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ALAMEDA POINT
SSIC NO. 5090.3

CLEAN

Contract No. N62474-88-D-5086

Contract Task Order 0107

Navy Engineers-in-Charge: Gary J. Munekawa and George Kikugawa
PRC Project Manager: Duane Balch
Montgomery Watson Project Manager: Kenneth Leung

NAVAL AIR STATION, ALAMEDA
ALAMEDA, CALIFORNIA

SOLID WASTE WATER QUALITY ASSESSMENT TEST (SWAT) AND DATA SUMMARY REPORT FOR RI/FS PHASES 5 AND 6
VOLUME I

FINAL

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April 30, 1993

SOLID WASTE WATER QUALITY ASSESSMENT TEST (SWAT) AND DATA SUMMARY REPORT FOR RI/FS PHASES 5 AND 6 VOLUME I

FINAL

For:

NAVAL AIR STATION, ALAMEDA
ALAMEDA, CALIFORNIA

Contract No. N62474-88-D-5086
Contract Task Order 0107

Prepared for:

Department of the Navy

Prepared by: Scott Weber — Date: 4/30/93

Review and Approvals:

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NAVAL AIR STATION, ALAMEDA
SOLID WASTE WATER QUALITY ASSESSMENT
TEST (SWAT) AND DATA SUMMARY REPORT
FOR RI/FS PHASES 5 AND 6

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FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

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PAGE ES-1
EXECUTIVE SUMMARY

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1.0 INTRODUCTION

1.1 PURPOSE

This report presents the results of a solid waste water quality assessment test (SWAT) investigation performed at two landfill facilities at Naval Air Station (NAS) Alameda, located in Alameda, California. The SWAT investigation was performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62474-88-D-5086, Contract Task Order (CTO) Nos. 0085 and 0107 by Montgomery Watson (MW), previously known as James M. Montgomery, Consulting Engineers, Inc. (JMM) and PRC Environmental Management Inc. (PRC), referred to herein as the PRC team. This study was completed under two CTOs due to incremental funding of Phases 5 and 6. The first portion of the study was covered by CTO No. 0085, which included the drilling of 12 of the boring locations. The second portion of the study was covered by CTO No. 0107, which included the remaining tasks in Phases 5 and 6. This study was undertaken as part of the remedial investigation/feasibility study (RI/FS) investigations in response to a Remedial Action Order (Order) received by the Navy from the California Department of Health Services (DHS), now known as the Department of Toxic Substances Control (DTSC), on June 6, 1988. The June 6, 1988 Order required that the Navy perform a remedial investigation at 20 sites at NAS Alameda, located on the east side of San Francisco Bay (Figure 1-1). The 20 sites identified in the Order are shown on Figure 1-2.

The Navy undertook the RI/FS investigations at the 20 sites using a phased approach as described below. Figure 1-3 presents the current implementation schedule for the phased program.

Phase	Description	Sites Investigated
Phases 1 and 2A	Field investigation and data summary report	Sites 1 (partial), 2 (partial), 3, 4 (partial), 9, 10B, 13, 16, and 19
Phases 2B and 3	Field investigation and data summary report	Sites 4 (partial), 5, 6, 7A, 7B, 8, 10A, 11, 12, 14, and 15
Phase 4	Ecological assessment	Sites 17 and 20
Phases 5 and 6	SWAT investigation	Sites 1 and 2 (1943-1956 Disposal Area and West Beach Landfill)
Phase 7	Comprehensive RI report	All Sites
Phase 8	Feasibility Study report	All Sites

This report focuses on the results of the SWAT investigation (Phases 5 and 6) conducted at the 1943-1956 Disposal Area (Site 1) and West Beach Landfill (Site 2). The quality control summary report (QCSR) related to the SWAT will be a separate document (PRC/MW, 1993). As indicated above, other investigations that are not associated with the SWAT investigation have been conducted for Sites 1 and 2 under Phases 1 and 2A. These investigations were conducted by Canonie Environmental Services Corporation (Canonie). Seven other sites identified in the Order were investigated earlier by Canonie as part of Phases 1 and 2A activities. Results of Phases 1 and 2A work will be included in a future data summary report. Ten of the 20 sites were included in Phases 2B and 3 investigations. A draft-final Data Summary Report for the Phases 2B and 3 was submitted to the Navy in April 1992 (PRC/JMM, 1992). Two offshore areas identified in the Order will be included in a future ecological assessment investigation that is being performed as Phase 4. Phases 7 and 8 will consist of the comprehensive RI/FS reports that are tentatively scheduled to be initiated in late 1992.

The SWAT investigation was performed in accordance with the work plans prepared by Canonie, Volumes 1 through 8 (Canonie 1988 through 1990), and addendum to these plans prepared by the PRC team (PRC/JMM, 1991b). These work plans (PRC/JMM, 1990) and addendum were prepared to comply with the RI/FS guidance developed by the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). This report describes the field work, analytical methods, results, conclusions and recommendations of the investigations for Phases 5 and 6 only.

1.2 OVERALL REMEDIAL INVESTIGATION AND SWAT PROGRAMS

Prior to receipt of the Order, the Navy had begun investigations at NAS Alameda under the Naval Assessment and Control of Installation Pollutants (NACIP) program. Under the NACIP program, an initial assessment study (IAS) was conducted by Ecology & Environment, Inc. (E&E, 1983). A confirmation study (CS) was then performed by Wahler Associates in 1985 at sites identified for further study in the IAS. Results of the CS investigation for Site 1 is summarized in Section 8.0 of this report.

In 1988, the Navy retained Canonie to review the DTSC and EPA comments on the IAS and CS reports, and to develop a work plan to satisfy CERCLA guidance for conducting RI/FS activities. Canonie prepared work plans for the RI/FS work at sites identified for further study in the CS performed by Wahler (1985). The RI/FS work plans, including sampling plans, quality assurance project plan, and a health and safety plan, were approved by the DTSC.

The work plans proposed that a SWAT investigation be conducted at Sites 1 and 2 to evaluate whether the site groundwater has been impacted by chemicals that had been potentially disposed of at the landfills. All landfill owners are required under the provisions of the Calderon Bill (AB 3525), which has been incorporated into the California Water Code (Section 13273), to implement a SWAT program. A SWAT proposal was prepared by Canonie and was presented in Volume 1A of the Canonie RI/FS Sampling Plan (Canonie, 1990d). The proposal was prepared in accordance with the California State Water Resources Control Board document titled "Technical Guidance Manual, Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports" (Appendix A), dated

August 1988, and CERCLA's RI/FS guidances developed by EPA. Prior to the beginning of the SWAT investigation, the PRC team proposed several modifications to the original SWAT proposal. These modifications include changes to the sampling plan and the quality assurance project plan (QAPjP). The addendum to the SWAT proposal was submitted to the Navy for subsequent submittal to the regulatory agencies in April 1991. A summary of the approved addendum to the SWAT proposal is presented in Section 6.0 of this report. The SWAT Guidance Document states several issues that need to be discussed to consider the SWAT report complete. These issues are addressed in Section 10.4.

1.3 NAS ALAMEDA - SITE DESCRIPTION

This section describes the location, physiographic setting/climate, and history of NAS Alameda. Information regarding the regional geology and hydrogeology is presented in Section 2.0 (Regional Conceptual Model) of this report.

1.3.1 Location of NAS Alameda

NAS Alameda lies on the western end of Alameda Island, in Alameda and San Francisco Counties (Figure 1-1). Alameda Island lies along the eastern side of the San Francisco Bay, adjacent to the city of Oakland, and on the western edge of the East Bay Plain. NAS Alameda, rectangular in shape and occupies approximately 2,634 acres. Approximately 1,526 acres of NAS Alameda are above water and 1,108 acres are below water. A brief description of the locations of Sites 1 and 2 and an adjoining area are provided below. Details of the other site information (e.g., history, disposal activities, current use, etc.) for these two sites are summarized in Sections 8.0 and 9.0 of this report.

1.3.1.1 Site 1 - 1943-1956 Disposal Area. The Disposal Area is located in the northwestern corner of NAS Alameda and occupies an area of approximately 120 acres as shown on Figure 1-2. The Disposal Area is surrounded by the Oakland Inner Harbor to the north, the San Francisco Bay to the west, Site 2 to the south, and the Runway Area to the east. The north half of Site 1 is located in Section 32, Township 1 South, Range 4 West, and the southern half is in Section 5, T2S, R4W. The entire 1943-1956 Disposal Area is situated in Alameda County. Site 1 was active from 1943 to 1956.

1.3.1.2 Site 2 - West Beach Landfill. The West Beach Landfill is located at the southwestern corner of the air station, and occupies an area of approximately 110 acres as shown on Figure 1-2. The landfill is surrounded by the San Francisco Bay to the south and west, Site 1 to the north, and the Runway Area to the east. Site 2 is located in Section 5, T2S, R4W. The southwestern portion of Site 2 is situated in San Francisco County, the remainder of the landfill is in Alameda County. Site 2 was active from approximately 1952 to 1978.

1.3.1.3 Runway Area. In this investigation, soil and groundwater samples were also collected from the Runway Area for chemical analyses for estimating background chemical concentrations for Sites 1 and 2. As shown on Figure 1-2, the Runway Area is located immediately east of Sites 1 and 2 and occupies approximately 326 acres. Details of the construction and background regarding the Runway Area are presented in Section 7.0 of this report. The runways are active.

1.3.2 Physiographic Setting/Climate

Alameda Island is located within the San Francisco Bay Basin, which lies within the Coast Range physiographic province of California. The island lies at the foot of a gently westward-sloping plain that extends from the Oakland/Berkeley hills on the east to the shore of the San Francisco Bay on the west. Originally a peninsula, Alameda Island was detached from the mainland in 1876 when a channel was cut linking San Leandro Bay and San Francisco Bay. The channel was later dredged to allow access for commercial ship traffic to and from the island's early industrial sites.

The San Francisco Bay area experiences a maritime climate with mild summer and winter temperatures. Rainfall occurs primarily during the months of October through April. Due to the varied topography of the bay area, climatic conditions vary considerably throughout the region. Eastern Alameda County averages approximately 12 inches per year of rainfall (USGS, 1989; California RWQCB, 1986). NAS Alameda averages approximately 18 inches per year of rainfall (Air Traffic Control NAS Alameda, 1992). The area has been experiencing drought conditions since 1987; thus, precipitation has been below normal levels.

1.3.3 Operational History

Prior to 1930, at least two large industrial sites, a borax processing plant and an oil refinery, were located on the island near what is now the eastern end of NAS Alameda. The refinery was located in what is now considered Site 13 (Figure 1-2). The borax plant was located on what is now the southeastern corner of Atlantic and Eighth Streets (Sanborn, 1897). The 1899 U.S. Geological Survey (USGS) San Francisco Quadrangle (1:62,500) shows the Southern Pacific Railroad (SPRR) narrow-gage spur extending along the southern side of the present Oakland Inner Harbor (Figure 1-4).

The U.S. Army acquired the NAS site from the city of Alameda in 1930 and began construction activities in 1931. In 1936, the U.S. Navy acquired title to the land from the Army and began building the air station in response to the military buildup in Europe prior to World War II. The air station is largely constructed on hydraulic fill material, as discussed in Section 2.1. The Navy constructed NAS Alameda south of the SPRR narrow gage spur which was used as the northern breakwater for the air station. After the U.S. entered into the war in 1941, more land was acquired adjacent to the air station. Following the end of the war, NAS Alameda returned to its original primary mission of providing facilities and support for fleet aviation activities.

Disposal operations began in Site 1 in the early 1940s. The landfill was only used for NAS Alameda and other Naval facilities in the Oakland area, and was not open to the public. Records of the waste materials placed in the landfill were not maintained (Canonie, 1990d). Site 1 was operational until 1956.

Site 2 received almost all of the waste generated by the air station and lesser amounts of waste generated by nearby Navy bases. Other sources of waste were the Oak Knoll Naval Hospital (now Oakland Naval Hospital); Naval Supply Center, Oakland; and Treasure Island. Site 2 was operational from approximately 1952 to March 1978 (Canonie, 1990d). Site 2 went into full operation after Site 1 was closed in 1956.

Currently, the western portion of the air station is primarily developed with runways and support facilities. The western ends of the main runways are on top of the 1943-1956 Disposal Area (Site 1). The southwestern portion of the West Beach Landfill (Site 2) is now a wetland. The eastern portion of the air station is developed with offices, residences, and industrial facilities.

1.4 REPORT ORGANIZATION

This report is organized such that all site-specific information for each site investigated is presented in a single section. Elements common to both sites are discussed in Sections 2.0 through 6.0. Section 10.0 summarizes the results of the SWAT investigation and presents the recommendations.

It should be noted that this report presents only the results of the data collected during the SWAT investigation and the results of a preliminary assessment as to whether chemicals have been released into the groundwater and subsequently migrated off-site. A subsequent RI report will describe chemical fate and transport, provide a risk assessment, and address potential applicable or relevant and appropriate requirements (ARARs).

The report is organized as follows:

- Section 1.0 - Introduction
- Section 2.0 - Regional Conceptual Model
- Section 3.0 - Applicable or Relevant and Appropriate Requirements
- Section 4.0 - Public Health and Environmental Evaluation
- Section 5.0 - Criteria for Preliminary Data Evaluation
- Section 6.0 - Phases 5 and 6 Investigation Description and Methods
- Section 7.0 - Runway Area

- Section 8.0 - Site 1 - 1943-1956 Disposal Area
- Section 9.0 - Site 2 - West Beach Landfill
- Section 10.0 - Conclusions and Recommendations
- Section 11.0 - References
- Section 12.0 - Response to Comments

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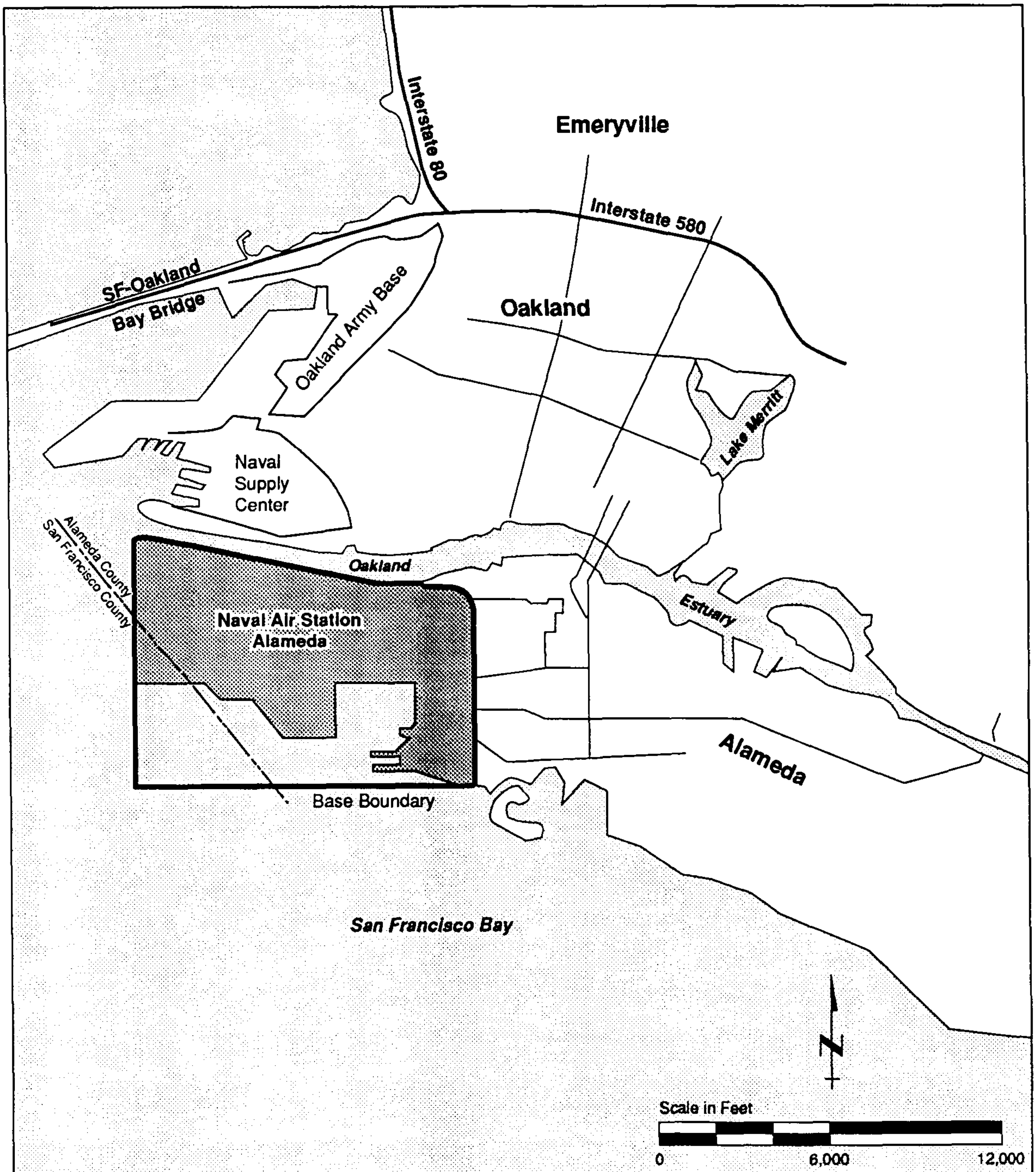
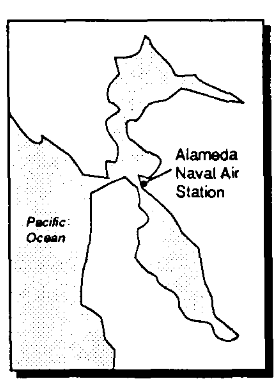
FIGURES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993





A-1

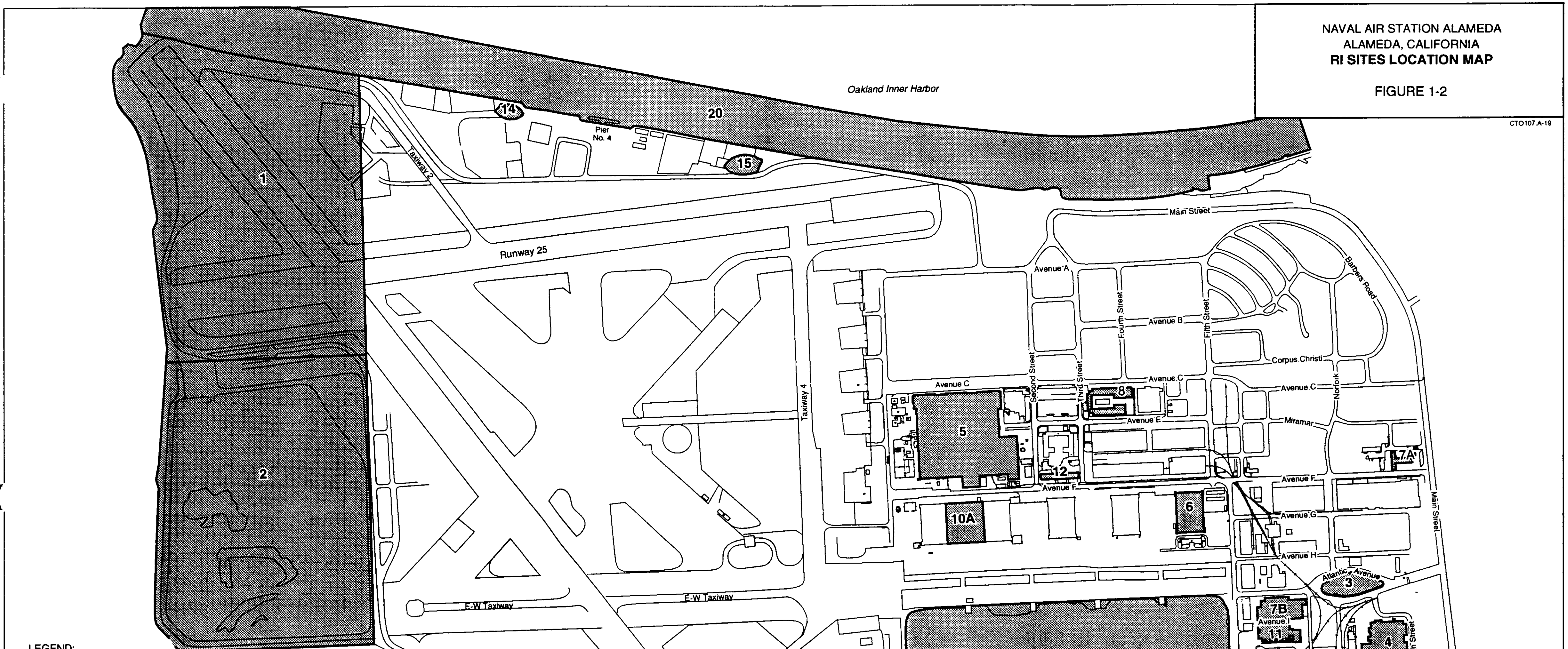
NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA

LOCATION MAP

FIGURE 1-1

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
RI SITES LOCATION MAP

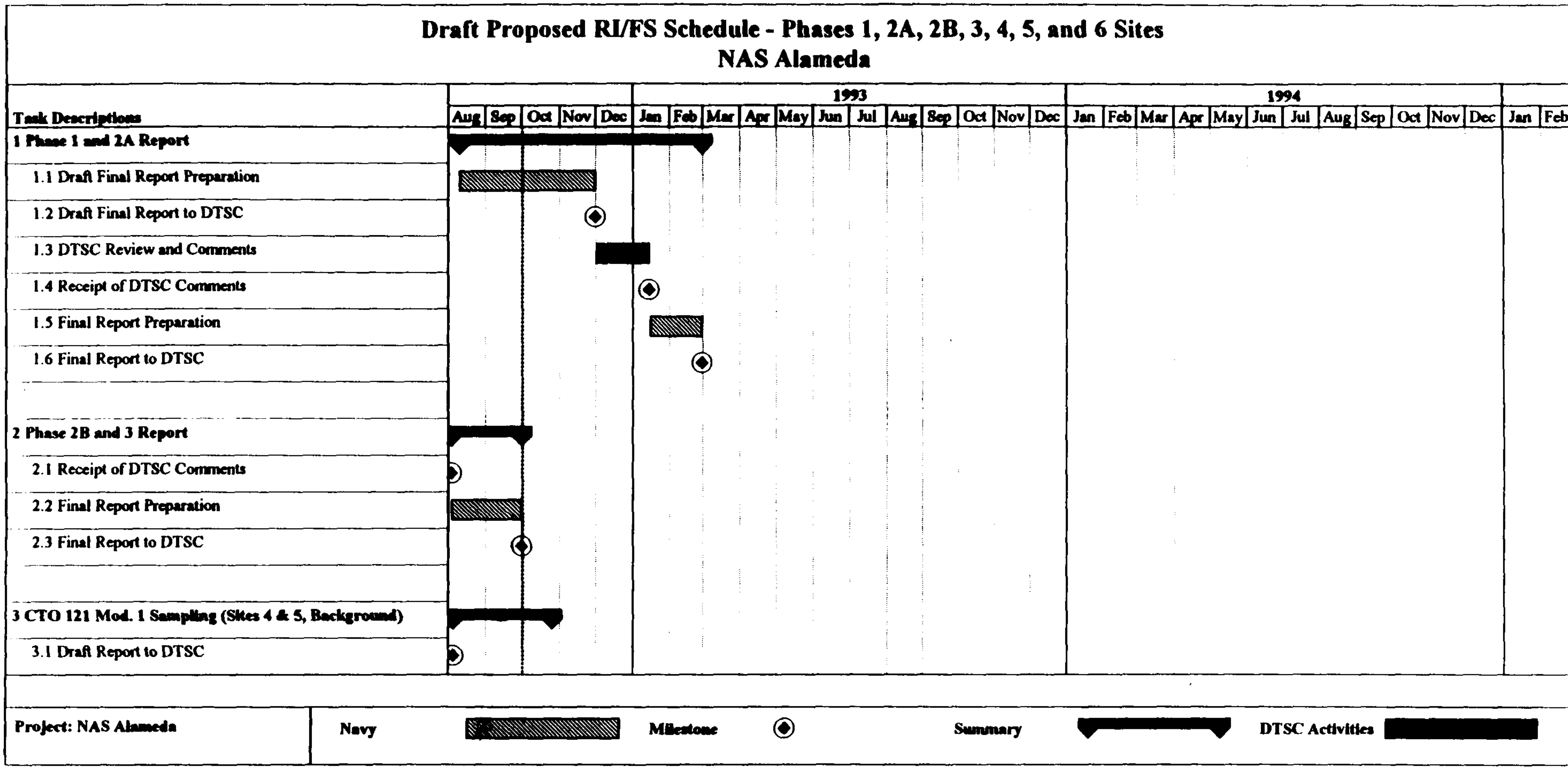
FIGURE 1-2



LEGEND:

SITE NO.	SITE DESCRIPTION
1*	1943-1956 Disposal Site
2*	West Beach Landfill
3	Area 97 (Aviation gasoline tanks)
4	Building 360 (Plating shop, engine cleaning shop, machine shop paint shop, and paint stripping shop)
5	Building 5 (Plating shop, paint stripping shop, cleaning shop, paint shop, selective plating shop, former hazardous waste storage area, battery storage area, and wastewater treatment area)
6	Building 41 (Aircraft intermediate maintenance department)
7	Buildings 459 (7A), 162 (7B), and 547 (7C) (Service stations)
8	Building 114 (Pest control area and separator pit)
9	Building 410 (Paint stripping)
10	Buildings 400 (10A) and 530 (10B) (Missile rework operations)
11	Building 14 (Engine test cell)
12	Building 10 (Power plant)
13	Oil refinery
14	Fire training area
15	Buildings 301 and 389 (Storage area)
16	Cans C-2 area
17	Seaplane Lagoon
18	Station Sewer System (Not on site)
19	Yard D-13 (Hazardous waste solvents)
20	Estuary (Oakland Inner Harbor)

* Phases 5 and 6 Sites



Major Assumptions:

1. Extensive effort is not required to reformat or restructure the Phases 1 and 2A site data base for QA/QC review.
2. It is assumed that DTSC will take between four to six weeks to review and comment on work plans and draft final reports for the sites at NAS Alameda undr CTO Nos. 107 and 121.
3. No additional assessmnet work is required after the submittal of the final report on the ecological assessment (Phase 4). The phase 4 work is anticipated to be awarded by the end of August, 1992. The actual start date of the the Phase 4 work will depend on the award date of the Phase 4 work.
4. Only one additional phase of field work for Phases 1, 2A, 2B, 3, 5, and 6 will be needed for the completion of the RI/FS.
5. Only four quarterly groundwater sampling and analyses are required for the RI/FS. No major aquifer testing is required for the RI/FS.

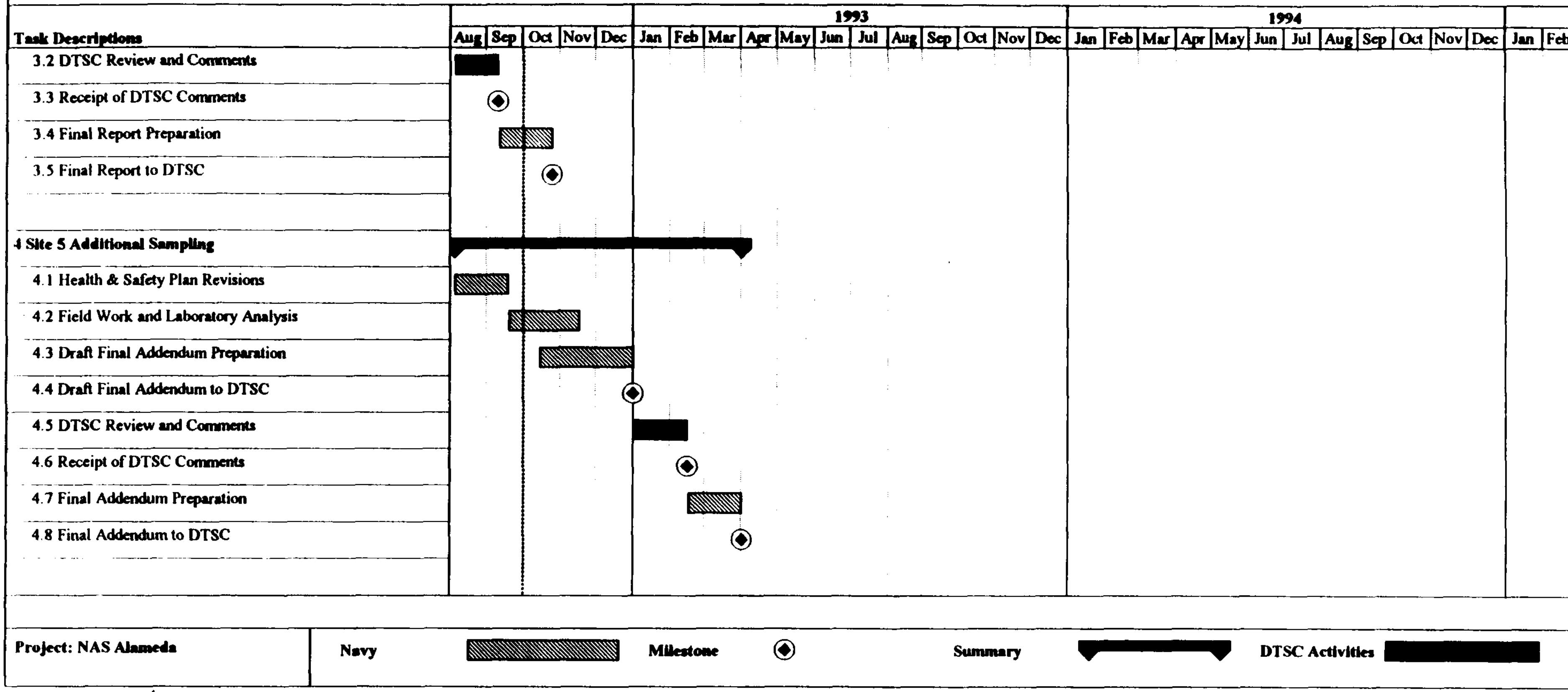
NAVAL AIR STATION ALAMEDA

ALAMEDA, CALIFORNIA

DRAFT PROPOSED SCHEDULE FOR IMPLEMENTATION OF OVERALL RI PROGRAM

FIGURE 1-3

Draft Proposed RI/FS Schedule - Phases 1, 2A, 2B, 3, 4, 5, and 6 Sites
NAS Alameda



