to shrink, harden, and become brittle upon drying. This reaction is a function of the mineral components and high water content of the Bay Mud. The mineral components of Bay Mud include mica, montmorillonite, chlorite, kaolinite, quartz, and feldspar. The very fine-grained texture of these minerals and the jelly-like matrix result in high porosities but very low permeabilities.

1.2.2.2 Hydrogeology. HAA is situated within the Novato Creek drainage basin which comprises an area of about 44 square miles. This basin is bounded by the Petaluma River basin to the north, San Pablo Bay to the east, the Coast Range mountains to the west and southwest, and the Gallinas Creek drainage system to the south. The Coast Range acts as boundary and as the principal source of groundwater recharge and surface water drainage for the basin. The basin can be divided into three principal watershed zones: Zone A includes the drainage from Pacheco Creek and the western portion of the base into the marshy ponding area; Zone B includes the base officers' quarters and part of the existing residential area which drain to the south and southeast; and Zone C includes the entire Base Closure Area and is drained by a series of concrete lined ditches into San Pablo Bay. These zones are shown in Figure 1-4.



SOURCE: U.S.G.S. TOPOGRAPHIC MAP 7.5 MINUTE SERIES, NOVATO, CALIFORNIA, 1954 AND PETALUMA POINT, CALIFORNIA, 1959, PHOTOREVISED 1980.

**LEGEND**

- SURFACE WATER
- WATERSHED DIVIDE



**FIGURE 1-4  
HYDROLOGIC MAP  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

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The Pacheco Creek system is the most important watershed with respect to HAA and comprises an area of approximately eight square miles. Pacheco Creek captures flow from around the western and southern sides of Ammo Hill (located south of Ignacio Reservoir [see Figure 1-4], off base closure property) and diverts it to Ignacio Reservoir. Ignacio Reservoir covers approximately 250 acres and has a capacity of about 600 acre feet (assuming water level at 6 feet above mean sea level [MSL]). An earthen levee located along the northwestern periphery of the flight line restricts water in the reservoir from flooding the airfield.

Prior to being enclosed by levees, the airfield belonged to the Novato Creek flood plain and much of it is topographically below MSL. Zone C is drained by a series of concrete lined ditches and storm drains which tie into a perimeter drainage ditch system. This system directs flow towards a pumping station adjacent to the eastern airfield levee where water is discharged over the levee into San Pablo Bay. All of these features are shown on Figure 1-4.

The pumping capacity of the pumps located at the levee is 106,500 gallons per minute (GPM). This capacity is sufficient to drain the airfield area in a short period of time if flooding or levee failure occurs. The drainage ditches range from 24 to 54 inches in diameter. The combined capacity of all drainages delivering water to the pump stations is approximately 240 cubic feet per second (cfs) with about two feet of free board.

The majority of HAA, particularly the airfield, is subject to the hydrological effects of San Pablo Bay because of its low-lying elevation (greater than 90% of the base closure area is below MSL) and topographic position in the landscape. The airfield was built in the Novato Creek floodplain adjacent to the Bay. HAA is protected from flooding and tidal influences by a series of levees and pumps. The highest expected tide in the vicinity of HAA is about seven feet, with six feet as the average.

Surface waters in Zone A and C are hydraulically connected through Novato Creek to San Pablo Bay and are affected by tidal influences, although these influences are diminished by several floodgates within the levee system. The impermeable nature of the bay mud deposits tend to retard the hydraulic responses of groundwater from tidal influences, consequently limiting changes in static groundwater levels.

The hydraulic characteristics of the geologic units at HAA can be segregated into two discrete groups. The rocks belonging to the Franciscan Complex are essentially impermeable, although flow through this unit is principally controlled by the presence of numerous fractures and joints. The orientations of fracture planes and their apertures are highly variable and do not show any distinct trends.

The Bay plain and stream channel deposits comprise the second discrete hydrogeologic unit. The stream channel deposits are composed of granular, primarily non-cohesive soils, and will act as the major avenue for groundwater movement. They occur as discontinuous lenses and buried stream channel beds. Their effect upon local hydrologic conditions will occur primarily around Ammo Hill and the landfill areas which are located south of Ignacio Reservoir (see

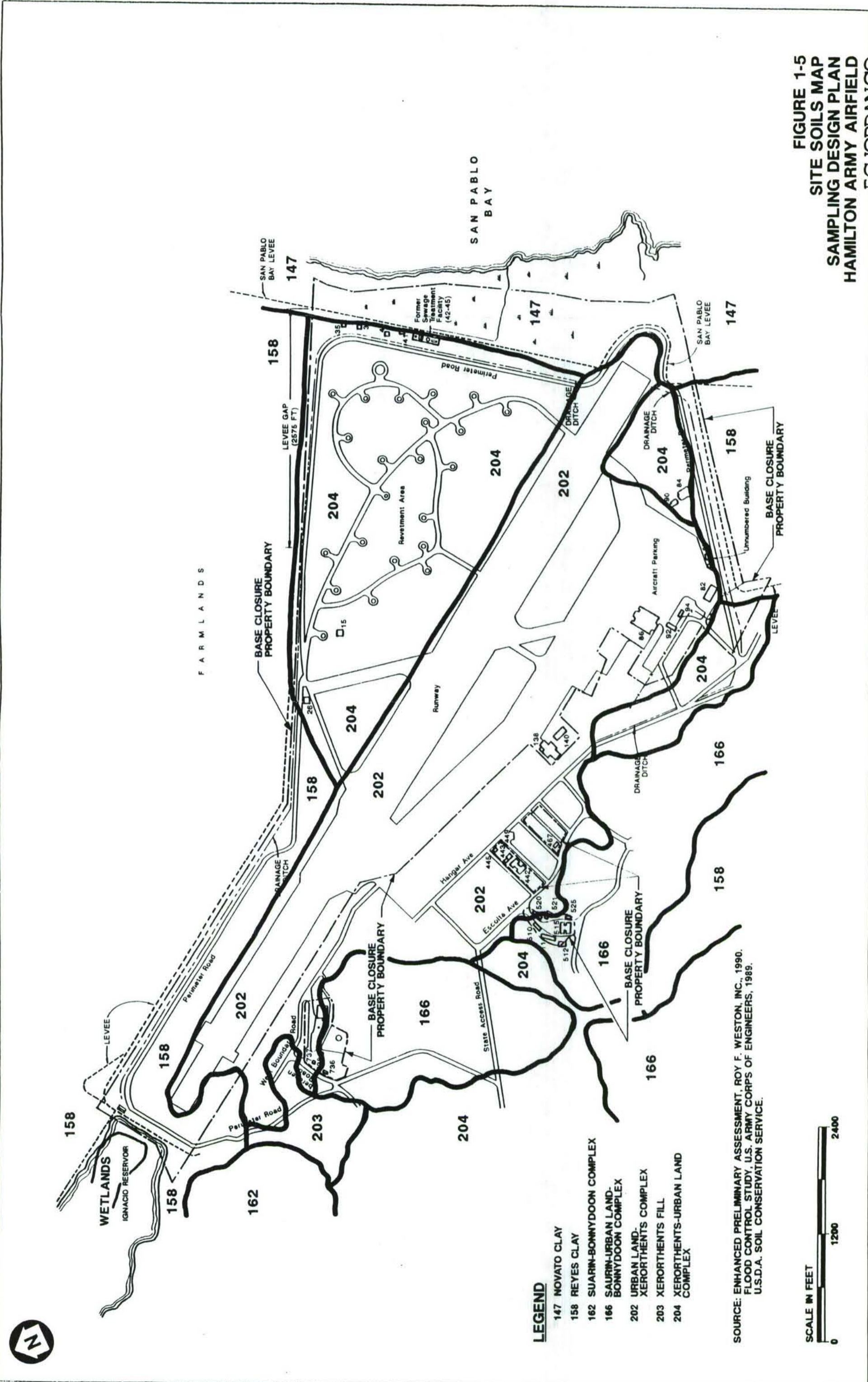
Figure 1-4), off base closure property. The Bay plain deposits are dominated by thick sequences of cohesive, impermeable clays. These deposits prograde bayward and underlie the entire airfield and adjacent support buildings. Horizontal hydraulic conductivities for the fine-grained deposits are estimated to be on the order of .0001 feet per day (ft/day) while the channel deposits may reach 1 ft/day.

Seasonal variations result in variable water levels, up to 8 feet below grade during late summer to near surface conditions during late winter-early spring.

Groundwater gradients are very shallow across the site and are mostly affected by seasonal climatic changes and to a lesser localized extent tidal fluctuations (WCC, 1985). Zone A has an approximate gradient of .001 foot per foot to the west and Zone C has an approximate gradient of .0003 foot per foot to the east. The net groundwater flow direction is generally to the east and towards San Pablo Bay.

1.2.2.3 Soils. Surficial deposits are variable at the HAA. Soil types and their distribution are presented in Figure 1-5. The soils data on Figure 1-5 and in the following descriptions were provided by the U.S. Department of Agriculture Soil Conservation Service (SCS):

- o Novato Clay: A clay material with 0 to 2 percent slopes. Novato clay is poorly drained and is light gray in color.
- o Reyes Clay: A clay material with 0 to 2 percent slopes. Reyes clay is poorly drained and light brownish-gray in color.
- o Saurin-Bonnydoon Complex: A yellowish-brown clayey loam to brown gravelly loam has 15 to 50 percent slopes. This material is moderate to well drained.
- o Saurin-Urban Land Bonnydoon Complex: A yellowish-brown clayey loam to brown gravelly loam has 30 to 50 percent slopes. This material is moderate to well drained.
- o Urban Land-Xerorthents Complex: This material exhibits a variable cut and fill composed of soil, rock, cement, asphalt, bay mud, and other solid materials with 0 to 9 percent slopes. Variable drainage occurs with this soil type.
- o Xerorthents Fill: This soil exhibits variable fill composed of soil, rock, cement, and other materials. Xerorthents fill has variable slopes as well as variable drainage.
- o Xerorthents-Urban Land Complex: This soil has variable cut and fill composed of soil, rock, cement, asphalt, bay mud, and other solid materials. This material has 0 to 9 percent slopes and variable drainage.



**FIGURE 1-5**  
**SITE SOILS MAP**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**  
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SOURCE: ENHANCED PRELIMINARY ASSESSMENT, ROY F. WESTON, INC., 1990.  
 FLOOD CONTROL STUDY, U.S. ARMY CORPS OF ENGINEERS, 1989.  
 U.S.D.A. SOIL CONSERVATION SERVICE.

Bay Mud makes up the majority of the naturally occurring surficial deposits at the HAA. Records from one known soil boring conducted at HAA detected Bay Mud to a depth of 58 feet. The boring was conducted on August 4, 1977 by the United States Geological Survey (USGS) and was located in the southeastern portion of the base. The top part of the Bay Mud deposit has been oxidized, weathered and desiccated and has a light to medium gray color. The stiff desiccated zone extends to a depth of about 10 feet. Below the upper zone the Bay Mud is a soft dark gray silty clay with various silt and fine sand lenses. It contains numerous very small shell fragments and small amounts of organic material.

2.0 SITE MANAGEMENT

Site management comprises support activities to the data collection activities. These activities include mobilization, site access considerations, documentation, field instrumentation, decontamination, and control and disposal of contaminated materials.

2.1 MOBILIZATION

The following activities will be performed at HAA as part of mobilization:

- o command post setup, including office trailer/sample management trailer, communications (i.e., two-way radios), utility hookups, and portable toilets
- o staking and utility clearance (i.e., excavation permits) of all exploration locations
- o field team orientation, including security clearances (if necessary) for work on-site
- o a field team health and safety meeting

2.2 SITE ACCESS AND CONTROL

HAA is an open base and, for most areas, access is unrestricted. It will be necessary to coordinate with base security when investigations will be conducted on the runway. HAA Security will be provided with the names of all field personnel and will be informed of planned activities on a daily basis during field operations.

2.3 DOCUMENTATION

Documentation and records (described in the following subsections) of all procedures performed at HAA will be kept on-site during field operations.

2.3.1 Site Logbook

A site logbook will be kept at the field operations office trailer. Administrative information concerning daily operations during the field program will be recorded (e.g., on-site personnel, weather, and work accomplished). Data entry into logs, forms, and notebooks will be written in black, indelible ink and initialled by the author. Entry errors in the logbook or field notebooks will be crossed out with a single line, dated, and initialed. The Field Operations Leader (FOL) will be responsible for completing the site logbook.

### 2.3.2 Field Sampling Logbooks

Bound field sampling logbooks will document the details of each activity during the field investigation. Information documented in the logbooks will follow the guidance outlined in the USATHAMA QA Program, January 1990, Section 7.3. The logbooks will document any deviations from the TP, Quality Control Plan (QCP), HASP, and SDP. Included in the logbooks will be field data sheets and logs. The FOL will be responsible for maintaining and insuring the integrity of the logbooks.

### 2.3.3 Photodocumentation

A photographic record of field activities at HAA will be maintained. Two copies of each print will be submitted to the USATHAMA Project Manager. A photograph logbook will accompany the site camera at all times to record the date, location, time, and subject matter for each picture taken. The photograph logbook will be maintained by individual photographers. The photographs will also be referenced and included in the field sampling logbooks.

### 2.3.4 Plans

A copy of the project plans and all referenced plans and documents will be kept on-site. The HASP will be issued to all project personnel in the field. Appropriate plans, standard operating procedures (SOPs), and the QCP will be provided to each rig or field geologist and sampling team.

## 2.4 FIELD INSTRUMENTATION

The following monitoring instruments will be used during field activities at HAA:

- o photoionization detector (PID);
- o explosimeter;
- o radiation meter;
- o Alpha Scintillation Meter;
- o Draeger tubes for benzene;
- o pH-temperature-specific conductance meter;
- o oil-water interface probe;
- o electronic water level meter;
- o metal detector; and
- o two-way radios.

Instruments will be calibrated and inspected daily before field activities begin, or as suggested by the manufacturers. Calibration information will be recorded on a calibration log, which will be kept on file at the field office trailer. The calibration log will be referenced in the field sampling logbook following the guidance outlined in the USATHAMA QA Program. Malfunctioning instruments will be repaired or replaced. Monitoring equipment will be protected (as much as possible) from contamination during field exploration activities without hindering operation of the unit. Equipment maintenance will

be performed according to manufacturer specifications before field use, or by cycling units out of the field. As appropriate, routine periodic maintenance may be performed as a function of field calibration.

2.5 DECONTAMINATION

To prevent cross-contamination, downhole drilling equipment, sampling equipment, and backhoe buckets will be decontaminated before use and at completion of each exploration. Decontamination of drilling and backhoe equipment (by steam-cleaning) will be conducted at each drilling or excavation location, or at a designated decontamination area. Decontamination procedures will be provided as a SOP to all field sampling teams.

Sampling equipment (e.g., split-spoons, bucket augers, and bailers) will be decontaminated between samples, according to the following sequence of procedures:

- o steam detergent
- o clean water rinse
- o deionized water rinse
- o air drying of equipment

When analytical samples are not being collected at a borehole, split-spoons will be decontaminated using only the first two procedures. Decontamination will be done by personnel wearing required protective gear.

Certified clean bottles (i.e., I-Chem 300 series) will be used for analytical sample collection. Exterior surfaces of sample bottles will be wiped clean and the bottles stored in a clean cooler, on ice, before transport to the analytical laboratory. Samples will be labeled and checked against the Chain-of-Custody (COC) record, and will be shipped to the laboratory within 24 hours of collection, whenever possible. Sample labeling and chain-of-custody should reflect information required in the USATHAMA QA Program, January 1990 (Section 7.3 and 7.4). The laboratory will be notified of samples shipped in excess of 24 hours after collection to expedite analysis and not exceed hold times.

2.6 CONTROL AND DISPOSAL OF CONTAMINATED MATERIALS

As borings are advanced, spillage and dispersal of potentially contaminated soils and water will be minimized by using collection methods specific to the drilling technique chosen. Before mobilization, the drilling subcontractor shall be required to submit a plan subject to approval by the EI Contractor to minimize contact of contaminated soils and water with the environment. A copy of the approved SOP for handling contaminated materials will be provided to each field sampling crew.

Drill cuttings, wash and drill water, and excess soil from split-spoon samples will be inspected visually for evidence of contamination and scanned with a PID

to detect the possible presence of organic vapors. Purge water that is bailed or pumped from the monitoring wells (during well development and before groundwater sampling activities) will be similarly screened. A minimum of one sample of the waste material from each boring or test pit will be collected and submitted for laboratory analyses to detect possible contaminants. Waste soil samples will be collected from locations identified in the screening process as having the highest potential contaminant levels. Until analytical results confirm that contaminants are absent, the material will be considered contaminated, and will be collected and containerized in Department of Transportation (DOT) approved, 55-gallon, steel drums. Soils and water will be drummed separately; the contents will be identified with weather-resistant labels attached to the drum exteriors. Labels on drums will specify, at a minimum, the exploration location, date, and drum contents.

Depending on the levels of personal protection used during the field investigation, disposable personal protective equipment and decontamination fluids will be generated. If contamination is suspected, these materials will be collected and containerized in DOT-approved, 55-gallon, steel drums (separately from contaminated soils and water); the contents will be identified with weather-resistant labels attached to the drum exteriors.

Drummed materials will be transported to and staged at a temporary location predetermined by HAA. The EI Contractor will maintain a log of the drums and their contents. Drum contents will be evaluated upon receipt of analytical data obtained during field investigations. The base Environmental Coordinator, located at PSF, will be notified about drums that contain hazardous material. PSF will take responsibility for disposal of the drums and their contents when staged. These materials will be handled, transported, and disposed according to requirements mandated by the Resource Conservation and Recovery Act (RCRA) and other applicable federal, state, and local regulations. Nonhazardous waste materials will be returned to the site where they originated, or contained and disposed of in a dumpster, or via a licensed waste hauler, as appropriate. Waste classified as "designated waste" under California regulations will be transported and disposed in a Class II or III Landfill. Waste classified as "hazardous waste" under California regulations will be transported and disposed in a Class I Landfill.

3.0 ENVIRONMENTAL INVESTIGATION DATA COLLECTION

This section describes data collection methods designed to meet the DQOs outlined in the Technical Plan. These methods include 1) surface geophysical measurements; 2) shallow and deep subsurface explorations, 3) headspace screening; 4) monitoring well installation and development; 5) in-situ hydraulic conductivity testing; 6) groundwater, soil and surface water/sediment sampling and laboratory analysis; and 7) a topographic and elevation survey. A QCP that describes the specific procedures to be followed to assure that all data collected is of high quality will be prepared before data collection begins. References to the QCP are made in the SDP and in all cases refer to this future document. The following subsections describe the specific field investigation techniques that will be used at HAA.

3.1 SURFACE GEOPHYSICAL MEASUREMENTS

Ground Penetrating Radar (GPR) surveys will be performed at HAA to better define the location of a buried JP-4 fuel pipeline. The GPR technique sends high frequency radio waves in the range of 80 to 1,000 megahertz into the subsurface. Wave energy is reflected from surfaces of contrasting electrical properties such as geologic horizons or buried manmade objects. The reflected energy is processed and a continuous record of depth versus time is recorded as the energy source (an antenna) is pulled along the ground at speeds varying from about 0.25 to 5 miles per hour (mph). The ground speed chosen is dependent on the amount of detail desired and the nature of the target. Penetration is dependent upon soil conditions, moisture conditions and the frequency. Dry, clean sands and low frequency energy result in the best penetration. High frequency energy results in high resolution. GPR is particularly useful in locating buried metal objects such as tanks and pipelines. The GSFI-SIR System III GPR will be used to confirm the location of the JP-4 pipeline at HAA.

3.2 SOIL GAS SAMPLING

Soil gas will be sampled at 50 foot intervals along the JP-4 pipe line and analyzed for the presence of benzene, toluene, ethylbenzene, and total xylenes (BTEX). The soil gas survey provides economical and rapid analytical results which will be used to evaluate the extent of potential contamination around the JP-4 line.

Samples will be collected by driving a one-inch outer diameter hollow-stem probe into the unsaturated soil to an approximate depth of five feet. The probe depth will be determined by site conditions, such as soil properties, depth to groundwater, and depth to the pipeline. Once the probe is in place, a tube connected to a suction pump will be attached to the probe and the probe will be pulled back one or two inches. The pump will be used to pull a sample of soil vapor into the tube. The sample will be extracted from the tube with a syringe before it reaches the pump. Samples will be analyzed with a gas chromatograph (GC) equipped with a flame ionization detector (FID) for BTEX. Standards will

be analyzed in order to quantify established target compounds. Analyses shall be conducted utilizing USATHAMA certified methods.

### 3.3 SUBSURFACE EXPLORATIONS

The stratigraphy and distribution of contaminants in soils at HAA will be evaluated with test pits and soil borings at selected sites (see Section 5 for specific site programs and rationale). Shallow subsurface exploration program procedures are discussed in the following subsections.

#### 3.3.1 Test Pits

Test pits will be excavated at selected sites to examine subsurface conditions and to assess the vertical and horizontal distribution of shallow soil contamination. (i.e., at depths of approximately zero to 5 feet). A backhoe will be used to excavate the test pit to a depth of 5 feet or to the water table, whichever is deepest. The backhoe bucket will be steam-cleaned between test pits to prevent cross-contamination. Standard techniques for decontaminating equipment are described in Section 2.5 and in the QCP. Soils, stratigraphy, groundwater conditions, and evidence of contamination (i.e., stained soils or standing liquid) will be logged and photographed by the EI contractor personnel.

The actual layout of each test pit, temporary staging area, and spoils pile will depend on site conditions and wind direction at the time the test pit is made. During excavation, sampling, and logging of each test pit, the backhoe operator and all site personnel will remain upwind or crosswind of the test pit and spoils pile. Wind direction will be monitored by means of a wind sock or other banner located in a prominent position visible to all personnel. Soils will be logged using the Unified Soil Classification System (USCS) on the test pit record and test pit profile record sheets shown in Figures 3-1 and 3-2. These records will also include safety and sample screening information. A minimum of two soil samples per test pit will be submitted for laboratory analysis. Following sample collection, excavated soil will be returned to the test pit from which it originated. Analytical soil samples will be selected based on field monitoring results (i.e., elevated PID readings) and visual indications of contamination. Standard techniques for sampling soils from test pits are described in Section 3.10.

#### 3.3.2 Soil Borings

Soil borings will be completed in areas where exploration depths are anticipated to be below the water table (estimated to be 1 to 10 feet below ground surface [bgs]) and where test pits are not feasible. The borings will be sampled either continuously or at 5-foot intervals using a split-spoon sampler, depending on site-specific data needs. Most borings will be completed to a depth of approximately 15 feet bgs. Four borings will be completed as deep borings, approximately 30 feet bgs, to investigate deeper groundwater contamination at the POL Area. Shallower borings (i.e., less than 10 feet bgs) will be completed at selected sites to conduct shallow soil sampling. Soils from the boreholes will be drummed in 55-gallon DOT-approved drums or put into a roll-off container





and labeled. The drum labels will include borehole identifications. Based on a review of analyses of soil samples from the boreholes and waste analyses, hazardous soils will be disposed of in the manner described in Section 2.6.

Soil samples will be collected and logged by EI field personnel using the USCS and the field boring log shown in Figure 3-3. At a minimum, one soil sample will be collected for laboratory analysis from upgradient borings and two from downgradient borings. A minimum of three soil samples will be collected from downgradient borings if a surface soil sample is also being collected at that location. Analytical samples will be selected based on field monitoring results (i.e., elevated PID readings) and visual indication of contamination.

As per USATHAMA Geotechnical Requirements (Paragraph III.A.12), 10 to 20 percent of the soil samples will be collected for geotechnical analysis. The soil samples will be collected from borings and will be selected by the contractor to be representative of the range and frequency of soil types encountered. Geotechnical tests shall include Atterberg Limits, sieve grain size distribution, and assignment of USCS symbols. Laboratory and summary sheets shall be submitted to USATHAMA within ten working days of final test completion.

Upon completion, borings which are not equipped with monitoring wells will be backfilled to the ground surface with 20:1 cement-bentonite grout. The grout used will be an organic-free, moderate pH, high solids bentonite specifically designed to seal environmental monitoring wells and boreholes. A maximum of 8 gallons of approved water per 94-pound bag of cement will be used. SOPs for soil sampling are described in Section 3.10 of this report. Specifications for grout preparation are described in USATHAMA's Geotechnical Requirements. Air quality in the breathing zone will be monitored using a PID during borehole advancement. Personal protective equipment will be used as prescribed in the HASP (Data Item A009).

#### 3.4 HEADSPACE SCREENING

Headspace from soil samples collected and placed in glass jars will be screened using a PID. Headspace will only be measured in soil samples submitted for Semi-Volatile Organic Compounds (SVOCs), inorganics, or PCB analysis. The screening method will consist of placing aluminum foil over the sample jar before closing the cover and, after several minutes, inserting the PID through the aluminum foil cover to measure volatile organic compounds (VOCs) in the headspace. Samples for laboratory analysis will be selected based on results of split-spoon and headspace PID readings, and visual evidence of contamination (e.g., stained soils).

#### 3.5 MONITORING WELL INSTALLATION AND DEVELOPMENT

Twenty-eight monitoring wells will be installed at HAA in conjunction with EI/AA activities. A summary of estimated drilling footages and required material quantities are shown in Table 3-1. Groundwater monitoring wells will be installed by California state-licensed drillers to provide groundwater sample

FIELD BORING LOG			Boring No:
Project No.	Project Name:		Page of
Contractor:	Driller	Date Started	Completed
Method	Casing Size	PID	Protect'n Level
Ground El.	Soil Drilled	$\nabla$ Below grnd	Total Depth
Logged By	Ch'd by	Date	

Background PID Level:

Sample No.	Depth in Feet	Blows per 6 inches	Pen Rec	PID S.Spoon	Soil Description and Comments on advance of boring (include water loss and major strata changes)	USCS

**FIGURE 3-3  
FIELD BORING LOG  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

TABLE 3-1  
**SUMMARY OF DRILLING PROGRAM**  
**ENVIRONMENTAL INVESTIGATION**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

SITE	NO. MONITORING WELL BORINGS	NO. SOIL BORINGS W/O WELLS	TOTAL BORING DEPTH (LF)	NO. OF SPLIT SPOON SAMPLES	PVC SCREEN (LF)	PVC RISER (LF)*	BENTONITE		CLAY GROUT (LF)	PROTECTIVE WELL CASINGS	ESTIMATED NO. 55 GALLON DRUMS	ESTIMATED HOURS WELL DEVELOPMENT
							PELLET SEAL (LF)	PVC RISER (LF)				
Active POL Area	17	0	315	74	170	145	85	62	17	42	34	
Pump Station Area	1	0	15	10	10	5	5	2	1	2	2	
Former Sewage Treatment Plant	1	0	15	10	10	5	5	2	1	2	2	
Aircraft Storage/Maintenance Area	0	0	0	0	0	0	0	0	0	0	0	
Burn Pit	4	0	60	22	40	20	20	8	4	8	8	
JP-4 Line	0	0	0	0	0	0	0	0	0	0	0	
Revetment Area	0	1	5	3	0	0	0	0	0	0	0	
East Levee Landfill	5	0	75	26	45	30	25	10	5	10	10	
Building 442	0	0	0	0	0	0	0	0	0	0	0	

Legend

L.F. - Linear Feet

\* Wells in POL Area are assumed to be flush-mounted; all others are assumed to extend 2.5 feet above grade. Assume 5 feet of bentonite pellet seal per well. This may be modified in field with USATHAMA approval if field conditions do not permit 5-foot seals.

collection and chemical analyses, monitor groundwater elevations, and measure in situ hydraulic conductivities. Twenty-three of the proposed monitoring wells will be shallow with screens that intercept the water table surface. Four monitoring wells (all at the POL Area) will be installed as deep wells to: (1) monitor deeper groundwater quality, and (2) collect groundwater elevation data to investigate vertical gradients. The final well will be installed through the East Levee Landfill and will be screened beneath the refuse zone. Standard techniques and requirements for monitoring well installation and development are described in the USATHAMA Geotechnical Requirements (USATHAMA, 1987). Applicable paragraphs are cited below:

- o Secure and comply with boring/well drilling permits (Paragraph III.A.5).
- o Arrange drill sites (e.g., the drilling subcontractor will have containment material on hand) to minimize the potential for the possibility of spills and leaks from the drilling operation entering the borehole (Paragraph III.A.8).
- o Steam-clean drilling equipment prior to movement to HAA (Paragraph III.A.15).
- o Store well drilling equipment and well installation supplies in a staging area. At each drill location, clean equipment and supplies will be temporarily stored on sheets of disposable polyethylene sheeting to eliminate contamination from the native soils at the well location.

Drilling techniques, monitoring well installation, development, and hydraulic conductivity testing procedures are discussed in the following sections.

### 3.5.1 Drilling Techniques

A California-certified geologist representing the EI contractor will be present during the drilling of borings and installation of monitoring wells. These field personnel will maintain drilling logs, collect appropriate samples, and be equipped as required by the USATHAMA Geotechnical Requirements (USATHAMA, 1987).

Drilling will be subcontracted to a qualified drilling contractor, if necessary, who can supply the type and number of drilling rigs capable of performing hollow stem auger and solid stem auger drilling, if necessary, in the bedrock, split-spoon sampling, and monitoring well installation. Generally, the drilling will proceed as follows:

1. Potable water for drilling and decontamination will be obtained from the Petaluma Water Department, located on North McDowell Professional Drive in Petaluma, approximately 13 miles north of HAA. This is the nearest source of non-chlorinated water, (the contact is Steve Simmons, Phone No. (707) 778-4392). This water source will be analyzed for all site-related chemicals. Resulting analytical data will be approved by USATHAMA three weeks prior to commencement of drilling (USATHAMA, 1987).

2. Bentonite and granular backfill materials (including bentonite drilling fluid, if applicable) will be selected and submitted to USATHAMA for approval by the Contracting Officer's Representative (COR) or the USATHAMA geologist.
3. Drilling will be conducted by an approved drilling contractor under subcontract, if necessary, to the EI contractor.
4. Drilling tools and rigs will be steam-cleaned prior to being delivered on-site.
5. Between borings and well installations, drilling tools will be decontaminated by steam-cleaning using the identified and approved potable water source at the decontamination area.
6. All well materials (e.g., well screen, well riser) will be cleaned prior to installation, as described in the USATHAMA Geotechnical Requirements. Well materials will be cleaned on wooden pallets at the drill site, or at a decontamination area, whichever is logistically practical.

All drill fluids and cuttings will be contained and disposed of as described in Subsection 2.6.

The EI contractor's geologist will collect soil samples for geologic classification. Ten to 20 percent of the samples collected will be tested for geotechnical parameters including Atterberg Limits, sieve grain size distribution, and USCS Classification. The soil samples will be collected from split-spoons where possible, as described in Subsection 3.10.1. Monitoring well borings will be logged as required by the USATHAMA Geotechnical Requirements (Paragraph IIIB). An example Field Boring Log is shown in Figure 3-3. Copies of the original field boring logs will be transmitted to the USATHAMA COR within three working days of boring completion. The originals will be transmitted to USATHAMA upon completion of reports.

3.5.2 Monitoring Well Installation

Monitoring wells will be constructed of 4-inch ID, Schedule 40, flush-threaded, polyvinyl chloride (PVC) screen and riser. All well screens will be machine-slotted (0.01-inch) and will have a threaded bottom cap or plug. Well screens and risers will be steam-cleaned by the drilling contractor with water from an approved source and well joints will be wrapped with USATHAMA-approved Teflon tape, prior to installation. Solid riser will extend from the screen to approximately 2.5 feet above ground surface at all above-grade locations or to 0.2 feet below ground surface where flush-mount wells are required.

The annulus or annular space around all well screens will be backfilled with a clean silica sand, compatible with the screen slot size. The sandpack will be approved by the Contracting Officer's Representative (COR) prior to drilling, in accordance with USATHAMA geotechnical requirements. If field conditions permit,

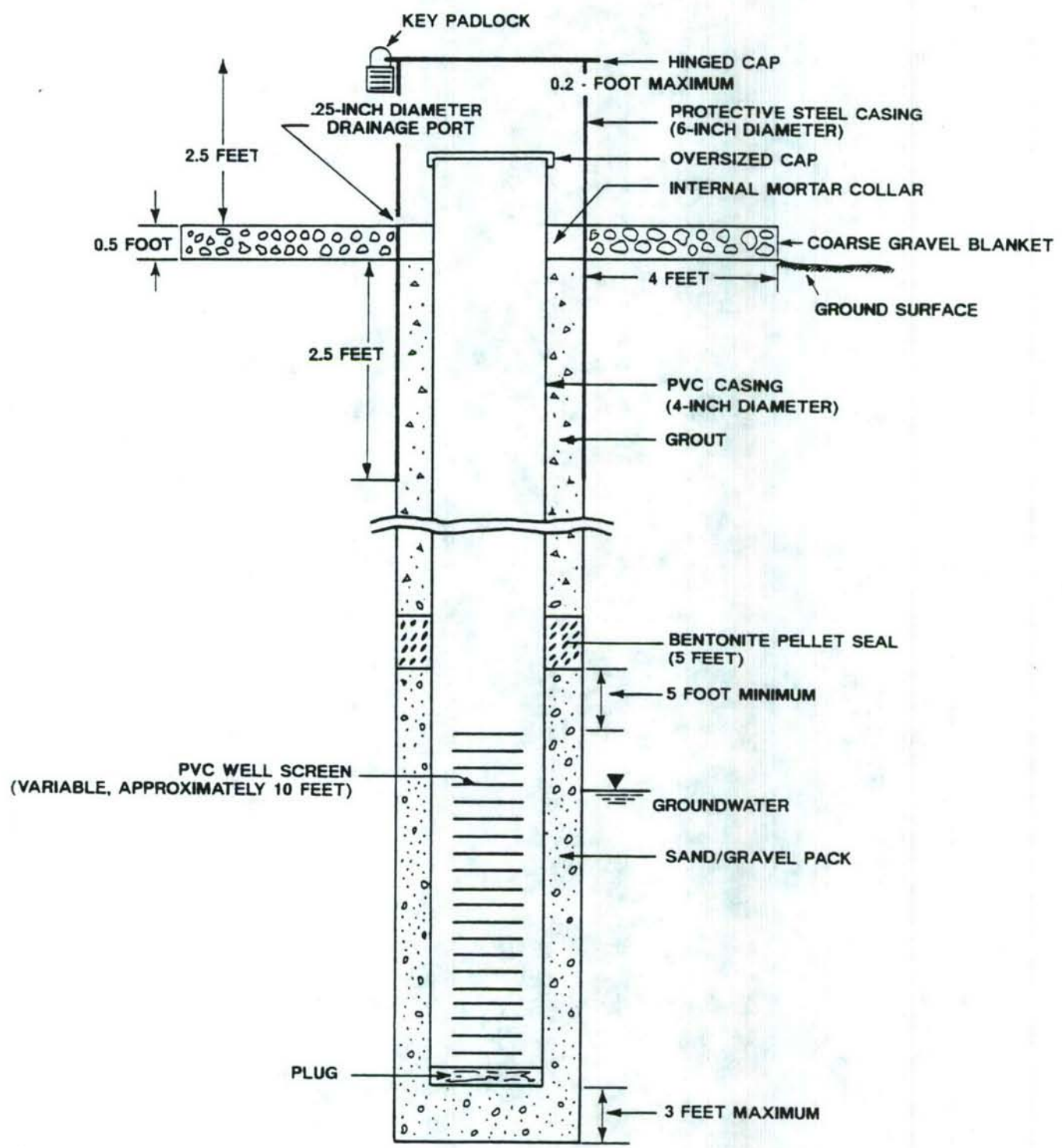
the sandpack will extend from a maximum of 3 feet below the bottom of the well screen (at the borehole bottom) to a minimum of 5 feet above the top of the well screen. If field conditions permit, a 5-foot bentonite pellet seal will be installed above the sandpack in the shallow wells. If, as anticipated, the water table is shallow (less than 12 feet below ground surface), USATHAMA requirements for a minimum 5-foot bentonite pellet seal and 5 feet of sand above the top of the well screen cannot be implemented. In this case, approval for alternate specifications will be sought from the USATHAMA COR or geologist. For the water table wells, grout will be tremied into the annulus above the bentonite pellet seal, without disturbing the seal or the sandpack, to the ground surface. In deeper wells, if bentonite pellets cannot be placed at the required depth, a bentonite slurry seal will be tremied into place above the sandpack.

Monitoring wells will have either flush-mounted or aboveground protective casings installed and sealed into the ground over the well riser. It is anticipated that wells in the active POL Area will be flush-mounted, but the final height of all well casings will be decided by USATHAMA and HAA officials. Protective steel casings will be clearly labeled and equipped with locking covers. Wells will be equipped with keyed-alike locks across the entire base. A cement seal and gravel base will be placed at the ground surface around each protective casing as required by Paragraph III.C.15 of the USATHAMA Geotechnical Requirements to secure the casing, prevent surface runoff from entering the borehole, and direct runoff away from the casing. Where required, pickets and wire, as required by Paragraph III.C.12 of the USATHAMA Geotechnical Requirements, will be placed around the well to protect it from damage. The aboveground portions of both the well riser and protective casing will be vented. The protective casing will have a weep hole near ground level to allow water to drain from inside the casing. Wells will be permanently and properly identified in the field. Flush-mounted monitoring wells will be protected from flooding by watertight caps and a sloped concrete pad to divert water. Figure 3-4 is a typical water table monitoring well installation diagram.

The EI contractor's geologist will be present during monitoring well installation to record details of the well installation. An example monitoring well installation data record, to be filled out upon installation, is shown in Figure 3-5. Monitoring wells will be installed in all designated borings unless the lithology requires abandoning the boring. Abandoned borings will be grouted to ground surface in accordance with Paragraph III.A.11 of the Geotechnical Requirements (USATHAMA, 1987).

The following materials will be used in well construction:

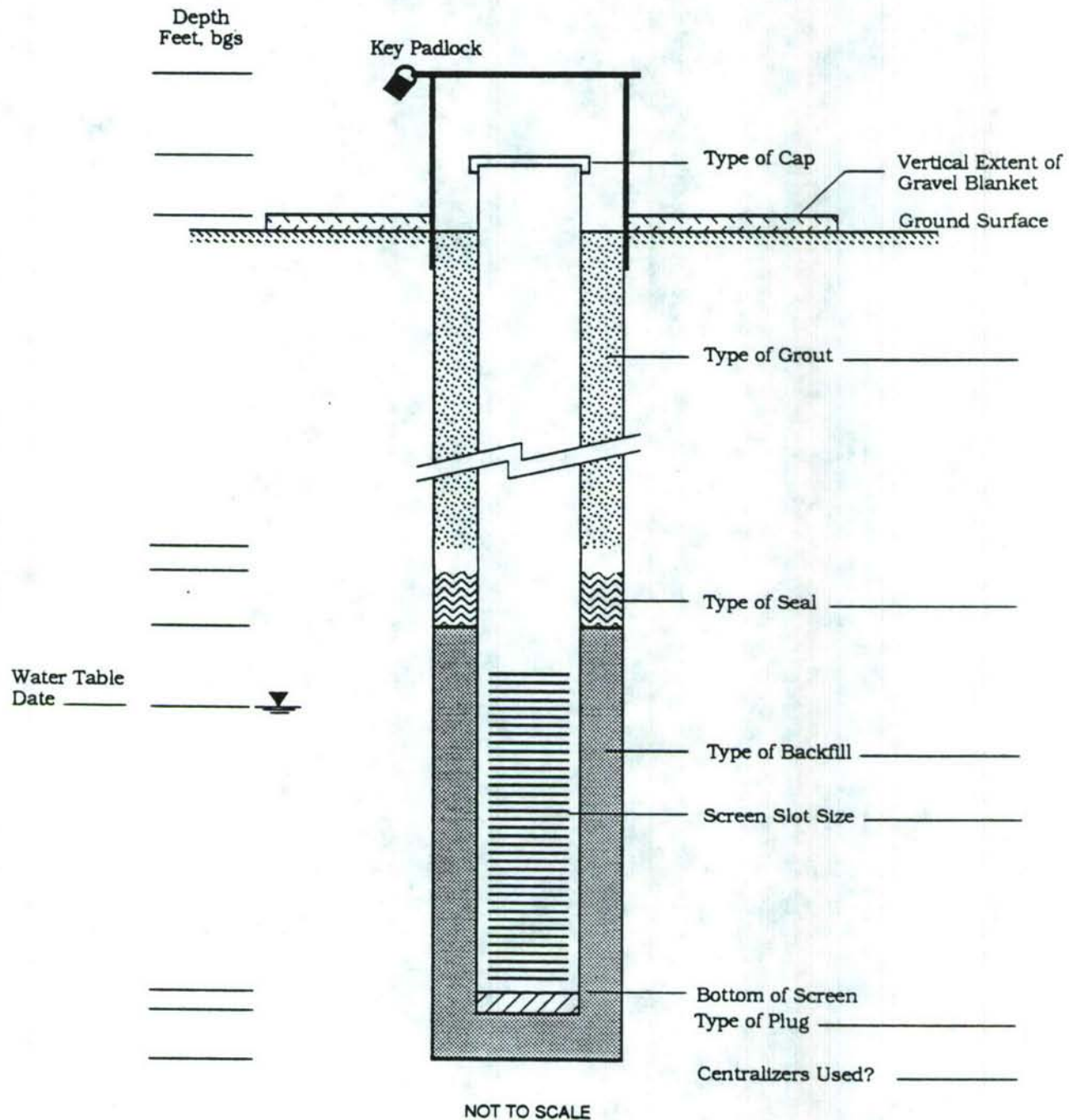
1. Casing will be threaded PVC Schedule 40, 4-inch (nominal) inside diameter (ID). No PVC solvent will be used. The well screen will be factory-slotted, with a slot width of 0.010 inch. A loose-fitting PVC cap will be used to cover the top of the well riser and will allow equilibration of the well water level with atmospheric pressure. Water table well screen lengths will be 5 to 10 feet and well screens will be positioned approximately 3 feet above the regional water table.



NOTE: NOT TO SCALE

FIGURE 3-4  
WATER TABLE MONITORING WELL  
INSTALLATION DIAGRAM  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

Project Name	Boring Diameter	Well No.
Project No.	Well Inside Diameter	Date Installed
Drilling Co.	Well Material	Drilling Method
Field Scientist	Top of PVC Elevation	Development Method
	GS Elevation	



**FIGURE 3-5  
MONITORING WELL INSTALLATION  
DATA RECORD  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

2. Grout will be composed by weight of 20-parts Portland Type II or V cement for one-part bentonite, with a maximum of 8 gallons of approved water per 94-pound bag of cement. These proportions may be modified with USATHAMA approval. Bentonite will be added after mixing the cement and water. Information concerning the bentonite will be submitted to USATHAMA for approval, as specified by Paragraph III.A.10.C of the Geotechnical Requirements.
3. Bentonite pellets used in the seal will be a commercially available product designed for well sealing purposes. These pellets are also subject to USATHAMA approval.
4. Sand material used in the annulus around the well screen will be selected to be compatible with both the screen slot size and aquifer materials.
5. Prior to use, 1 pint of the proposed granular backfill material will be submitted to USATHAMA for approval. The lithology, grain-size distribution, and source of the material will be provided.
6. At least one sample of the granular backfill (0.5 pint in volume) used as part of a well installation will be taken from each shipment of sand, stored with the soil samples, and recorded on the sketch of each installation for which that material was used.
7. A 6-inch ID protective steel casing will be installed around all wells. For aboveground wells, this casing will extend approximately 2.5 feet above ground surface and will be seated 2.5 feet into the grout. The protective steel casing will extend a maximum of 0.2 feet above the top of the well cap. In accordance with the USATHAMA Geotechnical Requirements (Paragraph III.C.8.C), this casing will be closed with a lockable, hinged cap. This cap will prevent entry of water but not air. Therefore, the well will be open to the atmosphere to allow for water level stabilization. The cap will be fitted with a padlock. The same key will be used for all padlocks at the site.
8. A sketch of the well installation will be included with the boring log; it will show, by depth from the ground surface, the bottom of the boring, screen location, coupling location, granular backfill, seals, grout, water level, cave-in, and height of riser above ground surface (see Figure 3-5). The actual composition of the grout, seals, and granular backfill will be recorded on each sketch.
9. Well sketches will include the protective casing detail.
10. After the grout seal has set (approximately 24 hours), it will be checked for settlement; additional grout (of approved composition) will be added to fill any depressions.

### 3.5.3 Monitoring Well Development

Monitoring well development will be performed as soon as practical after well installation, but not sooner than 48 hours following placement of the mortar collar. The mortar must be set at the time of well development. Field information collected during well development will be recorded and submitted to the COR within three working days after development. The following data must be recorded, as required in the USATHAMA Geotechnical Requirements (Paragraph III.D.14):

- o well designation
- o date of well installation
- o date of development
- o static water level before, and 24 consecutive hours after, development
- o quantity of drilling fluid loss during drilling and fluid purging, if any drilling fluids are used
- o specific conductivity, temperature, and pH measurements taken and recorded at the start, twice during, and at the conclusion of development (calibration standards will be run prior to, during, and after each day's operation in the field)
- o depth from top of well casing to bottom of well
- o screen length
- o depth from top of well casing to top of sediment inside well, before and after development
- o physical character of removed water, including changes during development in clarity, color, particulates, and odor
- o type and size/capacity of pump and/or bailer used
- o height of well casing above ground surface
- o typical pumping rate
- o estimate of recharge rate
- o quantity of water removed and time for removal

Development of wells will be accomplished with an electric-powered submersible pump and/or bailer. The pump will be steam-cleaned with water from the approved water source prior to use in the next well (see Section 2.5).

USATHAMA defines a well to be fully developed when all the following criteria are met:

- o the well water is clear to the unaided eye
- o the sediment thickness remaining in the well is less than 1 percent of the screen length
- o the total volume of water removed from the well equals five times the well volume (including 30% porosity within the sand pack) plus five times the volume of drilling fluid lost

(Note: should the recharge to the well be so slow that the required volume cannot be removed in 48 consecutive hours, the water remains discolored, or excess sediment remains after the five-volume removal, the COR should be contacted for guidance.)

These criteria may be modified with USATHAMA approval. A 1-pint sample of the last water obtained from the development process for each well will be retained and stored so as not to freeze, as required by USATHAMA. The cap and all internal components of the well casing above the water table will be rinsed with well water to remove all traces of soil, sediment, and cuttings. This washing will be conducted before and/or during development.

3.6 HYDRAULIC CONDUCTIVITY TESTING

No sooner than two weeks after well development, hydraulic conductivity testing will be conducted in selected wells located in areas deemed representative of the formation. Of the 28 wells to be drilled during the EI, 18 will be tested. The 18 wells include all wells of all sites with the exception of 10 wells at the POL Area. The seven wells that will be tested at the POL Area will be selected based on lithology and location. Rising- or constant-head permeability tests will be performed, depending on the hydraulic conductivity of the medium being tested. Only rising-head tests will be performed on wells straddling the water table. Using a pressure transducer and data logger, or a water level meter, water level changes will be measured as a function of time as the water level returns to its static level. A minimum of one monitoring well will be tested per site. A minimum of two tests per well will be conducted to assess variations associated with each test, evaluate inertial effects associated with each well, and provide quality control. To the extent practical, to minimize disposal of potentially contaminated water and minimize health and safety risks, the wells will be selected from upgradient areas relative to their respective sites, or in areas anticipated to contain low levels of contamination. Test data will be evaluated using the Hvorslev (1951) or Bouwer and Rice (1976) analysis methods.

3.7 WATER LEVEL AND FREE PRODUCT THICKNESS MEASUREMENTS

Groundwater levels will be measured immediately prior to pre-sample purging in all 28 of the EI monitoring wells. The levels will be measured in accordance

with USATHAMA Geotechnical Requirements, Paragraph III E. (USATHAMA, 1987). Depth to static groundwater will be measured from the top of the PVC riser (not protective casing) and marked, so that the exact same point will be surveyed for vertical control. The depths to groundwater will be converted to elevations for reporting purposes. Water levels at each site will be collected within a consecutive 10-hour period. If ground surface elevations can be located for the 1985 WCC monitoring wells at the POL Area (MW-10 through MW-20), water levels will also be collected in a selected number of these wells.

If free product is present, its thickness will be measured in the wells using an electronic interface probe with a detection limit of 0.01-foot. Water levels can also be obtained using the interface probe or an electronic water level meter. Measuring devices will be decontaminated between wells using potable water (see Section 2.5).

### 3.8 TIDAL INFLUENCE STUDIES

A study of the influence of tides on groundwater levels and flow directions and rates will be conducted at the East Levee Landfill, where tides may exert some influence. The tidal study will be performed using pressure transducers and one or more electronic data loggers. Changes in water levels will be measured versus time in individual wells and in San Pablo Bay for a minimum of one full tidal cycle (i.e., high tide to next high tide or low tide to next low tide). Water level measurements will be recorded at regular time intervals of 20 minutes or less and plotted versus time to allow an evaluation of the magnitude and timing of groundwater responses to tidal changes.

### 3.9 GROUNDWATER SAMPLING

One round of groundwater samples will be collected no sooner than two weeks after well development from each of the wells installed as part of the EI. A total of 23 water table wells and 5 deeper wells will be sampled. Groundwater samples will be obtained from monitoring wells using methods specific to the analysis to be performed. Field instruments will be calibrated daily and between sites, and calibration records will be recorded on the Field Instrumentation Quality Assurance Record (Figure 3-6) and included as part of the field sampling logbook. Before sample collection, water level and ambient air quality data (measured with a PID) will be obtained and recorded on field data sheets. Sample bottles will be rinsed three times with well water before being filled. Wells will be purged (i.e., removal of five well and annular volumes) before sampling using a pump, bailer, or other suitable equipment in accordance with the USATHAMA Geotechnical Requirements. Field parameters, including temperature, pH, and specific conductance, will be measured and recorded on field data sheets (Figure 3-7) at the time of sampling. Purged water will be collected and disposed of in the manner described in Section 2.6.

Any additional groundwater sampling needs will be determined after review of analytical results. A revised sampling plan will reflect recommendations for any additional sampling.

FIELD INSTRUMENTATION QUALITY ASSURANCE RECORD

PROJECT/SWMU  JOB NO.  DATE

EQUIP. TYPE/I.D.	BATTERY COND.	CALIBRATION INFORMATION		
		pH 4	pH 7	pH 10
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	COND STD. _____ / _____	COND STD. _____ / _____	COND STD. _____ / _____
_____	_____	COND STD. _____ / _____	COND STD. _____ / _____	COND STD. _____ / _____
_____	_____	COND STD. _____ / _____	COND STD. _____ / _____	COND STD. _____ / _____
DISSOLVED OXYGEN	_____	AVG. WINKLER VALUE _____ PPM	METER VALUE _____ PPM	CORR _____
REDOX	_____	ZOBELL SOL. VALUE _____	METER VALUE _____	CORR _____
PHOTOIONIZATION METER	_____	ZERO/ZERO AIR? [ ] YES [ ] NO	SPAN GAS VALUE _____ PPM EQUIV.	METER VALUE _____ PPM EQUIV.
OTHER	_____	_____	_____	_____

FLUIDS MATERIALS RECORD

DEIONIZED WATER SOURCE: [ ] ECJ STAGING [ ] PORT. SYSTEM [ ] OTHER \_\_\_\_\_

TRIP BLANK WATER SOURCE: [ ] ECJ LAB, LOT NO. \_\_\_\_\_  
 [ ] OTHER, ID \_\_\_\_\_

DECONTAMINATION FLUID: [ ] METHYL HYDRATE, LOT NO. \_\_\_\_\_ [ ] OTHER \_\_\_\_\_ LOT NO. \_\_\_\_\_

SAMPLER BLANK WATER SOURCE: [ ] ECJ STAGING [ ] PORT. SYSTEM [ ] OTHER \_\_\_\_\_

HNO3/D.I. RINSE SOLUTION: [ ] ECJ STAGING, ID \_\_\_\_\_

\* PRESERVATION CHEMICAL LOT I.D.'S: CHEMICALS USED: [ ] HNO3 LOT NO. \_\_\_\_\_  
 [ ] H2SO4 LOT NO. \_\_\_\_\_  
 [ ] HCL LOT NO. \_\_\_\_\_  
 [ ] NaOH LOT NO. \_\_\_\_\_  
 [ ] ZNAOC LOT NO. \_\_\_\_\_  
 [ ] \_\_\_\_\_

FILTRATION PAPER I.D.: \_\_\_\_\_

MANUF/TYPE \_\_\_\_\_  
 LOT NO. \_\_\_\_\_

SAMPLER SIGNATURE \_\_\_\_\_

STANDARDS

MANUF. \_\_\_\_\_  
 LOT NO. \_\_\_\_\_

FIGURE 3-6  
 FIELD INSTRUMENTATION QUALITY ASSURANCE RECORD  
 SAMPLING DESIGN PLAN  
 HAMILTON ARMY AIRFIELD

PROJECT  JOB NUMBER  DATE

SAMPLE LOCATION ID  LOCATION ACTIVITY  START:  END:

WATER LEVEL / WELL DATA

WELL DEPTH  FT  MEASURED  TOP OF WELL WELL RISER STICK-UP  FT  
 HISTORICAL  TOP OF PROTECTIVE CASING (FROM GROUND) PROTECTIVE CASING/WELL DIFF  FT  
 PROTECTIVE CASING  FT

WELL MATERIAL: WELL LOCKED?: WELL DIA.  2 INCH WATER LEVEL EQUIP. USED:  
 PVC  \_\_\_\_\_  YES  4 INCH  ELECT.COND.PROBE  
 SS  NO  6 INCH  FLOAT ACTIVATED  
 \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  PRESS. TRANSDUCER

HEIGHT OF WATER COLUMN  FT X  .16 GAL/FT (2 IN.)  GAL/VOL  
 .65 GAL/FT (4 IN.) =  GAL/VOL  
 1.5 GAL/FT (6 IN.) =  GAL/VOL  
 \_\_\_\_\_ GAL/FT (\_\_\_\_ IN.) =  TOTAL GAL PURGED

WELL INTEGRITY: YES NO  
 PROT. CASING SECURE    
 CONCRETE COLLAR INTACT    
 OTHER \_\_\_\_\_

EQUIPMENT DOCUMENTATION

PURGING/SAMPLING EQUIP. USED:  IF USED FOR: PURGING SAMPLING

<input type="checkbox"/>	<input type="checkbox"/>	PERISTALTIC PUMP	EQUIPMENT ID	DECONTAMINATION FLUIDS USED:
<input type="checkbox"/>	<input type="checkbox"/>	SUBMERSIBLE PUMP	_____	(✓ ALL THAT APPLY AT LOCATION
<input type="checkbox"/>	<input type="checkbox"/>	BAILER	_____	<input type="checkbox"/> ETHYL ALCOHOL
<input type="checkbox"/>	<input type="checkbox"/>	PVC/SILICON TUBING	_____	<input type="checkbox"/> DEIONIZED WATER
<input type="checkbox"/>	<input type="checkbox"/>	TEFLON/SILICON TUBING	_____	<input type="checkbox"/> TSP SOLUTION
<input type="checkbox"/>	<input type="checkbox"/>	AIR LIFT	_____	<input type="checkbox"/> HEXANE
<input type="checkbox"/>	<input type="checkbox"/>	HAND PUMP	_____	<input type="checkbox"/> HNO3/D.I. WATER SOLUTION
<input type="checkbox"/>	<input type="checkbox"/>	IN-LINE FILTER	_____	<input type="checkbox"/> POTABLE WATER
<input type="checkbox"/>	<input type="checkbox"/>	PRESS/VAC FILTER	_____	<input type="checkbox"/> NONE
<input type="checkbox"/>	<input type="checkbox"/>		_____	<input type="checkbox"/> _____
<input type="checkbox"/>	<input type="checkbox"/>		_____	<input type="checkbox"/> _____

FIELD ANALYSIS DATA

AMBIENT AIR VOA  PPM WELL MOUTH  PPM FIELD DATA COLLECTED  IN-LINE  
 IN CONTAINER

PURGE DATA	@ _____ GAL	@ _____ GAL	@ _____ GAL	@ _____ GAL	@ _____ GAL	SAMPLE OBSERVATIONS:
TEMPERATURE, DEG C	_____	_____	_____	_____	_____	<input type="checkbox"/> TURBID
pH, units	_____	_____	_____	_____	_____	<input type="checkbox"/> COLORED
SPECIFIC CONDUCTIVITY (umhos/cm. @ 25 deg.c)	_____	_____	_____	_____	_____	<input type="checkbox"/> CLOUDY
OXIDATION-REDUCTION, +/- mv	_____	_____	_____	_____	_____	<input type="checkbox"/> CLEAR
DISSOLVED OXYGEN, ppm	_____	_____	_____	_____	_____	<input type="checkbox"/> ODOR

SAMPLE COLLECTION REQUIREMENTS  
(✓ IF REQUIRED AT THIS LOCATION)

ANALYTICAL PARAMETER	✓ IF FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	✓ IF SAMPLE COLLECTED	SAMPLE BOTTLE ID'S
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____
<input type="checkbox"/>				<input type="checkbox"/>	_____/_____/_____/_____

NOTES:

FIGURE 3-7  
 GROUNDWATER SAMPLE - FIELD DATA RECORD  
 SAMPLING DESIGN PLAN  
 HAMILTON ARMY AIRFIELD

Inorganic samples will be collected using a submersible pump and filtered in the field through in-line 0.45-micron membrane filters using the proper preservatives in sampling containers. Water samples to be analyzed for volatile organic compounds (VOCs) and SVOCs will be collected using a Teflon or stainless-steel bailer with a ball check valve lowered to the midpoint of the screened interval and pulled back to the surface. Water from the bailer will be poured directly into the sample bottles.

3.10 SOIL SAMPLING

3.10.1 Subsurface Soil Samples

Soil samples will be collected for geologic interpretation, laboratory analysis, and geotechnical testing. Sample selection for chemical analysis will be based on monitoring during exploration activities or as specified in the site-specific exploration program. Soil samples will be obtained from either soil borings using split-spoon samplers with brass sleeves or from test pits using a backhoe. Samples collected will be screened with a PID immediately following collection. Based on results of the field screening, soil samples will be submitted for laboratory analysis. Generally, one boring per site will be sampled continuously to characterize subsurface geology. The remaining boreholes will be sampled at a maximum of 5-foot intervals or more frequently at stratigraphic changes. Of these samples, two soil samples from the upgradient boring(s) and an average of three samples from each downgradient boring will be submitted for laboratory analysis. Ten to twenty percent of all soil samples collected from borings and test pits will be submitted for geotechnical analysis, including Atterberg Limits, USCS description, and grain size distribution analysis.

Test pits will be used for collecting shallow (less than five feet) subsurface soils at some sites as described in Section 4. In general, one sample from the surface and one from 4 feet below surface or at obvious areas of contamination staining will be submitted for laboratory analysis from each test pit. Soil samples collected from test pits will generally be obtained from the center of the backhoe bucket. The sampler will direct the backhoe operator to remove material from the selected depth or location within the test pit. The bucket will be brought to the surface and moved away from the test pit. Discrete samples will be selected from the center of the bucket based on visual evidence of contamination. Site personnel will not enter excavations that are not adequately shored or sloped.

3.10.2 Surface Soil Samples

Hand augers (for sample depths from zero to 5 feet) and bulb planters or trowels (for sample depths from zero to 6 inches) will be used to collect shallow soil samples for laboratory analysis. If used, hand-augers and trowels will be decontaminated before sampling and discarded after use. The soil samples will be logged by field personnel using the USCS.

### 3.11 SURFACE WATER, STORM WATER, AND SEDIMENT SAMPLING

#### 3.11.1 Storm Water and Sediment Sampling

Stormwater and sediment samples will be collected at selected sites within the storm sewer system to assess potential contaminant migration by surface runoff or sediment transport within the storm sewer system. Sampling will begin downstream and work progressively upstream to avoid disturbing sediments that could contaminate subsequent samples. Field information will be recorded on surface water and sediment sample data sheets (Figure 3-8). Based on observed flows and depths of water at the designated sampling locations, water samples will be collected at approximate mid-depth levels in the water column. At water depth of 2 to 6 feet, the samples will be collected using a discrete stainless-steel water sampler. At shallow locations, samples will be collected by direct immersion of sample bottles. Care will be taken to avoid stirring up sediments that would contaminate the water sample. Where both water and sediment sampling is planned, water samples will be collected before sediment samples at each site. Sediment samples will be collected using either a gravity corer stainless-steel split-spoon sampler, or clamshell-type sediment sampler, depending on the bottom type and overlying water depth.

#### 3.11.2 Surface Water Sampling

Surface water will be collected from two groundwater seeps at the former Sewage Treatment Plant. Sample bottles will be filled by placing them directly in the seep flow. Surface water sampling will be performed in accordance the USATHAMA QA Program, January 1990, Section 6.6.