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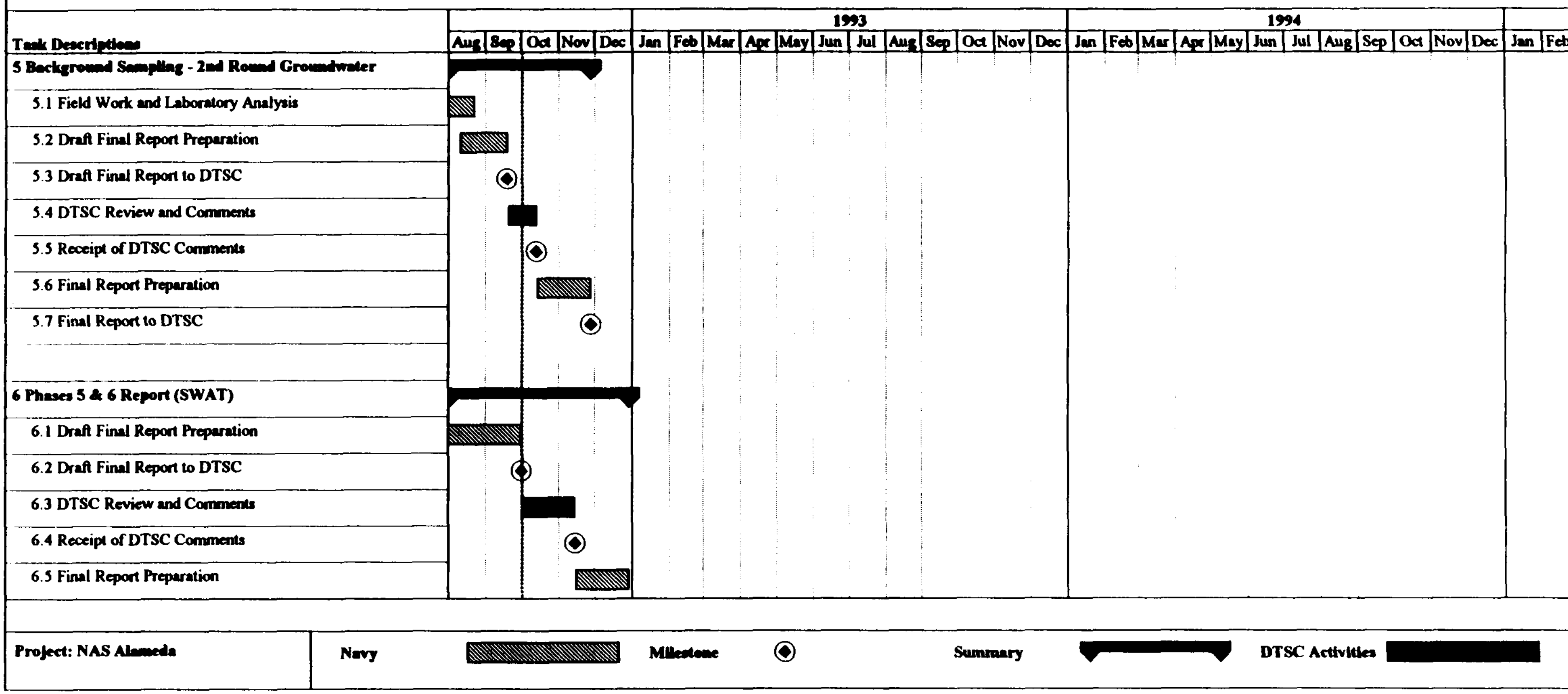
NAVAL AIR STATION ALAMEDA

ALAMEDA, CALIFORNIA

DRAFT PROPOSED SCHEDULE FOR IMPLEMENTATION OF OVERALL RI PROGRAM

FIGURE 1-3

Draft Proposed RI/FS Schedule - Phases 1, 2A, 2B, 3, 4, 5, and 6 Sites
NAS Alameda



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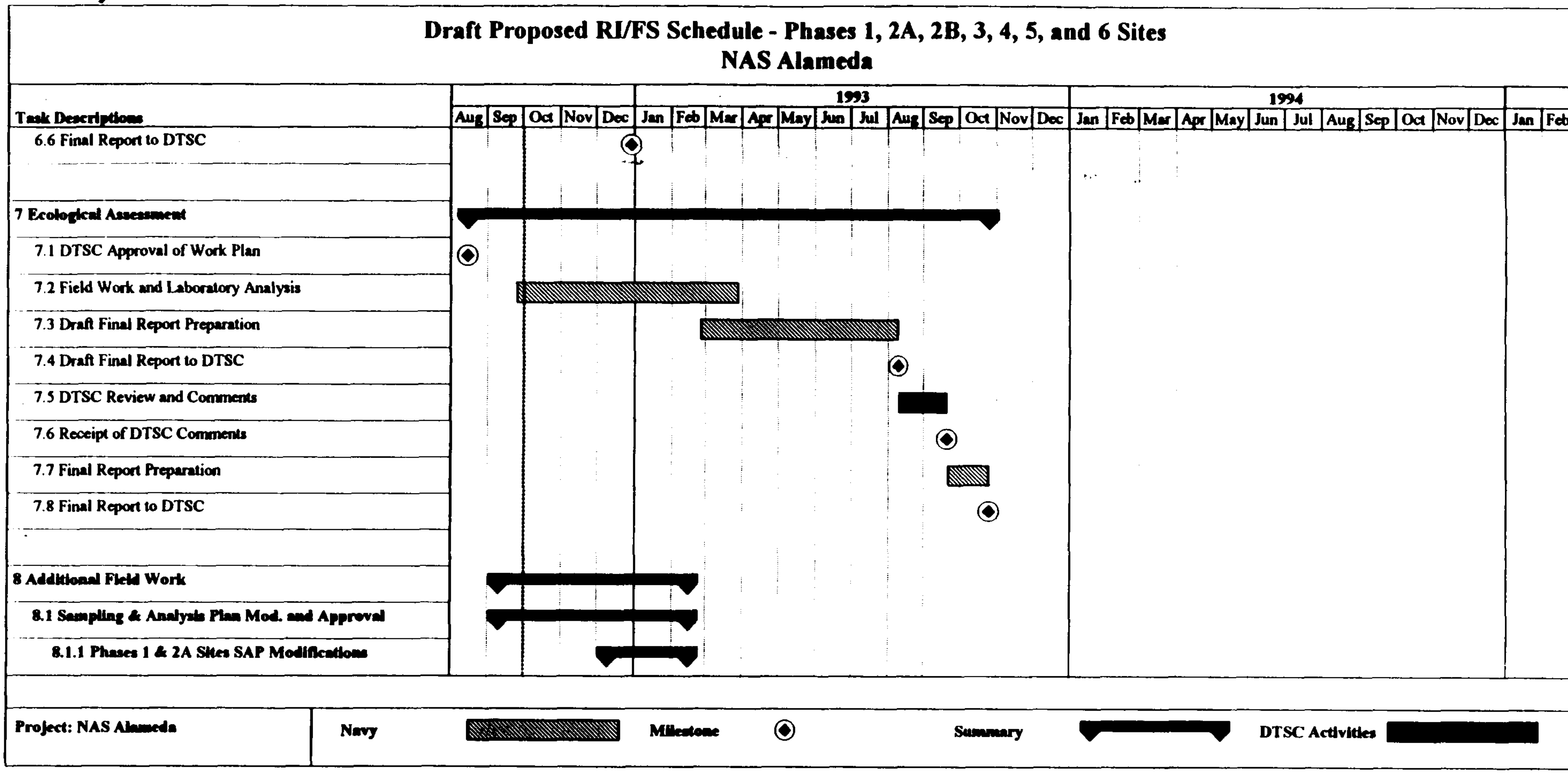
NAVAL AIR STATION ALAMEDA

ALAMEDA, CALIFORNIA

DRAFT PROPOSED SCHEDULE FOR IMPLEMENTATION OF OVERALL RI PROGRAM

FIGURE 1-3



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NAVAL AIR STATION ALAMEDA

ALAMEDA, CALIFORNIA

DRAFT PROPOSED SCHEDULE FOR IMPLEMENTATION OF OVERALL RI PROGRAM

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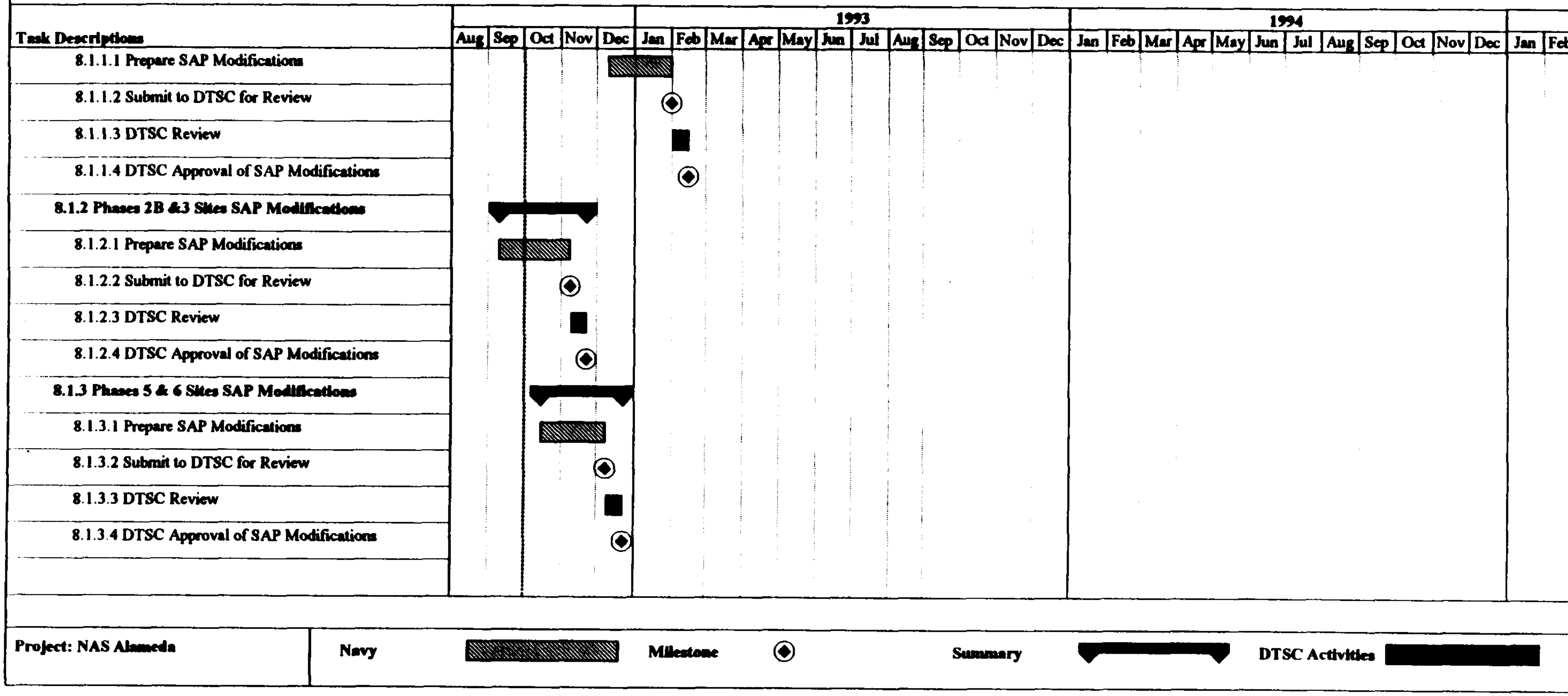
NAS Alameda



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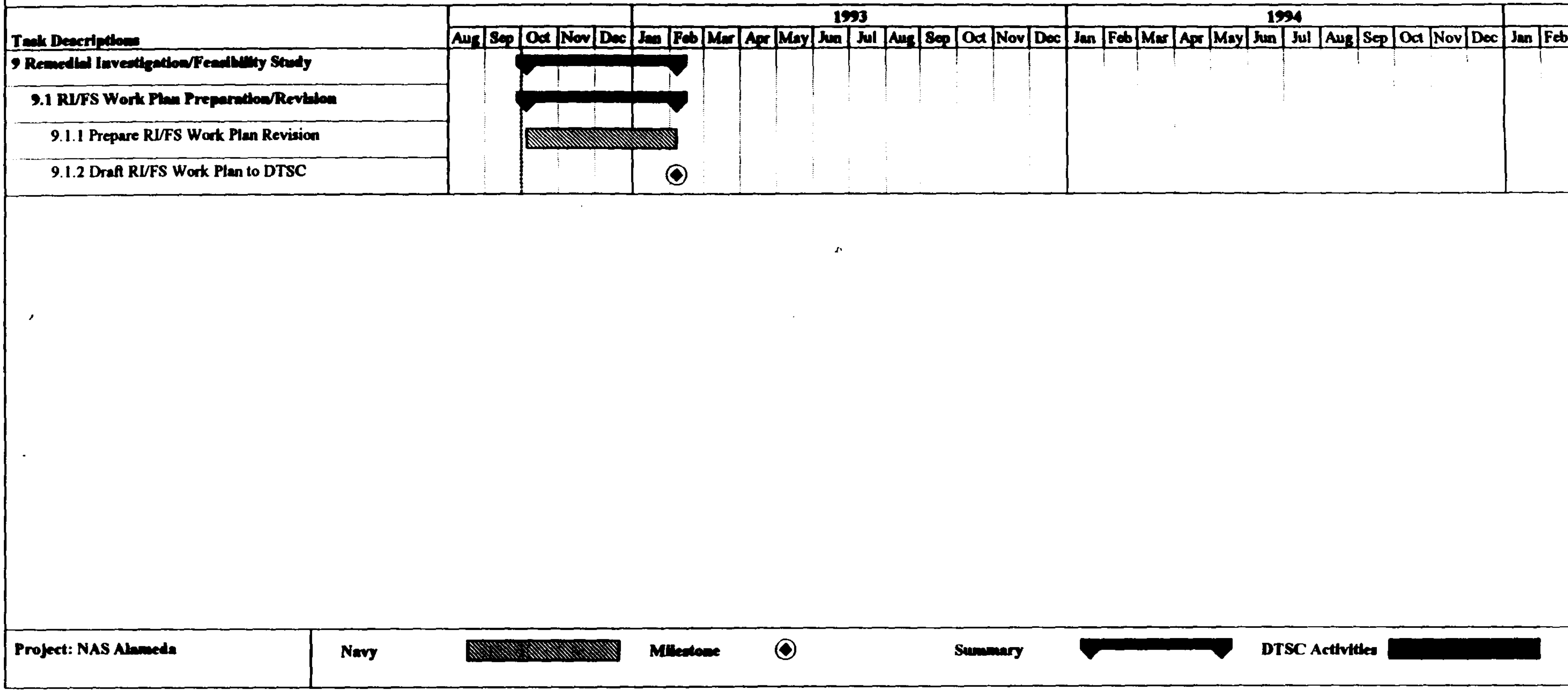

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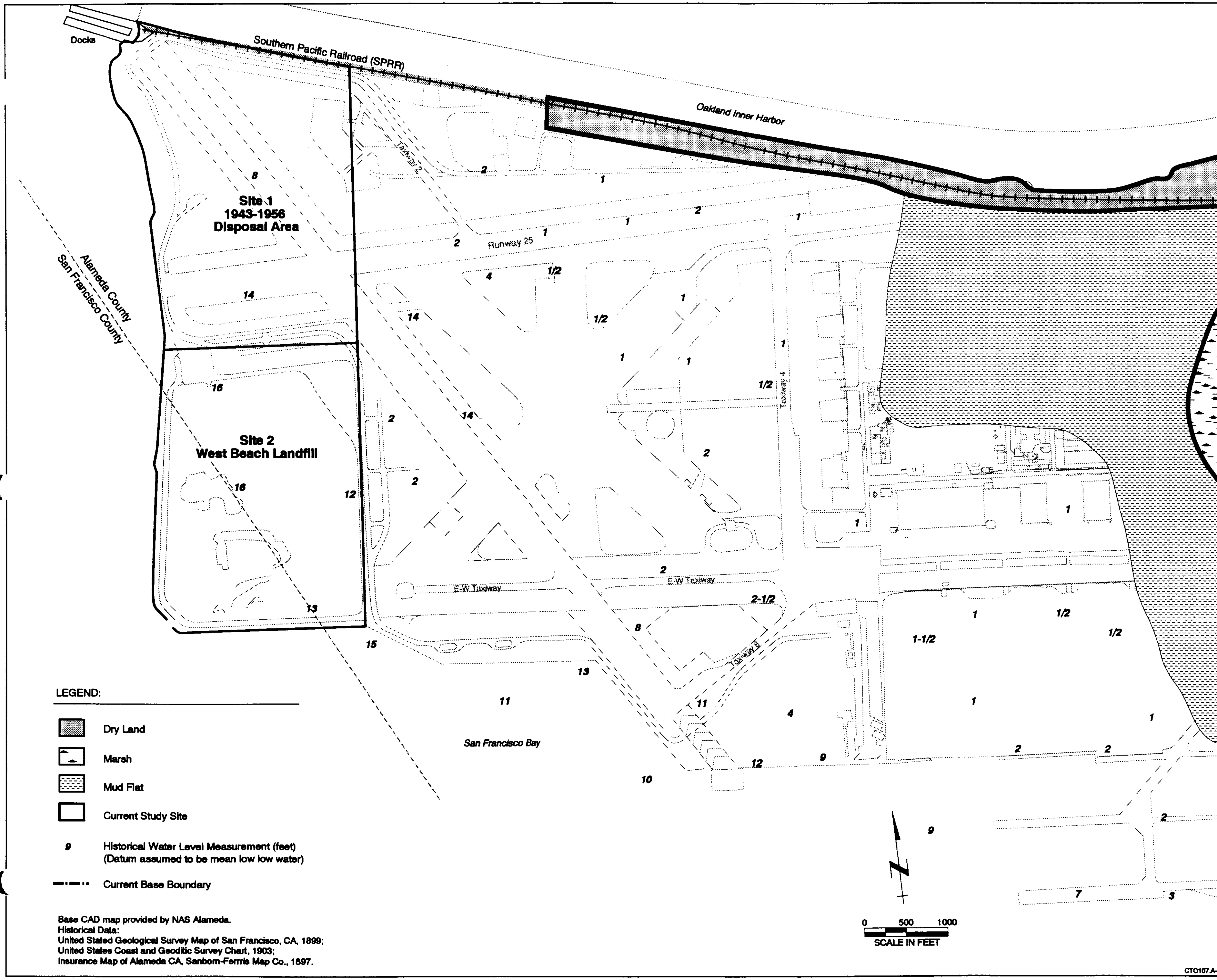
NAVAL AIR STATION ALAMEDA

ALAMEDA, CALIFORNIA

DRAFT PROPOSED SCHEDULE FOR IMPLEMENTATION OF OVERALL RI PROGRAM

FIGURE 1-3



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SHORELINE CIRCA 1900

FIGURE 1-4

CTO107 A-5

2.0 REGIONAL CONCEPTUAL MODEL

This section presents a conceptual model for NAS Alameda that includes an overview of the geology and hydrogeology of the area and a discussion of the occurrence and quality of groundwater. Site-specific geologic information is presented in the individual site sections, along with the results of the investigation for each site.

2.1 REGIONAL GEOLOGY/HYDROGEOLOGY

Alameda Island is underlain by approximately 400 to 500 feet of unconsolidated sediments unconformably overlying consolidated, Jurassic/Cretaceous Franciscan bedrock (Rogers and Figuers, 1991). The unconsolidated units, from oldest to youngest, are Pliocene to late Pleistocene terrestrial and estuarine deposits, late Pleistocene estuarine deposits, late Pleistocene/Holocene alluvial and eolian deposits, and Holocene estuarine deposits (Atwater, Hedel, and Helley, 1977). These units are roughly equivalent to the Alameda, San Antonio, and Posey formations, the Merritt Sand, and the Young Bay Mud described by previous authors (Trask and Rolston, 1951; Radbruch, 1957) (Figure 2-1). The Holocene estuarine deposits are overlain by artificial fill at the NAS Alameda site. Figure 2-1 presents generallized stratigraphic columns for the area with a comparison to stratigraphic nomenclature previously applied to units in the NAS Alameda area. Figure 2-2 shows the well locations at Sites 1, 2, and the Runway Area at NAS Alameda and the cross section lines. Generalized cross sections illustrating the lateral and vertical relationships of the stratigraphic units are presented on Figures 2-3, 2-4, and 2-5.

The Alameda, San Antonio, and Posey formations have been previously referred to collectively as the Old Bay Mud (Treasher, 1963). This terminology implies estuarine (bay) deposition for the entire sequence, although much of which has been terrestrial alluvium (stream) deposits. The term Old Bay Mud is therefore not used in this report. The Holocene estuarine units have been previously identified as Young Bay Mud, and the terminology Holocene Bay Mud Unit has been adopted for this report.

The units of primary concern in this investigation are the late Pleistocene/Holocene deposits, the Holocene Bay Mud Unit, and overlying artificial fill. Descriptions of the entire sequence with the exception of the Jurassic/Cretaceous Franciscan, are presented below, beginning with the oldest (deepest).

<u>Undivided Pliocene/Pleistocene Terrestrial and Estuarine Deposits.</u> Pliocene/Pleistocene deposits immediately overlie Franciscan bedrock in the vicinity of Alameda Island. These Pleistocene deposits are approximately correlative with the Alameda formation of Trask and Rolston (1951) (Figure 2-1). The unit consists of undifferentiated terrestrial and estuarine deposits of early Pleistocene age (Atwater, Hedel, and Helley, 1977). It is the most extensive of all the late Pleistocene-age deposits in the Bay Area. Rogers and Figuers (1991) suggest that the Alameda formation can be divided into two units: the lower continental (terrestrial) unit (300 to 600 feet thick) and an upper marine (esturine) unit (200 to 400 feet thick).

The lower continental unit was deposited as alluvial fans, flood plain deposits, streams, lakes, and swamps. The alluvial fans were shed off the Oakland/Berkeley hills located east of the island. The terrestrial portion consists of channels of sands and gravel, with silt and clay interbeds. The units are discontinuous and correlation of individual beds is difficult.

Between 400,000 and 500,000 years ago the sea entered the bay depression and the depositional environments changed from exclusively continental to interbedded alluvial, brackish-estuarine, and marine (Hall, 1965; Sarna-Wojcicki, 1985; Clifton and Hunter, 1991). The estuarine portion was deposited in a shallow estuary at the site of the present-day San Francisco Bay. The estuarine portion consists of relatively finer-grained material and contains sparse microscopic marine fossils.

The thickness of the early Pleistocene deposits in the vicinity of Alameda Island is not known. However, the Alameda formation has a known maximum thickness of 1,050 feet and is approximately 360 feet thick in the vicinity of NAS Alameda (Radbruch, 1957). This unit was not sampled in the Phases 5 and 6 investigation, and the depth at which it occurs under the sites investigated is unknown.

Late Pleistocene Estuarine Deposits. Estuarine deposits of late Pleistocene age overlie the undivided Pliocene/Pleistocene deposits. These estuarine deposits include most of the San Antonio formation of Trask and Rolston (1951) (Figure 2-1). The estuarine deposits, in the vicinity of NAS Alameda, consist of a dark greenish-gray silty clay. The unit is approximately 36 feet thick under the westernmost portion of Alameda Island (Atwater, Hedel, and Helley, 1977). The unit is considered an aquitard in the NAS Alameda area and is present at a depth of approximately 90 feet under the westernmost portions of NAS Alameda (PRC, 1991).

Late Pleistocene/Holocene Deposits. Alluvial and eolian deposits of late Pleistocene to Holocene age unconformably overlie the late Pleistocene estuarine deposits (Atwater, Hedel, and Helley, 1977). The oldest portions of the alluvial deposits are approximately equivalent to the Posey formation of Trask and Rolston (1951). The younger portions of the alluvial deposits were deposited east of the Alameda area and are not discussed further in this report. The eolian (windblown) deposits are approximately equivalent to the Merritt Sand of Trask and Rolston (1951). These deposits formed as sand dunes when sea level was much lower than at present and the shoreline of the west coast was outside the Golden Gate passage on what is the present continental shelf (Atwater, Hedel, and Helley, 1977).

Eolian deposits in the vicinity of NAS Alameda consist of fine-grained sand to silty sand. Bivalve shells and shell hash were observed in the unit, indicating some marine reworking during the most recent sea level rise. A paleochannel has been previously identified that downcuts into or bisects the eolian deposits in the vicinity of NAS Alameda (Radbruch, 1957; PRC, 1991). The paleochannel trends roughly east-west through the central portion of NAS Alameda.

There are two possible explanations for the paleochannel. The first is that the paleochannel was contemporaneous with the eolian deposits. The late Pleistocene estuarine deposits are overlain by alluvial deposits. The second explanation is a rejuvenated stream system in late Wisconsin time eroded the late Pleistocene deposits and underlying San Antonio formation (Rogers and Figuers, 1991). Thus, the eolian deposits are not present in the central portion of NAS Alameda, and the Holocene Bay Mud Unit directly overlie late Pleistocene estuarine or undivided Pliocene/Pleistocene terrestrial and estuarine deposits. The geologic data collected for this report indicates that a combination of the two theories is actually more correct. Without age dating the sediments, a more accurate picture of the geology is not possible. Stratigraphically, the contact between the two units is difficult to determine in locations where the sandy portion of the Holocene Bay Mud Unit directly overlies the alluvial deposits.

Holocene Bay Mud Unit. The Holocene Bay Mud Unit is the youngest naturally-occurring unit in the vicinity of NAS Alameda. The unit consists of fine-grained sediments deposited in an estuarine environment. The unit is still being deposited in the present-day San Francisco Bay. In the vicinity of NAS Alameda, the Holocene Bay Mud Unit consists of clay to silty clay with silty and clayey sand interbeds. Bivalve shells are present in some portions of the unit. In the eastern portion of the air station, the uppermost portions of the unit contain abundant plant remains. This area of the air station was mapped as tidal flats in an 1856 U.S. Coast and Geodetic Survey (Figure 2-6) (Radbruch, 1957). These tidal flat deposits are interpreted to grade westward into subtidal deposits and both are considered the Holocene Bay Mud Unit in this report.

Artificial Fill. The Holocene Bay Mud Unit is overlain by fill ranging in thickness from 0 to 30 feet over most of NAS Alameda. The fill is thinnest in the 1856 tidal flat area and thickens westward. The fill consists of dredge spoils from the surrounding San Francisco Bay, the Seaplane Lagoon, and the Oakland Channel. The composition of the fill varies, but it is generally silty sand to sand with minor inclusions of clay and/or gravels. The sand fill is similar to the late Pleistocene/Holocene eolian deposits, which in most cases served as a source for the fill where it underlies the surrounding bay.

Little information on the timing or the nature of the fill operations (i.e., hydraulic or other) is available. However, historical aerial photographs indicate that by 1939 portions of the present-day air station located both northeast and northwest of the Seaplane Lagoon are still submerged. The central portion of the air station (north of the Seaplane Lagoon) had been filled by what appears to be hydraulic fill operations. In a February 1939 photo (Pacific Aerial Surveys), the northern half of the airfield appears to be filled. In these photos fill appeared to be placed in east-west linear rows with the intervening swales filled with water. This fill procedure may have produced a systematic variation in grain size of the fill material, with finer-grained material being deposited closer to the water-filled swales and coarser-grained material being deposited closer to the point at which the hydraulic fill pipe discharged. This potential variation in grain size, if present, could affect shallow groundwater flow by creating preferential groundwater flow paths within the coarser-grained material.

2.2 GROUNDWATER OCCURRENCE

For the purposes of this report, the sediments beneath NAS Alameda are subdivided into two aquifers. The shallow or first aquifer consists of two water-bearing zones (Figure 2-7). The first water-bearing zone is in the fill, and the second water-bearing zone is in the late Pleistocene/Holocene deposits. The Alameda County Flood Control and Water Conservation District (ACFCWCD) defines wells that tap the shallow aquifer as those with depths generally not exceeding about 100 feet. The deeper or second aquifer is in the undivided Pliocene/Pleistocene terrestrial deposits (Alameda formation).

The fill comprises the first water-bearing zone underneath the western portion of NAS Alameda. The water-bearing fill underlies most of NAS Alameda, with the exception of the easternmost portion of the air station where the fill is thinnest. In the eastern portion of the air station, the uppermost water-bearing unit includes native sediments of the Holocene Bay Mud Unit (PRC/JMM, 1992).

The late Pleistocene/Holocene alluvial and eolian deposits are locally considered a separate water-bearing zone in the NAS Alameda area. The eolian/alluvial deposits were considered by Canonie to comprise an aquifer separated from the fill by the Holocene Bay Mud Unit (Canonie, 1990d; PRC, 1991). However, the Holocene Bay Mud Unit has been found to be discontinuous in the southwesternmost portion of Site 2 and the eastern portion of Site 1. Thus, in these localized areas the first and second water-bearing zones in the first aquifer are considered in this report to be at least possibly in partial hydraulic connection (PRC, 1991).

The alluvial portion of the underlying undivided Pliocene/Pleistocene deposits (Alameda formation) comprises a deeper, second aquifer. Existing information on the occurrence and quality of groundwater within these aquifers and water-bearing zones is presented below.

2.2.1 Expected Occurrence of Groundwater

Groundwater in coastal areas generally occurs as freshwater in inland areas with a zone of mixing along the coast where the freshwater meets saltwater. At NAS Alameda, freshwater to brackish water was identified in the first water-bearing zone around the two landfills and in the Runway Area (Figures 2-8 and 2-9). The groundwater in the second water-bearing zone is classified as brackish or saline (also see Section 2.3) (Figure 2-10).

Regional groundwater in the East Bay Plain reportedly flows from highlands east of the island westward toward the San Francisco Bay (ACFCWCD, 1988). In a simplistic model for Alameda Island, shallow groundwater would be recharged through unpaved surface areas at NAS Alameda and flow through the subsurface, outward, north, south, and west, toward the boundaries of the air station and island. This simplistic scenario may be complicated by the presence of preferential flow paths, regional gradient, low permeability zones (both vertical and horizontal, such as the Holocene Bay Mud Unit-filled paleochannel), local pumping and tidal influences on the perimeter of the island. A combination of these factors may affect gradients and flow directions.

Natural preferential flow paths exist such as stream channels. Two sources of man-made preferential flow pathways for groundwater are likely to exist at NAS Alameda. The first is hydraulic fill placed on the tidal flats and in shallow portions of the bay in the 1940s to create the island. These methods generally result in some sorting by grain size. Review of historic aerial photos indicates the hydraulic discharge pipes were moved in a series of east-west linear rows. This could result in some degree of preferential flow pathways along the rows.

A second and perhaps more locally significant type of feature that could affect flow pathways are utility trenches that intersect the water table in the first water-bearing zone. These are discussed in Section 2.4. The backfill material may be more permeable than the surrounding soils and could act as a conduit. Tidal action may extend inland and affect water table gradients along trenches and surrounding areas. The possible occurrences of tidal influences on groundwater flow and gradient along utility trenches and along the perimeter of the island were investigated in this report (Section 2.4).

2.2.2 Observed Occurrence of Groundwater

Groundwater in the first water-bearing zone was first encountered at approximately 3 to 5 feet below ground surface throughout most of Sites 1 and 2. Groundwater in the second water-bearing zone is semi-confined; the water level rose to approximately the same level as in the first water-bearing zone.

Groundwater flow in the first water-bearing zone is outward from the Runway Area, to the north, south, and west, with estimated gradients ranging from 0.0006 feet/foot in the vicinity of Site 1 to 0.003 feet/foot in the vicinity of Site 2. Groundwater flow in the second water-bearing zone is also outward from the area around the wells in the Runway Area to the north, south, and west, toward Sites 1 and 2, with estimated gradients ranging from 0.0011 feet/foot to 0.0006 feet/foot. These are slight to low gradients, and groundwater discharge rates from these zones are likely to be low.

A relatively deep utility trench containing a storm sewer exists along the eastern boundary of Site 2, running north to south. The outfall is through the sea wall in the vicinity of well M-015A. The backfill material could be acting as a preferential flow path increasing the tidal effects in the series of wells completed in the first water-bearing zone on the eastern side of Site 2. Results of the tidal investigation are presented in Section 2.4 of this report.

The wells designated with an "A" are screened across the water table of the first water-bearing zone in the saturated fill (Figure 2-7). This was done to accommodate for seasonal variations in the water table. The wells designated with an "E" were installed on the western perimeter of Sites 1 and 2, adjacent to San Francisco Bay. These wells are screened at the base of the first water-bearing zone and above the Holocene Bay Mud Unit. The wells designated with a "B" are screened in the second water-bearing zone in the late Pleistocene and Holocene alluvial/eolian deposits, below the Holocene Bay Mud Unit. Finally, the wells designated with a "C" are screened at the base of the Pleistocene alluvial/eolian deposits above the late Pleistocene estuarine deposits (San Antonio formation equivalent). Many of the wells around Sites 1, 2, and the Runway Area were drilled as clusters. Some "A" wells were drilled alone but all "B," "C," and "E" wells have at least an "A" well associated with them.