### 3.12 TOPOGRAPHIC AND ELEVATION SURVEY

To provide survey control for data management functions, a survey of monitoring wells will be completed for all sites to be evaluated under the EI. Topographic maps will use a scale of 1 inch equals 100 feet, and a 2-foot contour interval. The survey will be conducted by a California-licensed surveyor under contract to the EI contractor. The survey will be conducted according to USATHAMA requirements (paragraph III I of the Geotechnical Requirements). Universal Transverse Mercator (UTM) or State Planar grid will be used as a reference for horizontal control to an accuracy of within  $\pm 3$  feet. The National Geodetic Datum of 1929 will be used as a reference for the vertical survey. Vertical control will be within  $\pm 0.05$  feet. These maps will contain approximate locations of all surface features pertinent to the site and the investigation, including borings, test pits, soil gas sampling locations, and other sampling points completed as part of this EI, including surface water/sediment and surface soil sampling points.

Upon completion of the last well construction, but no longer than 5 weeks after well installation, the natural ground surface and the uncapped inner casing (riser) for the monitoring wells will be surveyed for both vertical and horizontal control, to a degree of accuracy of  $\pm 0.05$  feet and  $\pm 3$  feet,

FIELD DATA RECORD - SURFACE WATER & SEDIMENT

PROJECT  JOB NUMBER  DATE

SAMPLE LOCATION ID  LOCATION ACTIVITY  START:  END:

**SURFACE WATER INFORMATION**

WATER DEPTH @ SAMPLE LOCATION:  FT.

DEPTH OF SAMPLE FROM TOP OF WATER:  FT.

VELOCITY MEASUREMENTS OBTAINED?  YES, SEE FLOW MEASUREMENT DATA RECORD  NO

TEMPERATURE  DEG.C. SPEC. COND.  UMHOS/CM pH  UNITS DISS. O2  PPM

FIELD QC DATA:  FIELD DUPLICATE COLLECTED DUP. ID

**TYPE OF SURFACE WATER:**  STREAM  POND/LAKE  RIVER  SEEP

**EQUIPMENT USED FOR COLLECTION:**  NONE, GRAB INTO BOTTLE  BOMB SAMPLER  PUMP

**DECONTAMINATION FLUIDS USED:**  ALL USED  ETHYL ALCOHOL  DEIONIZED WATER  TSP SOLUTION  HEXANE  HNO3 SOLUTION  POTABLE WATER  NONE

**SAMPLE LOCATION SKETCH BELOW?**  YES  NO

**METHOD USED:**  WINKLER  PROBE

**SEDIMENT INFORMATION**

DEPTH OF SEDIMENT SAMPLE:  INCHES

TYPE OF SAMPLE COLLECTED:  DISCRETE  COMPOSITE

NO. OF DISCRETE SAMPLES FOR COMPOSITE:

FIELD QC DATA:  FIELD DUPLICATE COLLECTED DUP. ID

**EQUIPMENT USED FOR COLLECTION:**  GRAVITY CORER  S.S. SPLIT SPOON  DREDGE  HAND SPOON  ALUMINUM PANS  SS BUCKET

**DECONTAMINATION FLUIDS USED:**  ALL USED  ETHYL ALCOHOL  DEIONIZED WATER  TSP SOLUTION  HEXANE  HNO3 SOLUTION  POTABLE WATER  STREAM WATER  NONE

**SAMPLE OBSERVATIONS:**  ODOR  COLORED

SAMPLES COLLECTED (✓ IF REQUIRED AT THIS LOCATION)	MATRIX		✓ IF PRESERVED W/ACID-BASE	VOLUME REQUIRED	✓ IF SAMPLE COLLECTED	SAMPLE BOTTLE ID'S
	SW	SED				
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	_____/_____/_____/_____/_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	_____/_____/_____/_____/_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	_____/_____/_____/_____/_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	_____/_____/_____/_____/_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	_____/_____/_____/_____/_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	_____/_____/_____/_____/_____

NOTES/SKETCH

**FIGURE 3-8  
SURFACE WATER/SEDIMENT SAMPLE-  
FIELD DATA RECORD  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

SAMPLER SIGNATURE \_\_\_\_\_

respectively. Other exploration locations, such as test pits, borings, and other sampling locations will be interpolated from monitoring well locations using a cloth tape.

### 3.13 SAMPLE MANAGEMENT

The following subsections discuss sample designation, handling, custody, and Quality Assurance/Quality Control (QA/QC) procedures for field personnel.

#### 3.13.1 Sample Designation

All samples collected for laboratory analysis during the field investigation will be labeled with computer generated labels. The labels will display a 10-character site identification (site-ID) and an up to four-character site-type designation. The 10-character site-ID primarily identifies the sampling location (e.g., a boring number, or monitoring well number). The four-character site-type characterizes the sampling location (e.g., the sampling location is in a ditch). Together, the site-ID and site-type uniquely identify the source of analytical or geotechnical data acquired from the sample. Each identifier will be coded for compatibility with USATHAMA data management procedures and entry into the Installation Restoration Data Management System (IRDMS) for sample tracking and data manipulation.

3.13.1.1 Site-ID Numbers. The site-ID identifies the site as a unique horizontal sampling location. Information encoded in each 10-character site-ID identifies the site name, sample type (i.e., category), sample location and the year of sampling, and excavation or sample gathering activity. The 10 characters are divided into six information groups, as presented in Table 3-2, and described as follows:

The first two characters identify the name of the site where the sample originated. Table 3-3 lists the two-character site name abbreviation to each site that will be sampled at HAA.

The third character in the site-ID number describes the sample category. Examples of sample categories are listed in Table 3-2.

The fourth character of the 10-character code will always be a "dash" (-) and is not an information designator. Its sole utility is to separate the site identification and sample categories from the specific sample site information.

The fifth and sixth characters identify the year of sampling activity at the specific sampling location. For a monitoring well, it identifies the year the well was sampled.

The seventh, eighth, and ninth characters of the site-ID describe the horizontal sample location. This character sequence is used in one of two ways: (1) for sample locations to be installed/excavated, a two digit code preceded by a "dash" will be used (e.g. MW-3, horizontal location code is -03), and (2) in a

TABLE 3-3

EI SAMPLE DESIGNATION NAME ABBREVIATIONS

ENVIRONMENTAL INVESTIGATION SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

ABBREVIATION <sup>1</sup>	FULL NAME
PL	POL Area
PS	Pump Station Area
SP	Former Sewage Treatment Plant
AM	Aircraft Maintenance/Storage Areas
BP	Burn Pit
JP	JP-4 Pipe Line
RV	Revetment Area
EL	East Levee Landfill
BT	Building 442

NOTES:

<sup>1</sup> Abbreviation is used in character one and two of the site Site-ID

TABLE 3-2

SITE-ID FORMAT

ENVIRONMENTAL INVESTIGATION SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

CHARACTER NUMBER	1,2	3	4	5,6	7,8,9	10
Information Encoded By Characters	Abbreviated Site Name	Sample Category	Always a Dash -	Year of Sample Initiation	Horizontal Sample Location	Designates a nested well as A or B, or is blank
Examples	See Table 3-3	M = Monitoring Well B = Boring W = Surface Water P = Test Pit Q = Quality Control Sample D = Sediment G = Soil Gas T = Tank Content	90 = installed in 1990 91 = sampled in 1991	-03 = New monitoring well MW-03		

NOTE: \*Example codes applicable to EI sites.

grid system in which a two character code preceded by a "dash" allows for the use of 260 designations (-A0 through -Z9).

The tenth character is a vertical locator for nested well sampling sites only (e.g., deep groundwater = A, shallow groundwater = B). If the site sample number is not identifying a nested well, the character space is blank.

The following are examples of site-IDs:

PLM-90101A - an exploration location at the POL Area (PL). It is a monitoring well (M), sampled in 1990 (90), known as MW-101; it is the deeper well (A) of a noted well pair.

BPB-91-01 - an exploration location at the Burn Pit (BP). It is a boring (B), installed in 1991 (91); its location is designated as B-1 (01).

ELW-91-02 - is a sample taken at the East Levee (EL); it is a surface water sample (W) whose location was sampled in 1991 (91); its location is known as SW-D2 (02).

3.13.1.2 Site-Type Designation. The list of acceptable site-type designations are presented in Appendix B, as defined by USATHAMA (USATHAMA, 1988). The site-type consists of up to four-characters that describe landmarks, features, or construction activities at the sample collection site. The site-type designations follow the site-ID and site sample number. The following are examples of some of the site-type designations applicable to HAA:

- PLUG: a shovel sample
- BORE: a borehole sample
- WELL: groundwater sample from a well
- CMPH: composite soil or groundwater sample taken from multiple locations

3.13.2 Sample Handling

Hold times, sample preservation, and container preparation will be described in detail in the QCP. Appendix A-2 presents this information for use by field personnel.

3.13.3 Sample Custody

The environmental sample COC and management procedures to be used at HAA during the field investigation are described in the following paragraphs.

To assure that all environmental samples are accounted for at all times, the EI contractor will follow the USATHAMA Chain-of-Custody Procedures during sampling events. An example COC form is shown in Figure 3-9.

The COC and analytical request form (ARF) (Figure 3-10), which specifies the analysis to be performed, will be completed in quadruplicate. Two copies accompany the samples to the lab; one is kept for the project file; and one is





kept by the FOL and transferred to the laboratory QA coordinator for the EI Contractor.

3.13.4 Sample Staging/Shipping

The EI contractor FOL or designee will oversee the collection of surface and subsurface soil and groundwater samples during the HAA field investigation.

At the time of sampling, samples from the sites will be logged in and associated data records and COC forms will be checked for completeness as is outlined in Section 6.11 of the USATHAMA QA Program January, 1990. After review, data record sheets will be initialed and dated. COC forms will be signed and dated. Samples will be checked for integrity and lid closure to prevent leakage. Sample labels will be checked for completeness and integrity. Any leaking samples or other situations which may compromise sample data will be noted in the sample log and reported to the Project QA Manager and the COR or his/her representative.

Prior to shipment, glass sample bottles will be wrapped with plastic "bubble pack". Generally, sample bottles will be tightly packed in coolers for shipment. Excess space within coolers will be taken up with bubble pack to prevent possible breakage of sample bottles during shipment. Coolers shall be maintained at 4 degrees Celsius. Blue ice or ice packed in double Ziploc bags will be used to cool the samples during shipment to the USATHAMA-approved analytical laboratory. Samples will be shipped overnight to the laboratory via Federal Express (or other overnight carrier); in no case will samples for analytical chemical analysis be allowed to remain in temporary storage at the HAA sample staging area for more than 36 hours. The original COC form and analytical request form will also be packaged in a Ziploc bag and will accompany the samples during shipment to the laboratory. After shipment, the sample tracking forms will be updated to reflect sampling date, shipping date, sample location number, type of sample, analytical request form number, analytical laboratory, and Federal Express (or other overnight carriers) airbill number.

3.13.5 Establishment of Sample Lots

Groundwater and soil samples from the HAA field investigation that will receive laboratory analysis will be prepared and established into lots according to USATHAMA QA requirements. The field sampling program and shipment of samples will be coordinated to ensure that minimum lot size requirements are met and that holding times are not exceeded for any analysis. These procedures will include the following:

- o Sediment, surface water, and surface and subsurface soil samples will be collected for chemical analysis during the EI field program. These samples will be collected and shipped making sure not to exceed holding times. These samples will be established into one or more lots by the laboratory, based on the number of samples that can be processed through the limiting step of each analytical method in a 24-hour period.

- o Groundwater sampling will be initiated at a minimum of 14 days after completion of monitoring well development. Separate sample lots will be established as necessary within each group of samples to ensure that holding times are not exceeded and that USATHAMA requirements for establishing sample lots are met.

Sample lots will be established by the laboratory, based on the requirements outlined in the USATHAMA QA. A sample lot will consist of the maximum number of samples that can be processed through the time-limiting step in each method within a 24-hour period. For the purposes of lot establishment, field QC samples (trip blanks, field blanks, rinse blanks) and laboratory QC samples (method blanks, spikes) are included in assessing the total number of samples that can be analyzed in a single lot.

### 3.13.6 Quality Assurance/Quality Control

The following Subsections describe QA/QC procedures for field and laboratory samples.

3.13.6.1 Field Samples. Sampling and analysis of all matrices during the HAA field investigation will be carried out in accordance with the requirements of the USATHAMA Quality Assurance Program, January 1990. Samples will be properly handled and conveyed to the USATHAMA-certified laboratory in accordance with specified COC procedures, as previously described. QA approval of each batch will be performed by USATHAMA based on weekly QC reports. The EI contractor's QA responsibilities in data approval will include auditing data records supplied by the subcontractor laboratory regarding analytical data batches.

Field QC samples consist of VOC trip blanks, sampler (or rinse) blanks, field blanks, and filtration blanks. Trip blanks will consist of organic-free water contained in amber glass VOC bottles that will accompany each cooler of water samples during shipment from the field. Analysis of the trip blank for VOCs will indicate if contamination of the water samples has occurred during shipment. Sampler blanks will consist of water from the USATHAMA-approved source, collected from rinsing of clean sampling equipment prior to sampling of soil and groundwater once every 10 working days. Sampler blanks will be analyzed for all analytes for the HAA field investigation and will be included with the initial sample lot for each sampled environmental medium (e.g., soil and groundwater). Filtration blanks will be collected for water samples requiring inorganic analysis. Water from the USATHAMA-approved source will be passed through a clean filter, collected, and shipped for analysis with a sample lot every 10 working days. Containers to be used for the field blanks will be from the same container lot as the containers designated for the EI analytical samples.

3.13.6.2 Lab Samples. The laboratory QA/QC Coordinator will, on a weekly basis, provide the EI contractor QA Manager with all system and performance audit reports; COC forms; holding time/extraction analysis reports; batching reports; instrument logs; maintenance and calibration records; and complete analytical QC documentation (e.g., control charts, method blanks, surrogate recovery, and matrix spike results). Copies of all corrective actions will be

supplied to the EI contractor for approval. While the laboratory QA/QC coordinator provides operation control of the laboratory, the EI contractor QA Manager retains ultimate responsibility for data quality. Because the laboratory will be USATHAMA-certified with an existing, approved QA system, it is cost-effective for the EI contractor to fulfill QA responsibilities to USATHAMA primarily via review and auditing rather than on-site operational control. The EI contractor's QA Manager will be forwarded all of the above data along with the weekly QC report (Data Item A008), QA Manager will review all analytical lot QC data prior to submittal of the required report to USATHAMA. This report shall follow the guidance of the USATHAMA QA Program, January 1990 and is due five working days after the completion of analysis.

4.0 SITE SPECIFIC TECHNICAL PROGRAMS

This section of the SDP presents individual site descriptions, technical objectives, and proposed technical programs. The Base Closure PA (Weston, 1990) identified 12 ESOs or study areas present at HAA. These and other study areas observed during Jordan's site visit were reviewed in the HAA Technical Plan and a rationale was provided for either omitting or including each study area as part of the EI program (see Table 4-1 of the Technical Plan for rationale). Only those study areas that require remedial investigation are discussed in this SDP. The study areas have been separated into one property-wide, and nine other site areas. The property-wide investigation includes:

- o sampling electrical transformers for PCBs

The location of each site area is presented in Figure 4-1. A summary of the sampling and analytical programs which will be conducted as part of the HAA EI/AA are presented in Tables 4-1 and 4-2.

The site areas include the following:

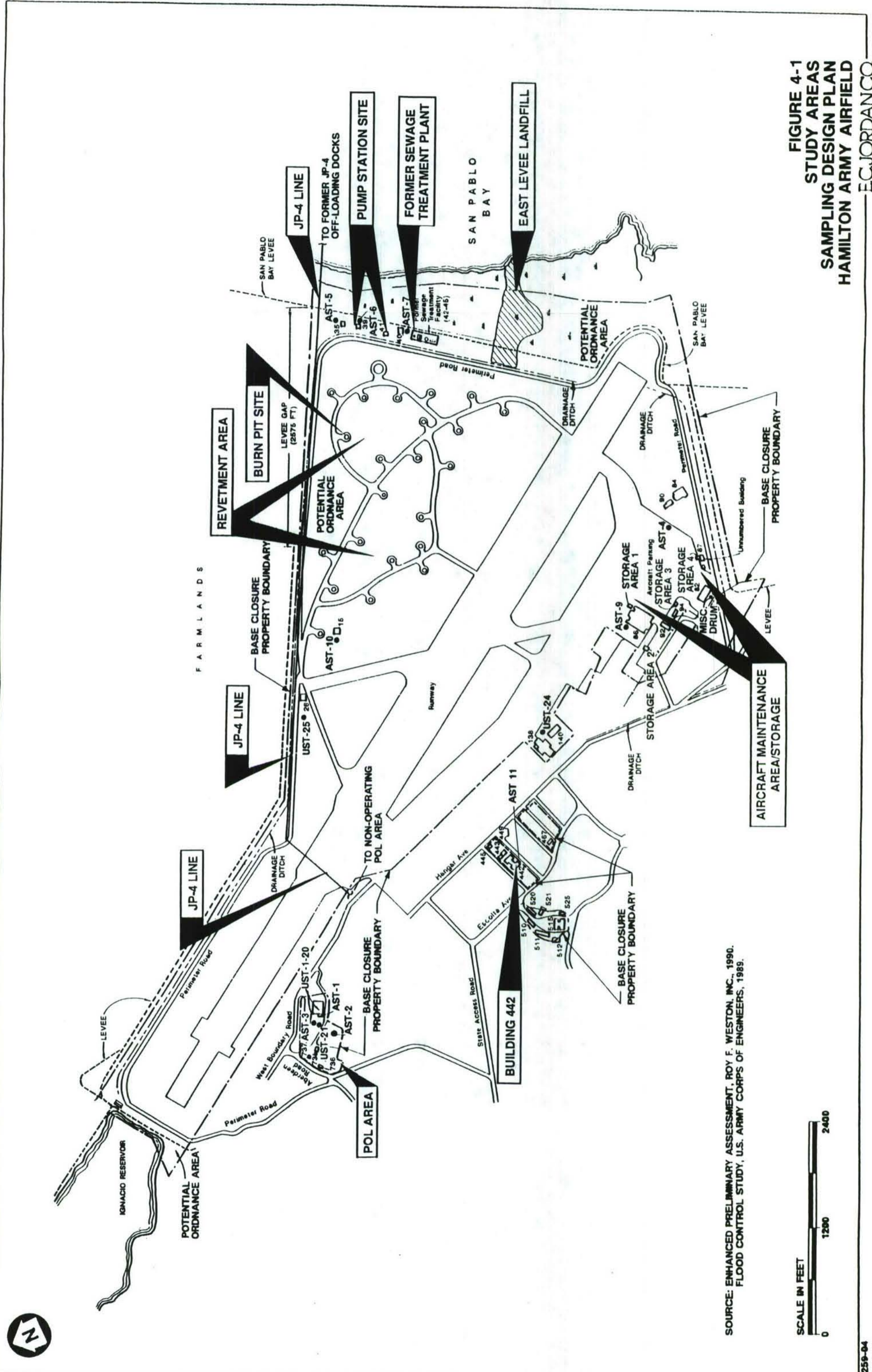
- o POL Area
- o Pump Station Area
- o Former Sewage Treatment Plant
- o Aircraft Maintenance/Storage Area
- o Burn Pit
- o JP-4 Pipeline
- o Revetment Area
- o East Levee Landfill
- o Building 442 AST site

4.1 PROPERTY-WIDE INVESTIGATIONS

4.1.1 Transformers

Surveys of HAA conducted by WCC (1987) and by Jordan identified 42 active or inactive electrical transformers at 15 locations on Base Closure Property that potentially contain PCBs (Figure 4-2). WCC collected, field screened, and performed laboratory analyses on samples from each of the 13 transformers identified in their survey. The 29 transformers identified by Jordan have not been tested and thus will need to be sampled to identify potential PCB hazards.

All of the transformers identified by Jordan are mounted on the ground except for those in the POL area. A sample of the cooling oil contained in each of these transformers will be collected, screened in the field using the Modified Spittler Method, and, if PCB presence is indicated, submitted for laboratory



SOURCE: ENHANCED PRELIMINARY ASSESSMENT, ROY F. WESTON, INC., 1990.  
 FLOOD CONTROL STUDY, U.S. ARMY CORPS OF ENGINEERS, 1989.

**FIGURE 4-1**  
**STUDY AREAS**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**  
 ECJORDANCO

TABLE 4-1  
SUMMARY OF SAMPLING PROGRAM

ENVIRONMENTAL INVESTIGATION  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

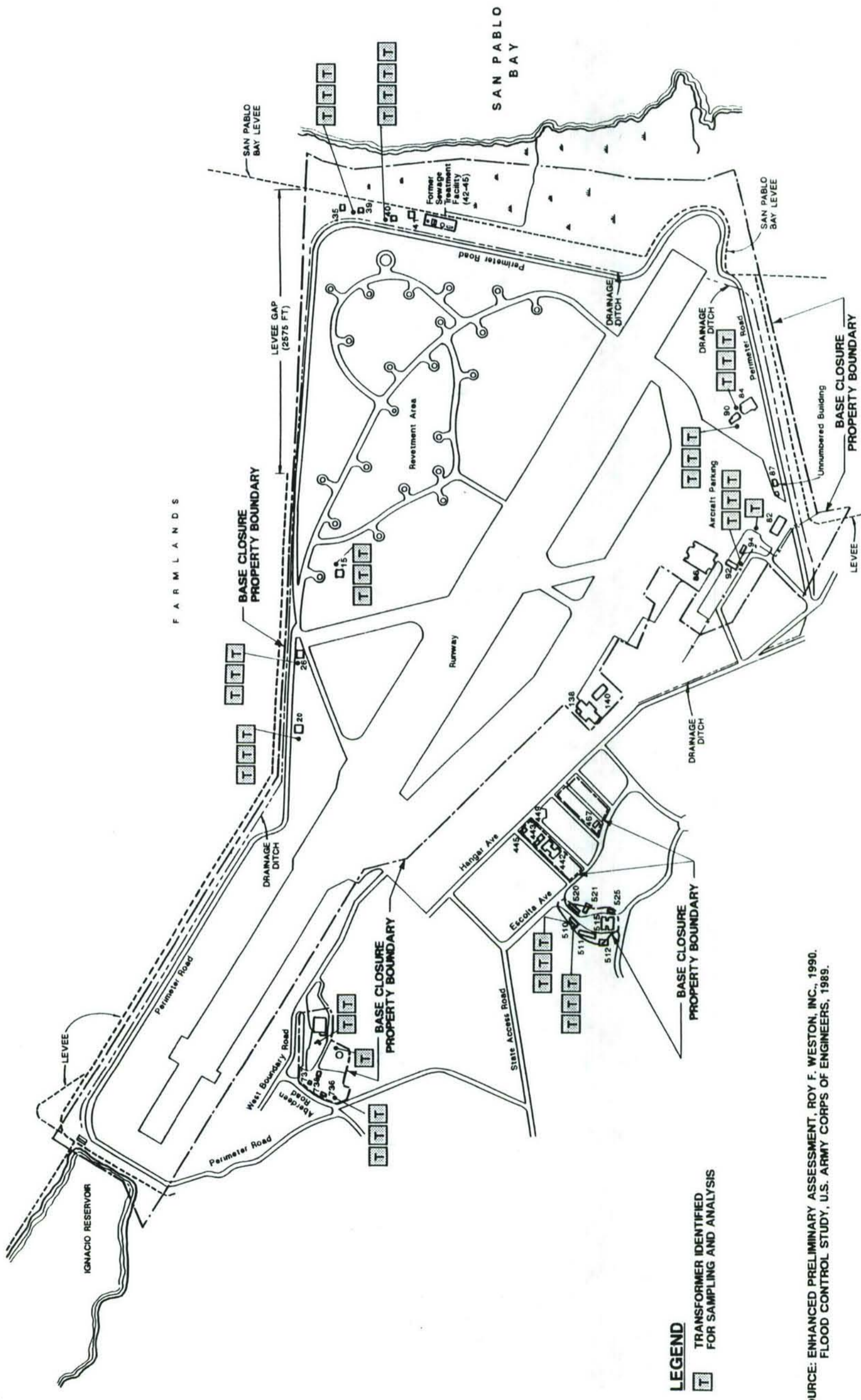
SITE	NO. TEST PIT		NO. BORINGS/ WELLS	NO. SPLIT SPOON		NO. SURFACE		NO. SEDIMENT SAMPLES	NO. SOIL GAS SAMPLING POINTS	NO. TANK CONTENT SAMPLES
	SOIL SAMPLES	PIT SAMPLES		GROUNDWATER SAMPLES	SOIL SAMPLES	WATER SAMPLES				
Active POL Area	0	0	17	74	17	0	0	0	0	0
Pump Station Area	0	0	1	10	1	8	0	3	0	0
Former Sewage Treatment Plant	0	0	1	10	1	0	2	2	0	0
Aircraft Storage/ Maintenance Area	6	18	1	3	1	0	0	3	0	0
Burn Pit	2	4	4	22	4	5	0	0	0	0
JP-4 Line	0	0	0	0	0	0	0	0	140	0
Revetment Area	3	9	1	3	1	22	0	0	0	1
East Levee Landfill	0	0	5	26	20	0	0	0	0	0
Building 442	0	0	0	0	0	0	0	3	9	0

NOTE: Quality control samples are not presented in this table, see QCP.

**TABLE 4-2**  
**SUMMARY OF ANALYTICAL PROGRAM**  
**ENVIRONMENTAL INVESTIGATION**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

SITE NAME	SAMPLE SOURCE	MEDIA	NO. OF SAMPLES ANALYZED	TCL VOC	TCL SVOC	TPH	DISSOLVED AND/OR TOTAL TCL		LEAD	MAJOR ANIONS + CATIONS	PCB
							INORGANICS*	TOTAL TCL			
Active POL Area	Boring Well	Soil	0	0	0	0	0	0	0	0	0
	Well	Water	17	17	17	17	0	0	17	0	0
Pump Station Area	Boring Well	Soil	3	3	3	3	0	0	3	0	0
	Well	Water	1	1	1	1	1	1	0	0	0
	Surface Soil	Soil	8	8	8	8	0	0	8	0	0
	Outfall	Sediment	3	3	3	0	3	3	0	0	0
Former Sewage Treatment Plant	Boring Well	Soil	2	2	2	0	2	2	0	0	0
	Well	Water	1	1	1	0	1	1	0	1	0
	Seep	Sediment	2	2	2	0	2	2	0	2	0
	Seep	Water	2	2	2	0	2	2	0	2	0
Aircraft Maintenance/Storage Area	Test Pit	Soil	18	18	18	18	18	18	0	0	0
	Storm Drain	Sediment	3	3	3	3	3	3	0	0	0
	Well	Water	1	1	1	0	1	1	0	0	0
Burn Pit	Boring	Soil	12	12	12	12	0	0	12	0	0
	Test Pit	Soil	4	4	4	4	0	0	4	0	0
	Well	Water	4	4	4	4	0	0	4	0	0
	Surface Soil	Soil	5	5	5	5	0	0	5	0	0
	Well	Water	1	1	1	1	0	0	1	0	0
Revetment Area	Test Pit	Soil	9	9	9	9	0	0	9	0	0
	Surface Soil	Soil	22	0	22	22	0	0	22	0	0
	Tank Content	Water	1	1	1	1	1	1	0	0	0
	Well	Water	20	20	20	0	20	20	0	5	0
East Levee Landfill	Boring	Soil	4	4	4	0	4	4	0	4	0
	Surface Soil	Sediment	3	3	3	3	0	0	3	0	0

NOTES: Quality control samples are not presented in this table, see QCP.  
 \* Groundwater samples will be analyzed for dissolved TCL inorganics; sediment, soil, and surface water will be analyzed for total TCL inorganics.



**LEGEND**  
 T TRANSFORMER IDENTIFIED FOR SAMPLING AND ANALYSIS

SOURCE: ENHANCED PRELIMINARY ASSESSMENT, ROY F. WESTON, INC., 1990.  
 FLOOD CONTROL STUDY, U.S. ARMY CORPS OF ENGINEERS, 1989.



**FIGURE 4-2**  
**TRANSFORMERS TO BE SAMPLED**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**  
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analysis. Transformers will be sampled according to procedures described in the QCP. Procedures for field screening and laboratory analysis of samples are described in Appendix A. Also, as part of the EI process it will be necessary to identify other PCB containing equipment (e.g. capacitors) on base closure property.

4.2 POL AREA

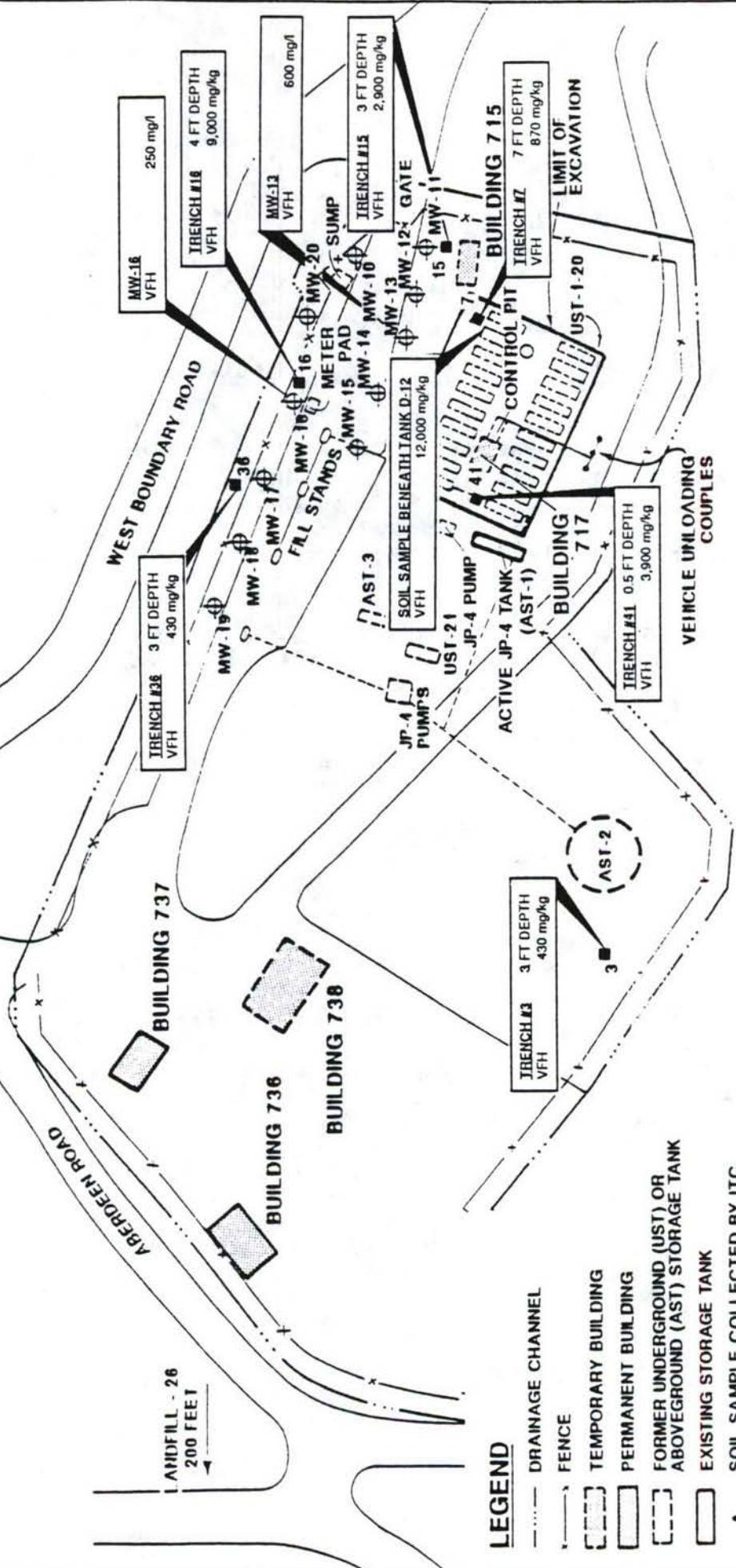
4.2.1 Site Description

The POL Area at HAA consists of approximately 7.5 acres located in the north-central part of the base, approximately 100 feet southeast of Ammo Hill and at the base of Reservoir Hill (see Figure 4-1). The POL Area is surrounded by the GSA Property, including Landfill Number 26 to the northwest. The northwestern end of the runway is located approximately 500 feet north of the POL Area. The ground surface at the POL Area is partly paved and partly covered with gravel and native soil.

The POL Area previously contained 21 USTs and several ASTs used to store aircraft fuel. Only one 25,000-gallon AST is currently operational. All of the USTs and one AST (AST-1) were removed during the summer of 1986 by International Technology Corporation (ITC) as part of the POL area remediation contracted by the USACE. There are three vacant buildings (Building Nos. 736, 737, and 738) at the POL Area which have been used for the temporary storage of waste oil prior to removal by a waste disposal contractor. Building 737 remains in use for this purpose. No staining or other evidence of spills or releases was found in the vicinity of the buildings (Jordan, 1990a). Figure 4-3 shows the locations of the former USTs, the former and existing ASTs, and the buildings at the POL Area.

Based on a review of the boring logs from monitoring wells installed north and west of the UST-1 through 20 area, the geology at this site consists primarily of Bay Mud over shallow bedrock (0.5 to 14 feet bgs) (WCC, 1985). Discontinuous silty sand or sand lenses (up to 5 feet thick) are occasionally found within the Bay Mud. Bedrock is very shallow (less than one foot bgs) around AST-2 and deepens to the north, east, and west. Borings completed during a previous investigation at Landfill No. 26 (WCC, 1985), located 200 feet to the west of the POL, encountered bedrock, in some cases, at depths of 50 feet bgs.

The shallow bedrock (upper 5 to 10 feet) is a yellow-brown weathered arkosic sandstone grading into a blue-gray unweathered, very hard arkosic sandstone (WCC, 1985). Franciscan Greywacke underlies the sandstone. Depth to static groundwater varies from 2 to 8 feet bgs in this area and is generally encountered within the Bay Mud (WCC, 1985). Groundwater flow directions at this site are anticipated to be to the west and north.

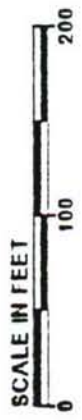


**FIGURE 4-3**  
**HISTORICAL SAMPLING LOCATIONS**  
**POL AREA**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

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**LEGEND**

- DRAINAGE CHANNEL
- - - FENCE
- [ ] TEMPORARY BUILDING
- [ ] PERMANENT BUILDING
- [ ] FORMER UNDERGROUND (UST) OR ABOVEGROUND (AST) STORAGE TANK
- [ ] EXISTING STORAGE TANK
- SOIL SAMPLE COLLECTED BY ITC AFTER CONTAMINATED SOIL REMOVAL, 1986
- SOIL SAMPLE FROM TRENCH EXCAVATED BY ITC IN 1986
- SOIL SAMPLE COLLECTED BY ITC AFTER TANK REMOVAL, 1986
- ⊕ MONITORING WELL, INSTALLED IN 1985 BY WCC AND SAMPLED BY ITC IN 1986
- VFH VOLATILE FUEL HYDROCARBONS

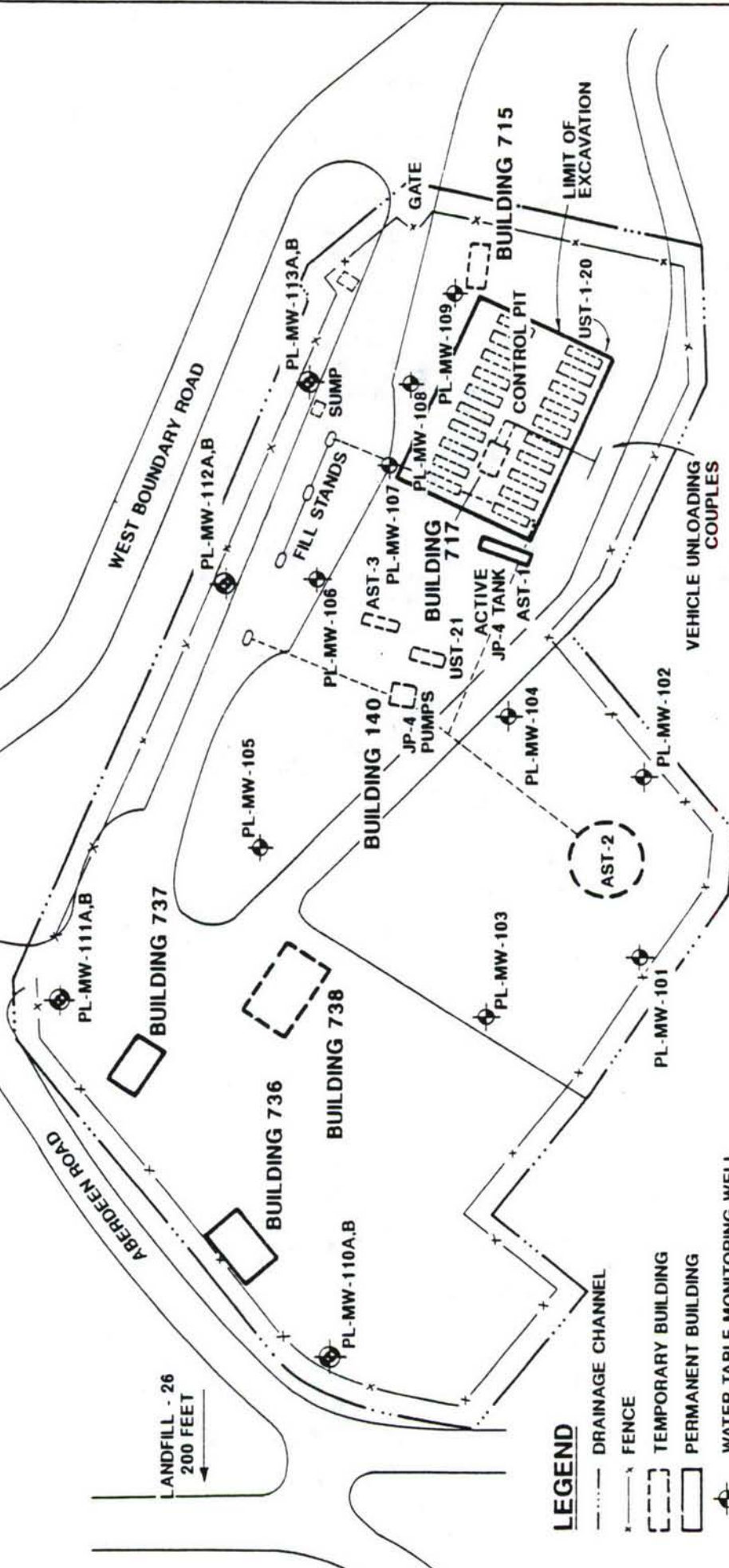


UST-1 through UST-20

Twenty of the USTs at the POL Area (UST-1 through UST-20) located in the southeast corner of the POL Area were arranged in two rows of ten 25,000-gallon tanks each. The tanks were each supported by four 3-foot high concrete strip footings built on the original grade. The tanks were then covered with 20 feet of soil which completely buried the tanks and formed a hill that blended into a natural rock outcrop on both the southeast and southwest sides of the site. A water control pit and water separator house (Building 717) were constructed on the ground directly above these USTs. Each of the tanks contained JP-4 jet fuel.

In May, 1986, the USACE contracted for the removal of the POL tanks and subsequent investigations of soils and groundwater in the area. The tank removals were completed during the summer of 1986. The water control pit, Building 717, and all 20 USTs and associated piping were removed at that time. Eleven monitoring wells (MW-10 through MW-20) were placed downgradient of the excavated area (Figure 4-4). The wells are 2-inch ID monitoring wells constructed of Schedule 40 PVC piping with 0.030-inch slotted 10-foot screens. The wells are suitable for water level measurements but do not meet USATHAMA Geotechnical Requirements for sampleable monitoring wells (USATHAMA, 1987). During Jordan's site visit, it was noted that the wells do not have protective casings and some of the wells are broken off at ground surface (Jordan, 1990a). Uncapped or unprotected wells are not protected from infiltration by rainwater or other debris. It was also noted that these monitoring wells were not backfilled with grout and the screen sections were not backfilled with the amount of sand required as part of the Geotechnical Requirements (i.e., 5 feet above the well screen. Analytical results for groundwater and soil samples collected by ITC in 1986 are shown in Figure 4-3. Based on the analytical results, an Av-gas (aviation fuel) water separator was also dismantled. Contaminated soils with up to 11,000 parts per million (ppm) volatile fuel hydrocarbons (VFH) were documented (ITC, 1987) in the following locations at the POL Area:

- o below the removed tanks
- o along the west boundary fence
- o adjacent to the drainage ditch
- o around the meter pad at the truck fill stand
- o just outside of the west boundary fence near the drainage ditch
- o at the sump that collected water from the water control pit
- o adjacent to Building 715, and
- o under the upper road truck fill area.



LANDFILL - 26  
200 FEET

**LEGEND**

- DRAINAGE CHANNEL
- x- FENCE
- - - - - TEMPORARY BUILDING
- ▭ PERMANENT BUILDING
- ⊕ WATER TABLE MONITORING WELL
- ⊕ WATER TABLE AND DEEP PAIRED MONITORING WELLS



**FIGURE 4-4**  
**PLANNED MONITORING WELL LOCATIONS**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

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Elevated levels of VFH were detected in groundwater samples collected from the ITC monitoring wells at the POL Area. A sample from MW-13, located immediately downgradient of the UST-1 through UST-20 excavated area, contained 600 ppm VFH. Lower concentrations of VFH (0.07 ppm to 1.0 ppm) were detected in MW-11, MW-12, MW-14, and MW-15, all located downgradient of the UST-1 area. MW-16, located immediately downgradient of the meter pad and several JP-4 lines, had 250 ppm VFH.

UST-21

UST-21 was a 750-gallon UST in the POL area formerly located 150 feet northwest of USTs 1 through 20 (see Figure 4-3). The age and material of UST-21 are unknown (Weston, 1990). The contents are thought to have been JP-4. UST-21 was removed by ITC as part of the POL remediation in 1986. No soil staining was observed upon excavation of the tank and VFH were not detected above 10 ppm in the soil samples collected from beneath the tank. Another soil sample collected from the area was analyzed for lead, and none was detected above the 0.3 ppm detection level. The excavation was backfilled with clean material (Weston, 1990).

AST-1

There were several ASTs (AST-1 through AST-3) located in the POL Area. AST-1 is an active 25,000-gallon JP-4 storage tank located immediately north of the former location of USTs 1 through 20. This tank is used to refuel the occasional aircraft which currently use the runway. There have been no documented spills or leaks from this tank.

AST-2

AST-2 was an 840,000-gallon JP-4 bulk storage tank which was located above the POL Area on a ridge (Reservoir Hill) and was removed in 1986. AST-2 received fuel through 6-inch diameter pipes and a pump station located below the ridge near AST-1.

Leaks from AST-2 were known to have occurred, although there was no evidence of soil discoloration beneath the tank during excavation (Weston, 1990). Following tank removal 10 trenches were dug to bedrock north and west of where the tank had been located (which were the only areas where depth to bedrock exceeded one foot). A total of 27 soil samples were collected, and of these, five samples contained VFHs at levels exceeding 1000 ppm (Weston, 1990). Two of the contaminated samples were collected from areas immediately downgradient of a 3-inch diameter drain valve located on the west side of the tank, indicating that there had been a leak or spill from the drain valve (Weston, 1990). The spill was thought to have been contained within the bermed area (Weston, 1990). Five contaminated soil samples were collected near the concrete drain box, located west of AST-2. Contaminated soils and clay-filled rock fractures were not removed but were buried in place with clean material at the direction of the USACE (Weston, 1990). Remediation of this area is currently underway with a Fall 1990 completion date.

### AST-3

The area referred to as AST-3 includes several 55-gallon drums, a 600-gallon AST, and a 2500-gallon AST, all of which are now reportedly empty (Weston, 1990). Also associated with AST-3 are approximately 10 full 55-gallon drums from Storage Area 2 (see Section 4.4.1) which are stored in a concrete-lined truck ramp with no drains. The drums are removed annually by an outside contractor (Weston, 1990). There have been no documented leaks or spills from any of the tanks or drums referred to as AST-3.

#### 4.2.2 Technical Program

An investigation and remediation of soils at the POL Area is currently being conducted by ITC, under contract to the Omaha office of the USACE. Therefore, the EI program at the POL Area will focus only on groundwater contamination.

The following technical objectives have been identified for the EI at the POL Area:

- o characterize groundwater quality immediately downgradient of USTs and ASTs at the POL Area
- o investigate shallow and deeper groundwater quality along the POL boundaries
- o characterize background groundwater quality at an area upgradient of the POL Area, anticipated to be south and east of AST-2
- o investigate vertical and horizontal groundwater gradients, in-situ hydraulic conductivities, and geotechnical properties of the soils and bedrock at the POL Area

Table 4-3 outlines the technical program for the POL Area, and Figure 4-4 show locations for proposed explorations. A total of 13 water table monitoring wells and 4 deeper monitoring wells will be installed at the POL Area. Each of the deeper wells is paired with a water table well. Water table monitoring wells will be screened in the uppermost saturated layer, which may be the Bay Mud, sands and silts (if present), or shallow bedrock. If the water table is encountered within the Bay Muds, which is a very impermeable surficial strata, the screens will be placed to intercept this unit and, if present, the next permeable strata (sand/silts or shallow bedrock). Deeper monitoring wells will screen the next stratigraphic water-bearing unit encountered or, if such a unit is not encountered, will screen a five-foot zone approximately 10 feet below the bottom of the water table well. The program includes:

1. Installing two water table monitoring wells upgradient of the POL Area, anticipated to be southwest and west of AST-2, to characterize background shallow groundwater quality. Depth to bedrock is expected to be very shallow (less than five feet) in this area, therefore, these wells will most likely be screened in the bedrock.

TABLE 4-3  
SUMMARY OF TECHNICAL PROGRAM  
POL AREA

ENVIRONMENTAL INVESTIGATION  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

EXPLORATION	DEPTH PER EXPLORATION	SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
Borings: PL-MW-103	15 feet	Split Spoon Soil Sample	Continuous 18-inch Samples	0	REFERENCE SAMPLES ONLY
PL-MW-101 PL-MW-102 PL-MW-104 to PL-MW-109	15 feet	Split Spoon Soil Sample	18-inch Samples At 5-foot Intervals	0	REFERENCE SAMPLES ONLY
PL-MW-110A PL-MW-111A PL-MW-112A PL-MW-113A	35 feet	Split Spoon Soil Sample	18-inch Samples At 5-foot Intervals	0	REFERENCE SAMPLES ONLY
Monitoring Wells: PL-MW-101 to PL-MW-109 and PL-MW-110B to PL-MW-113B	15 feet	Groundwater	Water Table	13	VOC, SVOC TPH, Lead
Monitoring Wells: PL-MW-110A to PL-MW-113A	35 feet	Groundwater	Deeper Groundwater	4	VOC, SVOC TPH, Lead

NOTE: Quality control samples are not presented in this table, see QCP.

- 2. Install two water table monitoring wells approximately 150 feet downgradient (north and east) of AST-2 to determine whether leaks from AST-2 have impacted shallow groundwater.
- 3. Install two water table monitoring wells downgradient of AST-3, to characterize shallow groundwater quality downgradient of these tanks. One of the wells will be located approximately 60 feet northeast of AST-3 and the other well will be approximately 160 feet north of UST-21. Both wells will also serve as second-tier downgradient wells for AST-2.
- 4. Install three water table monitoring wells immediately downgradient of the former location of UST-1 through UST-20 to further characterize groundwater immediately downgradient of this area. These wells will be located within 50 feet of the excavated area. The wells will effectively replace the ITC wells (which were not properly constructed for sampling and analyses), and will provide confirmation of earlier analyses.
- 5. Install four paired water table and deeper monitoring wells (a total of eight wells) around the downgradient edges of the POL Area, anticipated to be just inside the fence along the north and west borders.
- 6. Conduct in-situ hydraulic conductivity tests in a total of 7 wells at the POL Area to measure site-specific hydraulic conductivities of the sands/silts and bedrock. The wells to be tested will include three of the bedrock wells (preferably one upgradient of the AST-2 and two of the paired downgradient deeper wells) and four overburden wells (one downgradient of the UST-1-20 area, one downgradient of AST-2, and two of the paired downgradient water table wells).
- 7. Collect one groundwater sample from each of the 17 wells and analyze for Target Compound List (TCL) VOCs, TCL SVOCs, Total Petroleum Hydrocarbons (TPH), and lead.
- 8. Record water levels and, if present, free product thicknesses in each of the wells immediately prior to groundwater purging and sampling. An interface probe will be used to measure free product thickness and either the interface probe or an electronic water level meter will be used to measure water levels in the wells.

4.3 PUMP STATION AREA

4.3.1 Site Description

The Pump Station Area is located on the east side of HAA between the Perimeter Road and the east levee (see Figure 4-1). It includes Buildings 35, 39, 40, and 41, which house and support three stormwater pumps used to pump runoff from HAA into San Pablo Bay (Figure 4-5).

The stormwater pumps are located in Buildings 35, 39, and 40, with the pump in Building 39 operating automatically and those in the other buildings operating

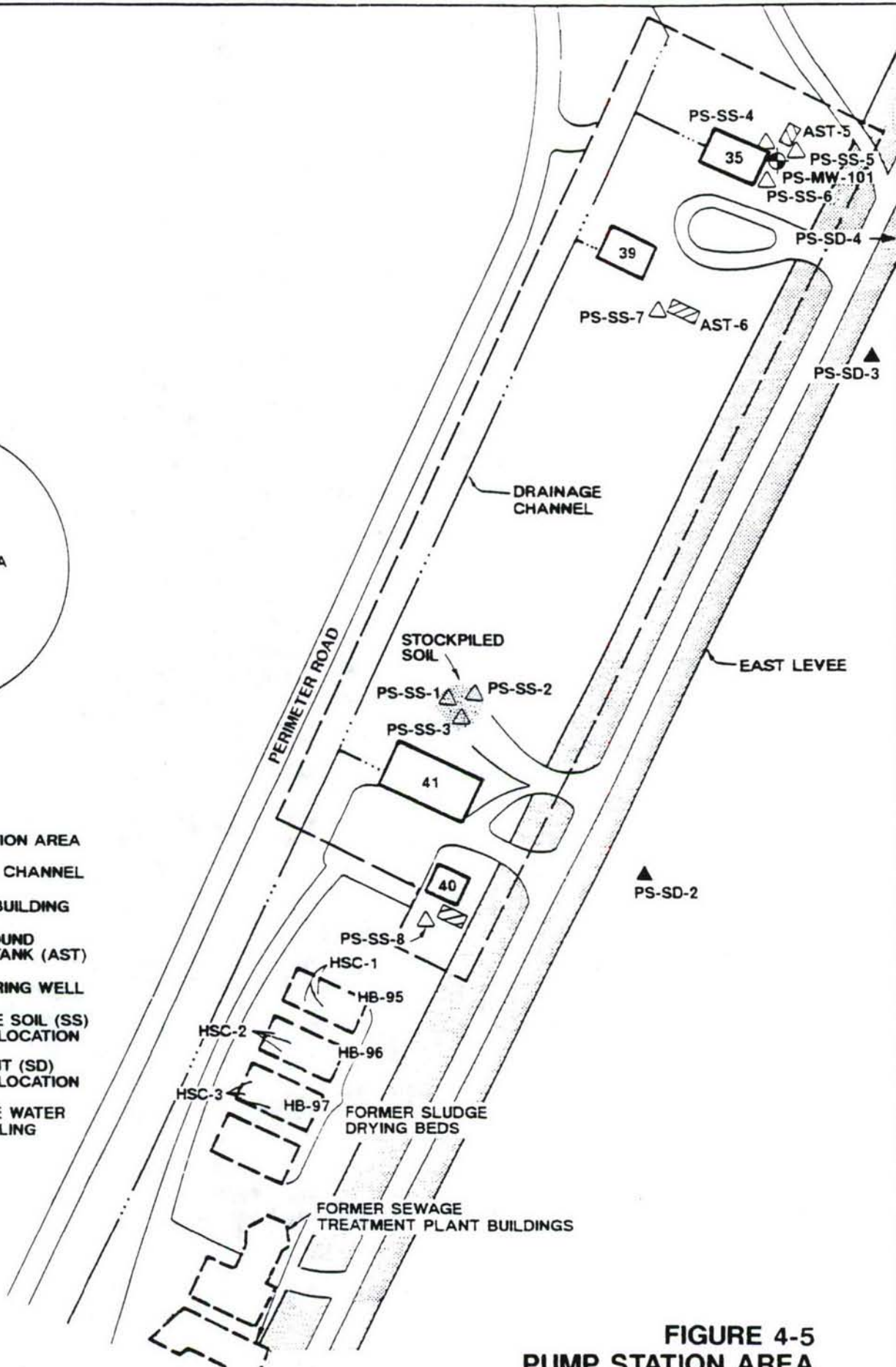


REVETMENT AREA  
NO. 6

### LEGEND

- PUMP STATION AREA
- DRAINAGE CHANNEL
- EXISTING BUILDING
- ABOVEGROUND STORAGE TANK (AST)
- EI MONITORING WELL
- EI SURFACE SOIL (SS) SAMPLING LOCATION
- EI SEDIMENT (SD) SAMPLING LOCATION
- EI SURFACE WATER (SW) SAMPLING LOCATION

SCALE IN FEET



**FIGURE 4-5**  
**PUMP STATION AREA**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

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manually. An above ground diesel storage tank is associated with each of the three pumphouses (ASTs 5, 6, and 7) and an inactive UST is located immediately north of Building 41. The UST is also assumed to have been used for diesel but this could not be confirmed. Beneath the south end of AST 5, located adjacent to Building 35, is a several square foot area of discolored soil and stressed vegetation where a significant spill of diesel apparently occurred (Jordan, 1990a). There is only minor staining at the bases of ASTs 6 and 7, located adjacent to buildings 39 and 40, respectively. During their site visit, Jordan also observed a visibly stained soil stockpile of approximately 75 cubic yards located on plastic sheeting adjacent to the north side of Building 41 (Jordan, 1990a). According to HAA personnel, this material is fuel contaminated soil stockpiled during remediation of a leaking tank associated with one of the pumphouses.

Storm runoff from HAA and surrounding areas is pumped to the tidal wetland area east of the east levee via a separate outfall pipe for each stormwater pump. Each outfall pipe discharges to a separate shallow depression in the wetland that has been lined with concrete to minimize erosion. The combined discharge capacity for the three pumps is more than 100,000 GPM.

4.3.2 Technical Program

No soil sampling has been conducted in the vicinity of the pump houses and no groundwater monitoring has been conducted in the Pump Station Area. The following technical objectives have been identified for the EI at the Pump Station Area:

- o investigate surface soil quality at ASTs 6 and 7
- o characterize the quality of the soils stockpiled north of Building 35
- o characterize surface and subsurface soils and groundwater quality at AST-5
- o investigate possible contamination of sediments in the three pump discharge basins east of the levee

Table 4-4 summarizes the technical program for the Pump Station Area and Figure 4-5 shows the sampling and exploration locations that are described below.

1. Collect one surface soil sample each from beneath ASTs 6 and 7, in the vicinity of each tanks filler port, and analyze both samples for TCL VOCs, TCL SVOCs, TPH, and lead.
2. Collect three discrete soil samples from atleast 6-inches into the soil stockpile and analyze for TCL VOCs, TCL SVOCs, TPH, and lead.
3. Collect three surface soil samples from beneath AST-5 and analyze each for TCL VOCs, TCL SVOCs, TPH, and lead.

TABLE 4-4  
**SUMMARY OF TECHNICAL PROGRAM**  
**PUMP STATION AREA**

**ENVIRONMENTAL INVESTIGATION**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

EXPLORATION	DEPTH PER EXPLORATION	SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
Borings: PS-MW-101	15 feet	Split Spoon Soil Sample	Continuous 18-inch Samples	3	VOC, SVOC, TPH, Lead
Monitoring Wells: PS-MW-101	15 feet	Groundwater	Water Table	1	VOC, SVOC, TPH, Dissolved TCL Inorganics,
Surface Soil: PS-SS-1 to PS-SS-8	6-inches	Surface Soil	--	8	VOC, SVOC, TPH, Lead
Sediment: PS-SD-1 to PS-SD-3	Ground Surface	Sediment	--	3	VOC, SVOC, Total TCL Inorganics,

NOTE: Quality control samples are not presented in this table, see QCP.

4. Collect a sediment sample from each of the three discharge basins associated with the pump outfall pipes and analyze them for TCL VOCs, TCL SVOCs, and total TCL Inorganics.
5. Install one water table monitoring well in the stained area next to AST-5 and collect continuous split spoon soil samples from the boring. Analyze soil samples from 2 and 4 feet bgs and from immediately above the water table for TCL VOCs, TCL SVOCs, TPH, and lead. The depth to water is not known at this location but is expected to be less than 10 feet. The well will be screened across the water table with a 10-foot screen. One groundwater sample will be collected and analyzed for TCL VOCs, TCL SVOCs, TPH, and TCL dissolved inorganics. As per USATHAMA Geotechnical Requirements (Paragraph III.A.12), 10 to 20 percent of the soil samples will be collected for geotechnical analysis. The soil samples will be collected from borings and will be selected by the contractor to be representative of the range and frequency of soil types encountered. Geotechnical tests shall include Atterberg Limits, sieve grain size distribution, and assignment of USCS symbols. Laboratory and summary sheets shall be submitted to the COR within ten working days of final test completion.
6. Conduct in-situ hydraulic conductivity test in the well to measure the site-specific hydraulic conductivity of the soils.

4.4 FORMER SEWAGE TREATMENT PLANT

4.4.1 Site Description

The STP operated until 1986, after which time all sanitary wastes from HAA were pumped to the Novato Sanitation District (Weston, 1990). Sometime between 1986 and 1987, all of the buildings were demolished (Environmental Photographic Interpretation Center (EPIC), 1990). No USTs or ASTs remain at the STP (Weston, 1990). Three unlined bermed sewage treatment sludge drying beds were also removed during the STP demolition (Dyson, 1990). The outfall pipe from the STP, extending from the levee to the bay (approximately 1000 feet), still exists (Jordan, 1990a). During their site visit, Jordan observed a black sludge-like fungus associated with surface seeps at two locations near the STP (Figure 4-6).

In 1985, WCC conducted an investigation of the soils at the STP. One soil boring was completed in each of the three sludge drying beds (HB-95, HB-96, and HB-97) to a depth of 10.5 feet bgs. Four soil samples were collected from each boring, at depths of 2, 4, 6, and 9 feet bgs. In addition, one surface soil sample was collected from each of the three active sludge drying beds (HSC-1, HSC-2, HSC-3). Each sample was a composite from three points on the bed (see Figure 4-6).

All samples were analyzed for metals. The results are included in Appendix C of the Technical Plan. In general, the results indicate that the composite surface soil samples contained more analytes and higher concentrations than did the

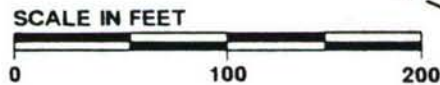


**REVETMENT AREA  
NO. 6**

CONTAMINANT	CONCENTRATION (mg/kg)
ARSENIC	5.0
BARIUM	1050.0
CADMIUM	3.8
CHROMIUM	78.0
COPPER	493.0
IRON	43,800
MERCURY	4.4
LEAD	36.3
ZINC	900.0

**LEGEND**

- FORMER SEWAGE TREATMENT PLANT AREA
- - - DRAINAGE CHANNEL
- ▭ EXISTING BUILDING
- ▭ ABOVEGROUND STORAGE TANK (AST)
- COMPOSITE SAMPLE (HSC) COLLECTED BY WCC IN 1985
- ⊕ SOIL BORING (HB) COMPLETED BY WCC IN 1985
- ⊕ EI MONITORING WELL
- ▲ EI SEDIMENT (SD) SAMPLING LOCATION
- EI SURFACE WATER (SW) SAMPLING LOCATION



CONTAMINANT	CONCENTRATION (mg/kg)			
	2 ft	4 ft	6 ft	9 ft
ARSENIC	11.3	13.0	9.3	6.3
BARIUM	85.0	48.0	32.5	29.0
CADMIUM	ND	ND	ND	ND
CHROMIUM	81.0	68.5	57.0	51.5
COPPER	40.5	39.5	28.5	24.5
IRON	29,950	20,700	21,150	20,500
MERCURY	ND	ND	ND	ND
LEAD	10.0	11.0	ND	ND
ZINC	207.0	73.0	57.5	54.0

**FIGURE 4-6  
FORMER SEWAGE TREATMENT PLANT  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

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subsurface soil samples (WCC, 1987). This pattern is indicative of the presence of STP filter cake material of the sludge drying beds. The STP sludge processing typically concentrates heavy metals while removing volatile and semivolatile compounds (WCC, 1987). The concentrations of metals detected in the soil samples were below the California Total Threshold Limit Concentration (TTLC) criteria for Biological Accumulative and Environmentally Persistent Compounds (WCC, 1987). In the case of three metals - Chromium (CR), Mercury (HG), and Silver (AG), levels detected did exceed California's designated levels for the protection of marine environments and/or surface water but were below designated levels for protection of ground water. No background soil samples are available for comparison.

4.4.2 Technical Program

The following technical objectives have been identified for the EI at the former STP:

- o characterize groundwater quality beneath the former STP sludge drying beds
- o investigate in-situ hydraulic conductivity, chemical, and geotechnical properties of the soils at the STP
- o investigate water and sediment quality at the two identified seep locations

Table 4-5 summarizes the technical program for the Former STP and Figure 4-6 shows the sampling and exploration locations that are described below.