2.3 GROUNDWATER QUALITY

Groundwater can be classified as fresh, brackish, or saline based on total dissolved solids (TDS) and/or specific conductivity values (Table 2-1). Analytical results for either one or both of these parameters are available for groundwater in all wells installed in the Phases 5 and 6 investigation. While no samples were collected from the deeper or second aquifer in this investigation, historical information on water quality is available for wells installed in this aquifer. Descriptions of water quality in both the shallow or first aquifer and deep or second aquifer in the NAS Alameda area are presented below.

2.3.1 First Aquifer

Water quality problems have been identified in wells that tap the first aquifer in the Alameda area (wells generally not exceeding about 100 feet) (ACFCWCD, 1988). Water quality problems identified in these wells include high concentrations of nitrates and saltwater intrusion (ACFCWCD, 1988). Nitrate concentrations in excess of public health standards have been identified in wells in the East Bay Plain area for many years (ACFCWCD, 1988). Saltwater intrusion into the late Pleistocene/Holocene eolian deposits has also been identified (ACFCWCD, 1988). The intrusion of saltwater into the late Pleistocene/Holocene deposits is thought to be related to density differences between saltwater and fresh water rather than pumping of groundwater. Moreover, monitoring of water levels in many of the wells installed in the investigation indicate the first and second water-bearing zones are influenced by tidal fluctuations. Therefore, the natural migration of saltwater into the water-bearing zones probably accounts for the elevated TDS concentrations.

The groundwater in the artificial fill (the first water-bearing zone) is classified as fresh to saline based on TDS concentrations ranging from 343 to 31,300 milligrams per liter (mg/L) (SWRCB, 1988a; Freeze and Cherry, 1979; Driscoll, 1987). Figures 2-8 and 2-9 summarize the TDS concentrations in wells installed in the artificial fill at Sites 1, 2, and the Runway Area. Groundwater in the fill at Sites 1 and 2 is influenced by freshwater recharge. There are large unpaved and grassy areas that allow infiltration of precipitation.

The groundwater in the late Pleistocene/Holocene deposits (the second water-bearing zone) is classified as brackish to saline based on TDS concentrations ranging from 3,980 to 29,100 mg/L (SWRCB, 1988a; Freeze and Cherry, 1979; Driscoll, 1987). Figure 2-10 summarizes the TDS concentrations in wells installed in the late Pleistocene/Holocene deposits at Sites 1, 2, and the Runway Area. The groundwater in the late Pleistocene/Holocene deposits may be influenced by direct communication with San Francisco Bay.

2.3.2 Second Aquifer

Groundwater within the gravel and sand beds of the undivided Pliocene/Pleistocene deposits was at one time used for industrial supply wells at NAS Alameda. At least two wells were taken out of service, the Pan American well and the Army well. The Pan American well, one of the industrial supply wells, was taken out of service due to mercury contamination, possibly derived from the Franciscan formation (HSI, 1977). The Pan American well was drilled to a total depth of 447 feet, and was completed in the Alameda formation (perforations at 275 feet to 280 feet, 320 feet to 345 feet, 385 feet to 387 feet, and 439 feet to 444 feet). The concentration of mercury detected in the well was 0.011 mg/L, which exceeds the MCL of 0.002 mg/L (EPA, 1991).

2.4 TIDAL INFLUENCE STUDY

A tidal influence study was conducted during April 1992 at NAS Alameda at Sites 1, 2, and the Runway Area. The purpose of the study was to produce the following information to assess the potential for landfill leachate discharge to the bay:

- An evaluation of the influence of tidal fluctuations in San Francisco Bay on the first and second water-bearing zones.
- Determination of groundwater gradients and flow directions in the two water-bearing zones.

The tidal influence study included monitoring the water levels in 55 wells as follows:

- 39 wells installed in the first water-bearing zone ("A" and "E" wells)
- 16 wells screened in the second water-bearing zone ("B" and "C" wells)

In addition, water levels in the bay were monitored for reference purposes. These water levels were taken at Pier 4 in the Oakland Inner Harbor estuary and at the small craft docks in the Seaplane Lagoon.

Water levels were monitored in all wells during a 4- to 5-day period. At the beginning and at the end of the monitoring period, water levels were measured manually with a weighted tape (to 0.01 feet) in each well to calibrate the equipment and provide reference measurements. During the monitoring period, water level measurements were collected at 15-minute intervals using a pressure transducer connected to an electronic data collection recorder (for this SWAT, Hermit 1000 and 2000 dataloggers were used).

The data collected from each well was reduced to a 72-hour period: from 18:00 hours on April 16, 1992, to 18:00 hours on April 19, 1992. This information was then used for comparisons among well data. The information was plotted on time vs. water level graphs; the plots are included in Appendix J. The water levels in the bay, measured at Pier 4, fluctuated approximately 9 feet, from 7.69 feet above mean low low water (MLLW) at high tide to 1.86 feet below MLLW at low tide, during this 72-hour period.

In general, water levels in the second water-bearing zone wells responded more quickly, but with less amplitude, to tidal influences than did the water levels in the first water-bearing zone (Figure 2-7). The rapid response of the second water-bearing zone to tidal fluctuations is due primarily to the semi-confined nature of the zone. Fluctuations in water levels in monitoring wells in both zones ranged from not-measurable to 7.5 feet and are shown on Figures 2-11 and 2-12;

- Fluctuations of greater than 2 feet were measured in 11 "A" and "E" wells and in 2 "B" and "C" wells;
- Fluctuations of 0.5 to 2 feet were measured in 4 "A" and "E" wells and in 7 "B" and "C" wells;
- Discernible (but less than 6 inches) fluctuations were recorded in 11 "A" and "E" wells and in 5 "B" and "C" wells; and
- Water levels in the remaining 13 "A" wells and 2 "B" wells showed no measurable tidal influence.

A downward vertical head difference between the first and second water-bearing zones was observed at all cluster wells in the Runway Area and along the eastern margin of Site 2, with the exception of well cluster M-010. In wells installed near the western shore, the hydraulic head differences between the first and second water-bearing zones reverse cyclically during each recorded tidal cycle. This oscillation occurs when the water level in the "A" or "E" wells fluctuate with greater magnitude than do the water levels in the "B" and "C" wells. This oscillation was observed at cluster wells M-020, M-021, M-023, M-025, and M-027. Figure 2-13 illustrates how the vertical hydraulic head differences change during the water level fluctuations observed in the cluster M-025.

A comparison of the temporal relationship of the high tide peaks in the bay and in the monitoring wells installed in the two water-bearing zones at the western shore shows that the first water-bearing zone wells lagged in response behind the wells in the second water-bearing zone by up to 2 hours. The water levels in "B" and "C" wells also showed that tidal influences are observed in the second water-bearing zone further inland than in the "A" and "E" wells.

Two potentiometric surface, or water level, contour maps were constructed from data collected during this study and are presented in this section as Figures 2-11 and 2-12 for the "A" wells/first water-bearing zone, and "B" wells/second water-bearing zone, respectively. Elevation datum on these figures is MLLW. Each map shows the estimated water level contours and includes bar graphs to illustrate the amount of tidal fluctuation measured at each well. For graphical clarity, no bar graphs were presented for wells that had water level fluctuations of less than 0.1 feet. The filtered data were prepared according to the filtering method of Serfes (1991). The filtering method consisted of taking 71 hours of consecutive readings and applying three moving averages to the measurements to yield a mean. The final result is the filtered mean, which is equivalent to the 35th hour of sample data.

2.4.1 First Water-Bearing Zone of First Aquifer

A review of graphic plots of the water level data (Appendix J) indicated that the influence of tidal cycles on the first water-bearing zone was felt most strongly in "A" and "E" wells near the western and southern shores of Site 2. Water levels measured in wells M-018E, M-020E, M-021E, and M-023E fluctuated 5.5 feet, 7.5 feet, 6.5 feet, and 6 feet, respectively. "A" and "E" monitoring wells located along the Site 1 western shore were tidally influenced also, but to a lesser degree; the maximum fluctuation recorded in these wells was 3.5 feet in well M-026A.

The "A" wells located along the northern side of Site 1 and the Runway Area, near the estuary, were not measurably influenced by tidal fluctuations, with the exception of well M-003A (0.11 feet). All "A" and "E" monitoring wells installed in the first water-bearing zone along the western edge and the southern edge of the air station were measurably influenced by tidal fluctuations, with the exception of well M-001A, which had no measurable fluctuations. Monitoring well M-001A is installed in the landfill approximately 200 feet from the western shore of Site 1 and may be hydraulically isolated from the bay. Water levels in wells in the Runway Area nearest to the estuary, M-004A, M-005A, and M-006A, indicate that tidal influences in the first water-bearing zone attenuate quickly with increasing distance from the northern shore.

Water level fluctuations in wells installed in the first water-bearing zone near the western and southern shores of Sites 1 and 2 are most likely caused by bay water infiltrating the shallow fill soils at the margins of the air station during the rise of the flood tide and then draining during the drop of water level as the tide ebbs. As water levels rise with the flood tide, the water level in "E" wells (screened in the base of the first water-bearing zone along the western shore of Sites 1 and 2) respond to the inflow of water from the bay before "A" wells (screened in the upper portion of the first water-bearing zone) respond. Heterogeneity and stratification of soils in the first water-bearing zone determine to a large degree the rate in which water levels respond to tidal fluctuations. The time lag between the "A" and "E" wells also suggests poor vertical hydraulic communication within the first water-bearing zone; the horizontal hydraulic conductivities are likely to be much greater than vertical hydraulic conductivities. The varied lithologies (interbedded sands, silty sands, clayey sands, silts, and clays) observed during drilling also suggest poor vertical hydraulic communication.

The water levels in the completely submerged screened interval of the "E" wells respond more quickly to the hydraulic pressure change, caused by the rising tide, than does the water level in the partially submerged screened interval of the "A" wells. The time lag occurs because the water levels in the "A" wells rise only after the voids in the unsaturated soils above the water table are filled by the incoming tide. Conversely, as the water levels drop in the bay during ebb tide, "E" wells again respond before "A" wells do. The water levels in the top portion of the first water-bearing zone decline as water drains under gravity from the soils. This may explain why water levels at many well clusters in "A" wells decline more slowly than do "E" wells. Figure 2-13 illustrates this behavior: the rising slope of the "A" well curve is steeper than the falling slope.

Figure 2-11 presents the water level contours in the first water-bearing zone using the filtered data. Groundwater flow direction in the first water-bearing zone is outward from the area around well M-109A to the north, south, and west, with a range of estimated gradients of 0.0006 feet/foot in Site 1 to 0.003 feet/foot near the eastern boundary of Site 2 and the Runway Area.

With the exception of three of the four "A" wells along the eastern side of Site 2 (M-010A, M-013A, and M-014A) and well M-007A, the water levels in "A" wells installed east of Sites 1 and 2 were not measurably influenced by tidal fluctuations. A storm sewer installed in a trench along the eastern side of Site 2 is in close proximity to the four Site 2 wells. The depth to water in these wells was measured on April 20, 1992 to be between 1.98 and 5.33 feet below surface. Although the water level fluctuations at these wells are 0.1 feet or less, the higher hydraulic conductivity of the backfill material in the utility trench may provide a pathway for tidal fluctuations to influence the four wells.

The water levels in the "A" and "E" wells along the western and southern shore (generally within 30 to 150 feet of the shore) peaked at high tide within 15 minutes to 1 hour after high tide was recorded at Pier 4. High tide in well M-029A, 150 feet from the bay, lagged by approximately 2 hours; and well M-007A, located 1,000 feet south of the estuary, peaked 4 hours after high tide in the estuary. However, well M-010A, located nearly 2,000 feet from the western and southern seawalls, showed high tide peaks about 1 hour after high tide.

2.4.2 Second Water-Bearing Zone of First Aquifer

The "B" and "C" wells installed in the second water-bearing zone respond to tidal fluctuations in the bay more quickly than the "A" and "E" wells. This occurs because the semi-confined second water-bearing zone experiences hydraulic pressure changes rather than the slower infiltration/drain process observed in the first water-bearing zone wells. The water level graph of well cluster M-025, Figure 2-13, illustrates this relationship; M-025C curves align with the Pier 4 curves; however the curves for M-025E and M-025A lag behind both the Pier 4 high tide and low tide points.

The fluctuations measured in the second water-bearing zone were more uniform in range than those measured in the first water-bearing zone; the water levels in all monitored wells located along the western shore fluctuated from 1 to 2 feet during the daily tidal cycle, with one exception, M-001B fluctuated approximately 5 feet. The second water-bearing zone is semi-confined at Sites 1, 2, and the Runway Area. Therefore, the water level response in the semi-confined "B" and "C" wells is caused by pressure changes, from tidal rise and fall, applied to the semi-confined zone. These pressure changes manifest themselves throughout the semi-confined zone much more quickly than do the water level changes in the first water-bearing zone. These responses also imply a hydraulic connection between the bay and the second water-bearing zone. This connection may have been enhanced by exposing the sediments of the second water-bearing zone during the periodic dredging in the estuary and the channel/turning basin, to the piers located on the southern side of the air station.

Figure 2-12 presents the estimated water level contours in the second water-bearing zone for the filtered data. Groundwater flow directions and gradients can be estimated from this figure; the flow direction in the second water-bearing zone appears to flow outward from the area around the wells in the Runway Area (M-103B, M-105B, and M-108B), to the north, south, and west, toward Sites 1 and 2, with an estimated gradient of 0.001 feet/foot.

The continuity and homogeneity of the second water-bearing zone is implied by the small but measurable tidal influence on wells M-108B and M-104C, 1,300 and 2,400 feet from the southern seawall, respectively. Only 3 of the 16 "B" and "C" wells, M-010B, M-012B, and M-103B, installed in this zone did not have measurable tidal influences.

2.5 POTENTIAL USES OF GROUNDWATER

The California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region, has identified the groundwater basin in which Alameda Island lies for potential use as "domestic or municipal supply, industrial process supply, industrial service supply, and agricultural supply" (RWQCB, 1986). However, the RWQCB indicates that "local groundwater quality conditions may vary significantly, due to natural factors, making some groundwater supplies unsuitable for the uses indicated."

Historical data indicate that shallow groundwater in the East Bay Plain area is affected by high nitrate concentrations and saltwater intrusion (ACFCWCD, 1988). Based on TDS and/or specific conductivity (Section 2.3), groundwater within the first and second water-bearing zones of the first aquifer at NAS Alameda is not suitable for use as a drinking water source. TDS values in the first water-bearing zone around Site 1 are variable, ranging from 517 mg/L to 23,800 mg/L. The fresh water lens along the western side of the site is only a few feet thick; in some of the clusters the "A" well is fresh (TDS below 3,000 mg/L) and the "E" well is brackish (TDS between 3,000 mg/L and 10,000 mg/L). TDS values in the first water-bearing zone around Site 2 are variable, ranging from

475 mg/L to 31,300 mg/L. The groundwater is fresh from wells along the eastern boundary of Site 2. The groundwater in the wells on the southern and western sides of Site 2 are saline (TDS values greater than 10,000 mg/L).

The groundwater in the second water-bearing zone around Site 1 is saline (TDS values between 11,900 mg/L to 19,600 mg/L) except for well M-025C which is brackish (TDS value of 3,980 mg/L). The groundwater in the second water-bearing zone is brackish to saline around Site 2. The groundwater is brackish along the western boundary of the site (TDS values between 5,520 mg/L to 9,340 mg/L) and saline along the eastern boundary (TDS values between 26,100 mg/L to 28,200 mg/L).

The deeper or second aquifer (Alameda formation) in the NAS Alameda area is not suitable as a drinking water source due to the presence of mercury (HSI, 1977) possibly derived from the Franciscan formation.

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ALAMEDA POINT
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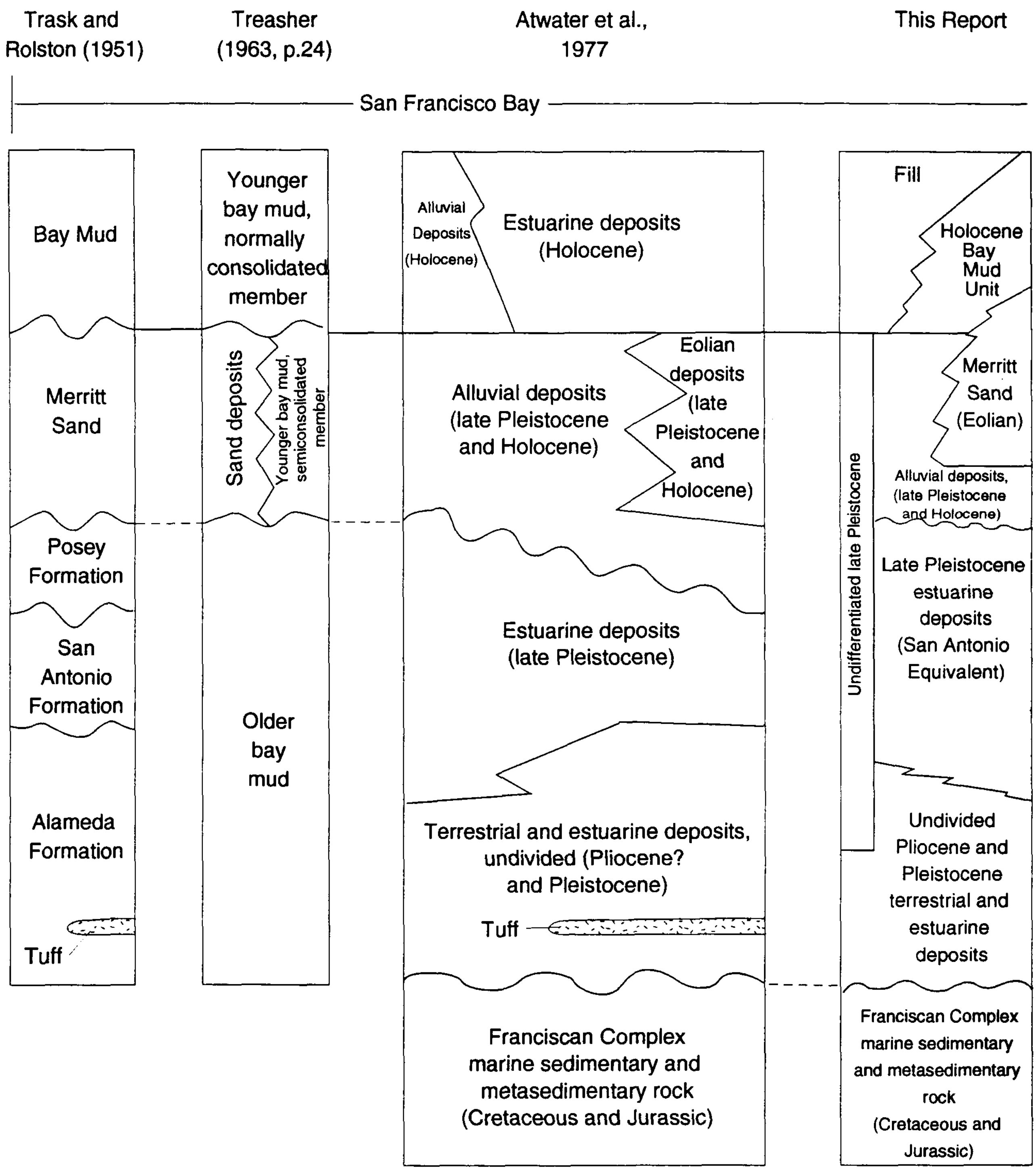
FIGURES

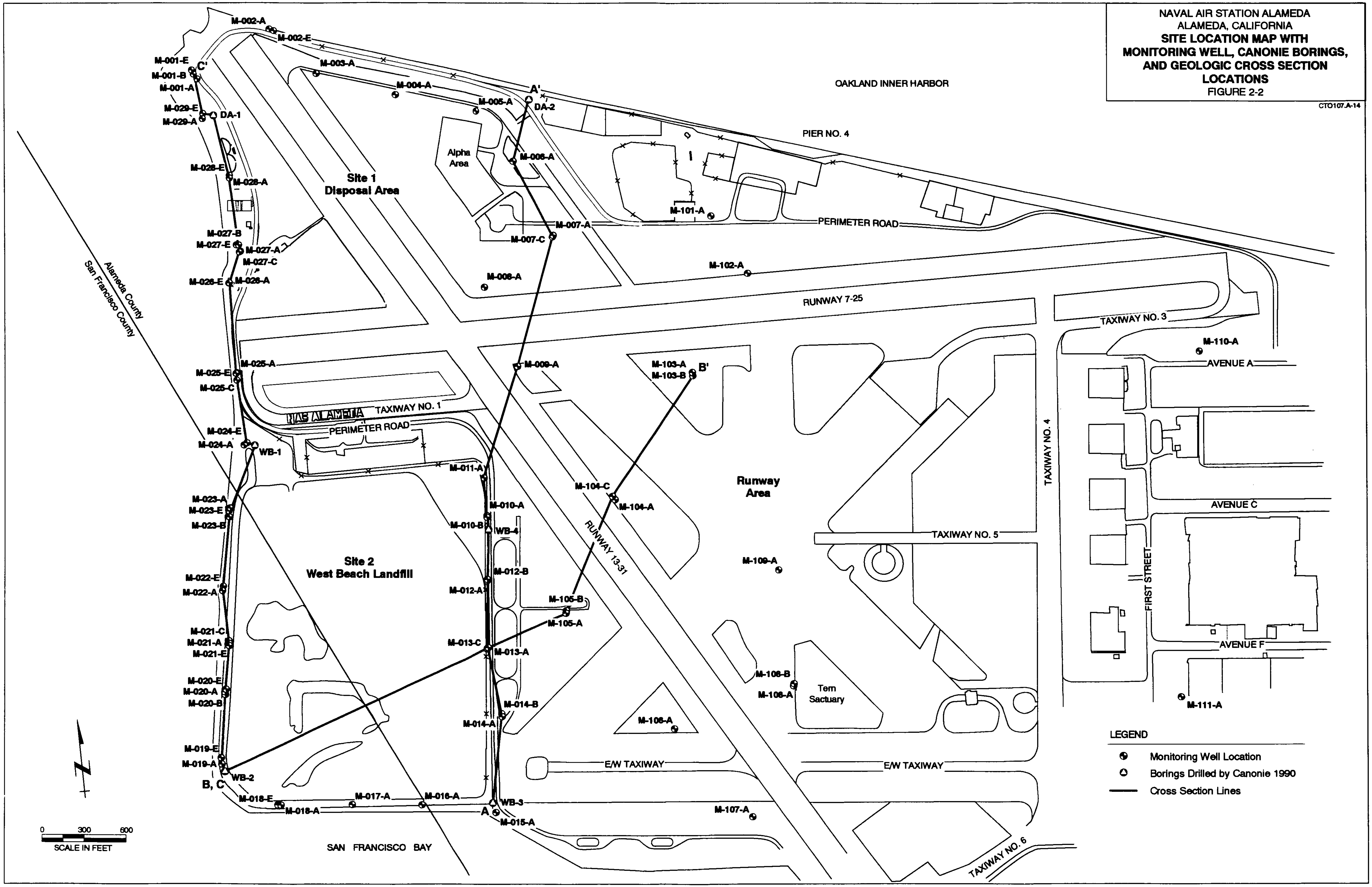
FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

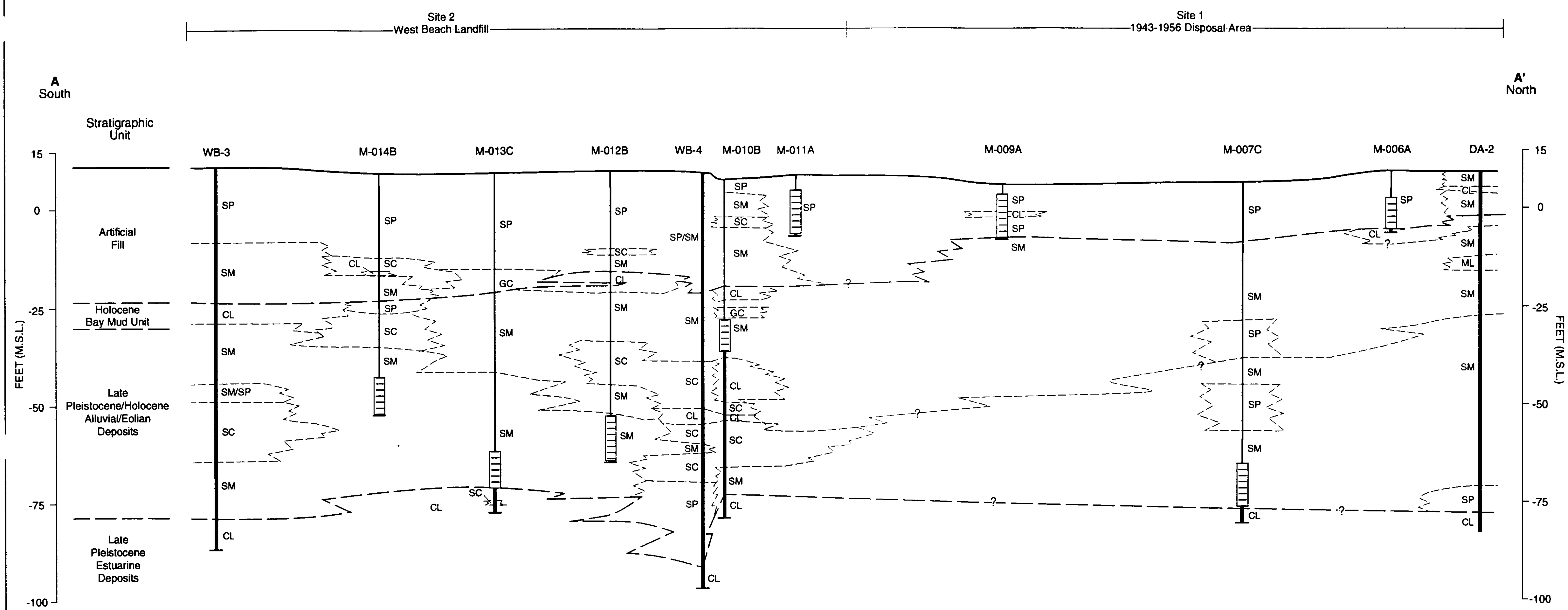


NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
IDEALIZED STRATIGRAPHIC COLUMN FOR ALAMEDA AREA

FIGURE 2-1



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE LOCATION MAP WITH MONITORING WELL, CANONIE BORINGS, AND GEOLOGIC CROSS SECTION LOCATIONS
FIGURE 2-2



LEGEND

Artifical Fill:
The fill material in the vicinity of NAS Alameda consists of silty sand to sand with inclusions of clays and/or gravels. The fill consists of dredge spoils from the surrounding San Francisco Bay, the Seaplane Lagoon, and the Oakland Channel. The fill was hydraulically emplaced.

Contact between Fill and Holocene Bay Mud Unit:
The contact is identified by a lithology change from silty sand to sand to, in certain locations, silty clay to clayey sand with abundant shells or an increased quantity of shell hash material.

Holocene Bay Mud:
The Holocene Bay Mud Unit in the vicinity of NAS Alameda consists of black to gray, clay to silty clay with silty and clayey sand to sands.

Late Pleistocene/Holocene Alluvial/Eolian Deposits:
The eolian deposits in the vicinity of NAS Alameda consist of yellow-brown, fine-grained sand to silty sand. The alluvial deposits in the vicinity of NAS Alameda consist of dark olive gray to gray, silty sand to clayey sand to fine-sand with clay stringers.

Contact between the Late Pleistocene/Holocene Alluvial/Eolian Deposits and Late Pleistocene Estuarine Deposits:
The contact is identified by an unconformity defined by a definite color and lithology change from dark olive gray to gray for the alluvial deposits or yellow-brown silty or clayey sand to sand for the eolian deposits to dark greenish gray to gray, organic silty clay.

Late Pleistocene Estuarine Deposits:
The estuarine deposits in the vicinity of NAS Alameda consist of a dark greenish-gray to gray, very stiff, organic, silty clay.