1. Install one water table monitoring well within the former sludge drying beds. Collect continuous split-spoon soil samples from the boring and analyze two of the soil samples for TCL VOCs, TCL SVOCs and total TCL inorganics. Groundwater flow directions are unknown in this area, however it is assumed that a well placed in the middle of one of the former sludge drying beds will encounter representative groundwater quality emanating from this area. The well will be screened across the water table with a 10-foot screen.
2. Conduct in-situ hydraulic conductivity tests in the well to measure the site-specific hydraulic conductivity of the soils.
3. Collect one groundwater sample from the STP well and analyze the sample for TCL VOCs, TCL SVOCs, dissolved TCL inorganics, and major anions and cations. Anions include chloride, nitrate, and sulfate. Cations include carbonate and bicarbonate.
4. Collect one surface water sample and one sediment sample from each of the two seeps observed during the Jordan site visit. Analyze the surface water samples for major anions and cations and TCL VOCs, TCL SVOCs, and total TCL inorganics. Analyze the sediment samples for TCL VOCs, TCL SVOCs and total TCL inorganics.

TABLE 4-5  
 SUMMARY OF TECHNICAL PROGRAM  
 FORMER SEWAGE TREATMENT PLANT

ENVIRONMENTAL INVESTIGATION  
 SAMPLING DESIGN PLAN  
 HAMILTON ARMY AIRFIELD

EXPLORATION	DEPTH PER EXPLORATION	SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
Borings: TP-MW-101	15 feet	Split Spoon Soil Sample	18-inch Samples At 5-foot Intervals	2	VOC, SVOC, Total TCL Inorganics
Monitoring Wells: TP-MW-101	15 feet	Groundwater	Water Table	1	VOC, SVOC, Dissolved TCL Inorganics, Major Cations and Anions
Seeps: TP-SD-1 to TP-SD-2	Ground Surface	Sediment	--	2	VOC, SVOC, Total TCL Inorganics
TP-SW-1 to TP-SW-2	Ground Surface	Surface Water	--	2	VOC, SVOC, Total TCL Inorganics Major Cations and Anions

NOTE: Quality control samples are not presented in this table, see QCP.

4.5 AIRCRAFT MAINTENANCE AREA/STORAGE AREAS

4.5.1 Site Description

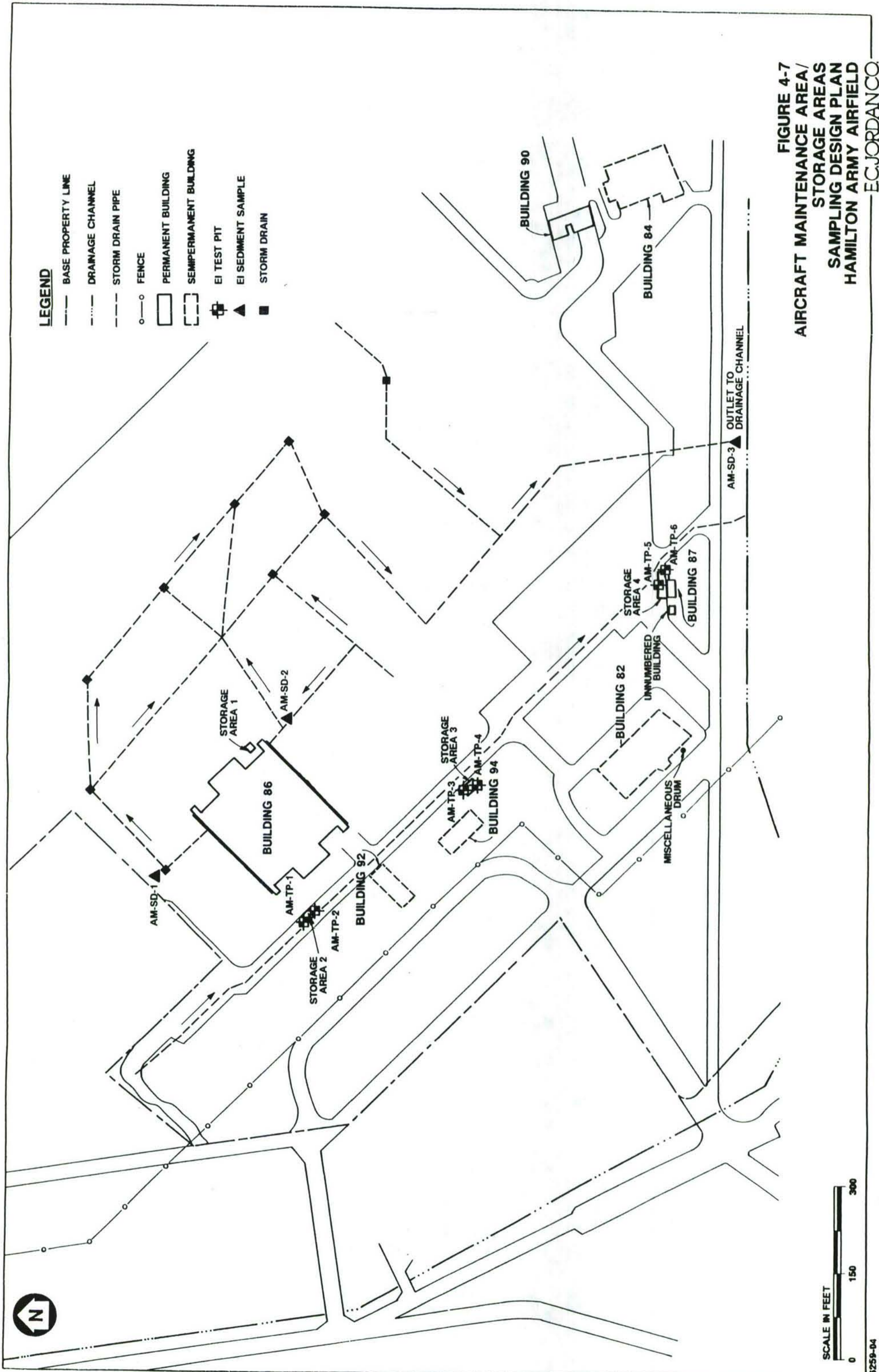
The aircraft maintenance area and associated storage areas are located at the southern end of HAA, adjacent to a paved aircraft parking area (see Figure 4-1). The area includes Building 86, the adjacent aircraft maintenance areas, and four separate materials storage areas (Figure 4-7). Aircraft maintenance, repair, and washing and the storage of maintenance fluids are the main activities that have occurred in the area. The potential exists for releases of aircraft-related oil, fuel, or cleaning solvents to have occurred during these activities.

Building 86 is the only hangar still being used for the maintenance of aircraft on base closure property. Light maintenance of aircraft occurs inside the hangar and in the surrounding areas and two of the four materials storage areas are located next to the building. Storage Area 1 is located on the northeast side of Building 86 and Storage Area 2 is located a short distance southwest of the building. Pavement that is contiguous with the airfield surrounds Building 86, but Storage Area 2 is located in a gravel area that begins a short distance to the southwest. The hangar has a concrete floor with trench floor drains, located at the bay doors, that discharge into the storm sewer. Additional storm drains are located throughout the paved aircraft parking area (see Figure 4-7).

A flammable material locker and at least one recirculating solvent parts cleaner are located inside Building 86. The locker contains POL, paint and spray cans in one gallon or smaller containers and includes a well at the bottom of the locker to contain potential spills. The parts cleaner uses PD-680 solvent that is contained in an estimated 35-gallon tank within the unit. The parts cleaner is reportedly used daily. Waste material from activities at Building 86 is taken to Storage Area 2 by Army personnel.

Storage Area 1, on the northeast side of Building 86, is a drum storage area with nine 55-gallon drums placed horizontally on metal storage and dispensing racks. The drums present during Jordan's site visit were labeled as containing aircraft and engine cleaning compounds and PD-680 solvent. Drip pans were positioned under the drums to contain drips and small spills but not the contents of an entire drum.

Storage Area 2, located southwest of Building 86, is a waste materials storage area consisting of approximately 12 55-gallon drums and several smaller containers. Stored materials include waste oil, waste fuel, and other maintenance related fluids. The materials are currently stored within a CONEX container that rests on a gravel surface and is surrounded by a sandbag berm. Previously (before Jordan's site visit), the drums and other containers were stored directly on the gravel surface, surrounded with the berm but not covered (Weston, 1990). Containers that become full are moved to Building 737 in the POL area to await quarterly removal for offsite disposal by a contractor.



**FIGURE 4-7**  
**AIRCRAFT MAINTENANCE AREA/  
 STORAGE AREAS**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**  
**ECJORDAN/CO**

Storage Area 3 is located east of Building 94 on broken asphalt pavement, (see Figure 4-7) and consists of five metal CONEX containers used to store maintenance-related fluids. The area is not surrounded by curbing or other surface containment. According to Weston (1990) the contents of each CONEX container are as follows:

- o POL and spray cans; largest container is 5 gal; total materials estimated to be 100 to 150 gallons.
- o Diesel and mogas (gasoline) fuel in 5-gal cans; 10 cans total.
- o Paint, isopropyl alcohol; largest container 5 gallons; estimated total materials at 200 to 300 gallons.
- o Paint, spray cans, ethyl glycol, denatured alcohol, naphtha, toluene, methyl ethyl ketone, corrosion resistant compound; estimated total materials at 150 to 200 gallons.
- o One 55-gallon drum cleaning compound.

Storage Area 4 consists of Building 87 and the surrounding area and is located immediately south of the paved aircraft parking area (see Figure 4-7). Building 87 is a cinderblock structure that is divided into two rooms and is used to store only unopened packaged products. Stored on one side of the building are flammables, mainly paint, and on the other side are oil, grease, antifreeze, solvents, and cleaning compounds. All these materials are stored in containers of five gallons or less. The building has a concrete floor with no floor drain but also has no curb at the door. Outside, the building is flanked by 55-gallon drums containing PD-680 solvent, aircraft cleaning compound, and turbine engine cleaner, all stored on horizontal dispensing racks. During Jordan's site visit, the racks held a total of 13 drums. Drip pans were positioned under the drums to contain drips but not major spills. Some staining was visible in the area around the drums. The final component of Storage Area 4 is a metal CONEX container located north of Building 87. It contains approximately 15 five-gallon cans of unleaded gasoline and has no curbing or other containment around it.

4.5.2 Technical Program

Although spills or releases have not been documented in this area, the quantities of hazardous materials present and typical waste handling practices of the past suggest it is likely that releases have occurred. No previous sampling has been conducted in the area. The following technical objectives have been identified for the EI at the Aircraft Maintenance and Storage Areas:

- o characterize surface and subsurface soil conditions at Storage Areas 2, 3, and 4
- o characterize groundwater quality at Storage Area 2
- o investigate sediment quality in the area's inlet and outfall to the storm sewer system

Table 4-6 summarizes the technical program for the Aircraft Maintenance and Storage Areas and Figure 4-7 shows the sampling and exploration locations that are described below.

1. Excavate two test pits each at Storage Areas 2, 3, and 4, collecting soil samples from each test pit at the ground surface and at 2 and 4 feet bgs, or at depths with either visible contamination or elevated PID readings. Analyze three samples from each test pit for TCL VOCs, TCL SVOCs, TPH, and total TCL inorganics.
2. Collect three sediment samples, one from the storm drain inlet north of Building 86, one from the Storm drain inlet south of Building 86, and one from the storm drainage outfall southeast of Building 87. Analyze the sediment samples for TCL VOCs, TCL SVOCs, TPH, and total TCL inorganics.
3. Install a monitoring well at Storage Area 2 and analysis for TCL VOCs, TCL SVOCs, and total TCL inorganics.

#### 4.6 BURN PIT

##### 4.6.1 Site Description

The burn pit is located in the east corner of the revetment area at aircraft staging pad number 10, located approximately 400 feet south of Perimeter Road (see Figure 4-1). The burn pit includes the approximately 100-foot-diameter paved pad and the adjacent unpaved areas that appear to have been impacted by activities at the site.

The burn pit was used for firefighter training activities from 1975 to 1987 (Weston, 1990). During that period, fuels and/or solvents as well as vehicles were placed on the pad and burned to provide training. In 1989, the pit was rebermed with clean fill in anticipation of being used again for this purpose, but no liner was installed, and the pit has remained inactive. The east side of the pad is stained black. Earth moving activities appear to have spread contaminated soil beyond the edge of the paved area. The pavement is broken by expansion joints which provide a pathway to the subsurface.

In June 1986, three soil borings were drilled at the burn pit (WCC, 1987) (Figure 4-8). Boring HB-88 was drilled through the northwest side of the pad to 11 feet bgs. Borings HB-89 and HB-90 were drilled northeast and south of the pad, respectively, each to 10.5 feet bgs. HB-89 was drilled through a black stained area. Soil samples were collected at depths of 1, 3, 6, and 9 feet bgs in each boring, with the exception that no sample was taken at 9 feet from HB-89. Soils were analyzed for petroleum hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), VOCs, and 13 metals. Sample HB-88-1, (from the one-foot depth) contained high concentrations of diesel #1, (3700 mg/kg), kerosene (1200 mg/kg), ethyl benzene (6.4 mg/kg), and toluene (6.0 mg/kg), as well as a lower concentration of benzene (0.053 mg/kg). HB-89 and HB-90 contained high concentrations of methylene chloride (0.4-4.5 mg/kg) but no other organic

TABLE 4-6  
**SUMMARY OF TECHNICAL PROGRAM**  
**AIRCRAFT MAINTENANCE AREA/STORAGE AREAS**

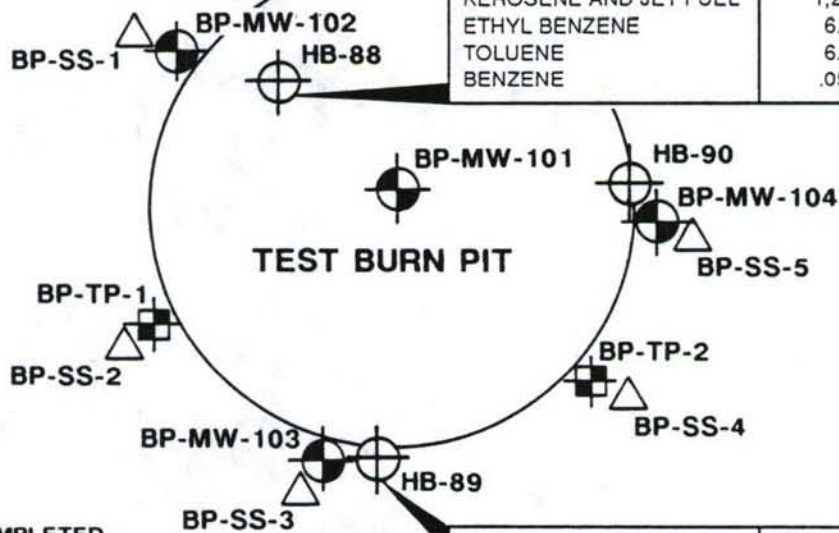
**ENVIRONMENTAL INVESTIGATION**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

EXPLORATION	DEPTH PER EXPLORATION	SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
Test Pits: AM-TP-1 to AM-TP-6	5 feet	Soil	Ground Surface, 2 and 4 feet bgs	18	VOC, SVOC, TPH, Total TCL Inorganics
Monitoring Well: AM-MW-1	15 feet	Water	Water Table	1	VOC, SVOC, Total TCL Inorganics
Storm Drains: AM-SD-1 to AM-SD-3	Ground Surface (Inlet Structure)	Sediment	--	3	VOC, SVOC, TPH, Total TCL Inorganics

NOTE: Quality control samples are not presented in this table, see QCP.



TAXIWAY



CONTAMINANT	CONCENTRATION (mg/kg)	
	1 ft	3 ft
DIESEL	3,700	ND
KEROSENE AND JET FUEL	1,200	11
ETHYL BENZENE	6.4	ND
TOLUENE	6.0	ND
BENZENE	.053	ND

CONTAMINANT	CONCENTRATION (mg/kg)		
	1 ft	3 ft	6 ft
METHYLENE CHLORIDE	1.1	4.5	3.8

**LEGEND**

- SOIL BORING, COMPLETED BY WCC IN 1985
- EI MONITORING WELL LOCATION
- EI TEST PIT
- RI SURFACE SOIL (SS) SAMPLING LOCATION

SCALE IN FEET



**FIGURE 4-8  
BURN PIT SITE  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

E.C. JORDAN CO.

compounds at all depths, with the exception of HB-90-3 which instead contained kerosene. No PAHs were detected in any of the samples. Of the 19 metals analyzed for, 13 were detected, with iron the highest in concentration, but no metals were found at levels above California TTLCs.

Boring logs show sand and gravel fill from ground surface to approximately 2.5 feet bgs. From 2.5 feet to the bottom of the borings a dark-colored silty clay of low plasticity and varying moisture content was encountered, with saturated conditions below 9 feet bgs. Groundwater flow direction and the depth to bedrock are not known at this site.

4.6.2 Technical Program

Although soils have been investigated at this site, further soil characterization is needed. No groundwater monitoring has been conducted. The following technical objectives have been identified for the EI at the burn pit:

- o characterize surface and subsurface soil quality at additional locations at the burn pit
- o Investigate depth to groundwater and groundwater flow direction, and characterize groundwater quality beneath the burn pit

Table 4-7 summarizes the technical program for the burn pit. Figure 4-8 shows the sampling and exploration locations that are described below.

1. Install four water table monitoring wells, one through the concrete pad and three adjacent to the pad. The bottom of the 10-foot well screens will be placed approximately 7 feet below the water table.
2. Collect split spoon soil samples from the monitoring well borings. Sample the boring through the concrete (BP-MW-1) continuously and sample the three borings adjacent to the pad at 5 foot intervals. Since groundwater flow direction at this site is unknown, three soil samples from each boring will be submitted for laboratory analysis. Samples should be collected from ground surface, immediately above the water table, and at an intermediate depth. Analyze the 12 soil samples for TCL VOCs, TCL SVOCs, TPH, and Lead.
3. Conduct in-situ hydraulic conductivity tests in the four wells to measure the site-specific hydraulic conductivities of the soils.
4. Collect one groundwater sample from each of the 4 wells and analyze the samples for TCL VOCs, TCL SVOCs, TPH, and lead.
5. Excavate two test pits to a depth of 5 feet or to the water table, whichever is encountered first, collecting soil samples at the ground surface and at the water table or from visibly stained zones. Analyze four soil samples (two from each test pit) for TCL VOCs, TCL SVOCs, TPH, and lead.

TABLE 4-7  
**SUMMARY OF TECHNICAL PROGRAM**  
**BURN PIT SITE**

**ENVIRONMENTAL INVESTIGATION**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

EXPLORATION	DEPTH PER		SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL	
	EXPLORATION				SAMPLES	ANALYSES
Borings: BP-MW-101	15 feet		Split Spoon Soil Sample	Continuous 18--inch Samples	3	VOC, SVOC, TPH, Lead
BP-MW-102 BP-MW-103 BP-MW-104	15 feet		Split Spoon Soil Sample	18--inch Samples At 5-foot Intervals	9	VOC, SVOC, TPH, Lead
Monitoring Wells: BP-MW-101 to BP-MW-104	15 feet		Groundwater	Water Table	4	VOC, SVOC, TPH, Lead
Test Pits: BP-TP-1 to BP-TP-2	5 feet		Soil	Ground Surface, and Water Table	4	VOC, SVOC, TPH, Lead
Surface Soil: BP-SS-1 to BP-SS-5	6--inches		Soil	Ground Surface	5	VOC, SVOC, TPH, Lead

NOTE: Quality control samples are not presented in this table, see QCP.

- 115
6. Collect 5 surface soil samples from approximately 10 feet outside the perimeter of the burn pit and analyze the samples for TCL VOCs, TCL SVOCs, TPH, and lead.

#### 4.7 JP-4 PIPE LINE

##### 4.7.1 Site Description

The JP-4 fuel pipe line enters the northeast corner of the base from the unloading pier in the San Pablo Bay (see Figure 4-1). The 6-inch ID pipe runs underground along the northern property boundary, immediately south of Perimeter Road, for approximately 6,500 feet to where it turns to the southwest and crosses under the airfield runway. It ends at the former POL area that is located off base-closure property approximately 500 feet southeast of the active POL area. The pipe runs above ground for approximately 10 feet as it enters the culvert that runs beneath Perimeter Road and the airfield and for approximately 50 feet at a pump station near the east end of HAA. The JP-4 line was used for off-loading barges delivering fuel to HAA. The pipeline has not been in use since 1975 and its installation date is unknown (Weston, 1990).

No leaks or spills from the JP-4 line have been documented and no previous investigations of the pipeline itself have been made. However, the EI/AA contractor will visually survey the entire length of the JP-4 line on base closure property to determine if repairs to the line was performed. If visual evidence of repairs is detected soil sampling will be conducted. The JP-4 line is a concern because of the potential for leakage of JP-4 fuel to soils and groundwater anywhere along its length within the base-closure property. Leaking pipe joints or general deterioration of the pipe could result in the release of contaminants to the environment. It is not known if the pipeline was emptied when taken out of service, but it is suspected that some fuel remains in the line.

It is not known whether groundwater is in contact with the pipeline at some point along its length; however, during periods of flooding the pipeline is submerged. The water table is anticipated to be within 10 feet of the ground surface in this area and the depth to which the pipeline is buried is not known. Depth to bedrock is unknown along the length of the pipeline.

##### 4.7.2 Technical Program

The potential contaminant associated with the pipeline, JP-4 jet fuel, is a mixture of aviation gas (volatile hydrocarbons) and kerosene (semi- and non-volatile components). The pipeline is a very long, linear, potential source of contamination. No soil or groundwater monitoring has been conducted at the site. The following technical objectives have been identified for the EI at the JP-4 line:

- o Investigate the precise location of the pipeline on the HAA base-closure property and determine through visual assessment of the ground surface if repairs to the line were made.

- o Evaluate soil gas in the vicinity of the pipeline, except for the active runway area, for potential contamination to provide a basis for selecting specific locations along the length of the pipeline for further investigation.

Table 4-8 summarizes the technical program for the JP-4 line described below.

1. Conduct a GPR Survey along the length of the pipeline in order to more precisely define the location and depth of the pipeline, and provide a basis for selecting soil gas sampling locations.
2. Collect soil gas samples at 50-foot intervals from within the trench fill materials along the entire 7,000-foot length of the pipeline excluding the active runway area. Due to the active nature of the runway and the thickness of the runway pavement, soil gas sampling will not be conducted in the runway. The soil gas samples will be screened with a Gas Chromatograph for JP-4 characteristics.

#### 4.8 REVETMENT AREA

##### 4.8.1 Site Description

The revetment area occupies approximately 200 acres in the eastern corner of HAA (see Figure 4-1). It consists of 24 paved, circular aircraft parking pads, roughly 100 feet in diameter, connected by taxiways. The pads are spread out to reduce potential aircraft losses from an air assault. The revetment area has been out of active service since 1974 (Weston, 1990). Currently the area is used during an annual air show, army drill sessions, and police auto and cycle training. Also, one AST (AST 10) is located adjacent Building 15.

As an active revetment area, routine aircraft maintenance was performed, and according to interviews with past employees, waste oils were spilled onto the ground (Weston, 1990). Aircraft were often parked with engines over unpaved areas and mobile fuel trucks also refueled aircraft in the revetment area. One enlarged pad was used as a jet engine test cell and features a large bolt in the center to which engines were anchored. Another pad (No. 10) was used as a burn pit for the purposes of fire training. A description of that site, which is considered separately, is provided in Section 4.6 of this document. In 1986, the taxiways were used to aerate soils removed during various tank excavations. The taxiways were bermed and lined with polyethylene. Soils contaminated with petroleum hydrocarbons greater than 100 ppm were spread 12 inches deep and physically manipulated and aerated until the target level of 100 ppm TPH was achieved, and then the soils were used to backfill the tank excavations (Weston, 1990).

No previous investigations have been conducted at the revetment area (except at the burn pit) beyond visual inspection during Jordan's site visit. Groundwater flow directions and depth to water are not known, however water was found at approximately 9 feet bgs in the three borings drilled at the burn pit. Depth to bedrock is not known.

TABLE 4-8  
 SUMMARY OF TECHNICAL PROGRAM  
 JP-4 LINE

ENVIRONMENTAL INVESTIGATION  
 SAMPLING DESIGN PLAN  
 HAMILTON ARMY AIRFIELD

EXPLORATION	DEPTH PER		SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
	EXPLORATION	EXPLORATION				
Soil Gas:	---		Soil Gas	3-5 feet	@ 130	BTEX
JP-SG-1 to						
JP-SG-130						

NOTE: Quality control samples are not presented in this table, see QCP.

Legend

@ Denotes approximate number of samples taken at 50-foot intervals along JP-4 Line  
 BTEX - Benzene, Toluene, Ethyl-benzene, and Xylenes.

#### 4.8.2 Technical Program

Because of potential fuel spills and suspected waste oil dumping in the area, the revetment area needs further characterization. Also, the contents of AST 10 must be verified. No previous soil or groundwater monitoring has been conducted at the revetment area. The following technical objectives have been identified for the EI at the Revetment Area:

- o characterize surface and subsurface soil and groundwater conditions at the engine test pad
- o characterize the general surface soil conditions in the revetment area
- o determine the contents of AST 10

Table 4-9 summarizes the technical program for the revetment area. Figure 4-9 shows the sample and exploration locations described below.

1. Excavate three test pits to five feet bgs around the engine test pad perimeter, collect soil samples from the pits at the ground surface and at 2 and 4 feet bgs, and analyze the soil samples for TCL VOCs, TCL SVOCs, TPH, and lead.
2. Drill one monitoring well adjacent the test pad, collecting split spoon soil samples continuously. Analyze the groundwater for TCL VOCs, TCL SVOCs, TPH, and lead.
3. Collect surface soil samples from 5 locations at each of the 22 parking pads (24 total minus the burn pit and the engine test pad), composite the samples into a single sample for each pad, and analyze each for TCL SVOCs, TPH, and lead. (Composite surface soil samples will not be analyzed for TCL VOCs).
4. Collect one sample from AST 10 and analyze for TCL VOCs, TCL SVOCs, TPH, and lead. If AST 10 is empty then a wipe sample will be collected and analyzed for the same parameters listed above.

#### 4.9 EAST LEVEE LANDFILL

##### 4.9.1 Site Description

The East Levee Landfill is located along the eastern side of the site, within the intertidal zone of San Pablo Bay. The landfill is approximately 2,500 feet long and is bordered by wetland to the north and south, by San Pablo Bay to the east, and by the base perimeter levee to the west (see Figure 4-1). Part of the landfill is on State-owned property. Ninety percent of the landfill is below mean sea level during periods of high tide and therefore landfill soils are continually saturated (Weston, 1990).

TABLE 4-9  
 SUMMARY OF TECHNICAL PROGRAM  
 REVETMENT AREA

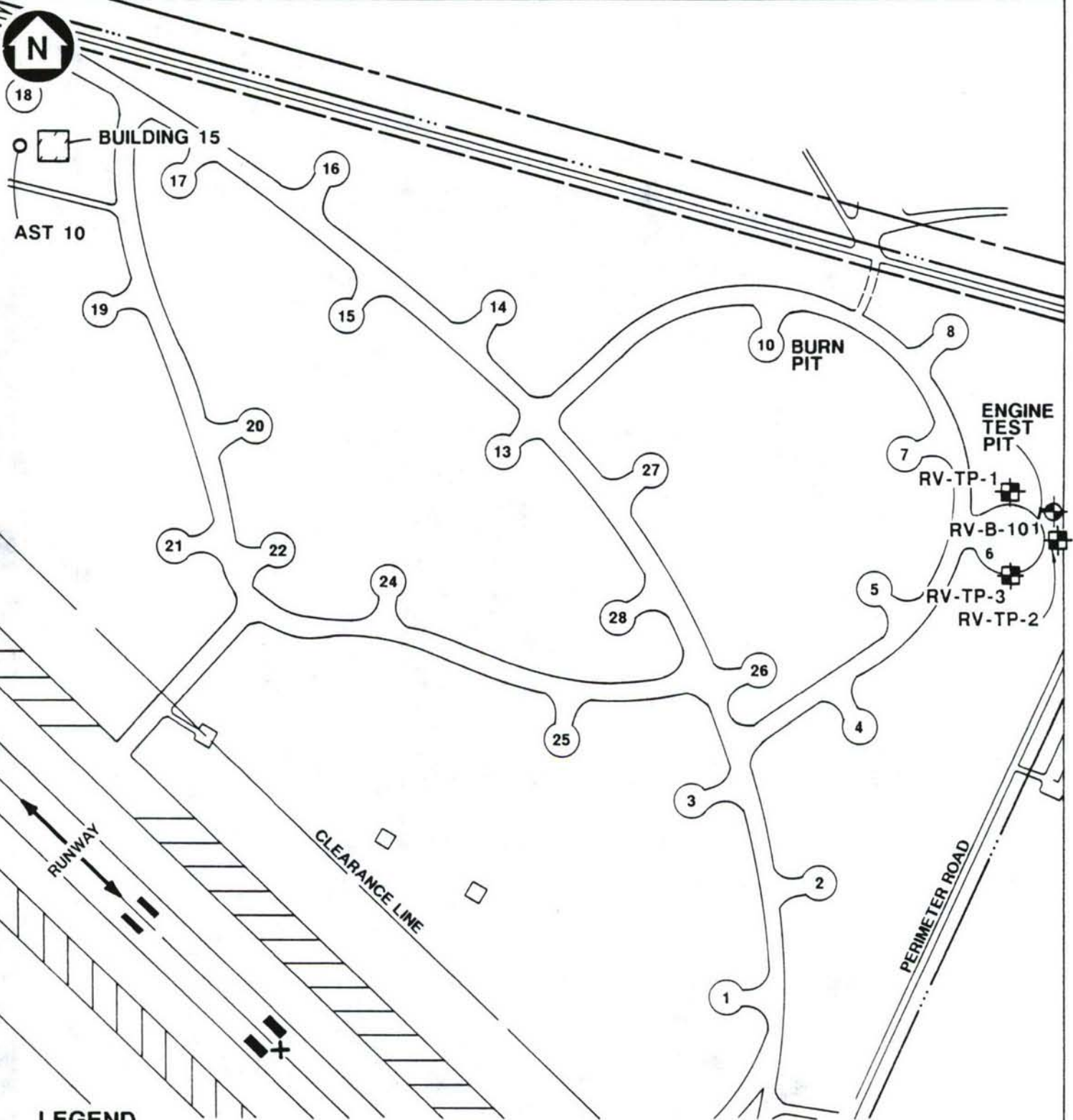
ENVIRONMENTAL INVESTIGATION  
 SAMPLING DESIGN PLAN  
 HAMILTON ARMY AIRFIELD

EXPLORATION	DEPTH PER		SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
	EXPLORATION					
Monitoring Well: RV-MW-1	15 feet		Water	Water Table	1	VOC, SVOC, TPH, Lead
Test Pits: RV-TP-1 to RV-TP-3	5 feet		Soil	Ground Surface, 2, 4 feet bgs	9	VOC, SVOC, TPH, Lead
Surface Soil: RV-SS-1 to RV-SS-22	--		Soil	6 inches	22*	SVOC, TPH, Lead
Tank Content: RV-TC-1	--		Liquid or Wipe	--	1	VOC, SVOC, TPH, Lead

NOTE: Quality control samples are not presented in this table, see QCP.