Monitoring Well/Boring

Screen

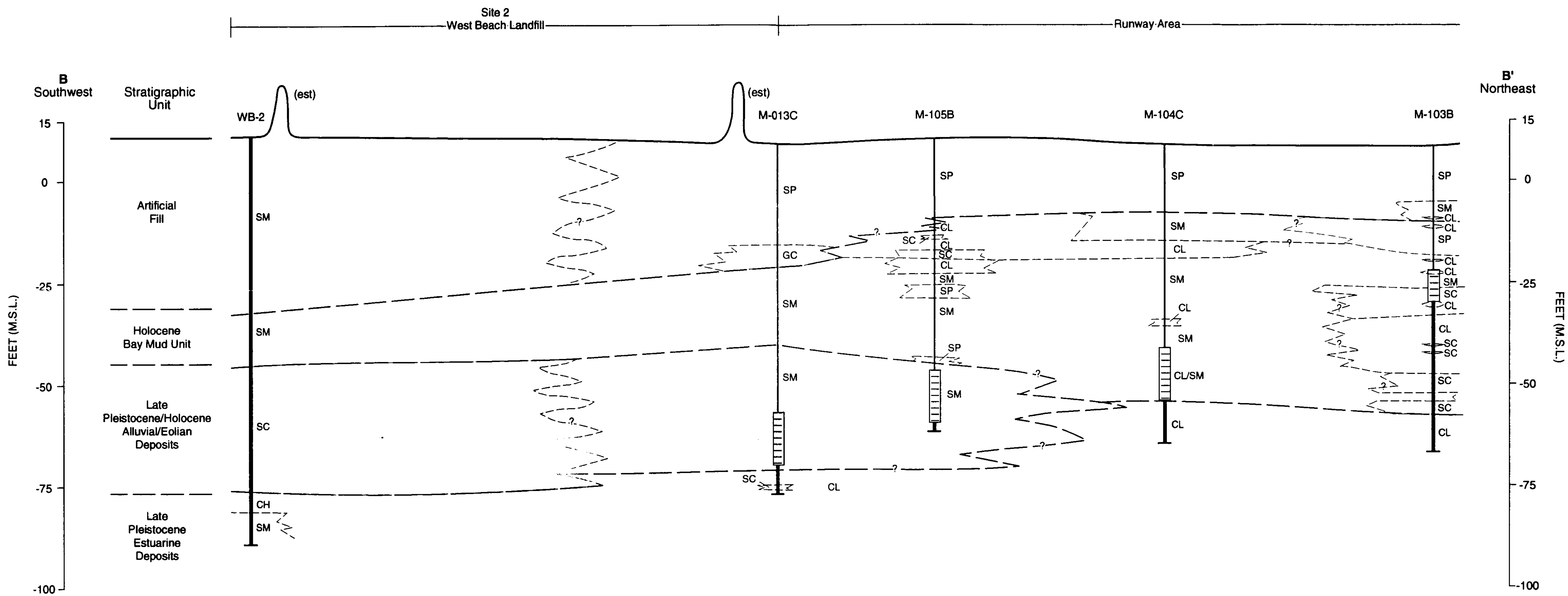
Backfill

For a description of the Unified Soil Classification System Units, see Appendix E of SWAT Report

0 400
SCALE IN FEET
VERTICAL SCALE: 1"=25'

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITES 1 AND 2
GEOLOGIC CROSS SECTION A-A'

FIGURE 2-3



LEGEND

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Monitoring Well/Boring

Screen

Backfill

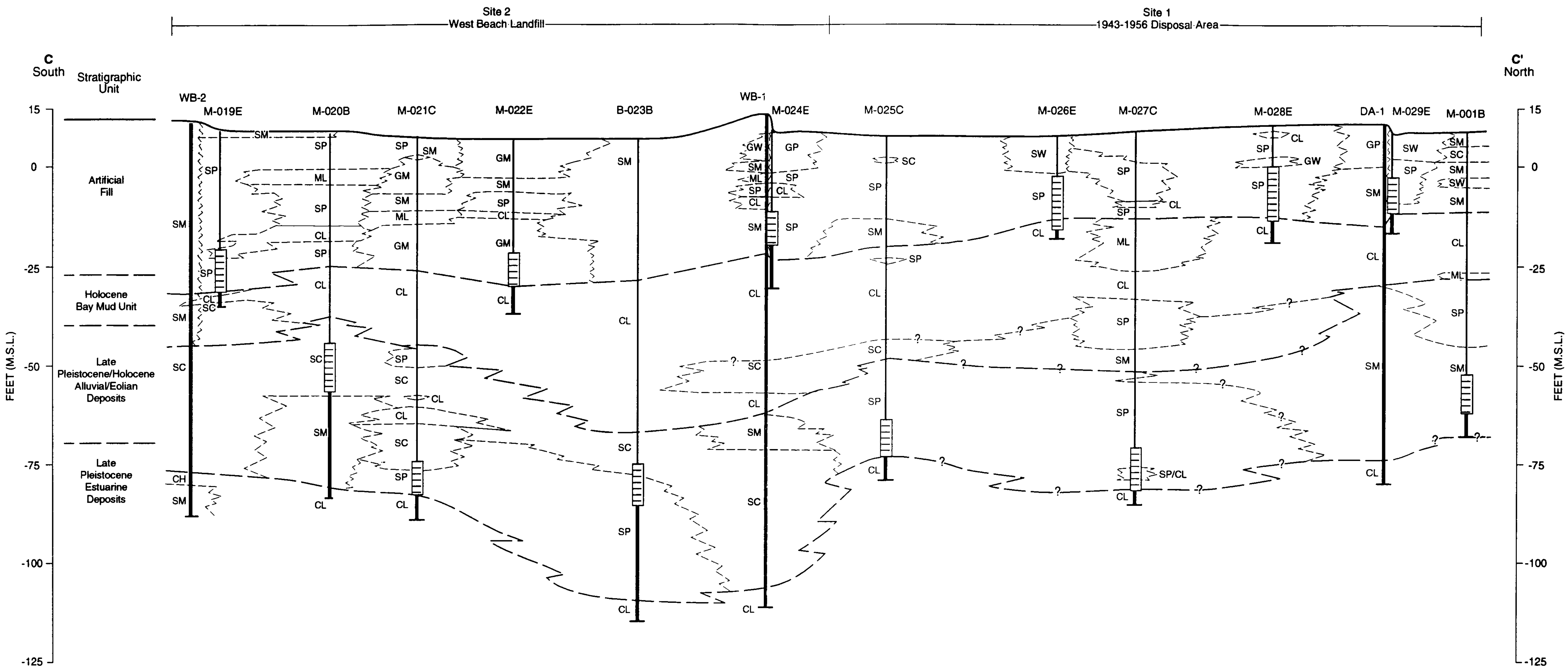
For a description of the Unified Soil Classification System Units, see Appendix E of SWAT Report

0 400
SCALE IN FEET
VERTICAL SCALE: 1"=25'

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITES 1 AND 2 AND THE RUNWAY AREA
GEOLOGIC CROSS SECTION B-B'

FIGURE 2-4

V2.A-16



LEGEND

Artifical Fill:
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Late Pleistocene Estuarine Deposits:
The estuarine deposits in the vicinity of NAS Alameda consist of a dark greenish-gray to gray, very stiff, organic, silty clay.

Monitoring Well/Boring

Screen

Backfill

For a description of the Unified Soil Classification System Units, see Appendix E of SWAT Report

0 400
SCALE IN FEET
VERTICAL SCALE: 1"=25'

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITES 1 AND 2
GEOLOGIC CROSS SECTION C-C'

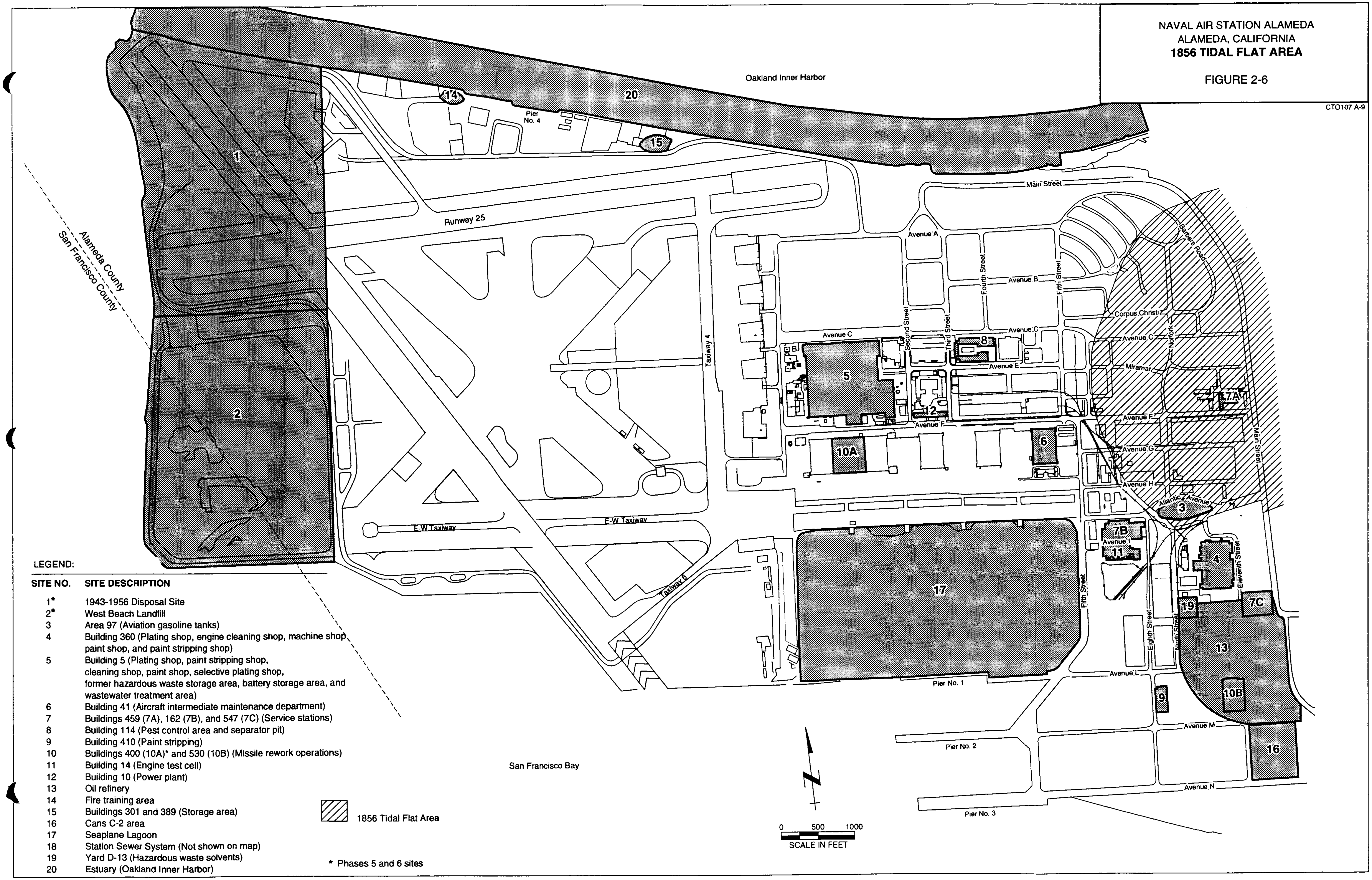
FIGURE 2-5

A-16

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
1856 TIDAL FLAT AREA

FIGURE 2-6

CTO107.A-9

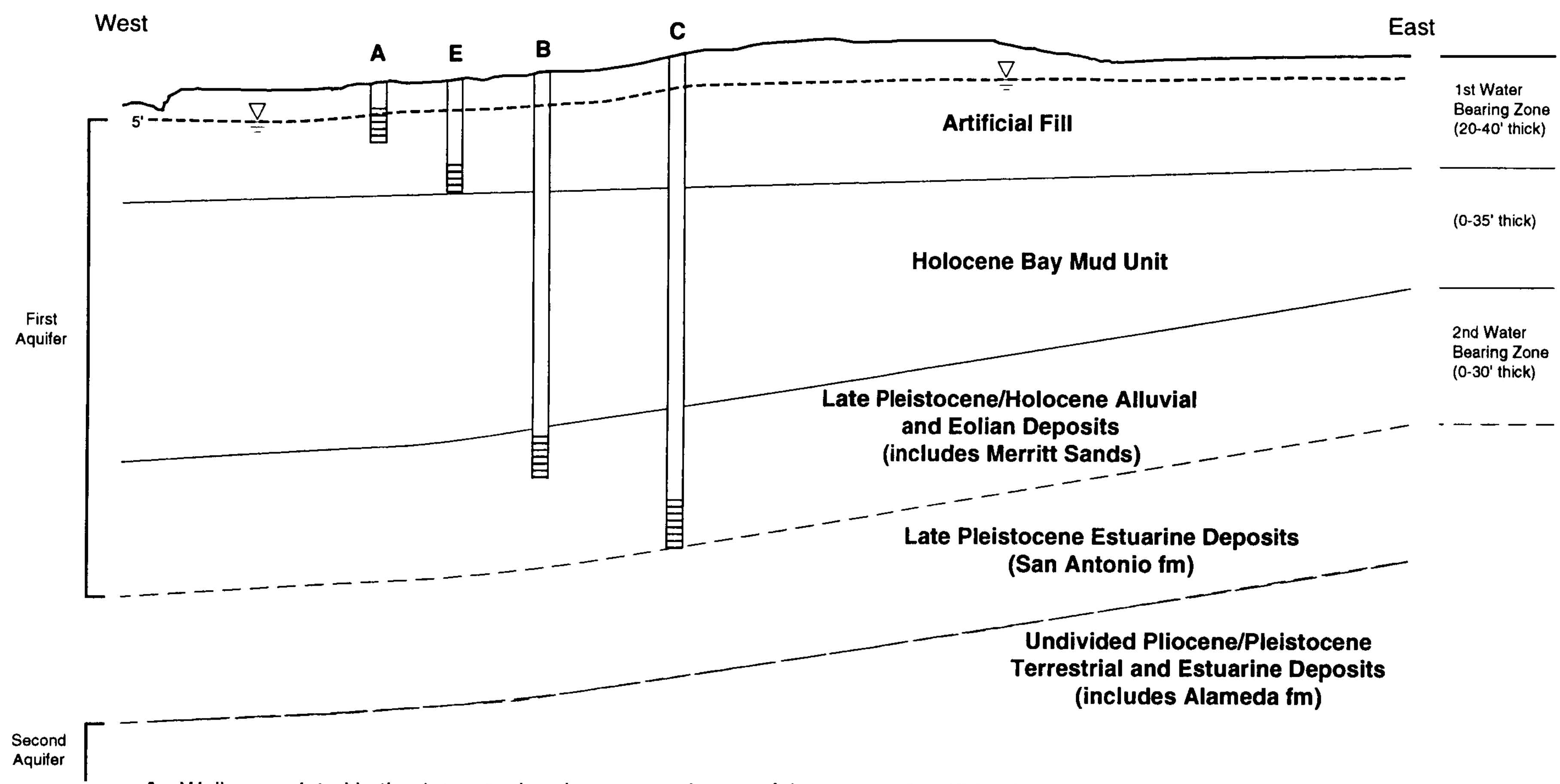


LEGEND:

SITE NO.	SITE DESCRIPTION
1*	1943-1956 Disposal Site
2*	West Beach Landfill
3	Area 97 (Aviation gasoline tanks)
4	Building 360 (Plating shop, engine cleaning shop, machine shop, paint shop, and paint stripping shop)
5	Building 5 (Plating shop, paint stripping shop, cleaning shop, paint shop, selective plating shop, former hazardous waste storage area, battery storage area, and wastewater treatment area)
6	Building 41 (Aircraft intermediate maintenance department)
7	Buildings 459 (7A), 162 (7B), and 547 (7C) (Service stations)
8	Building 114 (Pest control area and separator pit)
9	Building 410 (Paint stripping)
10	Buildings 400 (10A)* and 530 (10B) (Missile rework operations)
11	Building 14 (Engine test cell)
12	Building 10 (Power plant)
13	Oil refinery
14	Fire training area
15	Buildings 301 and 389 (Storage area)
16	Cans C-2 area
17	Seaplane Lagoon
18	Station Sewer System (Not shown on map)
19	Yard D-13 (Hazardous waste solvents)
20	Estuary (Oakland Inner Harbor)

1856 Tidal Flat Area

* Phases 5 and 6 sites



A - Wells completed in the 1st water-bearing zone at the top of the saturated Artificial Fill
E - Wells completed in the 1st water-bearing zone at the base of the Artificial Fill
B - Wells completed in 2nd water-bearing zone at the top of the Late Pleistocene/Holocene Alluvial and Eolian Deposits (beneath the Holocene Bay Mud Unit)
C - Wells completed in the 2nd water bearing zone at the base of the Late Pleistocene/Holocene Alluvial and Eolian Deposits above the Late Pleistocene Estuarine Deposits (San Antonio formation)

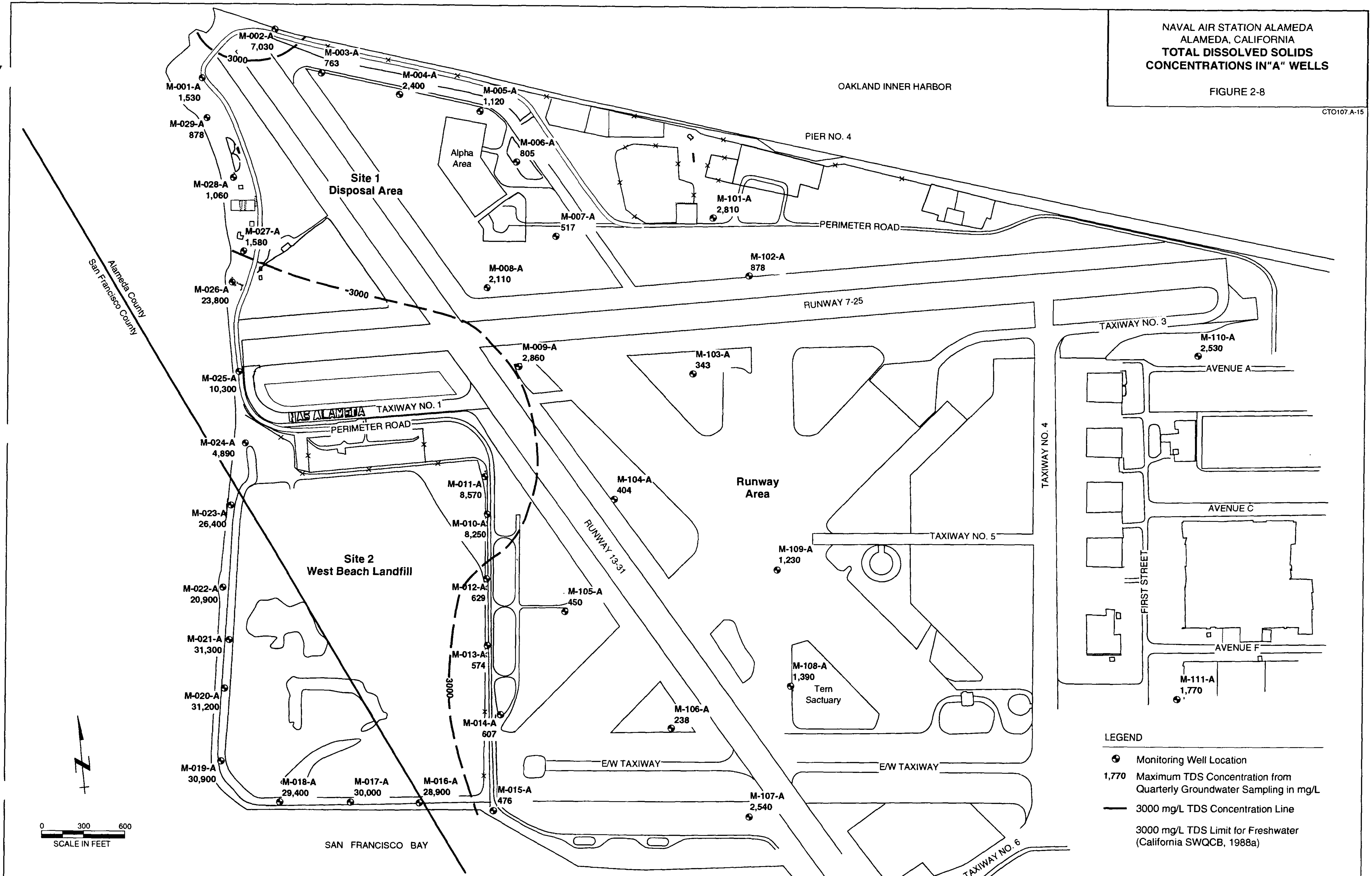
Static Water Level

Not to scale
This is a schematic representation of the stratigraphic units underlying Sites 1, 2, and the Runway Area

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SCHEMATIC DIAGRAM OF WELL TYPE AND PLACEMENT

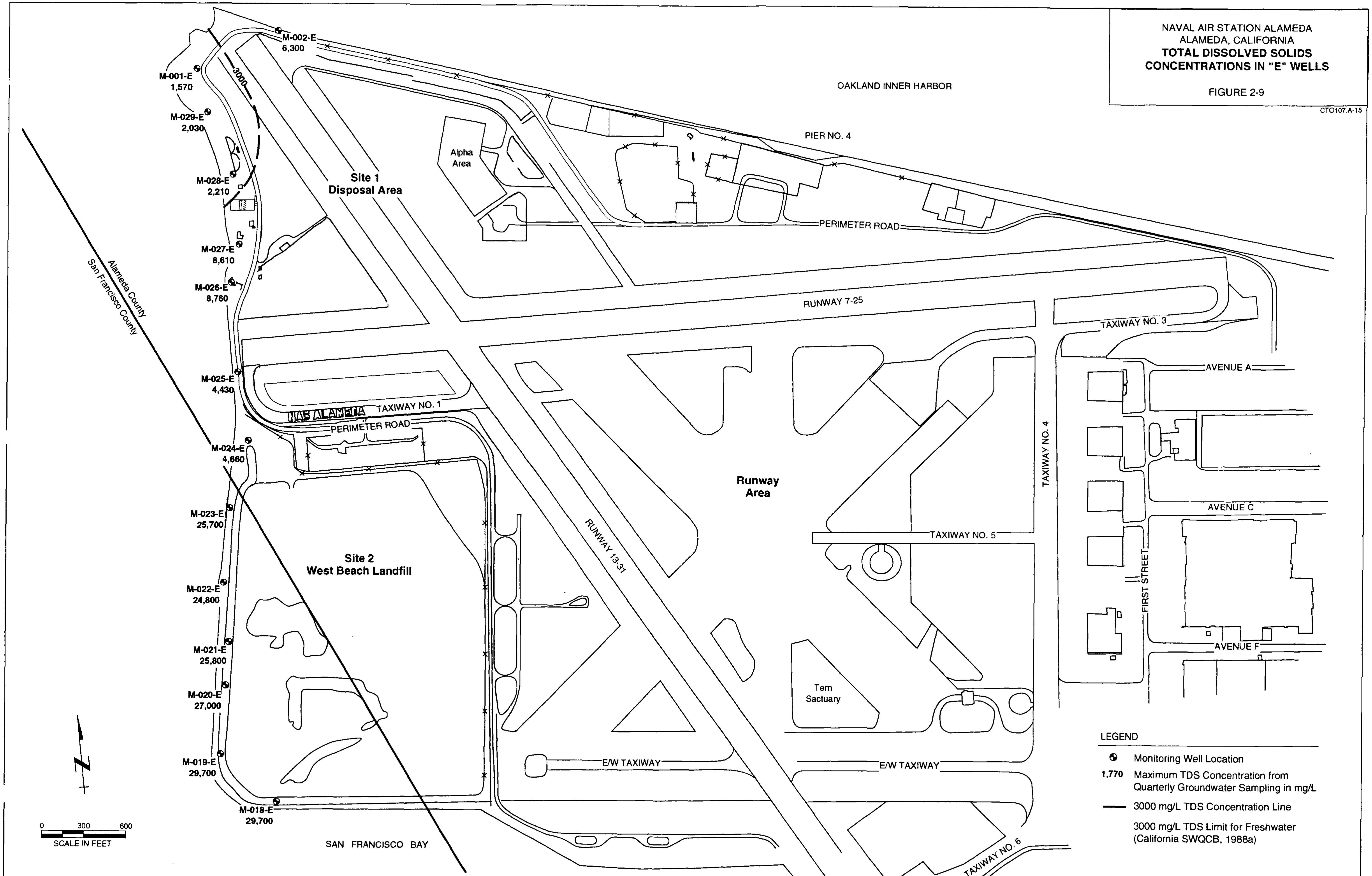
FIGURE 2-7

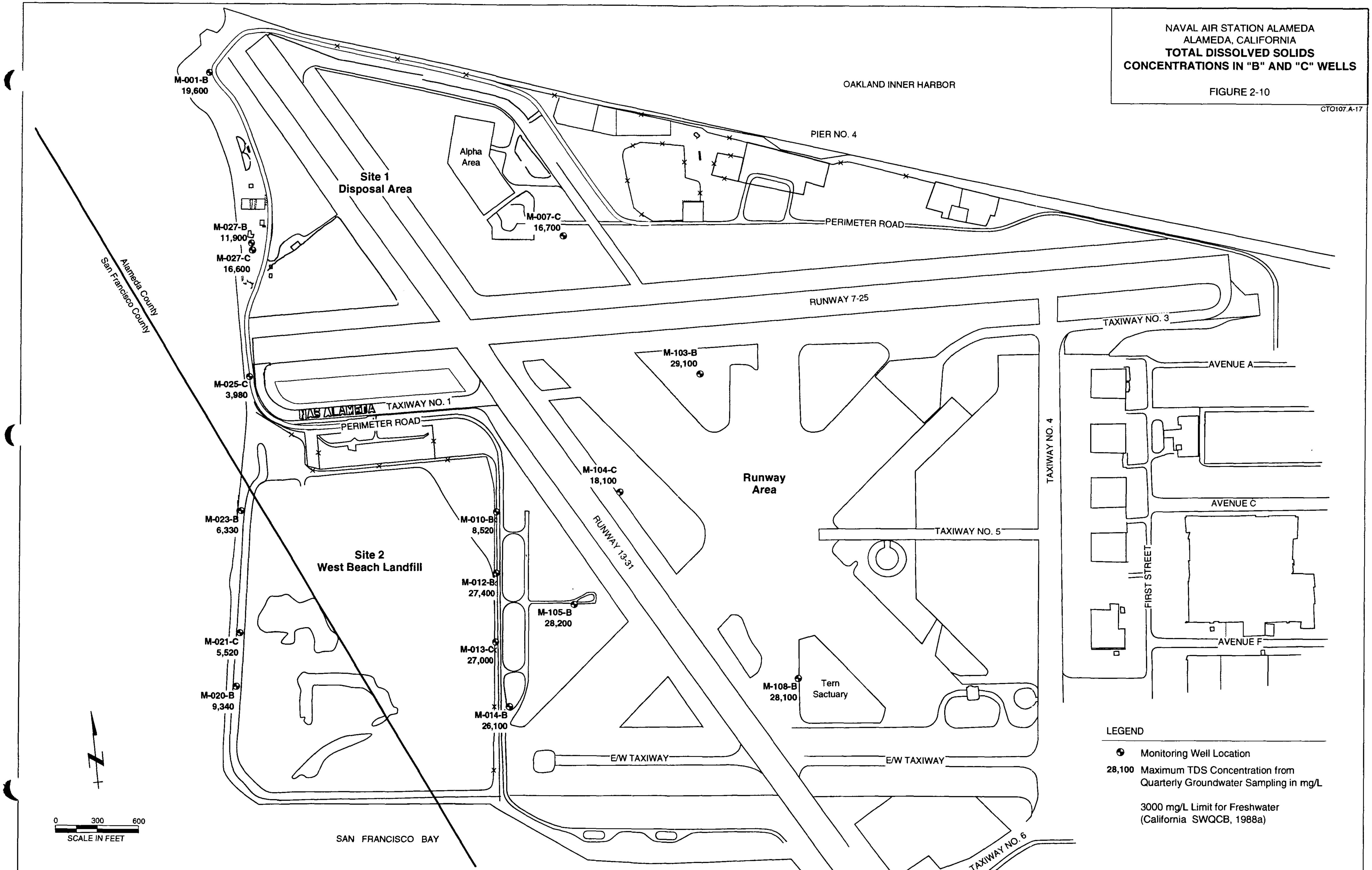
CTO107/A-6



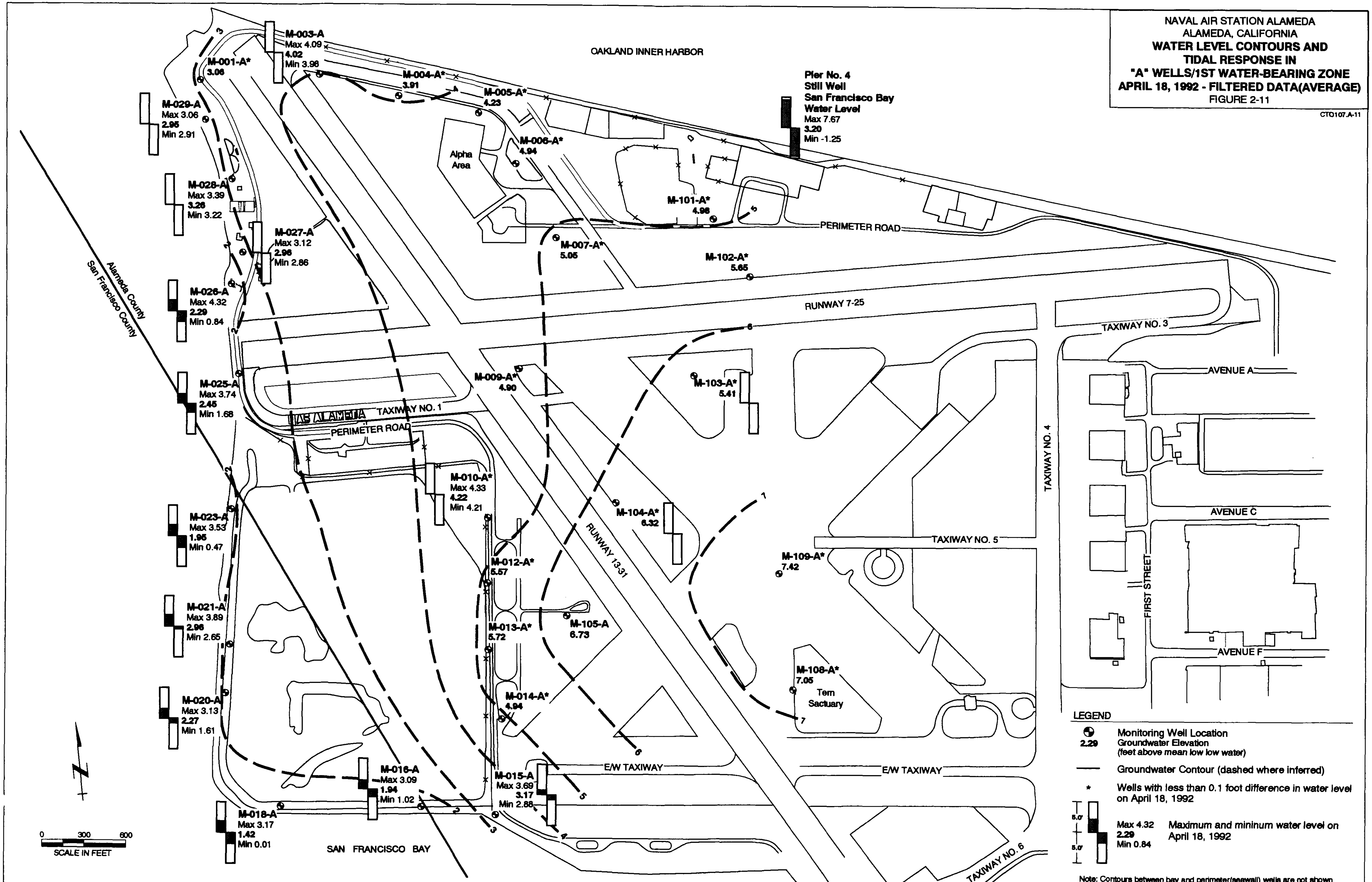
NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
TOTAL DISSOLVED SOLIDS CONCENTRATIONS IN "A" WELLS

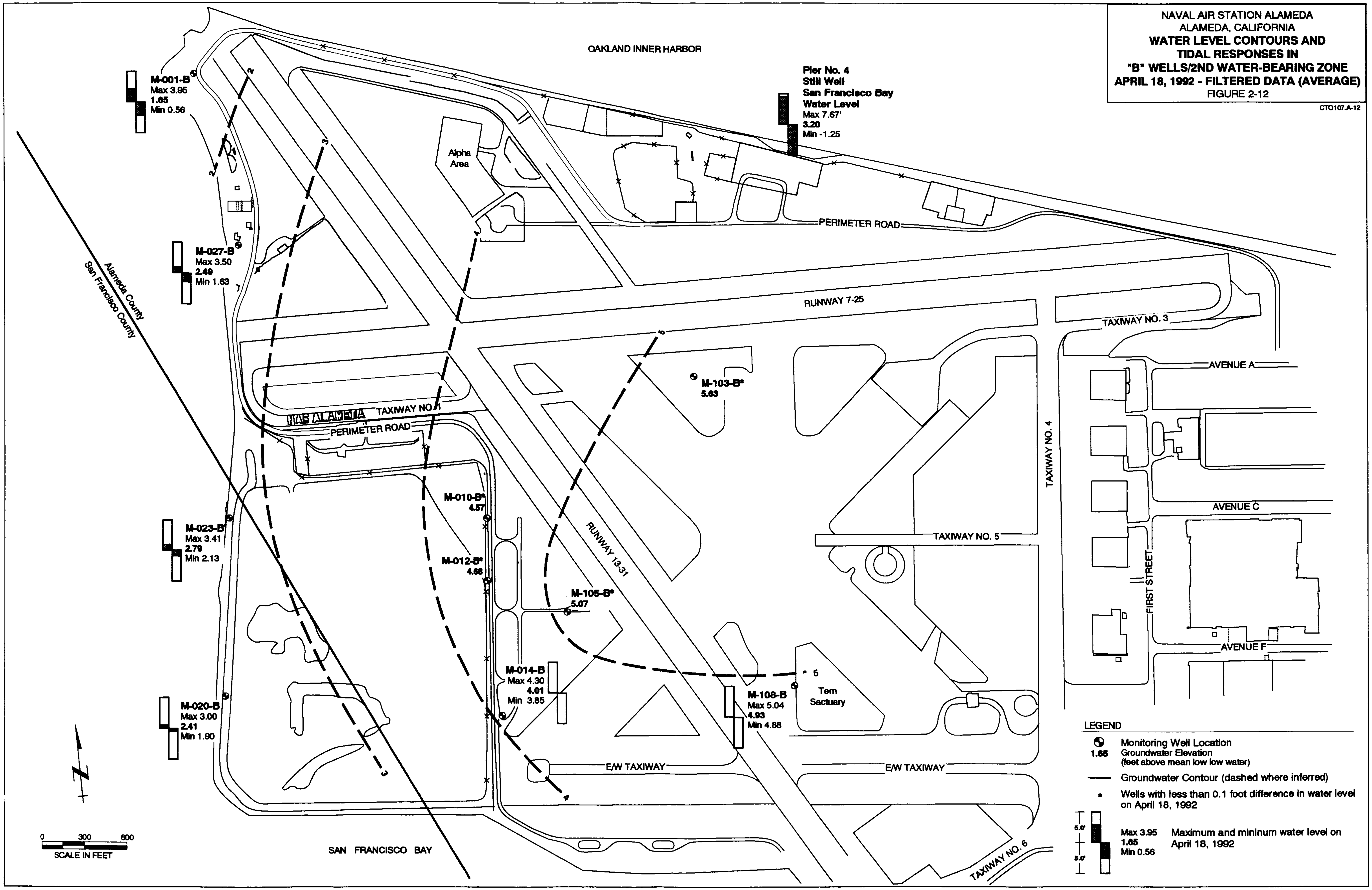
FIGURE 2-8

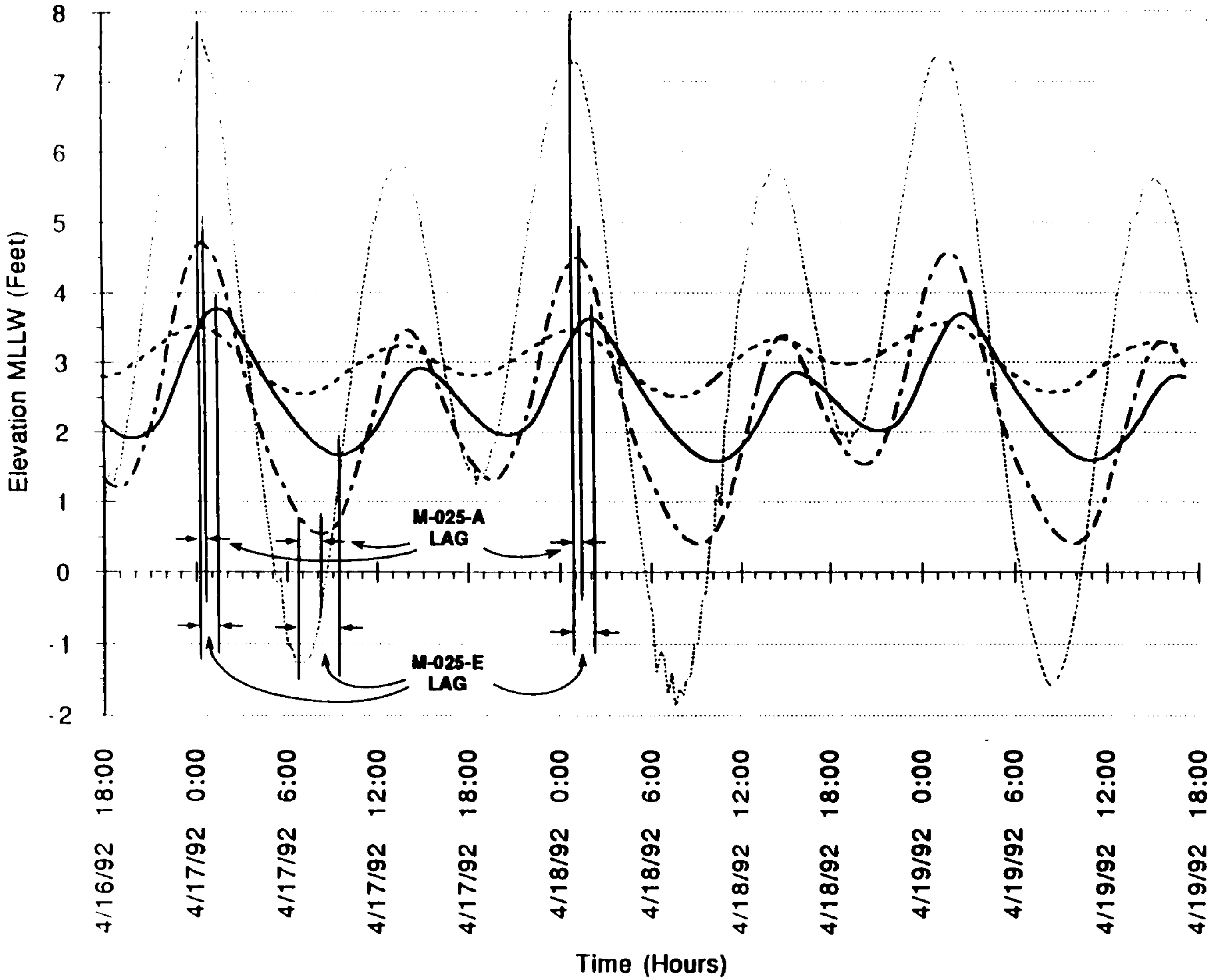

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
TOTAL DISSOLVED SOLIDS
CONCENTRATIONS IN "E" WELLS
FIGURE 2-9
CTO107.A-15
OAKLAND INNER HARBOR
PIER NO. 4
PERIMETER ROAD
RUNWAY 7-25
TAXIWAY NO. 3
AVENUE A
AVENUE C
AVENUE F
FIRST STREET
TAXIWAY NO. 4
TAXIWAY NO. 5
TAXIWAY NO. 1
TAXIWAY NO. 6
E/W TAXIWAY
E/W TAXIWAY
RUNWAY 13-31
Runway Area
Tern Sactuary
Alpha Area
Site 1 Disposal Area
Site 2 West Beach Landfill
NAS ALAMEDA
Alameda County
San Francisco County
SAN FRANCISCO BAY
3000
M-002-E 6,300
M-001-E 1,570
M-029-E 2,030
M-028-E 2,210
M-027-E 8,610
M-026-E 8,760
M-025-E 4,430
M-024-E 4,660
M-023-E 25,700
M-022-E 24,800
M-021-E 25,800
M-020-E 27,000
M-019-E 29,700
M-018-E 29,700
N
0 300 600
SCALE IN FEET
LEGEND
Monitoring Well Location
1,770 Maximum TDS Concentration from Quarterly Groundwater Sampling in mg/L
3000 mg/L TDS Concentration Line
3000 mg/L TDS Limit for Freshwater (California SWQCB, 1988a)



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
TOTAL DISSOLVED SOLIDS
CONCENTRATIONS IN "B" AND "C" WELLS
FIGURE 2-10
CTO107.A-17
OAKLAND INNER HARBOR
PIER NO. 4
PERIMETER ROAD
M-001-B
19,600
Alpha Area
Site 1
Disposal Area
M-007-C
16,700
M-027-B
11,900
M-027-C
16,600
Alameda County
San Francisco County
RUNWAY 7-25
TAXIWAY NO. 3
M-103-B
29,100
AVENUE A
M-025-C
3,980
NAS ALAMEDA
TAXIWAY NO. 1
PERIMETER ROAD
TAXIWAY NO. 4
M-104-C
18,100
Runway Area
AVENUE C
M-023-B
6,330
M-010-B
8,520
TAXIWAY NO. 5
RUNWAY 13-31
Site 2
West Beach Landfill
FIRST STREET
M-012-B
27,400
M-105-B
28,200
M-021-C
5,520
M-013-C
27,000
AVENUE F
M-020-B
9,340
M-108-B
28,100
Tern Sactuary
M-014-B
26,100
E/W TAXIWAY
E/W TAXIWAY
0 300 600
SCALE IN FEET
SAN FRANCISCO BAY
TAXIWAY NO. 6
LEGEND
Monitoring Well Location
28,100 Maximum TDS Concentration from Quarterly Groundwater Sampling in mg/L
3000 mg/L Limit for Freshwater (California SWQCB, 1988a)


NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
WATER LEVEL CONTOURS AND
TIDAL RESPONSE IN
"A" WELLS/1ST WATER-BEARING ZONE
APRIL 18, 1992 - FILTERED DATA(AVERAGE)
FIGURE 2-11
CTO107.A-11
OAKLAND INNER HARBOR
Pier No. 4
Still Well
San Francisco Bay
Water Level
Max 7.67
3.20
Min -1.25
M-003-A
Max 4.09
4.02
Min 3.98
M-001-A*
3.06
M-004-A*
3.91
M-005-A*
4.23
M-029-A
Max 3.06
2.95
Min 2.91
M-006-A*
4.94
Alpha Area
M-028-A
Max 3.39
3.26
Min 3.22
M-101-A*
4.96
PERIMETER ROAD
M-027-A
Max 3.12
2.96
Min 2.86
M-007-A*
5.05
M-102-A*
5.65
M-026-A
Max 4.32
2.29
Min 0.84
RUNWAY 7-25
Alameda County
San Francisco County
TAXIWAY NO. 3
M-009-A*
4.90
M-103-A*
5.41
AVENUE A
M-025-A
Max 3.74
2.45
Min 1.68
NAS ALAMEDA
TAXIWAY NO. 1
PERIMETER ROAD
M-010-A*
Max 4.33
4.22
Min 4.21
TAXIWAY NO. 4
M-104-A*
6.32
RUNWAY 13-31
AVENUE C
M-023-A
Max 3.53
1.95
Min 0.47
TAXIWAY NO. 5
M-012-A*
5.57
M-109-A*
7.42
FIRST STREET
M-021-A
Max 3.89
2.96
Min 2.65
M-013-A*
5.72
M-105-A
6.73
AVENUE F
M-108-A*
7.05
Tern Sactuary
M-020-A
Max 3.13
2.27
Min 1.61
M-014-A*
4.94
M-016-A
Max 3.09
1.94
Min 1.02
M-015-A
Max 3.69
3.17
Min 2.88
E/W TAXIWAY
E/W TAXIWAY
M-018-A
Max 3.17
1.42
Min 0.01
SAN FRANCISCO BAY
TAXIWAY NO. 6
0 300 600
SCALE IN FEET
LEGEND
Monitoring Well Location
2.29 Groundwater Elevation
(feet above mean low low water)
Groundwater Contour (dashed where inferred)
* Wells with less than 0.1 foot difference in water level on April 18, 1992
5.0'
5.0'
Max 4.32
2.29
Min 0.84
Maximum and mininum water level on April 18, 1992
Note: Contours between bay and perimeter(seawall) wells are not shown


NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
WATER LEVEL CONTOURS AND
TIDAL RESPONSES IN
"B" WELLS/2ND WATER-BEARING ZONE
APRIL 18, 1992 - FILTERED DATA (AVERAGE)
FIGURE 2-12
CTO107.A-12
OAKLAND INNER HARBOR
Pier No. 4
Still Well
San Francisco Bay
Water Level
Max 7.67'
3.20
Min -1.25
M-001-B
Max 3.95
1.65
Min 0.56
Alpha Area
PERIMETER ROAD
M-027-B
Max 3.50
2.49
Min 1.63
Alameda County
San Francisco County
RUNWAY 7-25
TAXIWAY NO. 3
AVENUE A
M-103-B*
5.63
NAS ALAMEDA
TAXIWAY NO. 1
PERIMETER ROAD
TAXIWAY NO. 4
M-010-B*
4.57
M-023-B
Max 3.41
2.79
Min 2.13
AVENUE C
RUNWAY 13-31
TAXIWAY NO. 5
M-012-B*
4.68
FIRST STREET
M-105-B*
5.07
AVENUE F
M-014-B
Max 4.30
4.01
Min 3.85
M-108-B
Max 5.04
4.93
Min 4.88
Tern Sactuary
M-020-B
Max 3.00
2.41
Min 1.90
E/W TAXIWAY
E/W TAXIWAY
TAXIWAY NO. 6
SAN FRANCISCO BAY
0 300 600
SCALE IN FEET
LEGEND
Monitoring Well Location
1.65 Groundwater Elevation
(feet above mean low low water)
Groundwater Contour (dashed where inferred)
* Wells with less than 0.1 foot difference in water level on April 18, 1992
5.0'
5.0'
Max 3.95
1.65
Min 0.56
Maximum and mininum water level on April 18, 1992



LEGEND

- M025A (solid line)
- M025C (dashed line)
- M025E (dash-dot line)
- Pier 4 (dotted line)

CTO107.A-10

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA

WATER LEVEL FLUCTUATIONS IN CLUSTER WELL M -025

FIGURE 2-13

N00236.000847
ALAMEDA POINT
SSIC NO. 5090.3

TABLES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE 2-1
CLASSIFICATION OF WATER BY TDS AND SPECIFIC CONDUCTIVITY

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

THE ABOVE IDENTIFIED TABLE IS NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY SOUTHWEST DIVISION TO LOCATE THIS TABLE. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
SOUTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable or relevant and appropriate requirements (ARARs) are not required for a SWAT. However, they will be required in the future comprehensive RI. A description of ARARs development and potential ARARs for the Alameda project are provided here. These proposed ARARs are intended to provide a starting point for discussions when ARARs are developed during the comprehensive RI.

ARARs are used to assess the appropriate extent of site cleanup, develop site-specific remedial response objectives, develop remedial action alternatives, and direct site cleanup. The CERCLA, as amended by the SARA and the National Contingency Plan (NCP), requires that hazardous waste site remedial actions, including those at Federal facilities, comply with Federal ARARs. SARA also requires attainment of state ARARs if they are more stringent than Federal ARARs, legally enforceable, and consistently enforced statewide.

3.1 APPLICABILITY OF REGULATORY REQUIREMENTS AT FEDERAL FACILITIES

Section 120 of CERCLA provides guidance for the remediation of hazardous constituents released from Federal facilities. CERCLA requires that each department, agency, and instrumentality of the U.S. government, including executive, legislative, and judicial branches of the government, be subject to and comply with CERCLA. Under Executive Order 12580 - Superfund Implementation, the President of the United States delegated to the Secretary of Defense the responsibility of responding to releases or threats of releases of hazardous contaminants from any facility or vessel under jurisdiction of the Department of Defense (DOD). Section 2701 of SARA - the Environmental Restoration Program authorizes the Secretary of Defense to carry out a program of environmental restoration at facilities under its jurisdiction. DOD environmental restoration activities must be carried out in a manner consistent with Section 120 of CERCLA.

3.2 DEFINITION AND DEVELOPMENT OF ARARs

An ARAR may be either applicable or relevant and appropriate, but not both. According to the NCP, "applicable" and "relevant and appropriate" are defined as follows:

- Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under state or Federal environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and are more stringent than Federal requirements may be applicable.

- Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under state or Federal environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Requirements that are applicable or relevant and appropriate must be met by CERCLA remedial actions; other types of standards or guidance information fall into the "to be considered" (TBC) category. TBCs are Federal and state advisories or guidance that are not legally binding and do not have the status of potential ARARs. However, if there are no specific ARARs for a chemical or site condition, or if existing ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure public health and environmental protection.

Section 121(d)(4) of CERCLA identifies the following six circumstances under which ARARs may be waived. An ARAR may only be waived for on-site remedial actions.

- The remedial action selected is only a part of a total remedial action (interim remedy) and the final remedy will attain the ARAR upon its completion.

- Compliance with the ARAR will result in a greater risk to human health and the environment than alternative options.

- Compliance with the ARAR is technically impracticable from an engineering perspective.

- An alternative remedial action will attain an equivalent standard of performance through the use of another method or approach.

- The ARAR is a state requirement that the state has not consistently applied (or demonstrated the intent to apply consistently) in similar circumstances.

- For Section 104 Superfund-financed remedial actions, compliance with the ARAR will not provide a balance between protecting human health and the environment and the availability of Superfund money for response at other facilities.

3.3 ARARs DEVELOPMENT

Identification of ARARs must be done on a site-specific basis. Neither SARA nor the NCP provide across-the-board standards for establishing specific cleanup goals at a particular site. Rather, the process recognizes that each site will have unique characteristics that must be evaluated and compared to those requirements that apply under the given circumstances. Described below are the three different types of requirements that CERCLA actions may have to comply with: chemical-specific, location-specific, and action-specific. A discussion of these requirements as they apply to NAS Alameda is presented in Section 3.4.

3.3.1 Chemical-Specific ARARs

Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies which represent acceptable concentrations of chemicals that may be found in, or discharged to, the ambient environment. If a chemical has more than one ARAR, the most stringent ARAR generally should be complied with. Both ARARs and TBCs should be subject to a site-specific risk assessment to ensure exposure levels are within acceptable limits for the protection of human health and other environmental receptors. In some cases, such as multiple exposure pathways or multiple contaminants, a risk assessment may indicate that an ARAR alone is not sufficiently protective and TBCs, including risk-based limits, will be used to establish cleanup requirements.

3.3.2 Location-Specific ARARs

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or restrictions on the conduct of activities solely because the sites are in specific types of locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

3.3.3 Action-Specific ARARs

Action-specific ARARs are requirements or limitations on specific potential remedial actions. The type and nature of these requirements are dependent upon the particular remedial or removal action taken at a site, and thus different actions or technologies are often subject to different action-specific ARARs. An example would be the restriction against exhausting off-gases from an air stripper due to air-quality requirements.

3.4 IDENTIFICATION OF CHEMICAL-SPECIFIC, LOCATION-SPECIFIC, AND ACTION SPECIFIC ARARs

For the Phases 5 and 6 investigation at NAS Alameda, potential chemical-specific ARARs and TBCs for groundwater have been identified by reviewing the EPA draft guidance document, CERCLA Compliance with Other Laws Manual, and state-specific regulations and criteria (EPA, 1988e). Chemical-specific ARARs identified here are preliminary and will be subject to review by the DTSC. Action-specific requirements will be identified when remedial alternatives are developed in the feasibility study that will be performed as Phase 8. Location-specific ARARs will be determined as part of the Phase 7 comprehensive RI planned for NAS Alameda. The following paragraphs describe the specific ARARs that apply to this investigation.

Maximum contaminant levels (MCLs) established for drinking water by EPA under the Safe Drinking Water Act (40 CFR Part 141) are applicable requirements when water will or would be used as a drinking water source for a community supply of 25 or more people, or 15 or more service connections. MCLs and non-zero maximum contaminant level goals (MCLGs) are relevant and appropriate requirements in other cases where surface water or groundwater is or may be directly used for drinking water, in which case the MCLs or MCLGs should be met in the surface water or groundwater itself. Due to the brackish and saline nature of the shallow groundwater at NAS Alameda, and the known groundwater quality problems related to nitrates and saltwater intrusion in the East Bay Plain area, the shallow groundwater is not considered a suitable potential drinking water source. Thus, MCLs are not considered applicable chemical-specific ARARs.

The California RWQCB, San Francisco Bay Region, has designated the groundwater basin in which Alameda Island lies for potential use as "domestic or municipal supply, industrial process supply, industrial service supply, and agricultural supply" (California RWQCB, 1986). However, the RWQCB indicates that "local groundwater quality conditions may vary significantly, due to natural factors, making some groundwater supplies unsuitable for the uses indicated." Groundwater within the second aquifer beneath NAS Alameda is no longer used due to mercury (HSI, 1977) possibly derived from the Franciscan formation. Thus, water quality goals identified by the RWQCB for basins designated potential agricultural or municipal water supply are not considered applicable chemical-specific ARARs.

Applied action levels (AALs) are developed according to procedures outlined in The California Site Mitigation Decision Tree Manual (DHS, 1986). These values are based on maximum acceptable exposure of biological receptors to substances associated with hazardous waste sites and facilities. Thus, AALs are derived by considering human health effects without dealing with technical feasibility, economic concerns, or other factors. Since AALs are entirely health-based, they are different on both a criterion and use basis from standards developed by other agencies (e.g., water quality criteria developed by EPA), and are therefore TBCs for NAS Alameda. AALs are summarized in Appendix B and are not referenced in the following chapters discussing site-specific analytical results.

The EPA has established water quality criteria (WQC) for the protection of marine aquatic life (EPA, 1986a). Acute and/or chronic criteria have been established for selected organic and inorganic compounds. Federal WQC are summarized in Table 3-1. Due to the proximity of the site to the San Francisco Bay, and the apparent discharge of shallow groundwater to the bay (see Section 4.0), Federal WQC are considered potential chemical-specific ARARs for shallow groundwater at NAS Alameda.

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TABLES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE 3-1

POTENTIAL CHEMICAL-SPECIFIC ARARS
(Sheet 1 of 2)

	Marine Acute Criteria (µg/L)[a]	Marine Chronic Criteria (µg/L)[a]
Organic Compounds		
Acenaphthene	970	710
Acrolein	55	
Benzene	5,100	700
Carbon Tetrachloride	50,000	
Chlorinated Benzenes		
Monochlorobenzenes	160	129
Dichlorobenzenes	1,970	
Chlorinated Ethanes		
Dichloroethanes	113,000	
Trichloroehanes	31,200	
Tetrachloroethanes	9,020	
Pentachloroethanes	390	
Hexachloroethanes	940	
Chlorinated Ethylenes		
Dichloroethylenes	224,000	
Trichloroethylenes	2,000	
Tetrachloroethylenes	10,200	450
Chlorinated Naphthalenes	7.5	
Chlorinated Phenols		
Monochlorophenols	29,700	
Tetrachlorophenols	440	
Pentachlorophenols	53	34
Dichloropropane	10,300	3,040
Dichloropropene	790	
Dinitrotoluene	590	
Ethylbenzene	430	
Fluoranthene	40	16
Halomethanes	12,000	6,400
Hexachlorobutadiene	32	
Hexachlorocyclopentadiene	7.0	
Isophorone	12,900	
Naphthalene	2,350	
Nitrobenzene	6,680	
Nitrophenols	4,850	
Nitrosamines	3,300,000	
Phenol	5,800	
Phthalate Esters	2,944	
Polynuclear Aromatic Hydrocarbons	300	
Toluene	6,300	5,000
Toxaphene	0.07[b]	
Pesticides/PCB		
Aldrin	1.3[b]	
BHC	0.34	
Chlordane	0.09[b]	0.0040[c]
DDE	14	
DDT	0.13[b]	0.0010[c]
Demeton		0.1

TABLE 3-1

POTENTIAL CHEMICAL-SPECIFIC ARARS
(Sheet 2 of 2)

	Marine Acute Criteria (µg/L)[a]	Marine Chronic Criteria (µg/L)[a]
Dieldrin	0.71[b]	0.0019[c]
Endosulfan	0.034[b]	0.0087[c]
Endrin	0.037[b]	0.0023[c]
Guthion		0.01
Heptachlor	0.053[b]	0.0036[c]
Lindane	0.16[b]	
Malathion		0.1
Methoxychlor		0.03
Mirex		0.001
Parathion		0.04
PCB		0.030[c]
TDE	3.6	
Inorganic Compound		
Chlorine	13[d]	7.5[e]
Cyanide	1[d]	
Hydrogen Sulfide		2
Phosphorous		0.10
Metals		
Arsenic	69[d]	36[e]
Arsenic (pent)	2,319[d]	
Arsenic (trivalent)	69[d]	36[e]
Cadmium	43[d]	9.3[e]
Chromium (hexavalent)	1,100[d]	50[e]
Copper	2.9[d]	
Lead	140[d]	5.6[e]
Manganese		100[f]
Mercury	2.1	0.025
Nickel	140[b]	7.1[c]
Selenium (inorganic selenite)	410[b]	54[c]
Silver	2.3[b]	
Thallium	2130	
Zinc	170[b]	58[c]

a - All criteria from EPA Quality Criteria for Water 1986. Methods used to establish acute and chronic criteria vary by compound.
b - Represents a maximum concentration never to be exceeded.
c - Represents a maximum 24-hour average.
d - Represents the 1-hour average concentration which may not be exceeded more than once every 3 years.
e - Represents the 4-day average concentration which may not be exceeded more than once every 3 years.
f - Represents maximum allowable concentration to protect human consumers of shellfish.

4.0 PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION

Canonie developed a public health and environmental evaluation (PHEE) plan as part of the work plan for NAS Alameda (Canonie, 1989d; and Canonie, 1990d). The PHEE plan addresses 20 sites and contains what Canonie described as a preliminary PHEE that was performed using information from a review of site history and industrial activities and operations. The preliminary PHEE used some chemical data obtained in the historical review, but the data were sometimes of uncertain application because they were from limited investigations. While the preliminary PHEE was then exhaustive in considering potential worker, visitor, resident, and ecological exposure pathways, it also concluded that "no data exist to quantitatively evaluate potential human health risks that may be posed by contaminants at NAS Alameda" (Canonie, 1990d). This preliminary PHEE was used, in part, to develop the Canonie RI/FS sampling plan, which was used as the basis for planning and conducting the work presented in this report.

The preliminary PHEE conducted by Canonie in 1989(d) followed EPA guidance from the "Risk Assessment Guidance for Superfund Volume 1," Human Health Evaluation Manual (Part A), December 1989," and Chapter 5, "Evaluate Protection of Public Health Requirements" from guidance on feasibility studies under CERCLA, June 1985. While the principals applied in developing the preliminary PHEE are largely consistent with current guidance, some of the specific methods and data used are not in accordance with current guidance and practice.

The discussion presented in the following sections expands upon and updates the preliminary PHEE prepared by Canonie. The discussion consists of a preliminary pathway analysis including identification of receptors and pathways, based upon the conceptual site model described in Section 2.0. This preliminary pathway analysis is intended to identify exposure pathways that have the most likely potential for being complete. A comprehensive risk assessment will further address these issues in a separate phase of the RI.

4.1 POTENTIAL RECEPTORS

Three potential receptors have been identified for this evaluation. These are humans, terrestrial organisms, and marine organisms. Freshwater organisms are not considered potential receptors for this evaluation because there is no permanent fresh surface water near any of the sites in this study. Freshwater receptors may be included in the risk assessment portion of the NAS Alameda comprehensive RI (Phase 7) because parts of the base with fresh surface water will be addressed in that report.

4.1.1 Human Receptors

Human receptors include workers and visitors to the base. For purposes of this preliminary evaluation, all human receptors are grouped together and no specific exposure scenarios are identified. Special receptor groups and exposure scenarios will be identified and fully discussed in the risk assessment portion of the comprehensive RI.

4.1.2 Terrestrial Organisms

Terrestrial organisms include all plants and non-aquatic animals found at NAS Alameda. For purposes of this preliminary evaluation, special categories of organisms, such as endangered species, have not been identified. Identification of special populations and exposure scenarios will be performed during the risk assessment portion of the comprehensive RI.

4.1.3 Marine Organisms

Marine organisms include the benthic biota inhabiting the bay and estuaries surrounding Alameda Island. Human consumption of benthic organisms as a secondary exposure route is not considered in this preliminary evaluation because the part of San Francisco Bay near NAS Alameda has been closed to harvesting of benthic organisms for many years. This secondary exposure route may be addressed during the risk assessment portion of the comprehensive RI.

4.2 POTENTIAL EXPOSURE PATHWAYS

Seven potential exposure pathways have been identified for this evaluation. Five of the pathways apply to human and terrestrial organism receptors. Two of the pathways apply to marine organism receptors. Table 4-1 illustrates which potential exposure pathways are complete for the receptors identified above. The individual pathways are discussed below. In the absence of exposure scenarios and fate and transport analysis, only the possibility of exposure to the receptors via each pathway is assessed in this preliminary evaluation. The likelihood of exposure will be assessed in the risk assessment portion of the comprehensive RI.

4.2.1 Human and Terrestrial Organism Receptors

The five potential exposure pathways identified for human and terrestrial organism receptors are drinking water, soil and dust ingestion, inhalation of dust, inhalation of vapors, and dermal contact.

4.2.1.1 Drinking Water. No human drinking water is currently derived from surface or groundwater at NAS Alameda. Currently, all human drinking water is supplied by the East Bay Municipal Utility District. It is not likely that drinking water will be derived from surface or groundwater at NAS Alameda in the future because, as discussed in Section 2.0, the first and second water-bearing zones are subject to saltwater and nitrate intrusion; the second aquifer are subject to mercury contamination possibly derived from the Franciscan formation. No terrestrial organisms use the groundwater for drinking water, and there is surface water only in the West Beach Landfill. For these reasons, the drinking water pathway is considered incomplete for human receptors at all of the sites studied for this project. The drinking water pathway is considered complete for terrestrial organisms in the surface water portion of Site 2.

4.2.1.2 Soil and Dust Ingestion. Inadvertent ingestion of surface soil or dust by humans or terrestrial organisms may occur when soil and dust are exposed (i.e., the site is unpaved) and available to the receptors. Currently, portions of Sites 1 and 2 are unpaved, therefore the soil ingestion pathway is considered complete for both humans and terrestrial organisms at the unpaved portions of Sites 1 and 2.

4.2.1.3 Inhalation of Dust. Fugitive dust is dust that can be blown about a site so that it is made available for human or terrestrial organisms to inhale. As with the soil and dust ingestion pathway, the dust inhalation pathway is complete for both humans and terrestrial organisms at Sites 1 and 2.

4.2.1.4 Inhalation of Vapors. Contaminants can volatilize, releasing vapors that are available for human or terrestrial organism receptors for inhalation. This only occurs when the compounds are in contact with the atmosphere and have sufficiently high vapor pressures to volatilize. Compounds with sufficiently high vapor pressures to volatilize under normal atmospheric conditions were not encountered in surface soils at the unpaved sites. Therefore, this pathway is considered incomplete at the study sites.

4.2.1.5 Dermal Contact. Human and terrestrial organism receptors may inadvertently come into contact with contaminated media when the media are exposed. The same constraints about exposure of the contaminated media for dust inhalation and soil and dust ingestion apply to dermal contact. Therefore, like these other pathways, the dermal contact pathway is considered complete for both humans and terrestrial organisms at Sites 1 and 2.

4.2.2 Marine Organism Receptors

The two potential exposure pathways identified for potential marine organism receptors include ingestion and surface contact.

4.2.2.1 Ingestion. Marine benthic organisms may ingest groundwater in the event that it reaches the bay and estuary that surrounds NAS Alameda and surface water in the West Beach Landfill. In the absence of fate and transport analysis, it has been assumed that groundwater from the sites may reach the bay and estuary. The pathway is therefore considered complete for the unpaved portions of the two landfills.

Detailed fate and transport analysis will be conducted during the comprehensive RI stage of work at NAS Alameda. After that analysis, the marine organism ingestion exposure pathway may be shown to be incomplete for one or both of the current study sites.

4.2.2.2 Dermal Contact. As with the marine organism ingestion exposure pathway, the marine organism surface contact exposure pathway has been assumed to be complete for all sites until detailed fate and transport analysis are performed.

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TABLES

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SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE 4 - 1

POTENTIAL PATHWAYS ANALYSIS

Site	Human and Terrestrial Organism Receptors: Drinking Water	Soil Ingestion	Inhalation of Dust	Inhalation of Vapors	Dermal Contact	Marine Organism Receptors: Ingestion*	Dermal Contact*
Site 1 - Disposal Area	I	C	C	I	C	C	C
Site 2 - West Beach Landfill	C	C	C	I	C	C	C

I = Pathway Incomplete

C = Pathway Complete

* = Pathway tentatively complete pending fate and transport analysis

5.0 CRITERIA FOR PRELIMINARY DATA EVALUATION

This section provides a discussion of issues related to the evaluation of analytical data generated in this investigation. It should be recognized that this report intends to provide a preliminary evaluation to determine if chemicals have been released into the groundwater at either site, and that detailed interpretations of the data will be presented in the comprehensive RI report. In addition, data presented here were evaluated to determine if additional activities such as drilling and sampling are necessary to further assess the subsurface conditions of these two sites.