Legend

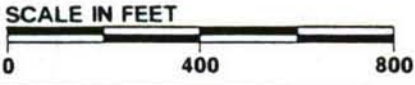
\* Denotes composite sample from 5 locations around each pad



**LEGEND**

- BOUNDARY OF BASE CLOSURE PROPERTY
- .-.- DRAINAGE CHANNEL
- JP-4 FUEL LINE
- (10) REVETMENT AREA
- ⊙ EI MONITORING WELL LOCATION
- ⊠ EI TEST PIT

AST 10 ABOVEGROUND STORAGE TANK NO. 10



**FIGURE 4-9  
REVETMENT AREA  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD**

EC.JORDAN CO.

The landfill was used primarily for the disposal of construction debris, beginning around 1961 (Weston, 1990). A site on the State-owned portion of the landfill was also used as a burn pit (WCC, 1987). The debris layer ranges from 2 to 6 feet thick and includes sticks, logs, lumber, concrete, asphalt, bricks, metal, and small amounts of glass and plastics (WCC, 1987). The debris layer is overlain by a 6-inch to 2-foot thick cap of stiff-to-hard brown sandy clay with gravel and concrete. The easternmost tip of the landfill extends approximately 150 feet into the bay and contains large pieces of concrete, steel, and asphalt, forming a riprap barrier for the landfill (WCC, 1987). Both the landfill and cap materials overlie Bay Mud, which is a medium- to highly-plastic silty clay of low permeability.

WCC conducted an investigation into the soils at the East Levee Landfill in 1985. They completed and logged 19 exploratory trenches, each 15 to 20 feet long, and collected a total of 36 composite soil samples from 15 of these trenches. The soil samples were analyzed for PCBs, VOCs, SVOCs, cyanide, organochloride pesticides, petroleum hydrocarbons, and metals (WCC, 1987). The analytical results indicate the presence of heavy-end petroleum hydrocarbons (i.e., motor oil and C-21-C36), 1,1,1-trichloroethane (111TCE), and PAHs (including fluoranthene [FANT] and phenanthrene [PHANTR]) in a limited number of samples (WCC, 1987). Fourteen metals were detected in the soil samples in trace to minor concentrations (WCC, 1987). Included were arsenic (AS), barium (BA), chromium (CR), copper (CU), lead (PB), molybdenum (MO), nickel (NI), vanadium (V), zinc (ZN), and boron (B). Iron (FE) was present in the highest concentrations and was most pervasive. Based on their investigation, WCC concluded no additional remedial actions were necessary. The presence of the chlorinated hydrocarbons and PAHs indicate that the landfill may contain more than just construction debris, justifying investigating groundwater quality in accordance with the California Technical Guidance Manual for Conducting Solid Waste Water Quality Assessment Tests (SWAT Guidance) (State Water Resources Control Board, 1988).

4.9.2 Technical Program

Although soils have been investigated at this site, no groundwater monitoring has been conducted and no background soil samples have been collected. The following technical objectives have been identified for the EI at the East Levee Landfill. These requirements comply with the SWAT Guidance (State Water Resources Control Board, 1988).

- o characterize groundwater quality immediately downgradient of the landfill
- o characterize background groundwater quality in an area interpreted to be upgradient of the landfill
- o investigate horizontal groundwater gradients, in-situ hydraulic conductivities, and geotechnical properties of the soils at the East Levee Landfill area

- o characterize background subsurface soil quality around the perimeter of the landfill
- o determine the influence of tides on groundwater levels and flow directions

Table 4-10 summarizes the technical program for the East Levee Landfill and Figure 4-10 shows the locations of the explorations described below.

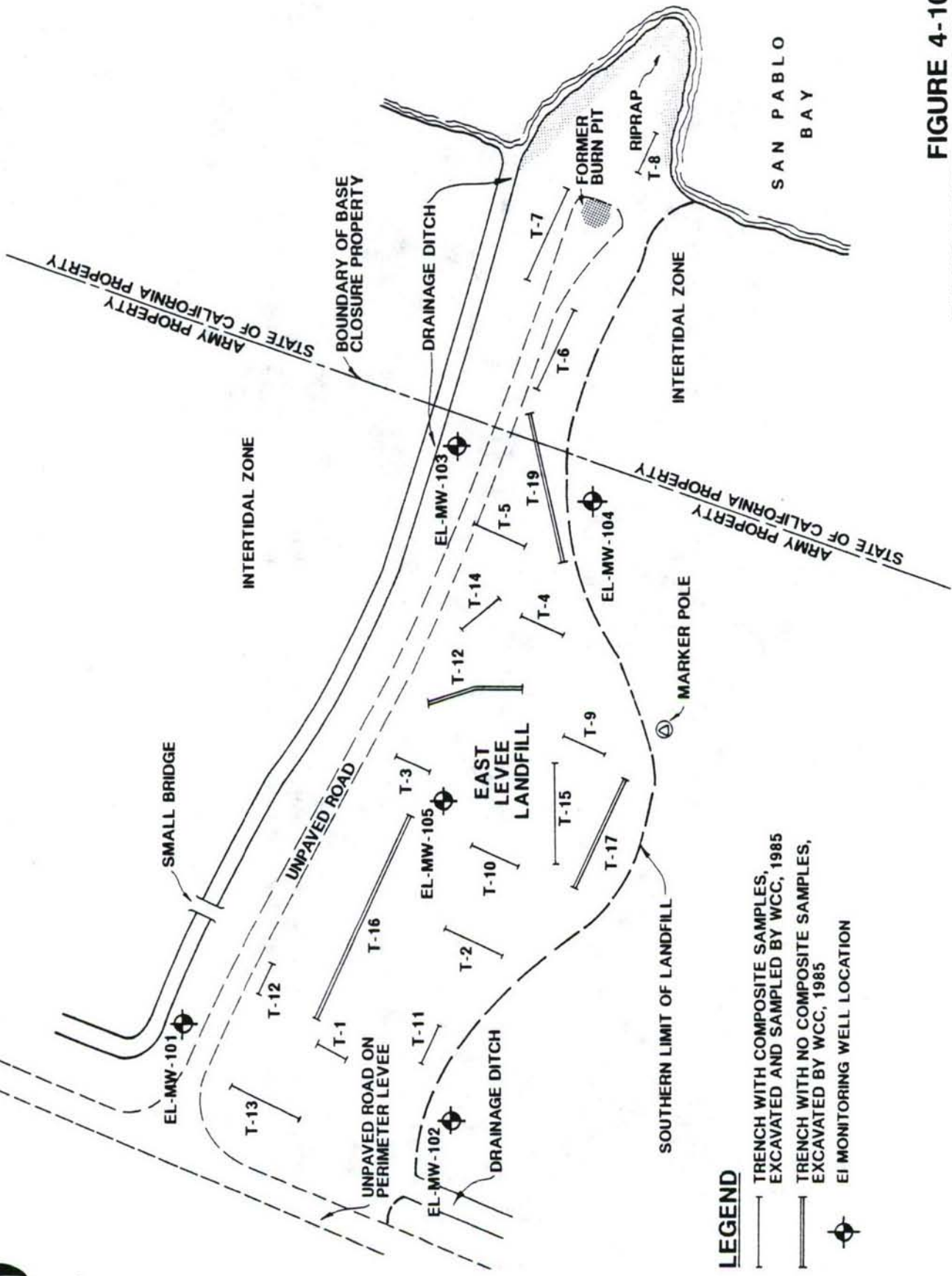
1. Install four water table monitoring wells around the East Levee Landfill perimeter. The wells will be placed just outside the northwest, northeast, southwest, and southeast perimeters of the landfill. Groundwater flow directions are unknown in this area, however it is assumed that at least one of the wells will serve as an upgradient well and the others will serve as downgradient wells. Depth to bedrock is unknown, but the wells will be screened across the water table with a 10-foot screen in either the Bay Mud, sand/silt unit, or shallow bedrock. Each boring will be sampled at 5-foot intervals using a split-spoon sampler.
2. Install one monitoring well in the center of the landfill to characterize groundwater quality immediately beneath the waste material. The well will have a five-foot screen placed approximately five feet beneath the bottom of the waste. The waste zone will be isolated from the screened zone by the bentonite seal above the sandpack and by grouting. This boring will be sampled continuously (every 18 inches, using the California split-spoon sampler).
3. Collect one subsurface soil sample from immediately above the water table in each of the 4 borings. Analyze these samples for TCL VOCs, TCL SVOCs, total TCL inorganics and major anions (sulfate, nitrate, chloride) and cations (carbonate and bicarbonate).
4. Conduct in-situ hydraulic conductivity tests in each of the four perimeter wells to measure site-specific hydraulic conductivities of the soils.
5. Collect one groundwater sample quarterly for 1 year from each of the 5 wells and analyze for TCL VOCs, TCL SVOCs, dissolved TCL inorganics, and major Anions (sulfate, nitrate and chloride) and cations (carbonate and bicarbonate).
6. Conduct a tidal study to determine the influence of the tides on groundwater levels at the site. Changes in water levels will be measured versus time in each of the four perimeter wells using pressure transducers and one or more electronic data loggers. Water level changes will be recorded at regular intervals of 20 minutes or less for a minimum of one full tidal cycle (i.e., high tide to next high tide or low tide to next low tide). The water level measurements will be plotted versus time to allow an evaluation of the magnitude and timing of groundwater responses to tidal changes.

TABLE 4-10  
SUMMARY OF TECHNICAL PROGRAM  
EAST LEVEE LANDFILL

ENVIRONMENTAL INVESTIGATION  
SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

EXPLORATION	DEPTH PER		SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
	EXPLORATION					
Boring: EL-MW-105	15 feet		Split Spoon Soil Sample	Continous 18-inch Samples	0	REFERENCE SAMPLES ONLY
EL-MW-101 EL-MW-102 EL-MW-103 EL-MW-104	15 feet		Split Spoon Soil Sample	18-inch Samples At 5-foot Intervals	4	VOC, SVOC, Total Inorganics Major Cations and Anions
Monitoring Wells: EL-MW-101 TO EL-MW-105	15 feet		Groundwater	Water Table	20	VOC, SVOC, Dissolved TCL Inorganics Major Cations and Anions

NOTE: Quality control samples are not presented in this table, see QCP.  
Quantity monitoring of MW-101 through -104 will be conducted for 1 year in order to satisfy  
SWAT regulations.



**LEGEND**

- TRENCH WITH COMPOSITE SAMPLES, EXCAVATED AND SAMPLED BY WCC, 1985
- TRENCH WITH NO COMPOSITE SAMPLES, EXCAVATED BY WCC, 1985
- ⊕ EI MONITORING WELL LOCATION



**FIGURE 4-10**  
**EAST LEVEE LANDFILL**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**  
 EC.JORDANCO

4.10 BUILDING 442 SITE

4.10.1 Site Description

An approximately 500-gallon tank (AST11) is located adjacent to Building 442 (see Figure 4-1). The tank is currently inoperative and contains approximately 300 to 400 gallons of diesel fuel (Jordan, 1990b). AST 11 was used to store fuel that powered emergency generators for Building 442. It has been reported that diesel fuel from AST 11 has been observed in the utility trench adjacent to the tank.

4.10.2 Technical Program

It is unclear if the detected contamination occurred due to AST 11 or some other source (i.e., power equipment that may have been used in the trench); however, because contamination was observed, a limited sampling program for the trench and area surrounding the tank is appropriate. The following technical objectives have been identified for the EI at Building 442:

- o characterize the type and extent of contamination in the trench
- o characterize the subsurface soil quality adjacent to AST 11 and the trench using soil gas

Table 4-11 summarizes the technical program for this site. The technical program is as described below.

1. Collect three sediment samples in the trench in areas where visual evidence of contamination is observed or where PID readings are highest. The samples will be analyzed for TCL VOCs, TCL SVOCs, TPH, and lead.
2. Collect nine soil gas samples, four adjacent to the tank and five along the trench to determine if diesel fuel is present in the subsurface soils. The samples will be analyzed for diesel fuel components.

TABLE 4-11  
**SUMMARY OF TECHNICAL PROGRAM**  
**BUILDING 442**

**ENVIRONMENTAL INVESTIGATION**  
**SAMPLING DESIGN PLAN**  
**HAMILTON ARMY AIRFIELD**

EXPLORATION	DEPTH PER EXPLORATION	SAMPLE TYPE	SAMPLE DEPTHS	NO. ANALYTICAL SAMPLES	ANALYSES
Surface Soil: BT-SS-1 to BT-SS-3	6-inches	Sediment	Trench Surface	3	TCL VOC, TCL SVOC, Lead
Soil Gas BT-SG-1 to BT-SG-9	-	Soil Gas	3 - 5 feet	9	BTEX

NOTE: Quality control samples are not presented in this table, see QCP.

BTEX = benzene, toluene, ethylbenzene, and xylene.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ACMs Asbestos Containing Materials  
 AFB Air Force Base  
 ARF Analytical Request Form  
 AST Above Ground Storage Tanks  
 Av-gas Aviation fuel

bgs below ground surface  
 BTEX Benzene, Toluene, Ethylbenzene, Xylenes

CAP Civil Air Patrol  
 CERCLA Comprehensive Environmental Response Compensation, Liability Act  
 cfs cubic feet per second  
 COC Chain Of Custody  
 COR Contracting Officer's Representative  
 CTF Consolidated Training Facility

DOT Department of Transportation  
 DQO Data Quality Objectives

EI/AA Environmental Investigation/Alternatives Assessment  
 EPIC Environmental Photographic Interpretation Center (USEPA)  
 ESE Environmental Science and Engineering, Inc.  
 ESO Environmental Significant Operations

FID Flame Ionization Detector  
 FOL Field Operations Leader  
 FS Feasibility Study  
 FSP Field Sampling Plan  
 ft/day feet per day

GC Gas Chromatograph  
 GPM Gallons per Minute  
 GPR Ground Penetrating Radar  
 GSA Government Site Area

HAA Hamilton Army Aircraft  
 HASP Health and Safety Plan

ID Inside Diameter  
 IRDMS Installation Restoration Data Base Management System  
 IRP Installation Restoration Program  
 ITC International Technology Corporation

Jordan E.C. Jordan, Co.

LLA lowest liveable area

mph miles per hour

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

(continued)

MSL	mean sea level
NCP	National Contingency Plan
NPL	National Priority List
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated biphenyl
PID	Photoionization Detector
POL	Petroleum, oil and lubricants
ppm	parts per million
PSF	Presidio of San Francisco
PVC	polyvinyl chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Environmental investigation/alternatives assessment
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SDP	Sampling Design Plan
Site-ID	Site Identification
SOPs	Standard Operating Procedures
sq. ft.	square feet
SVOCs	Semi-Volatile Organic Compounds
TCL	Target Compound List
TP	Technical Plan
TPH	Total Petroleum Hydrocarbons
TTLC	Total Threshold Limit Concentration
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USCS	United Soil Classification System
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tanks
UTM	Universal Transverse Mercator
VFH	volatile fuel hydrocarbons
VOCs	Volatile Organic Compounds
WCC	Woodward Clyde Consultants
Weston	Roy F. Weston, Inc.

USATHAMA CHEMICAL CODES

AG	silver
AS	arsenic
B	boron
BA	barium
CR	chromium
CU	copper
DA	barium
FANT	fluoranthene
FE	iron
HG	mercury
MO	molybdenum
NI	nickel
PB	lead
PHANTR	phenanthrene
V	vanadium
ZN	zinc
III TCE	1,1,1-trichloroethane

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APPENDIX A  
ANALYTICAL PROGRAM AND METHODS

APPENDIX A  
ANALYTICAL PROGRAM AND METHODS

SAMPLING DESIGN PLAN  
HAMILTON ARMY AIRFIELD

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A-2	ANALYTICAL METHODS, PARAMETERS, AND TARGET REPORTING LIMIT

APPENDIX A-1  
CHEMICAL ANALYSIS PROGRAM

APPENDIX A CHEMICAL ANALYSIS PROGRAM

A.1 CHEMICAL ANALYSIS SCHEDULE

The chemical analysis schedule for Hamilton is presented in Table 4-2. Chemical analysis will be performed by a USATHAMA-certified laboratory in accordance with the requirements of the USATHAMA QA Plan (January 1990). The laboratory must also be certified by the State of California Department of Health Services. Analytical data will be generated using Class 1, 1A, and 1B USATHAMA certified procedures, which result in data considered equivalent to USEPA Level III and IV data. Groundwater, soil, surface water, and sediment samples will be analyzed for the following parameters:

- o VOCs and SVOCs using gas chromatography/mass spectrometry (GC/MS)
- o metals, by graphite-furnace, inductively coupled plasma, and cold-vapor atomic absorption spectrophotometry methods
- o pesticides/PCBs by gas chromatography (GC)
- o pH, temperature, and specific conductance will be determined in the field
- o field screening of PCBs by gas chromatography (GC)

Sample holding times, container requirements, and preservation techniques are described in detail in Section 3. Specific chemical analysis methods and QC requirements are described in the following section.

## A.2 CHEMICAL ANALYSIS METHODS

This section describes the analytical methods for groundwater, soil, surface water, and sediment samples collected during the field program. Analytical methods are summarized in Table A-1; and a list of certified parameters and applicable concentration ranges for these methods are presented in Appendix A-2. Since certified parameters and concentration ranges are laboratory specific, Appendix A-2 is presented as an example; this table will be finalized once a laboratory is selected.

### A.2.1 VOCs in Water by GC/MS

This GC/MS method covers the determination of purgeable organics in environmental water samples. The parameters determined by this method are shown in Appendix A-2.

This method is based on the direct purging of a water sample. An aliquot of solution containing surrogates and internal standards is added to a measured volume of water in a purging device. This mixture is purged with helium at ambient temperature, and the purgeable organics are collected and concentrated

TABLE A-1  
ANALYTICAL METHODS  
SAMPLING DESIGN PLAN  
HAMILTON, CA

PARAMETER	METHOD	MATRIX
TCL VOC	Purge and Trap GC/MS	Water/soil
TCL Base Neutral Acids	GC/MS	Water/soil
TCL Elements	AAS/ICAP	Water/soil
Cyanide	Colorimetric	Water/soil
TCL Pesticides/PCBs	GC/ECD	Water/soil
PCBs	GC/ECD	Transformer Waste Oil
pH (field)	Potentiometric	Water
Specific Conductance (field)	Conductance	Water
Nitrate	Colorimetric	Water
Fluoride	Potentiometric	Water
Sulfate	Ion Chromatography	Water
Chloride	Colorimetric	Water
Boron	AAS	Water
Total Dissolved Solids	Gravimetric	Water
Sulfide	Titrimetric	Water
Herbicides	GC/ECD	Water
Total Recoverable Phenolics	Colorimetric	Water
MBAS	Colorimetric	Water
Total Petroleum Hydrocarbons	Infrared	Water/Soil
Alkalinity	Titrimetric	Water

## NOTES:

TCL = target compound list  
 GC/MS = gas chromatography/mass spectrometry  
 AAS = atomic absorption spectroscopy  
 ICAP = inductively coupled argon plasma  
 GC/ECD = gas chromatography/electron capture detector  
 MBAS = methylene blue active substances  
 VOC = volatile organic compound

on a polymer trap. The trap is thermally desorbed and the purgeable organics are then analyzed by GC/MS. The internal standards typically used are bromochloromethane (BRCLM), 1,4-difluorobenzene (14DFB), and chlorobenzene-d<sub>5</sub> (CLC6D5). The surrogates typically used are 1,2-dichloroethane-d<sub>4</sub> (12DCD4), ethylbenzene-d<sub>10</sub> (ETBD10), methylene chloride-d<sub>2</sub> (CD2CL2), and toluene-d<sub>8</sub> (MED6D8).

The tested concentration range for VOCs in water may vary for each USATHAMA-certified laboratory. USATHAMA's target reporting limit for each analyte is shown in Appendix A-2.

#### A.2.2 VOCs in Soil by GC/MS

This GC/MS method covers the determination of purgeable organics in environmental soil samples. The parameters determined by this method are shown in Appendix A-2.

This method is based on the direct purging of a soil sample. An aliquot of aqueous solution containing surrogates and internal standards is added to a weighed quantity of soil in a purging device. This mixture is purged with helium at ambient temperature, and the purgeable organics are collected and concentrated on a polymer trap. The trap is thermally desorbed, and the purgeable organics are then analyzed by GC/MS. The internal standards typically are BRCLM, 14DFB, and CLC6D5. The surrogates typically used are 12DCD4, ETBD10, MEC6D8, and 4-bromofluorobenzene (4BFB).

#### A.2.6 Metals in Soil by AAS, Graphite Furnace Technique

This method is applicable to the determination of metals in soil samples by the AAS graphite furnace technique. The technique is the same as that described in Section A.2.5 for metals in water. The metals for which this method may be used are Se, As, Tl, and Pb.

The target reporting limits are listed for each analyte in Appendix A-2.

#### A.2.7 Trace Metals in Water by ICAP Atomic Emission Spectrometry

This method is applicable to the determination of metals in water samples by Inductively Coupled Argon Plasma (ICAP) atomic emission spectrometric analysis. In this method samples are nebulized and element-specific atomic-line emission/spectra are produced by radio frequency ICAP. The intensity of the emitted lines is proportional to the concentration of the specific elements.

The metals to be analyzed by this method are the following: AL, SB, BA, BE, CD, CA, CR, CO, CU, FE, MG, MN, NI, K, AG, B, NA, V, and ZN.

The target reporting limits are listed for each analyte in Appendix A-2.

#### A.2.8 Trace Metals in Soil by ICAP Atomic Emission Spectrometry

This method is applicable to the determination of the following metals in soil and sediment samples by ICAP atomic emission spectrometric analysis.

The method measures element-emitted light by optical spectrometry, as described in Section A.2.7. The metals in soil samples to be analyzed using this method are as follows: CA, CD, CO, CU, FE, MG, NI, K, ZN, CR, BE, BA, V, AL, B, AG, MN, NA, and SB. The target reporting limits are listed for each analyte in Appendix A-2.

A.2.9 Mercury in Water by Cold Vapor

This method is applicable to the determination of HG in water samples by the cold vapor atomic absorption (AA) technique.

The flameless AA procedure is based on the absorption of radiation at 253.7 nm by HG vapor. The HG is reduced to the elemental state and aerated from solution in a closed system. The HG vapor passes through a cell positioned in the light path of an AA spectrophotometer. Absorbance (peak height) is measured as a function of HG concentration and recorded in the usual manner.

The calculated equivalent tested concentration in water for HG is 0.1 to 2.0 ug/L, with 0.1 ug/L as the reporting limit (the reporting limit may vary, depending on the analytical laboratory chosen). This parameter is included in Appendix A-2.

A.2.10 Mercury in Soil by Cold Vapor AA

This method is applicable to the determination of HG in soil samples by the cold vapor AA technique, as described previously (see Section 4.2.15). The

The tested concentration range for the VOCs in soil may vary for each USATHAMA-certified laboratory. USATHAMA's target reporting range for each analyte is shown in Appendix A-2.

#### A.2.3 BN/As in Water by GC/MS

This method covers the determination of organic compounds that are partitioned into an organic solvent from water and are amenable to GC/MS analysis. The parameters determined by this method are shown in Appendix A-2.

A measured volume of water is spiked with surrogate compounds and extracted at both acid and alkaline pH with methylene chloride, and the extracts are dried and concentrated to 1 ml by evaporation. Quantification is performed using GC/MS. The internal standards typically used are 1,4-dichlorobenzene-d<sub>4</sub> (14DCLBD4), naphthalene-d<sub>8</sub> (NAPD8), acenaphthene-d<sub>10</sub> (ANAPNED10), phenanthrene-d<sub>10</sub> (PHANTRD10), chrysene-d<sub>12</sub> (CHRYD12), and perylene-d<sub>12</sub> (PERYD12). Typical surrogates used are 2-fluorobiphenyl, nitrobenzene, terphenyl-d<sub>14</sub>, phenol-d<sub>5</sub>, 2-fluorophenol, and 2,4,6-tribromophenol.

#### A.2.4 BN/As in Soil by GC/MS

This method covers the determination of organic compounds that are partitioned into an organic solvent from soil and are amenable to GC/MS analysis. The parameters certified for analysis by this method are shown in Appendix A-2.

A measured weight of soil is mixed with anhydrous sodium sulfate, spiked with surrogate compounds, and extracted with 1:1 methylene chloride/acetone using an ultrasonic probe. The extract is filtered and concentrated by evaporation. Quantification is performed using GC/MS with the following internal standards: 14DCLBD4, NAPD8, ANAPNED10, PHANTRD10, CHRYD12, and PERYD12. Typical surrogates used are 2-fluorbiphenyl, nitrobenzene-d<sub>5</sub>, terphenyl-d<sub>14</sub>, phenol-d<sub>5</sub>, 2-fluorophenol, and 2,4,6-tribormophenol.

The target reporting limit for each analyte is listed in Appendix A-2.

A.2.5 Metals in Water By AAS, Graphite Furnace Technique

This method is applicable to the determination of selected elements in water samples by the atomic absorption spectroscopy (AAS) graphite furnace technique. A representative aliquot of a digested sample is placed in the graphite tube in the furnace, evaporated to dryness, charred, and atomized. A greater percentage of available analyte atoms are vaporized and dissociated for absorption in the tube than in normal direct aspiration AAS using a flame. Consequently, this method is more applicable for detection of low concentrations of elements. The characteristic radiation from a given excited element is passed through the vapor containing ground state atoms of that element; the concentration of the element is determined by the intensity of the transmitted radiation.

The metals for which this method may be used are Pb, Se, Tl, and As. The tested concentration ranges and reporting limits (lowest concentration in tested range) are listed for each analyte in Appendix A-2.

calculated equivalent tested concentration for HG in soil is 0.0179 to 0.040 ug/g, and the reporting limit is 0.0179 ug/g (may vary, depending on the analytical laboratory chosen). These parameters are included in Appendix A-2.

#### A.2.11 Anions in Water by Ion Chromatography

This method is applicable to the determination of the following analytes: fluoride, chloride, nitrate, and sulfate in water. This method is based on the separation of anions by ion chromatography on an anion exchange column followed by quantification by conductivity measurement.

The tested concentration ranges and reporting limits are listed for each analyte in Appendix A-2.

#### A.2.12 Total Dissolved Solids (Filterable Residue)

This method is applicable to drinking, surface, and saline waters as well as domestic and industrial wastes. The practical range of the determination is 10 to 20,000 mg/L. Filterable residue is defined as those solids capable of passing through a glass fiber filter and dried to constant weight of 180°C.

#### A.2.13 Pesticides/PCBs in Water by GC/ECD

This method covers the determination pesticides/PCBs that are partitioned into an organic solvent from water and are amenable to GC/ECD analysis. The parameters determined by this method are shown in Appendix A-2.

A measured volume of water is extracted with methylene chloride. The extract is dried, exchanged to hexane, and concentrated by evaporation. Quantitation is performed by external standard calibration.

The target reporting limits for each analyte are listed in Appendix A-2.

A.2.14 Pesticides/PCBs in Soil by GC/ECD

This method covers the determination of pesticides/PCBs that are partitioned into an organic solvent from soil and are amenable to GC/ECD analysis. The parameters determined by this method are shown in Appendix A-2.

A measured weight of soil is mixed with anhydrous sodium sulfate and extracted with 1:1 methylene chloride/acetone using an ultrasonic probe. The extract is filtered, exchanged to hexane, and concentrated by evaporation. Quantitation is performed by external standard calibration.

The target reporting limits for each analyte are listed in Appendix A-2.

A.2.15 Total Cyanide in Water

This method is applicable to the determination of cyanide in surface water, groundwater, wastewater, and drinking water. A measured volume is treated by reflux-distillation, and the released cyanide is trapped in a scrubber containing a solution of sodium hydroxide. The cyanide in this solution is then determined colorimetrically.

The target reporting range is listed in Appendix A-2.

#### A.2.16 Total Cyanide in Soil

This method is applicable to the determination of cyanide in sediments and soils. A measured weight of soil is added to 500 ml of water and treated by reflux-distillation. The released cyanide is trapped in a scrubber consisting of a solution of sodium hydroxide and measured colorimetrically.

The target reporting range is listed in Appendix A-2.

#### A.2.17 Sulfide in Water

This method is applicable to drinking, surface, and saline waters as well as domestic and industrial wastes, and is suitable for measurement of sulfides in concentrations greater than 1 mg/L.

Excess iodine is added to a sample, which oxidizes the sulfide to sulfur. The excess iodine is titrated with sodium thiosulfate.

#### A.2.18 Total Recoverable Phenolics in Water

This method is applicable to the analysis of drinking, surface, and saline waters, domestic and industrial wastes, and is suitable for measurement of phenolics in concentrations greater than 5 ug/L.

A measure volume is distilled, mixed with solutions of 4-aminoantipyrine and potassium ferricyanide, and extracted with chloroform. The absorbance is measured on a spectrophotometer and the concentration calculated from a calibration curve.

A.2.19 Methylene Blue Active Substances (MBAS) in Water

This method is applicable to the analysis of drinking and surface waters, and domestic and industrial wastes. The practical range is 0.025 to 100 mg/L.

Methylene blue reacts with anionic surface active materials to form a blue colored salt. This salt is extracted with chloroform and the concentration is measured colormetrically.

A.2.20 Total Coliform Bacteria in Water

This method is applicable to drinking water, wastewater and groundwater. A measured sample volume is passed through a membrane filter. The filter is placed on a saturated pad of lauryl tryptose broth and incubated for 2 hours. The filter is transferred to a dish containing M-Endo agar and incubated for 21 hours. Colonies are counted under magnification and reported per 100 mL of sample.

#### A.2.21 Herbicides in Water by GC/ECD

This method covers the analysis of herbicides (2,4-D and 2,4,5-TP) that are partitioned into an organic solvent from water and are amenable to GC/ECD analysis.

A measured volume of water is extracted at acid pH with diethyl ether. The extract is hydrolyzed, re-extracted with diethyl ether, concentrated by evaporation, and esterified with diazomethane. Quantitation is performed by external standard calibration.

#### A.2.22 Petroleum Hydrocarbons in Water by Infrared Spectrophotometry

This method is applicable to the determination of petroleum hydrocarbons in water samples by the infrared spectrophotometry technique. It is used for the measurement of light fuels.