In the absence of site-specific fate and transport modeling and risk assessment data, the criteria described below were established for use in this preliminary data evaluation. These criteria were intended to provide a consistent basis for considering further action at individual sites. These criteria may subsequently be modified based on the results of additional sampling, and the performance of modeling and a risk assessment in future phases of work. The significance of these compounds will be fully discussed in the comprehensive RI report.

5.1 ANALYTICAL DATA QUALITY CONSIDERATIONS

When reviewing the analytical data presented herein, it is important to consider their limitations. Limitations could include errors during execution of the chemical analyses or cross contamination during sample collection. The data presented in this report represent three quarters of groundwater sampling events which should not be interpreted as an absolute indicator of contaminant levels at the sites. The QC data also indicate that some of the reported results have been affected by contaminants introduced in the laboratory. These items are discussed below.

Field QC samples consisted of field duplicates, travel blanks, source water, and equipment rinsate samples from equipment decontamination activities. Laboratory QC samples included method blanks, replicates, laboratory control samples (LCS), and matrix spikes and matrix spike duplicates (MS/MSD). Results of QC samples were used to qualify laboratory results presented in this report. The methods used in qualifying the data, and the flags used to indicate the type of qualifiers placed on a particular result, are discussed below. QC sample results are the tools to assess the quality of sample data. QC sample data that were acceptable, with regard to precision and accuracy, were assessed as being error free. These were not qualified, and results were valid. QC samples that did not meet criteria serve as flags for data that were qualified or replaced by corrective procedures. Data that were qualified as estimates are useable data for this report. Data that were rejected, either parameter or analyte, are considered unusable. Only 16 soil and water samples collected for this project had partial rejected qualifications primarily due to poor recoveries. Low recoveries may be indicative of the complex matrices found at NAS Alameda.

Completeness is defined as the percent of valid data relative to the total number of sample tests conducted. The goal of 90 percent has been surpassed.

5.1.1 Data Qualification - Method Blanks

Numerous QC batches had detectable quantities of common laboratory contaminants in the associated method blank results. The contaminants found in the volatile organic compound (VOC) method blanks were acetone and methylene chloride. Bis(2-ethylhexyl)phthalate, a plasticizer, was present in several semivolatile organic compound (SVOC) method blanks. Detectable quantities of these analytes in the associated field samples must be qualified (treated as though they may be higher than true values) due to the positive bias. The sample results presented in tables in this report are not corrected by subtracting the amount detected in the blank sample. Rather, they are assessed by comparing the sample result to a value 10 times the analyte concentration found in the method blank (EPA, 1988a and 1988b). Samples that then contain the contaminant at a concentration of 10 times or higher than the method blank concentration are flagged with a "J" qualifier indicating an estimated value due to the influence of the blank contaminant. Samples that contain less than the 10 times the guideline for the blank contaminant are considered as not detected for that compound and are flagged with a "UJ." No action is taken on samples that do not contain detectable concentrations of the blank contaminant.

5.1.2 Data Qualification - Matrix Spike/Matrix Spike Duplicates, Laboratory Control Samples, and Surrogate Samples

Systematic methods are used in qualifying data based on QC data sets or batches. The MS/MSDs associated with each batch of samples are used to assess possible matrix interferences. The percent recovery of the MS/MSD are used to evaluate the accuracy of the analytical methods. The associated relative percent differences (RPD) in recovery between the MS/MSD provides an assessment of the laboratory's precision. LCS associated with each batch of samples are used to measure the laboratory's accuracy for target analytes in a matrix without interferences. The LCS are used to distinguish a matrix interference from a laboratory performance problem. Data are initially evaluated on the basis of MS/MSD results. The results are compared to acceptance limits established in the U.S. EPA Contract Laboratory Program Statement of Work (EPA, 1988c and 1988d). If the MS/MSD results are unacceptable, the LCS results are reviewed. Data qualifiers are assigned as described below.

If the MS/MSD and associated RPD results do not meet acceptable values, and the LCS values are acceptable, then there are possible matrix interferences in the data batch. Therefore, data in the batch may be qualified as follows. If the MS/MSD and LCS values are above the upper acceptance limits, the positive results within the batch may have a positive bias (results are higher than what may actually be in the sample) and are therefore qualified as estimated values and flagged with a "J." When the MS/MSD and LCS results for a batch are below the lower acceptance limits, poor laboratory accuracy is indicated. The sample data within the batch may have a negative bias (results are lower than what may actually be in the sample) and both positive and non-detected results are qualified as estimated values and flagged with a "J." If MS/MSD and LCS recoveries are equal to or less than 10 percent, only the non-detected results within the batch are qualified as rejected and flagged with an "R."

Surrogate and post digestion spike recoveries provide individual sample assessment. Batch QC (i.e., MS/MSD, LCS, and replicates) may be acceptable, but individual sample recovery values within a batch may fail to meet method criteria limits for a specific analysis. Samples with recoveries above method criteria limits for a specific analysis may have positive bias; those with recoveries below method criteria limits for a specific analysis may have negative bias. When positive bias for a specific analysis is indicated in an individual sample, all positive sample results for that analysis are qualified as estimated values and flagged with a "J." When negative bias is indicated in an individual sample, all results, both positive and non-detected, for that analysis, are qualified as estimated values and flagged with a "J." If surrogate and post-digestion spike recoveries are equal to or below 10 percent, all non-detected results for that analysis are qualified as rejected and flagged with an "R."

5.2 QUALITY CONTROL SUMMARY REPORT

The quality control summary report (QCSR), submitted under separate cover, provides a review of the QC data for all analyses performed and the rationale for qualification of all sample results flagged in this report (PRC/JMM, 1992). The QC assessment uses the data quality objectives (DQO) expressed as precision, accuracy, representativeness, completeness, and comparability (PARCC) that are based on the U.S. EPA procedures. The QCSR is presented as a discussion of each PARCC criteria for each matrix. The QCSR also contains support batch QC documentation, including method blank results, surrogate percent recoveries, MS/MSD recoveries and relative percent differences (RPD), and associated LCS QC.

Documents necessary for evaluation of the PARCC criteria are included as appendices to the QCSR. These include cross-reference tables, duplicate summary tables, equipment and trip blank analyses, purified and source water analyses, reporting limits, sample schedules, sample dilution sheets, and chain-of-custody forms.

5.3 EVALUATION OF DATA FOR SOILS

Soil samples collected during this investigation were analyzed for VOC, SVOC, pesticides/PCBs, metals, total recoverable petroleum hydrocarbons, oil and grease, radiochemicals, and asbestos. Details of the results of the chemical analyses performed on the Runway Area and Sites 1 and 2 soil samples are included in Sections 7.0, 8.0, and 9.0, respectively. Because metals are naturally occurring in the environment, it is important to establish site-specific background metals concentrations in soils in order to evaluate whether surface and subsurface soils at Sites 1 and 2 have been impacted by metals that are a result of past landfill operations. During this investigation, soil samples were collected at locations from the Runway Area, where there is no known history of chemical uses or operations, for estimating the background metals concentrations in soil. Results of these metal analyses are presented in Section 7.0 of this report.

Based on these results, a statistical analysis was performed to estimate the site background metals concentrations at the 95 percent tolerance level for Sites 1 and 2. Results of this statistical analysis were used to evaluate whether any soil samples collected from Sites 1 and 2 during this investigation contained metals concentrations above background. Details of the statistical analysis are presented in Appendix I of this report. A brief discussion of metals found in soils at concentrations above background for each site is presented in each site section. These metals and their concentrations will be addressed on an individual basis to evaluate whether soil remediation is required. The evaluation will be made based on the results of a risk assessment to be conducted during Phase 7 of the comprehensive RI work.

Organic analyses are reported in the individual site sections of this report. However, unlike metals that are naturally occurring in the environment, most of the organic compounds detected at the sites are typically associated with past industrial activities. It is premature at this stage of the comprehensive RI/FS process to establish standards for allowable concentrations of organics in soils. Moreover, very few standards exist and the need for remediation is typically based on the results of a risk assessment. Therefore, no comparison to organic standards for soils is presented in this SWAT report.

5.4 EVALUATION OF DATA FOR GROUNDWATER

Groundwater samples collected during this investigation were analyzed for VOC, SVOC, pesticides/PCBs, metals, total recoverable petroleum hydrocarbons, oil and grease, radiochemicals, and asbestos. An evaluation of the background levels of metals in groundwater is included in Phases 5 and 6 activities.

For the purpose of this SWAT report, analytical results for metals in groundwater were compared by statistical analysis to Runway Area samples which are assumed to represent background levels. Evaluation of whether a site requires future investigation regarding inorganics (metals) or organics in groundwater may be modified based on the input from regulatory agencies on the potential ARARs.

6.0 PHASES 5 AND 6 INVESTIGATION DESCRIPTION AND METHODS

This SWAT investigation, performed under the CLEAN program, included Sites 1, 2, and the Runway Area at NAS Alameda. The purpose of the SWAT investigation was to determine whether chemicals have been released into the groundwater and migrated offsite. Methods used in the field portion of the SWAT investigation are described in the SWAT proposal and addenda to the plans prepared by Canonie (Canonie, 1990d) and the PRC team (PRC/JMM, 1990 and 1991b). The proposal followed the SWAT guidance document (SWRCB, 1988b) and the EPA CERCLA guidance (EPA, 1988e) for RI/FS activities. A description of the methods used and the SWAT proposal modification due to unexpected field conditions are described in Appendix C - Field Methods of this report.

6.1 FOCUS OF INVESTIGATION

The focus of the investigation varied according to activities historically performed at each site (Table 6-1). The investigation focused on the landfills and possible conduits for contamination to enter the groundwater and the bay. Borings were situated around the perimeter of the two landfills and in the Runway Area. Where appropriate, based on a review of past activities, potentially impacted surface areas (burn areas) and other potential subsurface conduits such as trenches were investigated. Interviews and record searches related to the investigation focus at each site were performed by E&E as part of the IAS, and Canonie as part of work plan preparation (E&E, 1983; Canonie, 1990d).

6.2 CHEMICAL ANALYSES

The suite of chemical analyses performed on soil and groundwater samples varied according to past and ongoing activities at each site. Analyses were selected on the basis of known or suspected disposal activities and suspected possible releases to the surface soils. Rationale for selection of chemical analyses is presented in the Canonie work plan (Canonie, 1990d). Tables 6-2 and 6-3 summarize the types of chemical analyses and laboratory methods performed on surface, subsurface soil samples, wetland sediment samples, wetland surface water samples, and groundwater samples at each site. As indicated in Table 6-2, surface soil samples were not analyzed for volatile constituents.

Table 6-4 presents the complete list of compounds detectable by each analysis. Data tables presented in the following sections include only those compounds detected in site samples.

6.3 SAMPLING PROCEDURES

Procedures for soil and water sampling during CTO No. 085 and CTO No. 107 are briefly discussed below. During CTO No. 085, Analytical Technology, Inc., of San Diego, California, performed all the required soil analyses, and during CTO No. 107, Environmental Science and Engineering, Inc., of Gainesville, Florida, performed all the required soil, sediment, and water analyses respective to the appropriate round of work. Samples were carefully packed with ice and shipped daily overnight to the respective labs. A more complete description of actual field procedures can be found in Appendix C - Field Methods.

6.3.1 Drilling Methods and Documentation

Three drilling methods were utilized during CTO No. 085 and CTO No. 107 activities. During CTO No. 085, hollow-stem auger and mud rotary methods were used for the "A" wells and the "B" wells, respectively. During CTO No. 107, air rotary casing hammer method was used for "B" and "C" wells completed in the second water-bearing zone, and the hollow-stem auger method was used for "A" and "E" wells completed in the first water-bearing zone.

At each boring location, the soils encountered were lithologically logged during all stages of drilling operations. For each soil boring, a detailed geologic field log was prepared as drilling operations proceeded. All soil samples were described in terms of color, consistency, grain size, and percentages of various constituents according to American Standard Testing and Materials (ASTM) version of the Unified Soil Classification System (ASTM, 1984), a standard practice for description and identification of soils (visual-manual procedures). Also recorded on the lithologic logs were photoionization detector (PID) readings, general drilling conditions, and number of blow counts while driving a split-spoon sampler. Wells were installed in all borings except those abandoned due to unexpected field conditions. Well construction information and materials used were recorded on the well construction and lithologic logs. Some slight variations exist of the lithologic documentation process and details of these variations are discussed in Appendix C - Field Methods. Geologic and well construction logs are included in Appendix E.

6.3.2 Surface Soil Sampling

Surface soil samples were collected in Site 1 (1943-1956 Disposal Area) and Site 2 (West Beach Landfill) on a 200 by 200 foot grid pattern. Samples were not taken on the runway or water covered areas. Sixty-nine surface soil samples were collected at Site 1 by Canonie (1990j). A qualitative assessment of Canonie's data is included in this report (Section 8.0). The detailed evaluation of these data were provided in the Data Summary Report for the Phases 1 and 2A work. One hundred-fifty surface soil samples, 15 duplicates and three resampled locations were collected at Site 2 by the PRC team.

6.3.3 Soil Sampling from Borings

Seventy wells were installed at Sites 1, 2, and the Runway Area during CTO No. 085 and CTO No. 107 investigations. Forty of the wells were installed with the screened interval straddling the water table of the first water-bearing zone in the fill (designated as "A" wells) (Figure 2-7). Fourteen of the wells were completed on the western perimeter of Sites 1 and 2, adjacent to the San Francisco Bay at the base of the first water-bearing zone and above the Holocene Bay Mud Unit (designated as "E" wells). Ten of the wells were completed in the second water-bearing zone in the late Pleistocene and Holocene alluvial/eolian deposits, below the Holocene Bay Mud Unit (designated as "B" wells). Finally, six of the wells were completed at the base of the late Pleistocene alluvial/eolian deposits above the late Pleistocene estuarine deposits (San Antonio formation equivalent) (designated as "C" wells). Six each of the "A" wells and "B" wells were installed during the CTO No. 085 portion of the investigation.

Two rounds of drilling occurred in which surface and subsurface soil samples were collected. During CTO No. 085, seven surface soil samples and one duplicate sample were collected and three subsurface soil samples were collected from the vadose zone from each of the Runway Area (M-103A, M-105A, M-108A) well clusters. During CTO No. 107, approximately three soil samples were collected from each well cluster. According to the approved SWAT work plan (PRC/JMM, 1990), one surface soil sample, one vadose zone soil sample, and one sample from the first and/or second water-bearing zone, depending on whether a first water-bearing or second water-bearing zone well, were to be installed.

Geotechnical soil samples were collected in the screen intervals when possible and the confining units at the base of the "E" and "C' wells. Only selected geotechnical samples from the aquitard and screened intervals were sent to a geotechnical laboratory for analyses.

6.3.4 Wetlands Sediment and Surface Water Sampling

Sediment and surface water samples were collected in the wetland area located in Site 2. Surface water samples were collected from 23 locations in the water bodies present at the time of sampling. Each location was marked with a wooden stake for later surveying. Sediment sampling from the wetland area followed the completion of the surface water sampling task. The 12 sediment samples collected were paired with 12 of the 23 surface water sample locations.

6.3.5 Quarterly Groundwater Sampling

Groundwater samples were collected from the 70 wells installed during CTO No. 085 and CTO No. 107. The first, second, third, and fourth rounds of quarterly sampling were conducted beginning on June 17, 1991, September 19, 1991, January 14, 1992, and March 24, 1992, respectively. Each well was purged of at least three well-bore volumes (the calculated volume of liquid in the casing and filter pack) prior to sampling, using either a Teflon ® bailer or a pump. Field parameters were measured and miscellaneous field observations were recorded after every well volume on groundwater sampling logs. The field parameters measured during well purging included pH, conductivity, and temperature. Purging was considered adequate when the field parameter measurements became stable. Once purging was completed, wells were sampled from the bottom using decontaminated Teflon ® bailers and new, clean nylon rope. Sample preservation and filtering was completed in the field after sample collection. All samples were placed in coolers with ice after collection. Duplicate samples were randomly collected on 10 percent of the "A," "B," "C," and "E" wells. Rinsate samples were collected from a clean bailer prior to purging or sampling. Field difficulties encountered and method modifications during each quarter and are discussed in Appendix C - Field Methods of this report.

6.4 ADDITIONAL FIELD INVESTIGATIONS

Additional field investigations were performed to collect geologic and hydrogeologic information to further evaluate the subsurface geology and hydrogeology at NAS Alameda. These tasks included geophysical surveys, slug tests, and a tidal influence study.

6.4.1 Geophysical Surveys

Transient electromagnetic (TEM) and ground magnetometer geophysical surveys were conducted at Sites 1 and 2. TEM was performed along several profiles in an attempt to collect information for classifying stratigraphic variations in the subsurface; in particular, a paleochannel that may be present at NAS Alameda, roughly from east to west beneath the southern half of Site 1 and the northern half of Site 2. A ground magnetometer survey was conducted over Site 2 to identify concentrations of metal objects in the upper few feet of the landfill. These surveys were performed by Norcal Geophysical Consultants of Petaluma, California. The report is in Appendix H of this report.

6.4.2 Slug Tests

Rising head slug tests were performed in each monitoring well to determine the in situ permeabilities of the water-bearing zones pertinent to each location. Data was recorded on Hermit 1000B and Hermit 2000B data loggers using 10 psi transducers. A discussion of the assumptions, formulas used, methodology, and data sheets, and curves are in Appendix G of this report.

6.4.3 Tidal Influence Study

A tidal influence study previously discussed in Section 2.4 was conducted to assess the magnitude and extent of tidal influences on groundwater levels in the shallow water-bearing zone (fill material), and the second water-bearing zone around Sites 1, 2, and the Runway Area. This study was conducted from April 16 to April 19 during the monthly high and low tides. Water level data was recorded every 15 minutes continuously for 72 hours on Hermit 1000B and Hermit 2000B data loggers using 10 psi transducers. The data sheets and curves are in Appendix J of this report.

TABLES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE 6-1

FORMER SITE USES AND SWAT TARGET AREAS

Site Number	Site Name	Historical Activities*	Investigation Focus
1	1943-1956 Disposal Area	Landfill	Surface soil samples, Subsurface soil samples and groundwater samples from the first water bearing zone and from the zone below the Holocene Bay Mud at the perimeter of landfill
2	West Beach Landfill	Landfill	Surface soil samples, subsurface soil samples and groundwater samples from the first water bearing zone and from the zone below the Holocene Bay Mud at the perimeter of landfill
	Runway Area	Runways for Alameda NAS	Upgradient of the landfills, surface soil samples, subsurface soil samples and groundwater samples from the first water bearing zone and from the zone below the Holocene Bay Mud

*Source - Canonie, Sampling Plan, Solid Waste Water Quality Assessment Test Proposal Addendum February 1990.

TABLE 6-2

SITE-SPECIFIC LABORATORY ANALYSES - SOIL

SITE NO.	Analysis / Method	VOC CLP	SVOC CLP	PEST/ PCBs CLP	TRPH EPA 418.1	METALS CLP	ASBESTOS PLM	GROSS ALPHA & BETA	RADIUM 226 & 228	OIL & GREASE EPA 413.2	TOC	pH
1	Surface soil - borings		x	x	x	x		x	x	x		
	Subsurface soil - borings	x	x	x		x	x	x	x		x	x
2	Surface soil - borings		x	x	x	x		x	x	x		
	Surface soil - landfill		x	x	x	x		x	x			
	Subsurface soil - borings	x	x	x		x	x	x	x		x	x
	Wetland sediment	x	x	x	x	x						
Runway Area*	Surface soil - borings		x	x	x	x		x	x	x		
	Subsurface soil - borings	x	x	x		x	x	x	x		x	x

VOC -Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds
PEST/PCBs - Pesticides and Polychlorinated Biphenyls
TOC - Total Organic Carbon
TRPH - Total Recoverable Petroleum Hydrocarbons
Metals include Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mn, Mg, Hg, Ni, K, Se, Ag, Na
*Runway Area - This is not a SWAT designated site, rather, a general area indicating to the reader where the upgradient borings/wells are located, that are used for establishing background values.

CLP - Contract Laboratory Program
PLM - Polarized Light Microscopy
Surface - 0" to 6"

Subsurface - Deeper than 6"

TABLE 6-3

SITE-SPECIFIC LABORATORY ANALYSES - SURFACE WATER AND GROUNDWATER

SITE NO.	Analysis / Method	VOC / CLP	SVOC / CLP	PEST/ PCBs / CLP	TRPH / EPA 418.1	METALS / CLP	TOTAL CYANIDE / CLP	ASBESTOS / PLM	GROSS ALPHA & BETA	RADIUM 226 & 228	GENERAL MINERALS
1	MW	x	x	x	x	x	x	x	x	x	x
2	MW	x	x	x	x	x	x	x	x	x	x
	SW	x	x	x	x	x	x	x	x	x	x
Runway Area*	MW	x	x	x	x	x	x	x	x	x	x

MW - Samples are from monitoring wells.
SW - Surface water samples are from the West Beach Landfill wetlands area.
CLP - Contract Laboratory Protocol
VOC - Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds
PEST/PCBs - Pesticides and Polychlorinated Biphenyls
TRPH - Total Recoverable Petroleum Hydrocarbons
General Minerals include Acidity, Alkalinity, Carbon Oxygen Demand, Hardness, Total Dissolved Solids, Specific Conductance, pH, Total Organic Carbon, Chloride, Cyanide, Fluoride, Nitrogen, and Sulfate
Metals include Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mn, Mg, Hg, Ni, K, Se, Ag, Na
*Runway Area - This is not a SWAT designated site, rather, a general area indicating to the reader where the upgradient borings/wells are located, that are used for establishing background values.

TABLE 6-4

DETECTABLE ANALYTES PER ANALYSIS METHOD
(Sheet 1 of 2)

VOCs	SVOCs	Pesticides/PCBs	Metals	General Chemical	Miscellaneous Analyses
1,1,1-Trichloroethane	1,2,4-Trichlorobenzene	4,4'-DDD	Aluminum	Chloride	Asbestos
1,1,2,2-Tetrachloroethane	1,2-Dichlorobenzene	4,4'-DDE	Antimony	Sulfate	Cyanide
1,1,2-Trichloroethane	1,3-Dichlorobenzene	4,4'-DDT	Arsenic	Flouride	Total Recoverable Petroleum Hydrocarbons
1,1-Dichloroethane	1,4-Dichlorobenzene	Aldrin	Barium	Nitrate	Radium 226 & 228
1,1-Dichloroethylene	2,4,5-Trichlorophenol	Aroclor-1016	Beryllium	Nitrite	Gross Alpha & Beta
1,2-Dichloroethane	2,4,6-Trichlorophenol	Aroclor-1221	Cadmium	Hardness	Oil & Grease
1,2-Dichloropropane	2,4-Dichlorophenol	Aroclor-1232	Calcium	Alkalinity	
2-Hexanone	2,4-Dimethylphenol	Aroclor-1242	Chromium	Acidity	
Acetone	2,4-Dinitrophenol	Aroclor-1248	Cobalt	COD	
Benzene	2,4-Dinitrotoluene	Aroclor-1254	Copper	TOC	
Bromodichloromethane	2,6-Dinitrotoluene	Aroclor-1260	Iron	Total dissolved residue	
Bromoform	2-Chloronaphthalene	Dieldrin	Lead	Specific conductivity	
Bromomethane	2-Chlorophenol	Endosulfan I	Magnesium		
Carbon Disulfide	2-Methyl-4,6-Dinitrophenol	Endosulfan II	Manganese		
Carbon Tetrachloride	2-Methylnaphthalene	Endosulfan Sulfate	Mercury		
Chlorobenzene	2-Methylphenol	Endrin	Nickel		
Chloroethane	2-Nitroaniline	Endrin ketone	Potassium		
Chloroform	2-Nitrophenol	Heptachlor	Selenium		
Chloromethane	3,3-Dichlorobenzidine	Heptachlor Epoxide	Silver		
Cis-1,3-Dichloropropene	3-Nitroaniline	MCPA	Sodium		
Dibromochloromethane	4-Bromophenyl Phenyl Ether	MCPP	Thallium		
Ethylbenzene	4-Chloro-3-Methylphenol	Methoxychlor	Vanadium		
Methyl Ethyl Ketone	4-Chloroaniline	Toxaphene	Zinc		
Methyl Isobutyl Ketone	4-Chlorophenylphenyl Ether	alpha-BHC			
Methylene Chloride	4-Methylphenol	alpha-Chlordane			
Styrene	4-Nitroaniline	beta-BHC			
Tetrachloroethene	4-Nitrophenol	delta-BHC			
Toluene	Acenaphthene	gamma-BHC (Lindane)			
Trans-1,2-Dichloroethene	Acenaphthylene	gamma-Chlordane			
Trans-1,3-Dichloropropene	Anthracene				
Trichloroethene	Benzo(a)Anthracene				
Vinyl Acetate	Benzo(a)Pyrene				
Vinyl Chloride	Benzo(b)Fluoranthene				
Xylene	Benzo(g,h,i)Perylene				
	Benzo(k)Fluoranthene				
	Benzoic Acid				
	Benzyl Alcohol				
	Bis(2-Chloroisopropyl) Ether				
	Bis(2-Chloroethoxy) Methane				
	Bis(2-Chloroethyl) Ether				
	Bis(2-Ethylhexyl) Phthalate				
	Butylbenzylphthalate				

TABLE 6-4

DETECTABLE ANALYTES PER ANALYSIS METHOD
(Sheet 2 of 2)

VOCs	SVOCs (cont)	Pesticides/PCBs	Metals	General Chemical	Miscellaneous Analyses
	Chrysene				
	Di-N-Butyl Phthalate				
	Di-N-Octyl Phthalate				
	Dibenzo(a,h)Anthracene				
	Dibenzofuran				
	Diethyl Phthalate				
	Dimethyl Phthalate				
	Fluoranthene				
	Fluorene				
	Hexachlorobenzene				
	Hexachlorobutadiene				
	Hexachlorocyclopentadiene				
	Hexachloroethane				
	Indeno(1,2,3-cd)Pyrene				
	Isophorone				
	N-Nitrosodi-N-Propylamine				
	N-Nitrosodiphenolamine				
	Naphthalene				
	Nitrobenzene				
	Pentachlphenol				
	Phenanthrene				
	Phenol				
	Pyrene				

VOC -Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds
Pesticides/PCBs - Pesticides and Polychlorinated Biphenyls

7.0 RUNWAY AREA

As discussed in Section 6.0, soil and groundwater samples were collected from the Runway Area for geotechnical and chemical analyses. The primary objective of these analyses was to collect sufficient data for estimating the background concentrations of metals and organics in soil and groundwater for both Sites 1 and 2. The estimated background concentrations were used to examine whether chemical releases into the groundwater at Sites 1 and 2 had occurred. This section provides descriptions of the site background, site geology/hydrogeology, and results of chemical testing performed on soil and groundwater samples collected from this area.

7.1 SITE DESCRIPTION AND BACKGROUND

The Runway Area occupies approximately 326 acres and is situated in Alameda County. As shown on Figure 7-1, the area is located immediately adjacent to both Sites 1 and 2 to the west, First Street of NAS Alameda to the east, the Oakland Inner Harbor to the north, and San Francisco Bay to the south.

7.1.1 Fill History

Review of aerial photographs indicate that the area was hydraulically filled before 1947. The average thickness of fill material as observed through drilling of Phase 5 borings at the Runway Area is between 15 feet and 20 feet. During this investigation, various aerial photographs obtained from Pacific Aerial Surveys, Oakland, California, were reviewed. Results of the aerial photo review are described below.

An aerial photo dated February 25, 1938, shows that the majority of the current Runway Area was covered by the bay and only the northern portion of the Runway Area had been filled with hydraulic fill.

An aerial photo dated February 18, 1939, indicates that the hydraulic fill operation in the area had begun and was in progress.

An aerial photo dated March 24, 1947, shows that the Runway Area had been constructed. The area appears to consist of runway and aircraft parking areas.

An aerial photo dated May 3, 1957, shows that construction of the new runways was completed. The current Runways 13-31 and 7-25 were completed and extended into Site 1. Photographs dated May 19, 1969, April 30, 1973, September 14, 1979, June 21, 1983, May 15, 1985, and March 30, 1988, (Pacific Aerial Surveys, 1969; Pacific Aerial Surveys, 1973; Pacific Aerial Surveys, 1979; Pacific Aerial Surveys, 1983; Pacific Aerial Surveys, 1985; and Pacific Aerial Surveys, 1988) do not reveal significant changes of operations at the area from the May 3, 1957 (Pacific Aerial Surveys, 1969) aerial photo.

7.1.2 Disposal History

Review of information provided by the Navy suggested that no history of chemical uses and operations has been documented at the Runway Area.

7.2 PREVIOUS INVESTIGATIONS

No known previous investigation has been conducted at this area. On June 11, 1987, the Navy was notified by the RWQCB of the requirement to perform a SWAT at Sites 1 and 2. A SWAT work plan, prepared and submitted by Canonie (1990d), proposed that soil samples be collected at the Runway Area for chemical analyses. Results of the chemical analyses are used to estimate the background concentrations for both Sites 1 and 2.

7.3 CURRENT USE

The Runway Area is currently used for Navy aircraft runways and parking area. A tern sanctuary is located south of taxiway No. 5, adjacent to the north side of the east/west taxiway and east of Runway 13-31.

7.4 SWAT INVESTIGATION

This field investigation for the Runway Area included collecting subsurface soil and groundwater samples for geotechnical and chemical analyses. A total of 15 groundwater monitoring wells were installed in this area during this investigation. Eleven of the 15 wells were installed with screens straddling the water table of the first water-bearing zone in the fill material (designated as "A" wells) (Figure 2-7). Three of the "A" wells were installed during CTO No. 0085. Three of the wells were completed in the second water-bearing zone in the late Pleistocene/Holocene alluvial/eolian deposits, below the Holocene Bay Mud Unit (designated as "B" wells). The "B" wells were installed during CTO No. 0085. Finally, one of the wells was completed at the base of the late Pleistocene alluvial/eolian deposit above the late Pleistocene estuarine deposits (San Antonio formation equivalent) (designated as "C" wells). During the well construction, a total of 18 subsurface soil samples, including two duplicates, was collected from these wells for chemical and geotechnical testing.

7.4.1 Site Geology/Hydrogeology

Figures 2-3, 2-4, and 2-5 are a series of geologic cross sections across Sites 1, 2, and the Runway Area. The 15 to 20 feet of fill material consists primarily of sands, silty sands, and clays. Trace shell and clay fragments are found throughout the fill, indicating that it is probably hydraulic fill and/or dredging material.

Below the fill material is the Holocene Bay Mud Unit, which consists of predominantly fine-grained, silt and clay with sand lenses. The unit varies in thickness from 20 feet to approximately 30 feet beneath the Runway Area.

Beneath the Holocene Bay Mud Unit is the late Pleistocene/Holocene alluvial/eolian deposits. The alluvial deposits consist of fine-grained material, silts and clays interbedded with sand lenses, similar to the sandy portions of the Holocene Bay Mud Unit. Stratigraphically, the contact between the two units is difficult to determine in locations where the sandy portion of the Holocene Bay Mud Unit directly overlies the alluvial deposits. The eolian unit consists of sands that are 20 to 50 feet thick, with a 4- to 5-foot clayey sand layer at the top.

Below the late Pleistocene/Holocene alluvial/eolian deposits are the late Pleistocene estuarine deposits, the upper portion consists of fat clay. The deepest borings drilled during this study were terminated in the late Pleistocene estuarine deposits.