The sample is acidified ( $\text{pH} < 2$ ) with hydrochloric acid and serially extracted with fluoro-carbon-113 in a separatory funnel. The solvent layer is filtered, and silica gel is added to remove interferences. Sample extract is analyzed with an infrared spectrophotometer.

#### A.2.23 Petroleum Hydrocarbons in Soil by Infrared Spectrophotometry

This method is applicable to the determination of petroleum hydrocarbons in soil samples by the infrared spectrophotometry technique.

A measured weight of sample is mixed with anhydrous sodium sulfate, placed in an extraction thimble and extracted using Fluorocarbon-113 in a Soxhlet extractor. Sonication may also be employed to extract the sample. Silica gel is then added to remove interferences prior to analysis of the extract by infrared spectrophotometry.

#### A.2.24 PCBs in Transformer Fluid and Waste Oils by GC/ECD

This method is applicable to the determination of PCBs that are partitioned into an organic solvent and are amenable to GC/ECD analysis. The parameters determined by this method include Aroclors 1016, 1232, 1242, 1248, 1254, 1260, 1262 and 1268.

A measured volume of transformer fluid or waste oil is mixed in a measured volume of hexane. Concentrated sulfuric acid (5 mL) is added to eliminate interferences. The sample is then mixed and the hexane layer is removed for analysis. Quantitation is performed by external standard calibration.

#### A.2.25 Carbonate and Bicarbonate in Water by Titration

This method is amenable to the determination of carbonate and bicarbonate in water by titration.

A known volume of sample is allowed to adjust to ambient temperature, and any free residual chlorine contamination is removed by adding 1 drop of 0.1M  $\text{Na}_2\text{S}_2\text{O}_3$ . An indicator is added to the sample prior to titration (bromocresol green or Metacresol purple). The sample is titrated with a standard solution of sulfuric or hydrochloric acid until the endpoint is reached. Quantitation is performed by comparing the volume of standard added to a standard titration curve.

A.3 Field Screening Analytical Methods

A.3.1 PCBs by GC/ECD

Field screening for PCBs will take place at Hamilton for "real time" identification and quantitation of PCB contamination to aid in the selection of samples for laboratory analysis.

The methodology involves a micro-extraction of soils and sediment with water/hexane/methanol followed by an acid clean-up. A similar procedure can be utilized for analysis of transformer oils. A measured volume of transformer fluid is acidified, extracted with hexane, and separated for analysis. The cleaned extract containing the PCBs is injected into GC for compound recognition based on the calibration runs made at the field site will be compared to samples for identification. PCBs will be quantified using a 3-point calibration curve with one point at or near the detection limit (approximately 0.5 ppm).

A.3.2 Exploratory Soil Gas Survey

Soil gas surveys will be used at one site at HAA to aid in delineating areas with potential soil and/or groundwater contamination. This information will be used to optimize locations of test borings, monitoring wells, and test pits. Soil gas analyses will assist in identifying areas with potential contamination. Soil gas studies are proposed for areas contingent to the JP-4 pipeline.

Soil gas is sampled by driving a 1-inch, hollow steel probe into unsaturated soil (i.e., the vadose zone) to a designated depth, generally 5 feet below ground surface. Probe depth is largely dependent on site-specific factors, including soil type, density, and depth to groundwater. Once the probe is in place, a tube is attached. The probe is then pulled back 1 to 2 inches creating a cavity, and the tube is connected to a suction pump. The pump pulls a sample of soil gas through the probe. The sample is extracted from the tube with a syringe before reaching the pump, and then injected into a gas chromatograph (GC) to determine the presence of selected VOCs. Generally, target compounds are benzene (C6H6), toluene (MEC6H5), xylenes (XYLEN), trichloroethylene (TRCLE), 1,1,1-trichloroethane (111TCE), and tetrachloroethylene (TCLEE). Other compounds may be selected or identified based on site-specific conditions or data needs. Data plotting and assessment of each sample run will be performed immediately in the field to maximize the effectiveness of determine areal extent of potentially contaminated soils or groundwater.

APPENDIX A-2

ANALYTICAL METHODS, PARAMETERS, AND  
TARGET REPORTING LIMIT (TRLs)

HAMILTON ARMY AIRFIELD

This is the list of the USATHAMA Target Reporting Limits as of 7 July 1988. Updates to this list will be posted on the 3COM net periodically. Check the date of the file to make sure that you have the most current version. Questions concerning this list should be directed to the Analytical Branch of USATHAMA.

(301) 671-4438, (301) 671-3206, (301) 676-7569

ANALYTE	METHOD	MATRIX	TRL	CODE
ALUMINUM (Al)	200.7 ICP	SOIL	4.5 ug/g	AL
ALUMINUM (Al)	200.7 ICP	WATER	45.0 ug/l	AL
ANTIMONY (Sb)	200.7 ICP	SOIL	3.0 ug/g	SB
ANTIMONY (Sb)	200.7 ICP	WATER	30.0 ug/l	SB
BARIUM (Ba)	200.7 ICP	SOIL	0.2 ug/g	BA
BARIUM (Ba)	200.7 ICP	WATER	2.0 ug/l	BA
BERYLLIUM (Be)	200.7 ICP	SOIL	0.05 ug/g	BE
BERYLLIUM (Be)	200.7 ICP	WATER	0.5 ug/l	BE
BISMUTH (Bi)	200.7 ICP	SOIL	5.0 ug/g	BI
BISMUTH (Bi)	200.7 ICP	WATER	50.0 ug/l	BI
BORON (B)	200.7 ICP	SOIL	5.0 ug/g	B
BORON (B)	200.7 ICP	WATER	50.0 ug/l	B
CADMIUM (Cd)	200.7 ICP	SOIL	0.25 ug/g	CD
CADMIUM (Cd)	200.7 ICP	WATER	2.5 ug/l	CD
CALCIUM (Ca)	200.7 ICP	SOIL	1.0 ug/g	CA
CALCIUM (Ca)	200.7 ICP	WATER	10.0 ug/l	CA
CHROMIUM (Cr)	200.7 ICP	SOIL	0.5 ug/g	CR
CHROMIUM (Cr)	200.7 ICP	WATER	5.0 ug/l	CR
COBALT (Co)	200.7 ICP	SOIL	5.0 ug/g	CO
COBALT (Co)	200.7 ICP	WATER	50.0 ug/l	CO
COPPER (Cu)	200.7 ICP	SOIL	0.2 ug/g	CU
COPPER (Cu)	200.7 ICP	WATER	2.0 ug/l	CU
IRON (Fe)	200.7 ICP	SOIL	0.5 ug/g	FE
IRON (Fe)	200.7 ICP	WATER	5.0 ug/l	FE
MAGNESIUM (Mg)	200.7 ICP	SOIL	2.5 ug/g	MG
MAGNESIUM (Mg)	200.7 ICP	WATER	25.0 ug/l	MG
MANGANESE (Mn)	200.7 ICP	SOIL	0.2 ug/g	MN
MANGANESE (Mn)	200.7 ICP	WATER	2.0 ug/l	MN
MOLYBDENUM (Mo)	200.7 ICP	SOIL	0.8 ug/g	MO
MOLYBDENUM (Mo)	200.7 ICP	WATER	8.0 ug/l	MO
NICKEL (Ni)	200.7 ICP	SOIL	1.5 ug/g	NI
NICKEL (Ni)	200.7 ICP	WATER	15.0 ug/l	NI
POTASSIUM (K)	200.7 ICP	SOIL	2.5 ug/g	K
POTASSIUM (K)	200.7 ICP	WATER	25 ug/l	K
SELENIUM (Se)	200.7 ICP	SOIL	7.5 ug/g	SE
SELENIUM (Se)	200.7 ICP	WATER	75 ug/l	SE
SILVER (Ag)	200.7 ICP	SOIL	0.5 ug/g	AG
SILVER (Ag)	200.7 ICP	WATER	5.0 ug/l	AG
SODIUM (Na)	200.7 ICP	SOIL	2.9 ug/g	NA
SODIUM (Na)	200.7 ICP	WATER	29 ug/l	NA
TELLURIUM (Te)	200.7 ICP	SOIL	1.0 ug/g	TE
TELLURIUM (Te)	200.7 ICP	WATER	10.0 ug/l	TE
THALLIUM (Tl)	200.7 ICP	SOIL	4.0 ug/g	TL
THALLIUM (Tl)	200.7 ICP	WATER	40.0 ug/l	TL
TIN (Sn)	200.7 ICP	SOIL	1.0 ug/g	SN
TIN (Sn)	200.7 ICP	WATER	1.0 ug/l	SN
URANIUM (U)	200.7 ICP	SOIL	1.0 ug/g	U
URANIUM (U)	200.7 ICP	WATER	1.0 ug/g	U
VANADIUM (V)	200.7 ICP	SOIL	0.8 ug/g	V
VANADIUM (V)	200.7 ICP	WATER	8.0 ug/l	V
ZINC (Zn)	200.7 ICP	SOIL	0.2 ug/g	ZN

ZINC (Zn)	200.7	ICP	WATER	2.0 ug/l	ZN
BROMIDE	300.0		SOIL	10 ug/g	BR
BROMIDE	300.0		WATER	100 ug/l	BR
CHLORIDE	300.0		SOIL	10 ug/g	CL
CHLORIDE	300.0		WATER	100 ug/l	CL
FLUORIDE	300.0		SOIL	10 ug/g	F
FLUORIDE	300.0		WATER	100 ug/l	F
NITRATE	300.0		SOIL	1.0 ug/g	NO3
NITRATE	300.0		WATER	10 ug/l	NO3
NITRITE	300.0		SOIL	1.0 ug/g	NO2
NITRITE	300.0		WATER	10 ug/l	NO2
PHOSPHATE	300.0		SOIL	2.0 ug/g	PO4
PHOSPHATE	300.0		WATER	20 ug/l	PO4
SULFATE	300.0		SOIL	10 ug/g	SO4
SULFATE	300.0		WATER	100 ug/l	SO4
1,1,1-TRICHLOROETHANE	601		SOIL	0.002 ug/g	111TCE
1,1,1-TRICHLOROETHANE	601		WATER	0.02 ug/l	111TCE
1,1,2,2-TETRACHLOROETHANE	601		SOIL	0.005 ug/g	TCLEA
1,1,2,2-TETRACHLOROETHANE	601		WATER	0.05 ug/l	TCLEA
1,1,2-TRICHLOROETHANE	601		SOIL	0.002 ug/g	112TCE
1,1,2-TRICHLOROETHANE	601		WATER	0.02 ug/l	112TCE
1,1-DICHLOROETHANE	601		SOIL	0.005 ug/g	11DCLE
1,1-DICHLOROETHANE	601		WATER	0.05 ug/l	11DCLE
1,1-DICHLOROETHENE	601		SOIL	0.01 ug/g	11DCE
1,1-DICHLOROETHENE	601		WATER	0.1 ug/l	11DCE
1,2-DICHLOROBENZENE	601		SOIL	0.02 ug/g	12DCLB
1,2-DICHLOROBENZENE	601		WATER	0.2 ug/l	12DCLB
1,2-DICHLOROETHANE	601		SOIL	0.005 ug/g	12DCLE
1,2-DICHLOROETHANE	601		WATER	0.05 ug/l	12DCLE
1,2-DICHLOROETHENE	601		SOIL	0.01 ug/g	12DEC
1,2-DICHLOROETHENE	601		WATER	0.1 ug/l	12DEC
1,2-DICHLOROPROPANE	601		SOIL	0.005 ug/g	12DCLP
1,2-DICHLOROPROPANE	601		WATER	0.05 ug/l	12DCLP
1,3-DICHLOROBENZENE	601		SOIL	0.02 ug/g	13DCLB
1,3-DICHLOROBENZENE	601		WATER	0.2 ug/l	13DCLB
1,4-DICHLOROBENZENE	601		SOIL	0.02 ug/g	14DCLB
1,4-DICHLOROBENZENE	601		WATER	0.2 ug/l	14DCLB
2-CHLOROETHYLVINYL ETHER	601		SOIL	0.01 ug/g	2CLEVE
2-CHLOROETHYLVINYL ETHER	601		WATER	0.1 ug/l	2CLEVE
BROMOCHLOROMETHANE	601		SOIL	0.05 ug/g	BRCLM
BROMOCHLOROMETHANE	601		WATER	0.5 ug/l	BRCLM
BROMOFORM	601		SOIL	0.02 ug/g	CHBR3
BROMOFORM	601		WATER	0.2 ug/l	CHBR3
CARBON TETRACHLORIDE	601		SOIL	0.01 ug/g	CCL4
CARBON TETRACHLORIDE	601		WATER	0.1 ug/l	CCL4
CHLOROBENZENE	601		SOIL	0.02 ug/g	CLC6H5
CHLOROBENZENE	601		WATER	0.2 ug/l	CLC6H5
CHLOROETHANE	601		SOIL	0.05 ug/g	C2H5CL
CHLOROETHANE	601		WATER	0.5 ug/l	C2H5CL
CHLOROFORM	601		SOIL	0.005 ug/g	CHCL3
CHLOROFORM	601		WATER	0.05 ug/l	CHCL3
CHLOROMETHANE	601		SOIL	0.01 ug/g	CH3CL
CHLOROMETHANE	601		WATER	0.1 ug/l	CH3CL
cis-1,3-DICHLOROPROPENE	601		SOIL	0.02 ug/g	C13DCP
cis-1,3-DICHLOROPROPENE	601		WATER	0.2 ug/l	C13DCP
DIBROMOCHLOROMETHANE	601		SOIL	0.01 ug/g	DBRCLM
DIBROMOCHLOROMETHANE	601		WATER	0.1 ug/l	DBRCLM
METHYLENE CHLORIDE	601		SOIL	0.02 ug/g	CH2CL2
METHYLENE CHLORIDE	601		WATER	0.2 ug/l	CH2CL2
TETRACHLOROETHENE	601		SOIL	0.005 ug/g	TCLEE

TETRACHLOROETHENE	601	WATER	0.05 ug/l	TCLEE
trans-1,3-DICHLOROPROPENE	601	SOIL	0.02 ug/g	T13DCP
trans-1,3-DICHLOROPROPENE	601	WATER	0.2 ug/l	T13DCP
TRICHLOROETHENE	601	SOIL	0.01 ug/g	TRCLE
TRICHLOROETHENE	601	WATER	0.1 ug/l	TRCLE
VINYL CHLORIDE	601	SOIL	0.02 ug/g	C2H3CL
VINYL CHLORIDE	601	WATER	0.2 ug/l	C2H3CL
1,2-DICHLOROBENZENE	602	SOIL	0.02 ug/g	12DCLB
1,2-DICHLOROBENZENE	602	WATER	0.2 ug/l	12DCLB
1,2-DIMETHYLBENZENE	602	SOIL	0.2 ug/g	XYLEN
1,2-DIMETHYLBENZENE	602	WATER	0.2 ug/l	XYLEN
1,3-DICHLOROBENZENE	602	SOIL	0.02 ug/g	13DCLB
1,3-DICHLOROBENZENE	602	WATER	0.2 ug/l	13DCLB
1,3-DIMETHYLBENZENE	602	SOIL	0.2 ug/g	XYLEN
1,3-DIMETHYLBENZENE	602	WATER	0.2 ug/l	XYLEN
1,4-DICHLOROBENZENE	602	SOIL	0.02 ug/g	14DCLB
1,4-DICHLOROBENZENE	602	WATER	0.2 ug/l	14DCLB
1,4-DIMETHYLBENZENE	602	SOIL	0.2 ug/g	XYLEN
1,4-DIMETHYLBENZENE	602	WATER	0.2 ug/l	XYLEN
BENZENE	602	SOIL	0.02 ug/g	C6H6
BENZENE	602	WATER	0.2 ug/l	C6H6
CHLOROBENZENE	602	SOIL	0.02 ug/g	CLC6H5
CHLOROBENZENE	602	WATER	0.2 ug/l	CLC6H5
ETHYLBENZENE	602	SOIL	0.02 ug/g	ETC6H5
ETHYLBENZENE	602	WATER	0.2 ug/l	ETC6H5
TOLUENE	602	SOIL	0.02 ug/g	MEC6H5
TOLUENE	602	WATER	0.2 ug/l	MEC6H5
2,4-DICHLOROPHENOL	604	SOIL	0.04 ug/g	24DCLP
2,4-DICHLOROPHENOL	604	WATER	0.4 ug/l	24DCLP
2,4-DIMETHYLPHENOL	604	SOIL	0.03 ug/g	24DMPN
2,4-DIMETHYLPHENOL	604	WATER	0.3 ug/l	24DMPN
2-CHLOROPHENOL	604	SOIL	0.03 ug/g	2CLP
2-CHLOROPHENOL	604	WATER	0.3 ug/l	2CLP
2-NITROPHENOL	604	SOIL	0.05 ug/g	2NP
2-NITROPHENOL	604	WATER	0.5 ug/l	2NP
4-CHLORO-3-METHYLPHENOL	604	SOIL	0.04 ug/g	4CL3C
4-CHLORO-3-METHYLPHENOL	604	WATER	0.4 ug/l	4CL3C
4-NITROPHENOL	604	SOIL	0.3 ug/g	4NP
4-NITROPHENOL	604	WATER	3.0 ug/l	4NP
METHYL-4,6-DINITROPHENOL	604	SOIL	1.5 ug/g	46DN2C
METHYL-4,6-DINITROPHENOL	604	WATER	15.0 ug/l	46DN2C
PENTACHLOROPHENOL	604	SOIL	0.7 ug/g	PCP
PENTACHLOROPHENOL	604	WATER	7.0 ug/l	PCP
PENTAFLUOROPHENOL	604	SOIL	0.7 ug/g	PFP
PENTAFLUOROPHENOL	604	WATER	7.0 ug/l	PFP
PHENOL	604	SOIL	0.01 ug/g	PHENOL
PHENOL	604	WATER	0.1 ug/l	PHENOL
TRICHLOROPHENOL	604	SOIL	0.05 ug/g	CL3P
TRICHLOROPHENOL	604	WATER	0.5 ug/l	CL3P
N-NITROSO DI-n-PROPLYAMINE	607	SOIL	0.05 ug/g	NDNPA
N-NITROSO DI-n-PROPLYAMINE	607	WATER	0.5 ug/l	NDNPA
N-NITROSO DIMETHYLAMINE	607	SOIL	0.02 ug/g	NNDMEA
N-NITROSO DIMETHYLAMINE	607	WATER	0.2 ug/l	NNDMEA
N-NITROSO DIPHENYLAMINE	607	SOIL	0.1 ug/g	NNDPA
N-NITROSO DIPHENYLAMINE	607	WATER	1.0 ug/l	NNDPA
2,4,5-T	608	SOIL	10 ug/g	245T
2,4,5-T	608	WATER	10 ug/l	245T
2,4-DICHLOROPHENOXYACETIC ACID	608	SOIL	100 ug/g	24D
2,4-DICHLOROPHENOXYACETIC ACID	608	WATER	100 ug/l	24D
4,4'-DDD	608	SOIL	0.005 ug/g	PPDDD

4,4'-DDD	608	WATER	0.005 ug/l	PPDDD
4,4'-DDE	608	SOIL	0.005 ug/g	PPDDE
4,4'-DDE	608	WATER	0.005 ug/l	PPDDE
4,4'-DDT	608	SOIL	0.005 ug/g	PPDDT
4,4'-DDT	608	WATER	0.005 ug/l	PPDDT
ALDRIN	608	SOIL	0.005 ug/g	ALDRN
ALDRIN	608	WATER	0.005 ug/l	ALDRN
ALPHA BHC	608	SOIL	0.003 ug/g	ABHC
ALPHA BHC	608	WATER	0.003 ug/l	LABHC
BETA BHC	608	SOIL	0.003 ug/g	BBHC
BETA BHC	608	WATER	0.003 ug/l	BBHC
CHLORDANE	608	SOIL	0.02 ug/g	CLDAN
CHLORDANE	608	WATER	0.02 ug/l	CLDAN
DELTA BHC	608	SOIL	0.003 ug/g	DBHC
DELTA BHC	608	WATER	0.003 ug/l	DBHC
DIELDRIN	608	SOIL	0.005 ug/g	DLDRN
DIELDRIN	608	WATER	0.005 ug/l	DLDRN
ENDOSULFAN I	608	SOIL	0.014 ug/g	AENSLF
ENDOSULFAN I	608	WATER	0.014 ug/l	AENSLF
ENDOSULFAN II	608	SOIL	0.004 ug/g	BENSLF
ENDOSULFAN II	608	WATER	0.004 ug/l	BENSLF
ENDRIN	608	SOIL	0.006 ug/g	ENDRN
ENDRIN	608	WATER	0.006 ug/l	ENDRN
ENDRIN ALDEHYDE	608	SOIL	0.023 ug/g	ENDRNA
ENDRIN ALDEHYDE	608	WATER	0.023 ug/l	ENDRNA
HEPTACHLOR	608	SOIL	0.005 ug/g	HPCL
HEPTACHLOR	608	WATER	0.005 ug/l	HPCL
HEPTACHLOR EPOXIDE	608	SOIL	0.05 ug/g	HPCLE
HEPTACHLOR EPOXIDE	608	WATER	0.05 ug/l	HPCLE
ISODRIN	608	SOIL	0.005 ug/g	ISODR
ISODRIN	608	WATER	0.005 ug/l	ISODR
LINDANE	608	SOIL	0.02 ug/g	LIN
LINDANE	608	WATER	0.02 ug/l	LIN
METHOXYCHLOR	608	SOIL	0.08 ug/g	MEXCLR
METHOXYCHLOR	608	WATER	0.5 ug/l	MEXCLR
PCB-1016	608	SOIL	0.05 ug/g	PCB016
PCB-1016	608	WATER	0.05 ug/l	PCB016
PCB-1221	608	SOIL	0.05 ug/g	PCB221
PCB-1221	608	WATER	0.05 ug/l	PCB221
PCB-1232	608	SOIL	0.05 ug/g	PCB232
PCB-1232	608	WATER	0.05 ug/l	PCB232
PCB-1242	608	SOIL	0.05 ug/g	PCB242
PCB-1242	608	WATER	0.05 ug/l	PCB242
PCB-1248	608	SOIL	0.05 ug/g	PCB248
PCB-1248	608	WATER	0.05 ug/l	PCB248
PCB-1254	608	SOIL	0.05 ug/g	PCB254
PCB-1254	608	WATER	0.05 ug/l	PCB254
PCB-1260	608	SOIL	0.05 ug/g	PCB260
PCB-1260	608	WATER	0.05 ug/l	PCB260
TOXAPHENE	608	SOIL	0.24 ug/g	TXPHEN
TOXAPHENE	608	WATER	0.25 ug/l	TXPHEN
2,4-DINITROTOLUENE	609	SOIL	0.002 ug/g	24DNT
2,4-DINITROTOLUENE	609	WATER	0.02 ug/l	24DNT
2,6-DINITROTOLUENE	609	SOIL	0.002 ug/g	26DNT
2,6-DINITROTOLUENE	609	WATER	0.02 ug/l	26DNT
NITROBENZENE	609	SOIL	1.0 ug/g	NB
NITROBENZENE	609	WATER	10.0 ug/l	NB
1,1,1-TRICHLOROETHANE	624	SOIL	0.4 ug/g	111TCE
1,1,1-TRICHLOROETHANE	624	WATER	4.0 ug/l	111TCE
1,1,2,2-TETRACHLOROETHANE	624	SOIL	0.5 ug/g	TCLEA

1,1,2,2-TETRACHLOROETHANE	624	WATER	5.0 ug/l	TCLEA
1,1,2-TRICHLOROETHANE	624	SOIL	0.4 ug/g	112TCE
1,1,2-TRICHLOROETHANE	624	WATER	4.0 ug/l	112TCE
1,1-DICHLOROETHANE	624	SOIL	0.2 ug/g	11DCLE
1,1-DICHLOROETHANE	624	WATER	2.0 ug/l	11DCLE
1,1-DICHLOROETHENE	624	SOIL	0.2 ug/g	11DCE
1,1-DICHLOROETHENE	624	WATER	2.0 ug/l	11DCE
1,2-DICHLOROBENZENE	624	SOIL	1.0 ug/g	12DCLB
1,2-DICHLOROBENZENE	624	WATER	10.0 ug/l	12DCLB
1,2-DICHLOROETHANE	624	SOIL	0.2 ug/g	12DCLE
1,2-DICHLOROETHANE	624	WATER	2.0 ug/l	12DCLE
1,2-DICHLOROETHANE-d4-S	624	SOIL	0.2 ug/g	12DCD4
1,2-DICHLOROETHANE-d4-S	624	WATER	2.0 ug/l	12DCD4
1,2-DICHLOROETHENE	624	SOIL	0.2 ug/g	12DEC
1,2-DICHLOROETHENE	624	WATER	2.0 ug/l	12DEC
1,2-DICHLOROPROPANE	624	SOIL	0.5 ug/g	12DCLP
1,2-DICHLOROPROPANE	624	WATER	5.0 ug/l	12DCLP
1,2-DIMETHYLBENZENE	624	SOIL	1.2 ug/g	XYLEN
1,2-DIMETHYLBENZENE	624	WATER	1.2 ug/l	XYLEN
1,3-DICHLOROBENZENE	624	SOIL	1.0 ug/g	13DCLB
1,3-DICHLOROBENZENE	624	WATER	10.0 ug/l	13DCLB
1,3-DICHLOROPROPANE	624	SOIL	0.5 ug/g	13DCP
1,3-DICHLOROPROPANE	624	WATER	5.0 ug/l	13DCP
1,3-DIMETHYLBENZENE	624	SOIL	1.2 ug/g	XYLEN
1,3-DIMETHYLBENZENE	624	WATER	1.2 ug/l	XYLEN
1,4-DICHLOROBENZENE	624	SOIL	1.0 ug/g	14DCLB
1,4-DICHLOROBENZENE	624	WATER	10.0 ug/l	14DCLB
1,4-DIMETHYLBENZENE	624	SOIL	1.2 ug/g	XYLEN
1,4-DIMETHYLBENZENE	624	WATER	1.2 ug/l	XYLEN
2-CHLOROETHYLVINYL ETHER	624	SOIL	1.0 ug/g	2CLEVE
2-CHLOROETHYLVINYL ETHER	624	WATER	10.0 ug/l	2CLEVE
ACROLEIN	624	SOIL	3.0 ug/g	ACROLN
ACROLEIN	624	WATER	30 ug/l	ACROLN
ACRYLONITRILE	624	SOIL	3.0 ug/g	ACRYLO
ACRYLONITRILE	624	WATER	30.0 ug/l	ACRYLO
BENZENE	624	SOIL	0.4 ug/g	C6H6
BENZENE	624	WATER	4.0 ug/l	C6H6
BROMODICHLOROMETHANE	624	SOIL	0.2 ug/g	BRDCLM
BROMODICHLOROMETHANE	624	WATER	2.0 ug/l	BRDCLM
BROMOFORM	624	SOIL	0.5 ug/g	CHBR3
BROMOFORM	624	WATER	5.0 ug/l	CHBR3
BROMOMETHANE	624	SOIL	0.4 ug/g	CH3BR
BROMOMETHANE	624	WATER	4.0 ug/l	CH3BR
CARBON TETRACHLORIDE	624	SOIL	0.2 ug/g	CCL4
CARBON TETRACHLORIDE	624	WATER	2.0 ug/l	CCL4
CHLOROBENZENE	624	SOIL	0.5 ug/g	CLC6H5
CHLOROBENZENE	624	WATER	5.0 ug/l	CLC6H5
CHLOROETHANE	624	SOIL	1.0 ug/g	C2H5CL
CHLOROETHANE	624	WATER	10.0 ug/l	C2H5CL
CHLOROFORM	624	SOIL	0.2 ug/g	CHCL3
CHLOROFORM	624	WATER	2.0 ug/l	CHCL3
CHLOROMETHANE	624	SOIL	1.0 ug/g	CH3CL
CHLOROMETHANE	624	WATER	10.0 ug/l	CH3CL
DIBROMOCHLOROMETHANE	624	SOIL	0.3 ug/g	DBRCLM
DIBROMOCHLOROMETHANE	624	WATER	3.0 ug/l	DBRCLM
ETHYLBENZENE	624	SOIL	0.5 ug/g	ETC6H5
ETHYLBENZENE	624	WATER	5.0 ug/l	ETC6H5
ETHYLBENZENE-d10-S	624	SOIL	0.5 ug/g	ETBD10
ETHYLBENZENE-d10-S	624	WATER	5.0 ug/l	ETBD10
METHYLENE CHLORIDE	624	SOIL	0.3 ug/g	CH2CL2

METHYLENE CHLORIDE	624	WATER	3.0 ug/l	CH2CL2
METHYLENE CHLORIDE-d2-S	624	SOIL	0.3 ug/g	CDCL2
METHYLENE CHLORIDE-d2-S	624	WATER	3.0 ug/l	CDCL2
TETRACHLOROETHENE	624	SOIL	0.4 ug/g	TCLEE
TETRACHLOROETHENE	624	WATER	4.0 ug/l	TCLEE
TOLUENE	624	SOIL	0.5 ug/g	MEC6H5
TOLUENE	624	WATER	5.0 ug/l	MEC6H5
TOLUENE-d8-S	624	SOIL	0.5 ug/g	MEC6D8
TOLUENE-d8-S	624	WATER	5.0 ug/l	MEC6D8
TRICHLOROETHENE	624	SOIL	0.2 ug/g	TRCLE
TRICHLOROETHENE	624	WATER	2.0 ug/l	TRCLE
TRICHLOROFLUOROMETHANE	624	SOIL	0.4 ug/g	CCL3F
TRICHLOROFLUOROMETHANE	624	WATER	4.0 ug/l	CCL3F
VINYL CHLORIDE	624	SOIL	0.2 ug/g	C2H3CL
VINYL CHLORIDE	624	WATER	2.0 ug/l	C2H3CL
1,2,3-TRICHLOROBENZENE	625	SOIL	0.2 ug/g	123TCB
1,2,3-TRICHLOROBENZENE	625	WATER	2.0 ug/l	123TCB
1,2,4-TRICHLOROBENZENE	625	SOIL	0.2 ug/g	124TCB
1,2,4-TRICHLOROBENZENE	625	WATER	2.0 ug/l	124TCB
1,2-DICHLOROBENZENE	625	SOIL	0.2 ug/g	12DCLB
1,2-DICHLOROBENZENE	625	WATER	2.0 ug/l	12DCLB
1,2-DIPHENYL HYDRAZINE	625	SOIL	2.0 ug/g	12DPH
1,2-DIPHENYL HYDRAZINE	625	WATER	20.0 ug/l	12DPH
1,3-DICHLOROBENZENE	625	SOIL	0.2 ug/g	13DCLB
1,3-DICHLOROBENZENE	625	WATER	2.0 ug/l	13DCLB
1,3-DICHLOROBENZENE-d4-S	625	SOIL	0.2 ug/g	13DBD4
1,3-DICHLOROBENZENE-d4-S	625	WATER	2.0 ug/l	13DBD4
1,4-DICHLOROBENZENE	625	SOIL	0.2 ug/g	14DCLB
1,4-DICHLOROBENZENE	625	WATER	2.0 ug/l	14DCLB
1,4-OXATHIANE (THIOXANE)	625	SOIL	0.2 ug/g	OXAT
1,4-OXATHIANE (THIOXANE)	625	WATER	2.0 ug/l	OXAT
2,4-DINITROPHENOL	625	SOIL	1.0 ug/g	24DNP
2,4-DINITROPHENOL	625	WATER	10.0 ug/l	24DNP
2,4-DINITROTOLUENE	625	SOIL	0.2 ug/g	24DNT
2,4-DINITROTOLUENE	625	WATER	2.0 ug/l	24DNT
2,6-DINITROANILINE	625	SOIL	0.2 ug/g	26DNA
2,6-DINITROANILINE	625	WATER	2.0 ug/l	26DNA
2,6-DINITROTOLUENE	625	SOIL	0.2 ug/g	26DNT
2,6-DINITROTOLUENE	625	WATER	2.0 ug/l	26DNT
2-CHLORONAPHTHALENE	625	SOIL	0.2 ug/g	2CNAP
2-CHLORONAPHTHALENE	625	WATER	2.0 ug/l	2CNAP
2-CHLOROPHENOL-d4-S	625	SOIL	0.2 ug/g	2CLPD4
2-CHLOROPHENOL-d4-S	625	WATER	2.0 ug/l	2CLPD4
3-NITROANILINE	625	SOIL	0.2 ug/g	3NANIL
3-NITROANILINE	625	WATER	2.0 ug/l	3NANIL
3-NITROTOLUENE	625	SOIL	0.2 ug/g	3NT
3-NITROTOLUENE	625	WATER	2.0 ug/l	3NT
3,3-DICHLOROBENZIDINE	625	SOIL	1.0 ug/g	33DCBD
3,3-DICHLOROBENZIDINE	625	WATER	10.0 ug/l	33DCBD
3,5-DINITROANILINE	625	SOIL	0.2 ug/g	35DNA
3,5-DINITROANILINE	625	WATER	2.0 ug/l	35DNA
4-BROMOPHENYL PHENYL ETHER	625	SOIL	0.2 ug/g	4BRPPE
4-BROMOPHENYL PHENYL ETHER	625	WATER	2.0 ug/l	4BRPPE
4-CHLOROPHENYL PHENYL ETHER	625	SOIL	0.4 ug/g	4CLPPE
4-CHLOROPHENYL PHENYL ETHER	625	WATER	4.0 ug/l	4CLPPE
4,4'-DDD	625	SOIL	0.3 ug/g	PPDDD
4,4'-DDD	625	WATER	3.0 ug/l	PPDDD
4,4'-DDE	625	SOIL	0.3 ug/g	PPDDE
4,4'-DDE	625	WATER	3.0 ug/l	PPDDE
4,4'-DDT	625	SOIL	0.3 ug/g	PPDDT

4,4'-DDT	625	WATER	3.0 ug/l	PPDDT
ACENAPHTHENE	625	SOIL	0.2 ug/g	ANAPNE
ACENAPHTHENE	625	WATER	2.0 ug/l	ANAPNE
ACENAPHTHYLENE	625	SOIL	0.2 ug/g	ANAPYL
ACENAPHTHYLENE	625	WATER	2.0 ug/l	ANAPYL
ALDRIN	625	SOIL	0.2 ug/g	ALDRN
ALDRIN	625	WATER	2.0 ug/l	ALDRN
ALPHA-BHC	625	SOIL	0.3 ug/g	ABHC
ALPHA-BHC	625	WATER	3.0 ug/l	ABHC
ANTHRACENE	625	SOIL	0.2 ug/g	ANTRC
ANTHRACENE	625	WATER	2.0 ug/l	ANTRC
BENZO (a) ANTHRACENE	625	SOIL	0.8 ug/g	BAANTR
BENZO (a) ANTHRACENE	625	WATER	8.0 ug/L	BAANTR
BENZO (a) PYRENE	625	SOIL	0.25 ug/g	BAPYR
BENZO (a) PYRENE	625	WATER	2.5 ug/l	BAPYR
BENZO (b) FLUORANTHENE	625	SOIL	0.5 ug/g	BBFANT
BENZO (b) FLUORANTHENE	625	WATER	5.0 ug/l	BBFANT
BENZO (ghi) PERYLENE	625	SOIL	0.4 ug/g	BGHIPY
BENZO (ghi) PERYLENE	625	WATER	4.0 ug/l	BGHIPY
BENZO (k) FLUORANTHENE	625	SOIL	0.25 ug/g	BKFANT
BENZO (k) FLUORANTHENE	625	WATER	2.5 ug/l	BKFANT
BETA-BHC	625	SOIL	0.3 ug/g	BBHC
BETA-BHC	625	WATER	3.0 ug/l	BBHC
Bis (2-CHLOROETHOXY) METHANE	625	SOIL	0.6 ug/g	B2CEXM
Bis (2-CHLOROETHOXY) METHANE	625	WATER	6.0 ug/l	B2CEXM
Bis (2-CHLOROETHYL) ETHER	625	SOIL	0.6 ug/g	B2CLEE
Bis (2-CHLOROETHYL) ETHER	625	WATER	6.0 ug/l	B2CLEE
Bis (2-ETHYLHEXYL) PHTHALATE	625	SOIL	0.25 ug/g	B2EHP
Bis (2-ETHYLHEXYL) PHTHALATE	625	WATER	2.5 ug/l	B2EHP
Bis (2-CHLOROISOPROPYL) ETHER	625	SOIL	0.4 ug/g	B2CIPE
Bis (2-CHLOROISOPROPYL) ETHER	625	WATER	4.0 ug/l	B2CIPE
BROMACIL	625	SOIL	1.0 ug/g	BRMCIL
BROMACIL	625	WATER	10.0 ug/l	BRMCIL
BUTYL BENZYL PHTHALATE	625	SOIL	0.2 ug/g	BBZP
BUTYL BENZYL PHTHALATE	625	WATER	2.0 ug/l	BBZP
CHLORDANE	625	SOIL	0.2 ug/g	CLDAN
CHLORDANE	625	WATER	2.0 ug/l	CLDAN
CHRYSENE	625	SOIL	0.25 ug/g	CHRY
CHRYSENE	625	WATER	2.5 ug/l	CHRY
DELTA-BHC	625	SOIL	0.3 ug/g	DBHC
DELTA-BHC	625	WATER	3.0 ug/l	DBHC
DI-n-OCTYLPHTHALATE	625	SOIL	0.25 ug/g	DNOP
DI-n-OCTYLPHTHALATE	625	WATER	2.5 ug/l	DNOP
DIBENZO (a,h) ANTHRACENE	625	SOIL	0.25 ug/g	DBAHA
DIBENZO (a,h) ANTHRACENE	625	WATER	2.5 ug/l	DBAHA
DIELDRIN	625	SOIL	0.2 ug/g	DLDRN
DIELDRIN	625	WATER	2.0 ug/l	DLDRN
DIETHYL PHTHALATE	625	SOIL	0.2 ug/g	DEP
DIETHYL PHTHALATE	625	WATER	2.0 ug/l	DEP
DIETHYL PHTHALATE-d4-S	625	SOIL	0.2 ug/g	DEPD4
DIETHYL PHTHALATE-d4-S	625	WATER	2.0 ug/l	DEPD4
DIMETHYL PHTHALATE	625	SOIL	0.2 ug/g	DMP
DIMETHYL PHTHALATE	625	WATER	2.0 ug/l	DMP
DI-n-BUTYL PHTHALATE	625	SOIL	0.2 ug/g	DNBP
DI-n-BUTYL PHTHALATE	625	WATER	2.0 ug/l	DNBP
DITHIANE	625	SOIL	0.2 ug/g	DITH
DITHIANE	625	WATER	2.0 ug/l	DITH
ENDOSULFAN SULFATE	625	SOIL	2.0 ug/g	ESFSO4
ENDOSULFAN SULFATE	625	WATER	20.0 ug/l	ESFSO4
ENDRIN	625	SOIL	0.2 ug/g	ENDRN

ENDRIN	625	WATER	2.0 ug/l	ENDRN
FLUORANTHENE	625	SOIL	0.2 ug/g	FANT
FLUORANTHENE	625	WATER	2.0 ug/l	FANT
HEPTACHLOR	625	SOIL	0.2 ug/g	HPLC
HEPTACHLOR	625	WATER	2.0 ug/l	HPLC
HEPTACHLOR EPOXIDE	625	SOIL	0.2 ug/g	HPCLE
HEPTACHLOR EPOXIDE	625	WATER	2.0 ug/l	HPCLE
HEXACHLOROBENZENE	625	SOIL	0.2 ug/g	CL6BZ
HEXACHLOROBENZENE	625	WATER	2.0 ug/l	CL6BZ
HEXACHLOROBUTADIENE	625	SOIL	0.1 ug/g	HCBD
HEXACHLOROBUTADIENE	625	WATER	1.0 ug/l	HCBD
HEXACHLOROETHANE	625	SOIL	0.2 ug/g	CL6ET
HEXACHLOROETHANE	625	WATER	2.0 ug/l	CL6ET
INDENO (1,2,3,cd) PYRENE	625	SOIL	0.4 ug/g	ICDPYR
INDENO (1,2,3,cd) PYRENE	625	WATER	4.0 ug/l	ICDPYR
ISOPHORONE	625	SOIL	0.2 ug/g	ISOPHR
ISOPHORONE	625	WATER	2.0 ug/l	ISOPHR
LINDANE (g BHC)	625	SOIL	0.3 ug/g	LIN
LINDANE (g BHC)	625	WATER	3.0 ug/l	LIN
MALATHION	625	SOIL	0.1 ug/g	MLTHN
MALATHION	625	WATER	1.0 ug/l	MLTHN
N-NITROSO DI-n-PROPYLAMINE	625	SOIL	1.0 ug/g	NDNPA
N-NITROSO DI-n-PROPYLAMINE	625	WATER	10.0 ug/l	NDNPA
NAPHTHALENE	625	SOIL	0.1 ug/g	NAP
NAPHTHALENE	625	WATER	1.0 ug/l	NAP
NITROBENZENE	625	SOIL	0.2 ug/g	NB
NITROBENZENE	625	WATER	2.0 ug/l	NB
NITROBENZENE-d5-S	625	SOIL	0.2 ug/g	NBD5
NITROBENZENE-d5-S	625	WATER	2.0 ug/l	NBD5
p-CHLOROPHENYLMETHYL SULFIDE	625	SOIL	0.2 ug/g	CPMS
p-CHLOROPHENYLMETHYL SULFIDE	625	WATER	2.0 ug/l	CPMS
p-CHLOROPHENYLMETHYL SULFONE	625	SOIL	0.2 ug/g	CPMSO2
p-CHLOROPHENYLMETHYL SULFONE	625	WATER	2.0 ug/l	CPMSO2
p-CHLOROPHENYLMETHYL SULFOXIDE	625	SOIL	0.2 ug/g	CPMSO
p-CHLOROPHENYLMETHYL SULFOXIDE	625	WATER	2.0 ug/l	CPMSO
PARATHION	625	SOIL	0.1 ug/g	PRTHN
PARATHION	625	WATER	1.0 ug/l	PRTHN
PCB 1016	625	SOIL	3.0 ug/g	PCB016
PCB 1016	625	WATER	30.0 ug/l	PCB016
PCB 1221	625	SOIL	3.0 ug/g	PCB221
PCB 1221	625	WATER	30.0 ug/l	PCB221
PCB 1232	625	SOIL	3.0 ug/g	PCB232
PCB 1232	625	WATER	30.0 ug/l	PCB232
PCB 1242	625	SOIL	3.0 ug/g	PCB242
PCB 1242	625	WATER	30.0 ug/l	PCB242
PCB 1248	625	SOIL	3.0 ug/g	PCB248
PCB 1248	625	WATER	30.0 ug/l	PCB248
PCB 1254	625	SOIL	3.0 ug/g	PCB254
PCB 1254	625	WATER	30.0 ug/l	PCB254
PCB 1260	625	SOIL	3.0 ug/g	PCB260
PCB 1260	625	WATER	30.0 ug/l	PCB260
PCB 1262	625	SOIL	3.0 ug/g	PCB262
PCB 1262	625	WATER	30.0 ug/l	PCB262
PHENANTHRENE	625	SOIL	0.5 ug/g	PHANTR
PHENANTHRENE	625	WATER	5.0 ug/l	PHANTR
PYRENE	625	SOIL	0.2 ug/g	PYR
PYRENE	625	WATER	2.0 ug/l	PYR
2,4-D	8150	SOIL	0.01 ug/g	24D
2,4-D	8150	WATER	0.1 ug/l	24D
2,4,5-T	8150	SOIL	0.01 ug/g	245T

2,4,5-T	8150	WATER	0.1 ug/l	245T
2,4,5-TP	8150	SOIL	0.01 ug/g	245TP
2,4,5-TP	8150	WATER	0.1 ug/l	245TP
BARIUM	AAS-FLAME	SOIL	10.0 ug/g	BA
BARIUM	AAS-FLAME	WATER	100 ug/l	BA
BERYLLIUM	AAS-FLAME	SOIL	5.0 ug/g	BE
BERYLLIUM	AAS-FLAME	WATER	0.5 ug/l	BE
CADMIUM	AAS-FLAME	SOIL	0.5 ug/g	CD
CADMIUM	AAS-FLAME	WATER	5.0 ug/l	CD
CHROMIUM	AAS-FLAME	SOIL	5.0 ug/g	CR
CHROMIUM	AAS-FLAME	WATER	50.0 ug/g	CR
COPPER	AAS-FLAME	SOIL	2.0 ug/g	CU
COPPER	AAS-FLAME	WATER	20.0 ug/l	CU
LEAD	AAS-FLAME	SOIL	10.0 ug/g	PB
LEAD	AAS-FLAME	WATER	100 ug/l	PB
NICKEL	AAS-FLAME	SOIL	4.0 ug/g	NI
NICKEL	AAS-FLAME	WATER	40.0 ug/g	NI
SILVER	AAS-FLAME	SOIL	1.0 ug/g	AG
SILVER	AAS-FLAME	WATER	10.0 ug/l	AG
ZINC	AAS-FLAME	SOIL	0.5 ug/g	ZN
ZINC	AAS-FLAME	WATER	5.0 ug/l	ZN
✓ MERCURY (Hg)	COLD VAPR	SOIL	0.02 ug/g	HG
✓ MERCURY (Hg)	COLD VAPR	WATER	0.2 ug/l	HG
CHROMIUM (HEXAVALENT)	COLORIMETRIC	SOIL <i>Not used</i>	5.0 ug/l	CR6
CHROMIUM (HEXAVALENT)	COLORIMETRIC	WATER <i>Not used</i>	5.0 ug/g	CR6
CYANIDE	COLORIMETRIC	SOIL <i>not used</i>	10 ug/g	CN
CYANIDE	COLORIMETRIC	WATER <i>not used</i>	10 ug/l	CN
NITROCELLULOSE	COLORIMETRIC	SOIL	10ug/g	NC
SULFIDE (S-)	COLORIMETRIC	SOIL	20 ug/g	S
SULFIDE (S-)	COLORIMETRIC	WATER	20 ug/l	S
ANTIMONY (Sb)	GFAA	SOIL	0.3 ug/g	SB
ANTIMONY (Sb)	GFAA	WATER	3.0 ug/l	SB
ARSENIC (As)	GFAA	SOIL	0.1 ug/g	AS
ARSENIC (As)	GFAA	WATER	1.0 ug/l	AS
BARIUM	GFAA	SOIL	10 ug/g	BA
BARIUM	GFAA	WATER	10 ug/l	BA
BERYLLIUM	GFAA	SOIL	2 ug/g	BE
BERYLLIUM	GFAA	WATER	2 ug/l	BE
CADMIUM	GFAA	SOIL	2 ug/g	CD
CADMIUM	GFAA	WATER	2 ug/l	CD
CHROMIUM	GFAA	SOIL	5 ug/g	CR
CHROMIUM	GFAA	WATER	5 ug/l	CR
COPPER	GFAA	SOIL	2 ug/g	CU
COPPER	GFAA	WATER	2 ug/l	CU
LEAD (Pb)	GFAA	SOIL	0.1 ug/g	PB
LEAD (Pb)	GFAA	WATER	1.0 ug/l	PB
MAGNESIUM (Mg)	GFAA	SOIL	1.0 ug/g	MG
MAGNESIUM (Mg)	GFAA	WATER	10.0 ug/l	MG
MANGANESE	GFAA	SOIL	5 ug/g	MN
MANGANESE	GFAA	WATER	5 ug/l	MN
NICKEL	GFAA	SOIL	10 ug/g	NI
NICKEL	GFAA	WATER	10 ug/l	NI
SELENIUM (Se)	GFAA	SOIL	0.2 ug/g	SE
SELENIUM (Se)	GFAA	WATER	2.0 ug/l	SE
SILVER (Ag)	GFAA	SOIL	0.02 ug/g	AG
SILVER (Ag)	GFAA	WATER	0.2 ug/l	AG
TELLURIUM (Te)	GFAA	SOIL	0.2 ug/g	TE
TELLURIUM (Te)	GFAA	WATER	2.0 ug/l	TE
✓ THALLIUM	GFAA	SOIL	5 ug/g	TL
✓ THALLIUM	GFAA	WATER	5 ug/l	TL

VANADIUM (V)	GFAA	SOIL	0.4 ug/g	V
VANADIUM (V)	GFAA	WATER	4.0 ug/l	V
1,3,5-TRINITROBENZENE	HPLC	SOIL	0.5 ug/g	135TNB
1,3,5-TRINITROBENZENE	HPLC	WATER	0.5 ug/l	135TNB
1,3-DINITROBENZENE	HPLC	SOIL	0.5 ug/g	13DNB
1,3-DINITROBENZENE	HPLC	WATER	0.5 ug/l	13DNB
2,4,6-TRINITROBENZALDEHYDE	HPLC	SOIL	1.0 ug/g	ATNBA
2,4,6-TRINITROBENZALDEHYDE	HPLC	WATER	1.0 ug/l	ATNBA
2,4,6-TRINITROTOLUENE	HPLC	SOIL	1.0 ug/g	246TNT
2,4,6-TRINITROTOLUENE	HPLC	WATER	1.0 ug/l	246TNT
2,4-DINITROTOLUENE	HPLC	SOIL	1.0 ug/g	24DNT
2,4-DINITROTOLUENE	HPLC	WATER	1.0 ug/l	24DNT
2,6-DINITROTOLUENE	HPLC	SOIL	1.0 ug/g	26DNT
2,6-DINITROTOLUENE	HPLC	WATER	1.0 ug/l	26DNT
HMX	HPLC	SOIL	1.0 ug/g	HMX
HMX	HPLC	WATER	1.0 ug/l	HMX
ISOPHORONE	HPLC	SOIL	10.0 ug/g	ISOPHR
ISOPHORONE	HPLC	WATER	100.0 ug/l	ISOPHR
NITROBENZENE	HPLC	SOIL	2.0 ug/g	NB
NITROBENZENE	HPLC	WATER	2.0 ug/l	NB
NITROGLYCERIN	HPLC	SOIL	1.0 ug/g	NG
NITROGLYCERIN	HPLC	WATER	1.0 ug/l	NG
PETN	HPLC	SOIL	2.0 ug/g	PETN
PETN	HPLC	WATER	2.0 ug/l	PETN
PICRIC ACID	HPLC	SOIL	1.0 ug/g	246TNP
PICRIC ACID	HPLC	WATER	1.0 ug/l	246TNP
RDX	HPLC	SOIL	1.0 ug/g	RDX
RDX	HPLC	WATER	1.0 ug/l	RDX
TETRAZENE	HPLC	SOIL	5.0 ug/g	TETR
TETRAZENE	HPLC	WATER	5.0 ug/l	TETR
TETRYL	HPLC	SOIL	5.0 ug/g	TETRYL
TETRYL	HPLC	WATER	5.0 ug/l	TETRYL
ARSENIC (As)	HYDRIDE	SOIL	0.2 ug/g	AS
ARSENIC (As)	HYDRIDE	WATER	2.0 ug/l	AS
SELENIUM (Se)	HYDRIDE	SOIL	0.2 ug/g	SE
SELENIUM (Se)	HYDRIDE	WATER	2.0 ug/l	SE
DIMETHYL HYDRAZINE	RMA	SOIL	1.0 ug/g	UDMH
DIMETHYL HYDRAZINE	RMA	WATER	10.0 ug/l	UDMH
1,4-OXATHIANE (THIOXANE)	RMA GCFPD	SOIL	2.5 ug/g	OXAT
1,4-OXATHIANE (THIOXANE)	RMA GCFPD	WATER	2.5 ug/l	OXAT
BENZOTHIAZOLE	RMA GCFPD	SOIL	2.5 ug/g	BTZ
BENZOTHIAZOLE	RMA GCFPD	WATER	2.5 ug/l	BTZ
DITHIANE	RMA GCFPD	SOIL	2.5 ug/g	DITH
DITHIANE	RMA GCFPD	WATER	2.5 ug/l	DITH
p-CHLOROPHENYLMETHYL SULFIDE	RMA GCFPD	SOIL	2.5 ug/g	CPMS
p-CHLOROPHENYLMETHYL SULFIDE	RMA GCFPD	WATER	2.5 ug/l	CPMS
p-CHLOROPHENYLMETHYL SULFONE	RMA GCFPD	SOIL	2.5 ug/g	CPMSO2
p-CHLOROPHENYLMETHYL SULFONE	RMA GCFPD	WATER	2.5 ug/l	CPMSO2
p-CHLOROPHENYLMETHYL SULFOXIDERMA	GCFPD	SOIL	2.5 ug/g	CPMSO
p-CHLOROPHENYLMETHYL SULFOXIDERMA	GCFPD	WATER	2.5 ug/l	CPMSO
THIODIGLYCOL	RMA GCFPD	SOIL	2.5 ug/g	TDGCL
THIODIGLYCOL	RMA GCFPD	WATER	2.5 ug/l	TDGCL
ATRAZINE	RMA NPD	SOIL	0.5 ug/g	ATZ
ATRAZINE	RMA NPD	WATER	0.5 ug/l	ATZ
ETHYL PARATHION	RMA NPD	SOIL	0.5 ug/g	EPRTHN
ETHYL PARATHION	RMA NPD	WATER	0.5 ug/l	EPRTHN
MALATHION	RMA NPD	SOIL	0.5 ug/g	MLTHN
MALATHION	RMA NPD	WATER	0.5 ug/l	MLTHN
SUPONA	RMA NPD	SOIL	0.5 ug/g	SUPONA
SUPONA	RMA NPD	WATER	0.5 ug/l	SUPONA

APPENDIX B

USATHAMA SITE-TYPE DESIGNATIONS

\*\*\*\* SITE TYPE \*\*\*\*

ABBREVIATION:

ELEMENT NAME:

-----  
SITE TYPE

-----  
SITE TYPE

ELEMENT IS USED IN THE FOLLOWING IR FILES:

DB#:

DB NAME:

-----  
CHEMICAL (25-28)

-----  
C201

-----  
IR

ELEMENT SIZE AND CHARACTERISTICS:

-----  
4 (ALPHA) LEFT JUSTIFY OR BLANK

ELEMENT DESCRIPTION:

-----  
UP TO 4 LETTER ABBREVIATION OF TYPE OF LANDMARK, FEATURE, OR  
CONSTRUCTION BEING IDENTIFIED. THIS DESCRIPTION/IDENTIFICATION  
WILL HAVE GRID COORDINATES ASSOCIATED WITH IT. HOWEVER, GRID  
COORDINATES WILL BE ENTERED IN THE MAP FILE.

NOTE: EXCEPT FOR QC SAMPLES, ALL SAMPLE POINTS ENTERED IN A DATA  
FILE MUST HAVE A MATCHING RECORD IN THE MAP FILE THAT DEFINES ITS  
LOCATION.

THE COMBINATION OF SITE-TYPE AND SITE-ID USED IN THE DATA FILES  
MUST MATCH EXACTLY THE SITE-TYPE AND SITE-ID USED IN THE MAP FILE  
AND VICE VERSA.

ACCEPTABLE CRITERIA:

- -REQUIRED ON ALL CHEMICAL RECORDS  
-MUST MATCH ONE OF THE ACCEPTABLE CODES BELOW  
-MUST MATCH SITE-TYPE ON THE MAP RECORD  
-MUST BE BLANK FOR FILE NAME = CQC

ACCEPTABLE ENTRIES AND CONDITIONS:

-----  
THE SITE TYPES LISTED BELOW HAVE BEEN BROKEN DOWN BY FILE TYPE FOR  
EASE OF USE.

\*\*\*\* SITE TYPE \*\*\*\*

GEOTECHNICAL FILES:

AQUIFER ANALYSIS FILE - FORM 41-0

WELL COMPLETED WELL  
LYSM LYSIMETER

GROUNDWATER STABILIZED FILE - FORM 46-0

WELL COMPLETED WELL  
LYSM LYSIMETER

FIELD DRILLING FILE - FORM 43-0

BORE BORE HOLE (IN-PROCESS OR COMPLETED)

PHYSICAL ANALYSIS FILE- FORM 44-0

BORE BORE HOLE (IN-PROCESS OR COMPLETED)

WELL CONSTRUCTION FILE - FORM 45-0

WELL COMPLETED WELL  
LYSM LYSIMETER

MAP FILE (GMA)-FORM 51.0:

ALL SITE-TYPES (EXCEPT QC) LISTED HEREIN ARE ALLOWABLE ENTRIES FOR THE MAP FILE. REMEMBER THAT THE SITE TYPE USED IN THE DATA FILE MUST MATCH EXACTLY TO THAT USED IN THE MAP FILE.

CHEMICAL OR RADIOLOGICAL FILES - FORMS 30 AND 60:

FILENAME: CAR (AIR)

OLSP OLD LAGOON SLUDGE PILE  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
CSDT CHEMICAL SLUDGE DISPOSAL TRENCHES  
ARMO AIR MONITORING STATION

FILENAME: CAT OR RAT (ANIMAL TISSUE)

BIOL BIOLOGICAL SAMPLE  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
CREK CREEK  
LAKE LAKE  
POND POND  
RVER RIVER  
STRM STREAM  
SURF SURFACES IN GENERAL

## \*\*\*\* SITE TYPE \*\*\*\*

## FILENAME: CBS OR RBS (BUILDING SURVEY)

BLDG BUILDING  
BATT BATTERY  
CASE CASEMATE  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS

## FILENAME: CGW OR RGW (GROUNDWATER)

CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
DRWM DRILLING WATER SOURCE  
FLPL FLOODPLAIN  
LYSM LYSIMETER  
SPRG SPRING  
WELD DRY WELL, OLD FASHION TYPE WELL  
WELL COMPLETED WELL

## FILENAME: CPC (PROCESS CONTROL)

CLGN CALGON PROCESS  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
ERDL ERDLATOR

## FILENAME: CPT OR RPT (PLANT TISSUE)

CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
LAKE LAKE  
PLUG SHOVEL SAMPLE  
POND POND  
SURF SURFACES IN GENERAL

## FILENAME: CSE OR RSE (SEDIMENT)

BASN BASIN  
BAYU BAYOU  
BORE BORE HOLE  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
CREK CREEK  
DTCH DITCH OR DRAINAGE  
FLPL FLOODPLAIN  
IWTP INDUSTRIAL WASTE TREATMENT PLANT  
LAFL LANDFILL  
LAGO LAGOON  
LAKE LAKE  
MAHO MANHOLE  
PLUG SHOVEL SAMPLE  
POND POND  
PRSW PROCESS SEWER  
RSVR RESERVOIR  
RVER RIVER  
SKHL SINK HOLE  
SPRG SPRING  
STP SANITARY TREATMENT PLANT

\*\*\*\* SITE TYPE \*\*\*\*

STRM STREAM  
SURF SURFACES IN GENERAL  
SWER SEWER  
WELD DRY WELL, OLD FASHION TYPE WELL

FILENAME: CSO OR RSO (SOIL)  
AREA AREA OF LAND  
BORE BORE HOLE  
BASN BASIN  
BLDG BUILDING  
BUGR BURNING GROUND  
CD CONIFEROUS-DECIDUOUS WOODLAND  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
COMP COMPOSITE SOIL SAMPLE TAKEN WITHIN 100M DIAMETER  
CREK CREEK  
CSDT CHEMICAL SLUDGE DISPOSAL TRENCHES  
DEMO DEMOLITION AREA  
DTCH DITCH OR DRAINAGE  
DW DECIDUOUS WOODLAND  
FELD FIELD  
FLPL FLOODPLAIN  
LAFL LANDFILL  
LAGO LAGOON  
PIT PIT/TREE SPADE  
PLUG SHOVEL SAMPLE  
OLSP OLD LAGOON SLUDGE PILE

FILENAME: CSE OR RSE (SEDIMENT)  
SKHL SINK HOLE  
SUMP SUMP  
TRST TREE STAND  
WASS SOLID WASTE  
WT WEEDY AREA

FILENAME: CSR OR RSR (SEWER)  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
SWER SEWER  
MAHO MANHOLE  
SASW SANITARY SEWER  
STP SANITARY TREATMENT PLANT

FILENAME: CSW OR RSW (SURFACE WATER)  
BASN BASIN  
BAYU BAYOU  
CMPH COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS  
CREK CREEK  
DAM DAM  
DTCH DITCH OR DRAINAGE

\*\*\*\* SITE TYPE \*\*\*\*

LAFI	LANDFILL
LAGO	LAGOON
LAKE	LAKE
MT	MARSHY AREA
POND	POND
RSVR	RESERVOIR
RVER	RIVER
SKHL	SINK HOLE
SPRG	SPRING
STP	SANITARY TREATMENT PLANT
STRM	STREAM
STSW	STORM SEWER
STWA	STANDING WATER
SUMP	SUMP
SWER	SEWER
TAPW	TAP WATER SOURCE

CHEMICAL OR RADIOLOGICAL FILES - FORMS 30.1 AND 60.1:

FILENAME: CBI OR RBI (BUILDING INTERIOR)

BLDG	BUILDING
BATT	BATTERY
CASE	CASEMATE
CMPH	COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS

CHEMICAL OR RADIOLOGICAL FILES - FORMS 30.2 AND 60.2:

FILENAME: CBX OR RBX (BUILDING EXTERIOR)

BLDG	BUILDING
BATT	BATTERY
CASE	CASEMATE
CMPH	COMPOSITE SAMPLE TAKEN FROM MULTIPLE LOCATIONS