Geotechnical soil sample results are summarized in Table 7-1. Geotechnical soil samples were collected and selected samples were analyzed from the fill material in the first water-bearing zone, the Holocene Bay Mud Unit, the late Pleistocene/Holocene alluvial/eolian deposits in the second water-bearing zone, and the late Pleistocene estuarine deposits (San Antonio formation). The results generally corroborate field descriptions of soils at the Runway Area. Hydraulic conductivity of one soil sample collected at 69 feet was measured as 2.07E-08 cm/sec. The geotechnical laboratory results are in Appendix F.

Vertical in situ permeability tests were conducted in the wells at the Runway Area. The hydraulic conductivities, as determined by the rising-head method of Bouwer and Rice, ranged from 1.029E-02 cm/sec to 7.40E-04 cm/sec for the first water-bearing zone, which is unconfined, and 1.7E-04 cm/sec to 2.3E-06 cm/sec for the second water-bearing zone, which is confined (Bouwer and Rice, 1976; Bouwer, 1989; Cooper et al., 1967; Cooper and Jacob, 1946). The vertical in situ permeability test data are presented in Appendix G.

Over most of the Runway Area, groundwater is found in two distinct zones. The first water-bearing zone is unconfined and occurs above the Holocene Bay Mud Unit. The second water-bearing zone in the late Pleistocene/Holocene alluvial/eolian deposits, occurs between the late Pleistocene estuarine deposits and the Holocene Bay Mud Unit.

Groundwater in the first water-bearing zone was first encountered at approximately 3 to 7.5 feet below ground surface in the Runway Area. Groundwater in the second water-bearing zone is confined; the water level rose to approximately the same level as in the first water-bearing zone.

Groundwater flow in the first water-bearing zone is outward from the Runway Area to the north, south, and west, with estimated gradients, ranging from 0.0006 feet/foot in the vicinity of Site 1 to 0.003 feet/foot in the vicinity of Site 2. Groundwater flow in the second water-bearing zone is also outward from the area around the wells in the Runway Area to the north, south, and west, toward Sites 1 and 2, with estimated gradients ranging from 0.0011 feet/foot to 0.0006 feet/foot. The shallow gradients indicate that groundwater discharge rates from this zone are likely to be low.

7.4.2 Analytical Results - Soil Samples from Fill

Twenty-four soil samples were collected during the construction of 11 "A" wells (M-101A, M-102A, M-103A, M-104A, M-105A, M-106A, M-107A, M-108A, M-109A, M-110A, and M-111A) at the Runway Area. Three of the wells were installed during CTO No. 0085 (M-103A, M-105A, and M-108A) and the remaining eight wells were installed during CTO No. 0107 (M-101A, M-102A, M-104A, M-106A, M-107A, M-109A, M-110A, and M-111A). Twelve of the twenty-four soil samples were collected from the surface. The remaining 12 soil samples were obtained from depths ranging from 0.5 feet to 5.5 feet below ground surface. All 24 soil samples were analyzed for VOC, SVOC, pesticides/PCBs, total recoverable petroleum hydrocarbons (TRPH), oil and grease (O&G), and metals. Organic compounds and metals detected in these soil samples from fill are listed in Tables 7-2 and 7-4, respectively. Analytical results for organic compounds and metals are summarized in Tables 7-3 and 7-5, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 7-2 and 7-4, respectively. Laboratory QA/QC data are summarized in the QCSR submitted under separate cover. The ranges for metals concentrations found in "Typical" soils as per Dragun (1988) are listed in Table 7-6.

7.4.2.1 Volatile Organic Compounds. Only one volatile organic compound (VOC), acetone, was detected in eight of the soil samples (Table 7-2). Table 7-3 summarizes the acetone detected in the fill at the Runway Area.

7.4.2.2 Semivolatile Organic Compounds. Semivolatile organic compounds (SVOC) were detected in seven soil samples collected from the fill material (Table 7-3).

The suite of polycyclic aromatic hydrocarbons (PAH) present in the soil samples collected from the fill material are acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. These PAH were detected in only three soil samples which were collected above 2.0 feet from borings M-101A and M-102A at concentrations ranging from 110 μg/kg to 4,600 μg/kg (Table 7-3).

Two phthalate compounds were detected in six soil samples (Table 7-3). These compounds are bis(2-ethylhexyl)phthalate and butylbenzylphthalate. Only one sample collected at the surface from M-101A contained both phthalates. Six samples collected from borings M-101A, M-102A, M-104A, M-104C, M-109A, and M-110A were reported to contain bis(2-ethylhexyl)phthalate. Butylbenzylphthalate was only detected in one sample. Phthalates were detected in concentrations ranging from 110 μg/kg to 250 μg/kg (Table 7-3).

7.4.2.3 Pesticides/PCBs. Pesticides were detected in only one soil sample collected from the surface from boring M-102A (Table 7-2). These pesticides include 4,4'-DDD (26.7 μg/kg), 4,4'-DDE (5.38 μg/kg), 4,4'-DDT (93.4 μg/kg), and gamma-chlordane (4.21 μg/kg) (Table 7-3).

Aroclor-1260 was detected in two soil samples collected from the surface from borings M-101A and M-102A at 130 μg/kg and 100 μg/kg, respectively (Table 7-2). The sample from boring M-101A was qualified as an estimate.

7.4.2.4 Total Recoverable Petroleum Hydrocarbons. Eight soil samples collected from the surface were analyzed for total recoverable petroleum hydrocarbons (TRPH). The concentrations of TRPH are summarized in Table 7-3.

7.4.2.5 Oil and Grease. Eight soil samples collected from the surface were analyzed for O&G. The concentrations of oil and grease are summarized in Table 7-3.

7.4.2.6 Metals. Twenty-four soil samples were analyzed for metals (Table 7-4). The concentrations of metals are summarized in Table 7-5. The reported concentrations of the metals found in these soil samples were evaluated using typical ranges of metals concentrations found in soil (Dragun, 1988), listed in Table 7-6.

Aluminum was detected in all 24 samples, 17 of these results were qualified as estimates. The concentrations in the soil samples ranged from 3,220 mg/kg to 7,480 mg/kg. None of these concentrations exceed the typical range of aluminum concentration of 10,000 to 300,000 mg/kg (Dragun, 1988).

Antimony was detected in 1 sample as an estimate. No typical range of antimony was established in soil.

Arsenic was detected in 24 samples, one of which was an estimate. The concentrations in the soil samples ranged from 0.435 mg/kg to 15.6 mg/kg. Eight of these concentrations exceed the range of concentrations (1.0 to 4.0 mg/kg) typically found in soil.

Barium was detected in all 24 samples, eight of which were qualified as estimates. The concentrations in the soil samples ranged from 12.5 mg/kg and 364 mg/kg. None of these concentrations exceed the typical range of 100 mg/kg to 3,500 mg/kg.

Beryllium was detected in 18 samples. The concentrations in the soil samples ranged from 0.15 mg/kg to 1.47 mg/kg. None of these concentrations exceed the typical range of 0.1 to 40 mg/kg.

Cadmium was detected in eight soil samples. The concentrations in the soil samples ranged from 0.336 mg/kg to 2.59 mg/kg, which are within the typical range of 0.01 to 7 mg/kg.

Chromium was detected in all 24 samples, 13 of which were estimates. The concentrations in the soil samples ranged from 15.6 mg/kg to 56.7 mg/kg. None of these concentrations exceed the typical range of 5 mg/kg to 3,000 mg/kg.

Cobalt was detected in 24 samples. The concentrations in the soil samples ranged from 3.02 mg/kg to 49.7 mg/kg. Only one soil sample (surface soil sample from boring M-109A) contained cobalt concentration slightly above the upper limit of the typical concentration range of 1 mg/kg to 40 mg/kg, at a concentration of 49.7 mg/kg.

Copper was detected in 24 samples, five of which were estimates. The concentrations in the soil samples ranged from 3.12 mg/kg to 38.2 mg/kg. None of these concentrations exceed the typical range of 2 mg/kg to 100 mg/kg.

Lead was detected in 24 samples, two of which were estimates. The concentrations in the soil samples ranged from 1.5 mg/kg to 185 mg/kg. None of these concentrations exceed the typical range of 2 mg/kg to 200 mg/kg.

Mercury was detected in three samples. The concentrations in the soil samples ranged from 0.063 mg/kg to 0.09 mg/kg. One of these concentrations exceed the typical range of 0.01 mg/kg to 0.08 mg/kg.

Nickel was detected in 24 samples, nine of which were estimates. The concentrations in the soil samples ranged from 17 mg/kg to 64.6 mg/kg. None of these concentrations exceed the typical range of 5 mg/kg to 1,000 mg/kg.

Selenium was not detected in any of the soil samples.

Silver was detected in eight samples, five of which were estimates. The concentrations in the soil samples ranged from 0.468 mg/kg (estimated) to 1.36 mg/kg. None of these concentrations exceed the typical range of 0.1 mg/kg to 5 mg/kg.

Thallium was not detected in any of the soil samples.

Vanadium was detected in 24 samples, nine of which were estimates. The concentrations in the soil samples ranged from 10.5 mg/kg (estimated) to 37.6 mg/kg. None of these concentrations exceed the typical range of 20 mg/kg to 500 mg/kg.

Zinc was detected in 24 samples. The concentrations in the soil samples ranged from 9.98 mg/kg to 119 mg/kg. None of these concentrations exceed the typical range of 10 mg/kg to 300 mg/kg.

7.4.2.7 Radionuclides. Radionuclide analyses performed on the surface soil samples include gross alpha, gross beta, radium 226, and radium 228. Results of these radionuclides are presented in Appendix D. A discussion of the radionuclide data is presented in Appendix K.

Eleven surface (depth 0.0 to 0.5 foot) soil samples were collected at seven well locations shown on Figure 7-1. The range of values is:

Gross alpha	0.5 ± 0.8	to	3.5 ± 0.8 picocuries per gram (pCi/g)
Gross beta	0.3 ± 0.6	to	3.6 ± 0.6 pCi/g
Radium 226	0.9 ± 0.3	to	6.0 ± 0.9 pCi/g
Radium 228	< 0.3 ± 0.4	to	0.5 ± 0.4 pCi/g

Six subsurface soil samples were collected from the fill, one from each of six of the wells drilled under CTO No. 107, at depths between 1.5 and 5.5 feet. The range of values is:

Gross alpha	0.4 ± 0.3	to	4.9 ± 1.4 pCi/g
Gross beta	< 0.3 ± 0.5	to	3.5 ± 0.8 pCi/g
Radium 226	1.0 ± 0.3	to	3.0 ± 0.4 pCi/g
Radium 228	< 0.3 ± 0.4	to	< 0.3 ± 0.4 pCi/g

7.4.3 Analytical Results - Soil Samples Late Pleistocene/Holocene Alluvial/Eolian Deposits

One soil sample was collected from 62 feet during the construction of a "C" well (M-104C) at the Runway Area. The soil sample was analyzed for VOC, SVOC, pesticides/PCBs, TRPH, O&G, and metals. Organic compounds and metals detected in soil samples from the late Pleistocene/Holocene alluvial/eolian deposits are listed in Tables 7-7 and 7-8, respectively. Laboratory QA/QC data are summarized in the QCSR.

7.4.3.1 Volatile Organic Compounds. Acetone was the only VOC detected in the soil sample but is considered as an estimate and as non-detected after QC evaluation (Table 7-7).

7.4.3.2 Semivolatile Organic Compounds. Semivolatile organic compounds were not detected in the soil sample (Table 7-7).

7.4.3.3 Pesticides/PCBs. No pesticides or PCBs were detected above the detection limits in the soil sample (Table 7-7).

7.4.3.4 Total Recoverable Petroleum Hydrocarbons. TRPH were not detected in the soil sample from the second water-bearing zone (Table 7-7).

7.4.3.5 Oil and Grease. O&G were not detected in the sample (Table 7-7).

7.4.3.6 Metals. The reported concentrations of the metals found in the soil sample are noted in Table 7-8. As listed in Table 7-8, with the exception of antimony, cadmium, mercury, selenium, and thallium, the remaining metals that were analyzed were detected in the soil sample. A comparison of the metals concentrations found in this soil sample with the ranges of metals concentrations typically found in soils indicated none of the detected metals are above the range of metals concentrations in typical soils (Dragun, 1988), Table 7-6.

7.4.3.7 Radionuclides. Radionuclide analyses performed on the soil sample collected from 62 feet from well M-104C include gross alpha, gross beta, radium 226, and radium 228. The reported values are presented below. Results of these radionuclides are presented in Appendix D. A discussion of the radionuclide data is presented in Appendix K.

One subsurface soil sample was collected from the second water-bearing zone from well M-104C at a depth of 62 feet. The reported values are:

Gross alpha	1.2 ± 0.5 pCi/g
Gross beta	0.4 ± 0.6 pCi/g
Radium 226	3.0 ± 0.5 pCi/g
Radium 228	< 0.3 ± 0.4 pCi/g

7.4.4 Analytical Results - Groundwater Samples from "A" Wells

Groundwater samples from 11 "A" wells were collected for four quarters (July 1991, October 1991, February 1992, and April 1992). These groundwater samples were analyzed for VOC, SVOC, pesticides/PCBs, TRPH, metals, general chemicals, and radionuclides. Organic compounds, metals, and general chemicals detected in groundwater samples from "A" wells are listed in Tables 7-9, 7-11, and 7-13 and can be found at the end of this section. Analytical results for organic compounds, metals, and general chemicals are summarized in Tables 7-10, 7-12, and 7-14, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 7-9, 7-11, and 7-13. Laboratory QA/QC data are summarized in the QCSR.

7.4.4.1 Volatile Organic Compounds. VOC detected in groundwater samples collected from these wells include 1,1-DCA, 1,1-DCE, 1,2-DCE, acetone, chlorobenzene, chloroform, PCE, TCE, Toluene, vinyl chloride, and xylenes. Results of the VOC analysis are presented in Table 7-9 and are shown on Figure 7-2. VOC detected in groundwater from "A" wells are summarized in Table 7-10. These VOC were primarily detected in groundwater samples collected from wells M-101A and M-111A (Figure 7-2). The concentrations of several of the VOC in well M-101A generally increased with time. The highest concentration of vinyl chloride was in the third quarterly sampling event for well M-101A at a concentration of 390 μg/L. The concentrations of 1,1-DCA and 1,1-DCE in well M-111A decreased slightly over time (Figure 7-2). Xylenes were only detected in the fourth quarter samples from wells M-102A, M-103A, M-110A, and M-111A. The highest concentration was in well M-102A at 4.2 μg/L.

7.4.4.2 Semivolatile Organic Compounds. SVOC detected in groundwater collected from the "A" wells include 4-chloro-3-methylphenol, bis(2-ethylhexyl)phthalate, and pyrene. Results of the SVOC analysis are presented in Table 7-9 and are shown on Figure 7-3. SVOC detected in groundwater from "A" wells are summarized in Table 7-10.

4-Chloro-3-methylphenol was detected only in the third quarter sampling event in well M-109A at a concentration of 4.3 μg/L. Pyrene was detected only in the second quarter sampling event in well M-110A at a concentration of 3.4 μg/L. Bis(2-ethylhexyl)phthalate was detected in all 11 wells, the highest concentration was 110 μg/L in the sample collected during the second quarter of groundwater monitoring, from well M-102A. The majority of the detections of bis(2-ethylhexyl)phthalate are qualified as not detected after QC evaluation.

7.4.4.3 Pesticides/PCBs. Only dieldrin was detected at a concentration of 1.66 μg/L in the groundwater sample collected from well M-107A during the third quarter monitoring (Table 7-9).

7.4.4.4 Total Recoverable Petroleum Hydrocarbons. TRPH were detected in one sample (M-107A) during the second round of quarterly sampling and in two wells (M-101A and M-109A) during the fourth quarter of quarterly sampling. The highest concentration was in the sample from well M-109A at 0.6 mg/L.

7.4.4.5 Metals. Results of the metals analyses performed on these groundwater samples are listed in Table 7-11. Metals detected in groundwater from "A" wells are summarized in Table 7-12.

7.4.4.6 General Chemicals. General chemical analyses performed on the groundwater samples include total acidity, total alkalinity, chemical oxygen demand, hardness, total dissolved solids, specific conductance, pH, temperature, total organic carbon, asbestos, chloride, cyanide, fluoride, nitrogen (nitrite and nitrate), and sulfate. Results of the general chemical analyses are listed in Table 7-13. General chemicals detected in groundwater from "A" wells are summarized in Table 7-14.

7.4.4.7 Radionuclides. Radionuclide analyses performed on the groundwater samples include gross alpha, gross beta, radium 226, and radium 228. Results of these radionuclides are presented in Table 7-13. A discussion of the radionuclide data is presented in Appendix K.

Forty-eight water samples were obtained from the 11 "A" wells. The well locations are shown on Figure 7-1. The range of values is:

Gross alpha	< 0.1 ± 2.9	to	79.4 ± 25.4 pCi/L
Gross beta	< 0.3 ± 3.9	to	133 ± 141 pCi/L
Radium 226	0.3 ± 0.5	to	18.0 ± 2.5 pCi/L
Radium 228	< 0.3 ± 0.5	to	6.1 ± 1.1 pCi/L

7.4.5 Analytical Results - Groundwater Samples from "B" and "C" Wells

Groundwater samples from four "B" and "C" wells were collected for four quarters (July 1991, October 1991, February 1992, and April 1992). These groundwater samples were analyzed for VOC, SVOC, pesticides/PCBs, TRPH, metals, general chemicals, and radionuclides. Organic compounds, metals, and general chemicals detected in groundwater samples from "B" and "C" wells are listed in Tables 7-15, 7-17, and 7-19, respectively, and can be found at the end of this section. Analytical results for organic compounds, metals, and general chemicals are summarized in Tables 7-16, 7-18, and 7-20, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 7-15, 7-17, and 7-19. Laboratory QA/QC data are summarized in the QCSR.

7.4.5.1 Volatile Organic Compounds. Only groundwater samples collected from wells M-103B and M-108B contained VOC. These VOC are acetone, carbon disulfide, chloromethane, and methyl ethyl ketone. Acetone was detected in the first and fourth quarter samples at concentrations of 2.9 μg/L and 17 μg/L, respectively. Concentrations of acetone detected in the second and third quarter samples were considered not detected after QC evaluation. The concentration of acetone detected in the fourth quarter sample from well M-108B was considered not detected after QC evaluation. Carbon disulfide was detected in the third and fourth quarter sampling events at concentrations of 1.7 μg/L and 2.1 μg/L. Chloromethane and methyl ethyl ketone were only detected in the fourth quarter sample from well M-103B, at concentrations of 1.2 μg/L and 3.6 μg/L, respectively. Results of the VOC analysis are presented in Table 7-15 and are shown on Figure 7-4. VOC detected in groundwater from "B" and "C" wells are summarized in Table 7-16.

7.4.5.2 Semivolatile Organic Compounds. Bis(2-ethylhexyl)phthalate and dimethylphthalate were detected in groundwater collected from the "B" and "C" wells. There is no apparent pattern to the distribution of the detected bis(2-ethylhexyl)phthalate (Figure 7-5). Dimethylphthalate was only detected in the fourth quarter groundwater sample from well M-103B at a concentration of 59 μg/L. Results of the SVOC analysis are presented in Table 7-15 and shown on Figure 7-5. SVOC detected in groundwater from "B" and "C" wells are summarized in Table 7-16.

7.4.5.3 Pesticides/PCBs. No pesticides/PCBs were detected above the detection limits from any of the groundwater samples collected from the "B" and "C" wells at the Runway Area (Table 7-15).

7.4.5.4 Total Recoverable Petroleum Hydrocarbons. No TRPH were detected above the detection limits from any of the groundwater samples collected from the "B" and "C" wells at the Runway Area (Table 7-15).

7.4.5.5 Metals. Results of the metals analyses performed on these groundwater samples from the "B" and "C" wells are listed in Table 7-17. Metals detected in groundwater from "B" and "C" wells are summarized in Table 7-18.

7.4.5.6 General Chemicals. General chemical analyses performed on the groundwater samples include total acidity, total alkalinity, chemical oxygen demand, hardness, total dissolved solids, specific conductance, pH, temperature, total organic carbon, asbestos, chloride, cyanide, fluoride, nitrogen (nitrite and nitrate), and sulfate. Results of the general chemical analyses are listed in Table 7-19. General chemicals detected in groundwater from "B" and "C" wells are summarized in Table 7-20.

7.4.5.7 Radionuclides. Radionuclide analyses performed on the groundwater samples include gross alpha, gross beta, radium 226, and radium 228. Results of these radionuclides are presented in Table 7-19. A discussion of the radionuclide data is presented in Appendix K.

Sixteen water samples were obtained from the second water-bearing zone from four well locations. Twelve of the samples are from the "B" wells and four are from the "C" wells. The well locations are shown on Figure 7-1. The range of values is:

Gross alpha	< 0.1 ± 60.3	to	170 ± 184 pCi/L
Gross beta	< 0.3 ± 132	to	502 ± 221 pCi/L
Radium 226	1.2 ± 0.9	to	7.1 ± 1.7 pCi/L
Radium 228	< 0.3 ± 0.8	to	3.8 ± 0.7 pCi/L

7.5 STATISTICAL ANALYSIS OF METALS CONCENTRATIONS IN SOIL AND GROUNDWATER

This section presents the results of a statistical analysis designed to estimate the background metals concentrations in soil and groundwater at NAS Alameda, further discussion is presented in Appendix I. The 95 percent/95 percent statistical tolerance interval was calculated for soil and groundwater samples collected from the background wells drilled in the Runway Area. The 95 percent/95 percent statistical tolerance interval is the range within which 95 percent of samples collected on the base (Sites 1 and 2) are expected to fall 95 percent of the time. Samples with concentrations outside of this range may be below or above background concentrations.

In general, population distributions of naturally occurring inorganic soil constituents, including metals, are best described by a normal distribution curve (Gilbert, 1987). Therefore, this statistical analysis of metals was conducted assuming that the background populations for the NAS Alameda follow a normal distribution.

The procedures used to determine the 95 percent/95 percent statistical tolerance interval are as follows. Metal concentrations of the background samples were treated as constituents of a normal population. The detection limit divided by two was substituted for nondetected values (Horning and Reed, 1990). Arithmetic means and standard deviations were calculated for each metal. Lower and upper limits of the 95 percent/95 percent statistical tolerance interval were calculated by adding and subtracting the standard deviation multiplied by a statistical tolerance factor (K) to the mean. K is a variable dependent on the proportion of the population one wishes to include in the tolerance interval, the probability of inclusion in the interval, and the number of samples on which the standard deviation is based (Taylor, 1990).

Samples from Sites 1 and 2 were compared to the 95 percent/95 percent statistical tolerance interval to determine whether or not they were above background concentrations.

- The same basic procedure was used for both soil and groundwater samples. In order to account for seasonal fluctuations of naturally occurring metals in groundwater, tolerance intervals were computed separately for each round of groundwater samples collected from the background wells. The statistical data for the background soil samples, the background water samples from "A" wells, and "B" and "C" wells are presented in Tables 7-21, 7-22, and 7-23, respectively.

7.6 SUMMARY AND CONCLUSIONS

The purpose of the investigation conducted in this area is to collect adequate information for establishing groundwater gradients and estimating the background concentrations of potential chemicals of concern in soil and groundwater at Sites 1 and 2. The estimated background concentrations are intended to be used for assessing whether chemicals detected in soil and groundwater samples collected at both landfills are consistently found at concentrations above the background. Results of this assessment would also be used for prioritizing future work at Sites 1 and 2. Results of the investigation concluded the following:

7.6.1 Soils

Twenty-four soil samples were collected during the construction of 11 "A" wells at the Runway Area. Three of the wells were installed during CTO No. 0085. Twelve of the twenty-four soil samples were collected from the surface. The remaining 12 soil samples were obtained from depths ranging from 0.5 feet to 5.5 feet below ground surface.

One soil sample was collected from 62 feet during the construction of a "C" well at the Runway Area.

7.6.1.1 Fill Samples. Based on the review of aerial photographs, borings M-101A, M-102A, and M-111A appear to be located in areas where previous site operations such as aircraft maintenance might have been conducted. However, additional information from the Navy is required to confirm such operations. In addition, results of organic analyses performed on soil samples collected from borings M-101A, M-102A, and M-111A indicate that soils at these locations contain VOC, SVOC which include PAH, phthalates, and phenols, and pesticides/PCBs. Therefore, soils at these three locations are not considered to represent background conditions.

Statistical analyses were conducted to estimate the site background concentrations of metals and radionuclides for comparison with Sites 1 and 2. Results of these statistical analyses are presented in Appendices I and K for metals and radionuclides, respectively.

As discussed above, VOC, SVOC, (PAH, phthalates, and phenols), and pesticides/PCBs were primarily detected in soil samples collected from near the surface or immediately under asphalt from borings M-101A, M-102A, and M-111A. Only PAH, which are SVOC, were detected at concentrations over 1 mg/kg in the soil sample collected near surface from boring M-102A. Because the area near M-101A and M-102A is currently used for aircraft runway and parking, concentrations of organics detected in soil samples from these two borings do not pose an immediate threat to human health. Well M-111A is next to an aircraft maintenance building, beneath approximately 1 foot of concrete. Concentrations of organics detected in soil samples from this boring do not pose an immediate threat to human health since the areas are inaccesible. The significance of the concentrations found in these soil samples will be further examined during the risk assessment for the comprehensive RI/FS.

For the remaining soil samples collected from borings M-104A through M-111A, only acetone and bis(2-ethylhexyl)phthalate were detected at concentrations above the detection limits. Acetone was detected at low concentrations (< 0.32 mg/kg) in soil samples collected from borings. Bis(2-ethylhexyl)phthalate was detected at low concentrations (< 0.25 mg/kg) in a total of four samples collected from borings M-104A, M-104C, M-109A, and M-110A. Based on the facts that (1) acetone concentrations detected in these soil samples are considered estimated values, (2) acetone is known as a common laboratory contaminant, (3) the presence of bis(2-ethylhexyl)phthalate tends to be associated with plastics, and (4) no other VOC and SVOC were detected in these soil samples, there is no consistent evidence to indicate that the subsurface soil in this area has been impacted by organics. The presence of acetone and bis(2-ethylhexyl)phthalate in these soil samples are likely due to laboratory contamination and the sampling materials.

TRPH and O&G were detected in surface soil samples collected from the borings in this area. Analytical methods used for the TRPH and O&G analyses on these soil samples were EPA Methods 418.1 and 413.2, respectively. EPA Method 413.2 reports a single concentration for both naturally occurring and petroleum based hydrocarbons. However, results of TRPH analysis using EPA Method 418.1 report a single concentration for both light (gasoline) and heavy (oils, diesel, kerosene, and jet fuels) petroleum fractions for each sample analyzed. Any assessment and conclusions regarding the extent of petroleum hydrocarbons (such as diesel, gasoline, jet fuel, kerosene, and oils) in subsurface soil under the Runway Area made based on these results would not be useful. Therefore, no assessment was conducted in this investigation to evaluate the extent of petroleum hydrocarbons in soils at the Runway Area.

7.6.1.2 Late Pleistocene/Holocene Alluvial/Eolian Deposits Samples. One soil sample was collected from 62 feet at the Runway Area. No VOC, SVOC, pesticides/PCBs, TRPH, or O&G were detected after QC review. None of the metals detected in the soil sample are at concentrations above the concentration ranges detected in typical soil as per Dragun (1988).

7.6.2 Groundwater

For the purpose of this report, the sediments beneath NAS Alameda are subdivided into two aquifers. The first aquifer consists of two water-bearing zones (Figure 2-7). The first water-bearing zone is in the fill, and the second water-bearing zone is in the late Pleistocene/Holocene deposits. The deeper or second aquifer is in the undivided Pliocene/Pleistocene terrestrial deposits (Alameda formation). The second aquifer was not part of this investigation.

7.6.2.1 First Water-Bearing Zone. The first water-bearing zone is found in the hydraulic fill above the Holocene Bay Mud Unit. General groundwater gradients of the first water-bearing zones under the Runway Area, as shown on Figures 2-11 and 2-12, are to the west toward Sites 1 and 2, north to the Oakland Inner Harbor, and south to San Francisco Bay.

Based on the RWQCB's total dissolved solid (TDS) criteria stated in State Water Resource Control Board Resolution Number 88-63, groundwater in the first water-bearing zone is classified as fresh as shown on Figure 2-8. The fresh groundwater detected in the first water-bearing zone is believed to be primarily due to infiltration of surface or rain water through unpaved or grassy areas around the Runway Area.

Eleven "A" wells were installed in the upper portion of the first water-bearing zone. VOC detected in groundwater samples collected from "A" wells at the Runway Area, after QC review, include chloroform, acetone, chlorobenzene, 1,1-DCA, 1,1-DCE, 1,2-DCE, PCE, TCE, toluene, vinyl chloride, and xylenes. 1,1-DCA, 1,1-DCE, 1,2-DCE, PCE, TCE, and vinyl chloride were only detected in groundwater samples collected from wells M--101A and M-111A after QC review. Only low levels (near the detection limits) of chlorobenzene and chloroform were detected in groundwater samples collected from wells M-106A and M-109A during the first quarter sampling event. Also, groundwater samples from these two wells collected during subsequent quarterly sampling did not contain chlorobenzene and chloroform above the detection limits. Acetone was only detected in samples from wells M-101A and M-102A after QC review. Xylenes were detected in samples from wells M-102A, M-103A, M-110A and M-111A.

As presented on Figure 7-3, low levels of SVOC were detected in groundwater samples collected from the "A" wells in this area. After QC review, these SVOC include 4-chloro-3-methylphenol, bis(2-ethylhexyl)phthalate, and pyrene. With the exception of bis(2-ethylhexyl)phthalate, low levels (near the detection limits) of 4-chloro-3-methylphenol and pyrene were detected once in groundwater samples from wells M-109A and M-110A, respectively. The presence of bis(2-ethylhexyl)phthalate in the groundwater samples may be associated with plastic materials such as nylon rope used for sampling.

Dieldrin was detected at a concentration of 1.66 μg/L in the groundwater sample collected from well M-107A during the third quarter groundwater monitoring. This result was considered an estimate after QC review.

TRPH were detected in three groundwater samples, one in the second quarter (M-107A) and two in the fourth quarter (M-106A and M-109A). The highest concentration of TRPH were in the sample from well M-109A at a concentration of 0.6 mg/L.

With the exception of organics detected in groundwater samples collected from wells M-101A and M-111A, concentrations of VOC, SVOC, pesticides/PCBs, and TRPH were erratic throughout the quarterly sampling period. Therefore, there is no conclusive evidence to indicate that VOC, SVOC, pesticides/PCBs, and TRPH are present in groundwater in the first water-bearing zone underneath the Runway Area at levels of concern.

As listed in Tables 7-11, 7-12, and 7-13, various metals and radionuclides were detected in most of the groundwater samples. Because analysis of the aerial photographs indicate that previous site operations might have been conducted at areas near borings M-101A, M-102A, and M-111A, groundwater samples collected from wells M-101A, M-102A, and M-111A are not considered to represent background conditions. Therefore, results of chemical analyses performed on the groundwater samples obtained from these three wells are excluded from evaluation of chemical background levels. Statistical analyses of the remaining eight "A" wells were conducted to estimate the site background concentrations of metals and radionuclides. Results of these statistical analyses are presented in Appendices I and K for metals and radionuclides, respectively. There are no discernible patterns to the detections of metals and radionuclides over time.

7.6.2.2 Second Water-Bearing Zone. The second water-bearing zone is encountered in the sand and clayey sand geologic unit between the Holocene Bay Mud Unit and the late Pleistocene estuarine deposits. General groundwater gradients of the second water-bearing zones under the Runway Area, as shown on Figure 2-12, are to the west toward Sites 1 and 2 north to the Oakland Inner Harbor and south to San Francisco Bay.

Based on the RWQCB's total dissolved solid (TDS) criteria stated in State Water Resource Control Board Resolution Number 88-63, groundwater in the second water-bearing zone is classified as saline as shown on Figure 2-10.

A total of four "B" and "C" wells were installed in the second water-bearing zone in this area. Results of the VOC analyses indicated that only levels of acetone and carbon disulfide near the detection limits were detected in groundwater samples collected from M-103B and M-108B. Carbon disulfide was detected in the third and fourth quarterly sampling events. Only two acetone detections were considered as detected but as an estimated value for the groundwater sample collected in the first quarterly sampling event. Chloromethane and methyl ethyl ketone were only detected in the fourth quarter sample from well M-103B, at concentrations of 1.2 µg/L and 3.6 µg/L, respectively.

Only low levels of bis(2-ethylhexyl)phthalate were detected in groundwater samples collected from wells M-103B, M-104C, M-105B, and M-108B. As discussed above, the presence of bis(2-ethylhexyl)phthalate in the groundwater samples tends to be associated with plastic materials used such as nylon rope. Dimethylphthalate was only detected in one sample during the fourth quarter sampling event. Pesticides/PCBs and TRPH were not detected in any of the groundwater samples collected from the "B" and "C" wells in the Runway Area.

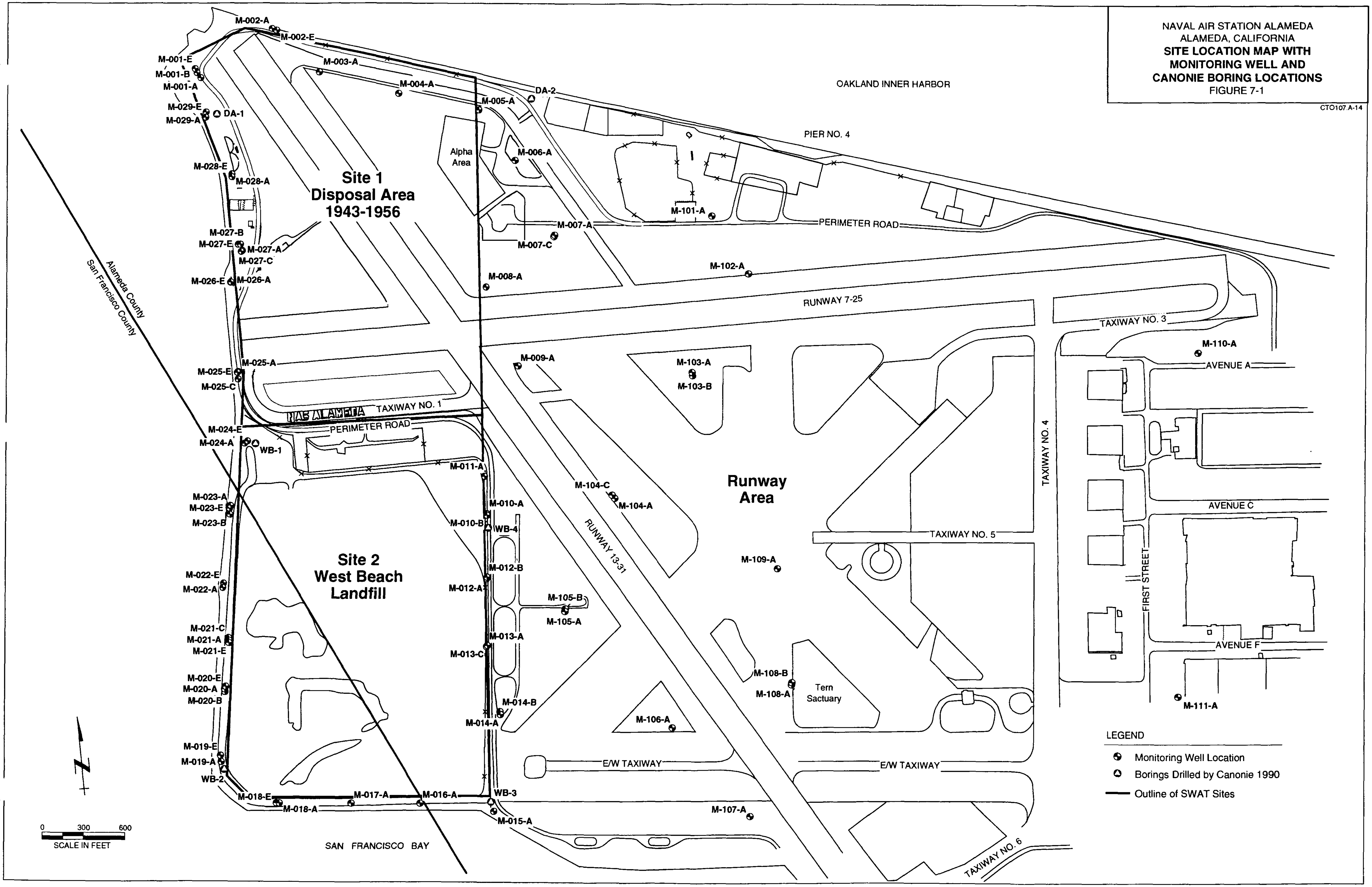
In summary, acetone, carbon disulfide, and bis(2-ethylhexyl)phthalate are not consistently detected in groundwater within the same wells in the Runway Area. As discussed above, acetone and bis(2-ethylhexyl)phthalate could be associated with laboratory contamination or sampling artifacts. Carbon disulfide is commonly found in reducing environments (Dragun, 1988). Therefore, there is no conclusive and consistent evidence to indicate that VOC, SVOC, pesticides/PCBs, and TRPH are present in groundwater in the second water-bearing zone underneath the Runway Area at levels of concern.

As listed in Tables 7-17, 7-18, and 7-19, various metals and radionuclides were detected in most of the groundwater samples. Statistical analyses of the "B" and "C" wells were conducted to estimate the site background concentrations of metals and radionuclides. Results of these statistical analyses are presented in Appendices I and K for metals and radionuclides, respectively.

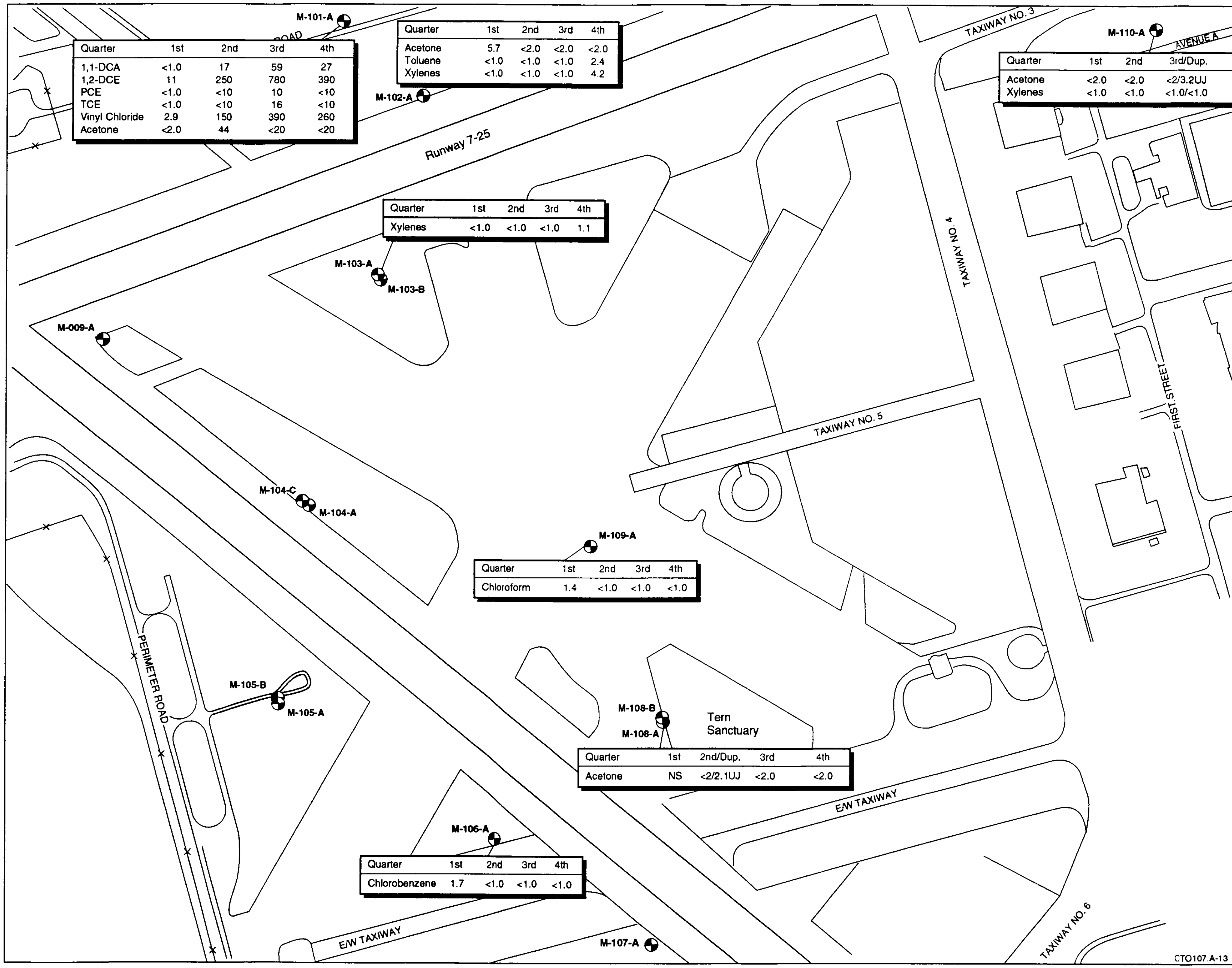
FIGURES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE LOCATION MAP WITH MONITORING WELL AND CANONIE BORING LOCATIONS
FIGURE 7-1



M-101-A

Quarter	1st	2nd	3rd	4th
1,1-DCA	<1.0	17	59	27
1,2-DCE	11	250	780	390
PCE	<1.0	<10	10	<10
TCE	<1.0	<10	16	<10
Vinyl Chloride	2.9	150	390	260
Acetone	<2.0	44	<20	<20

M-102-A

Quarter	1st	2nd	3rd	4th
Acetone	5.7	<2.0	<2.0	<2.0
Toluene	<1.0	<1.0	<1.0	2.4
Xylenes	<1.0	<1.0	<1.0	4.2

M-103-A

Quarter	1st	2nd	3rd	4th
Xylenes	<1.0	<1.0	<1.0	1.1

M-109-A

Quarter	1st	2nd	3rd	4th
Chloroform	1.4	<1.0	<1.0	<1.0

M-108-A

Quarter	1st	2nd/Dup.	3rd	4th
Acetone	NS	<2/2.1UJ	<2.0	<2.0

M-106-A

Quarter	1st	2nd	3rd	4th
Chlorobenzene	1.7	<1.0	<1.0	<1.0

M-110-A

Quarter	1st	2nd	3rd/Dup.	4th
Acetone	<2.0	<2.0	<2/3.2UJ	<2.0
Xylenes	<1.0	<1.0	<1.0/<1.0	1.7

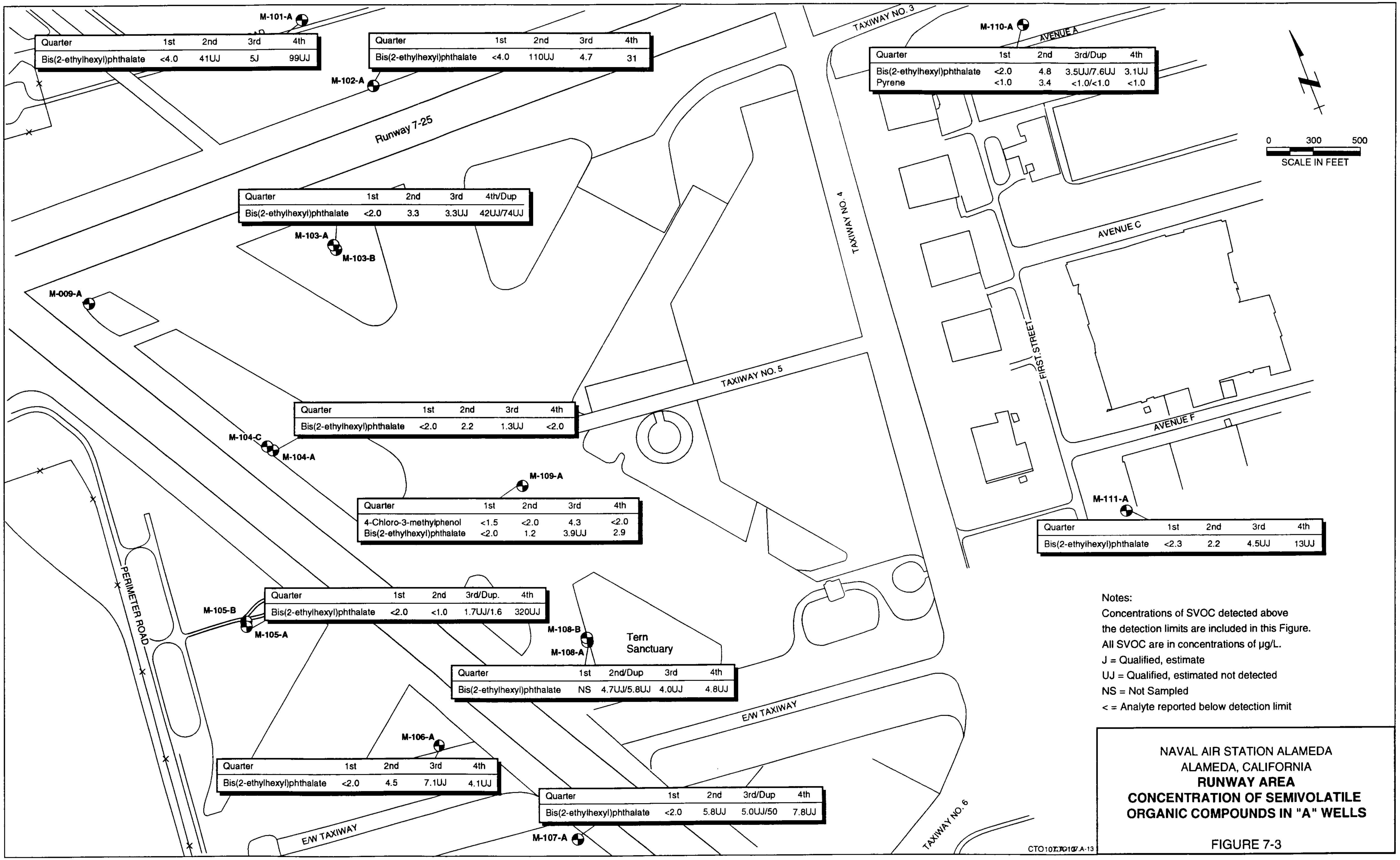
M-111-A

Quarter	1st	2nd	3rd	4th
1,1-DCA	7.2	5.1	6.1	5.2
1,1-DCE	4.7	4.1	3.7	3.3
Xylenes	<1.0	<1.0	<1.0	1.2

Notes:
Concentrations of VOC detected above the detection limits are included in this Figure.
All VOC are in concentrations of μg/L.
J = Qualified, estimate
UJ = Qualified, estimated not detected
TCE = Trichloroethene
PCE = Tetrachloroethene
1,1-DCA = 1,1-Dichloroethane
1,1-DCE = 1,1-Dichloroethylene
1,2-DCE = 1,2-Dichloroethene, Total
< = Analyte reported below detection limit

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
RUNWAY AREA
CONCENTRATION OF VOLATILE ORGANIC COMPOUNDS IN "A" WELLS

FIGURE 7-2



M-101-A

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<4.0	41UJ	5J	99UJ

M-102-A

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<4.0	110UJ	4.7	31

M-110-A

Quarter	1st	2nd	3rd/Dup	4th
Bis(2-ethylhexyl)phthalate	<2.0	4.8	3.5UJ/7.6UJ	3.1UJ
Pyrene	<1.0	3.4	<1.0/<1.0	<1.0

M-103-A

Quarter	1st	2nd	3rd	4th/Dup
Bis(2-ethylhexyl)phthalate	<2.0	3.3	3.3UJ	42UJ/74UJ

M-104-A

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	2.2	1.3UJ	<2.0

M-109-A

Quarter	1st	2nd	3rd	4th
4-Chloro-3-methylphenol	<1.5	<2.0	4.3	<2.0
Bis(2-ethylhexyl)phthalate	<2.0	1.2	3.9UJ	2.9

M-111-A

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.3	2.2	4.5UJ	13UJ

M-105-A

Quarter	1st	2nd	3rd/Dup.	4th
Bis(2-ethylhexyl)phthalate	<2.0	<1.0	1.7UJ/1.6	320UJ

M-108-A

Quarter	1st	2nd/Dup	3rd	4th
Bis(2-ethylhexyl)phthalate	NS	4.7UJ/5.8UJ	4.0UJ	4.8UJ

M-106-A

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	4.5	7.1UJ	4.1UJ

M-107-A

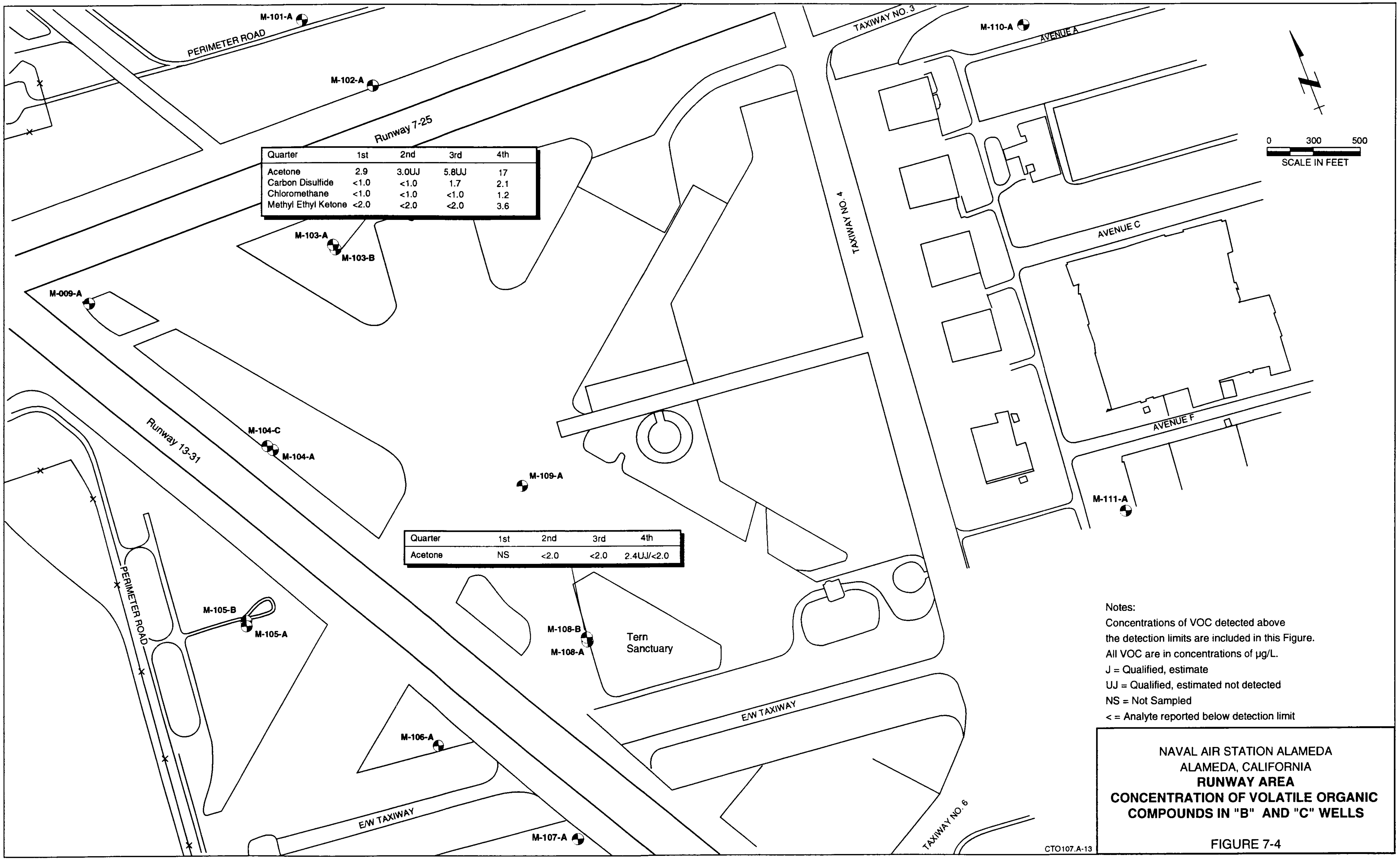
Quarter	1st	2nd	3rd/Dup	4th
Bis(2-ethylhexyl)phthalate	<2.0	5.8UJ	5.0UJ/50	7.8UJ

Notes:
Concentrations of SVOC detected above the detection limits are included in this Figure.
All SVOC are in concentrations of μg/L.
J = Qualified, estimate
UJ = Qualified, estimated not detected
NS = Not Sampled
< = Analyte reported below detection limit

CTO107.A10.7.A-13

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
RUNWAY AREA
CONCENTRATION OF SEMIVOLATILE ORGANIC COMPOUNDS IN "A" WELLS

FIGURE 7-3



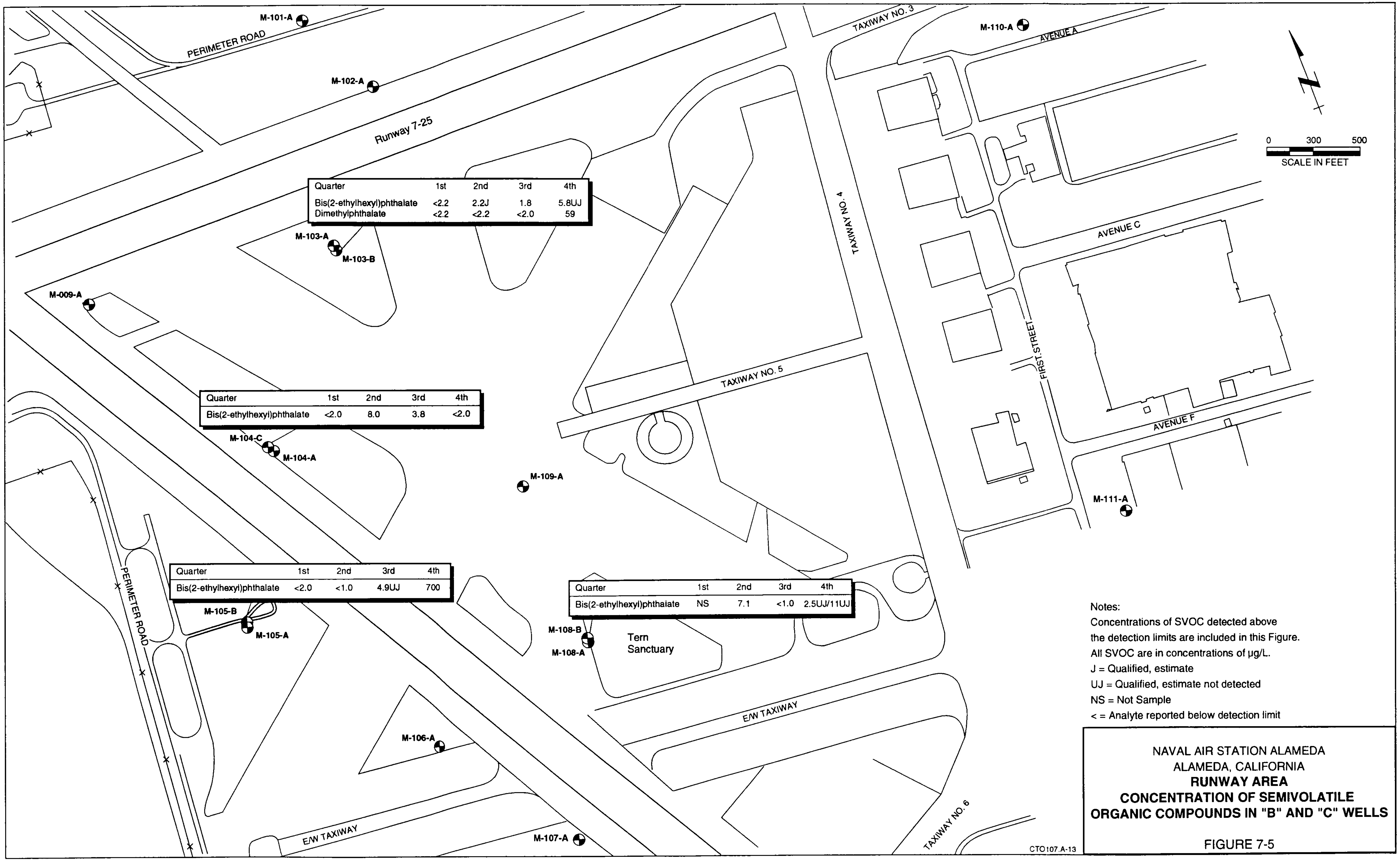
Quarter	1st	2nd	3rd	4th
Acetone	2.9	3.0UJ	5.8UJ	17
Carbon Disulfide	<1.0	<1.0	1.7	2.1
Chloromethane	<1.0	<1.0	<1.0	1.2
Methyl Ethyl Ketone	<2.0	<2.0	<2.0	3.6

Quarter	1st	2nd	3rd	4th
Acetone	NS	<2.0	<2.0	2.4UJ/<2.0

Notes:
Concentrations of VOC detected above the detection limits are included in this Figure.
All VOC are in concentrations of µg/L.
J = Qualified, estimate
UJ = Qualified, estimated not detected
NS = Not Sampled
< = Analyte reported below detection limit

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
RUNWAY AREA
CONCENTRATION OF VOLATILE ORGANIC COMPOUNDS IN "B" AND "C" WELLS

FIGURE 7-4



Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.2	2.2J	1.8	5.8UJ
Dimethylphthalate	<2.2	<2.2	<2.0	59

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	8.0	3.8	<2.0

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	<1.0	4.9UJ	700

Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	NS	7.1	<1.0	2.5UJ/11UJ

Notes:
Concentrations of SVOC detected above the detection limits are included in this Figure.
All SVOC are in concentrations of μg/L.
J = Qualified, estimate
UJ = Qualified, estimate not detected
NS = Not Sample
< = Analyte reported below detection limit

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
RUNWAY AREA
CONCENTRATION OF SEMIVOLATILE ORGANIC COMPOUNDS IN "B" AND "C" WELLS

FIGURE 7-5

N00236.000847
ALAMEDA POINT
SSIC NO. 5090.3

TABLES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

DATED 30 APRIL 1993

TABLE 7-1

RUNWAY AREA
GEOTECHNICAL SAMPLE LABORATORY TEST RESULTS

Sample Number	Depth (ft)	Soil Classification Laboratory (USCS)	Soil Classification Field (USCS)	Stratigraphic Unit	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	CEC (meq/100g)	TOC (%w/w)	Permeability Effective Stresses (psi)	Permeability Hydraulic Conductivity (cm/s)
M-101A	10-10.5	SC	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-102A	9-9.5	SP	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-104A	10.5-11	NA	SP	Fill	18.0	104.5	2.72	5.7	NA	NA	NA
M-104A	11-11.5	SP/SC	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-104C	69-69.5	NA	CL	PE	48.0	74.0	NA	NA	NA	35	2.07E-08
M-106A	10.5-11	SP	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-107A	11-11.5	SP	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-109A	10.5-11	SP	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-110A	10.5-11	SP	SP	Fill	NA	NA	NA	NA	NA	NA	NA
M-111A	10.5-11	SP	SP	Fill	NA	NA	NA	NA	NA	NA	NA

NA - Not Analyzed
Parameters not detectect are reported as less than method detection limit.
PE - Pleistocene Estuarine Deposits

Laboratory Methods (Units):
Soil Classification - Unified Soil Classification System (USCS) - ASTM D2487-90
USCS described in Appendix E
Moisture Content - ASTM D2216 (percent)
Dry Density - ASTM D2937 (pounds per cubic foot)
Specific Gravity - ASTM D854
Cation Exchange Capacity (CEC) - EPA 9080 (milliequivalents per 100 grams)
Total Organic Carbon (TOC) - ASA-SSSA Chp 29 (percent wet weight)
Effective Stress - EPA 9100 (pounds per square inch)
Hydraulic Conductivity - EPA 9100 (centimeters per second)

Table 7-2 - Runway Area Analytical Results for Soil in Fill - Organic Compounds

Sample Number	M-101A-000	M-101A-004	M-102A-000	M-102A-004	M-103A-000	M-103B-000	M-104A-002	Duplicate M-104A-002
Date Sampled	05/30/91	06/03/91	05/30/91	06/03/91	12/12/90	11/28/90	05/30/91	05/30/91
Depth of Sample	0.0 ft	2.0 ft	0.0 ft	2.0 ft	5.5 ft	0.5 ft	0.5 ft	0.5 ft
PARAMETER REPORTED								
Volatile Organics (µg/kg-Dry)								
Acetone	NA	78	NA	320	< 0.1	NA	< 11	53UJ
Semivolatile Organics (µg/kg-Dry)								
Acenaphthylene	< 81	< 80	350	< 84	< 0.17	< 0.17	< 89	< 92
Anthracene	< 81	< 80	660	< 84	< 0.17	< 0.17	< 89	< 92
Benzo(a)anthracene	< 100	< 110	2500	< 120	< 0.17	< 0.17	< 110	< 120
Benzo(a)pyrene	< 140	< 160	2600	< 170	< 0.17	< 0.17	< 160	< 160
Benzo(b)fluoranthene	130	< 110	4600	< 120	< 0.17	< 0.17	< 110	< 120
Benzo(g,h,i)perylene	< 160	< 180	3800	< 190	< 0.17	< 0.17	< 180	< 180
Benzo(k)fluoranthene	< 100	< 110	970	< 120	< 0.17	< 0.17	< 110	< 120
Bis(2-ethylhexyl)phthalate	160	290UJ	190	< 120	< 0.17	< 0.17	150	< 120
Butylbenzylphthalate	110	< 110	< 100	< 120	< 0.17	< 0.17	< 110	< 120
Chrysene	< 100	< 110	2300	< 120	< 0.17	< 0.17	< 110	< 120
Diben(a,h)anthracene	< 160	< 180	510	< 190	< 0.17	< 0.17	< 180	< 180
Fluoranthene	140	< 80	2800	< 84	< 0.17	< 0.17	< 89	< 92
Indeno(1,2,3-cd)pyrene	< 160	< 180	3500	< 190	< 0.17	< 0.17	< 180	< 180
Phenanthrene	< 81	< 80	1300	< 84	< 0.17	< 0.17	< 89	< 92
Pyrene	110	< 80	2500	< 84	< 0.17	< 0.17	< 89	< 92
Pesticides/PCBs/Herbicides (µg/kg-Dry)								
4,4'-DDD	< 6.72	< 7.65	26.71	< 7.96	< 0.010	< 0.010	< 7.46	< 7.69
4,4'-DDE	< 3.36	< 3.83	5.38	< 3.98	< 0.010	< 0.010	< 3.73	< 3.84
4,4'-DDT	< 6.72	< 7.65	93.4	< 7.96	< 0.010	< 0.010	< 7.46	< 7.69
Gamma-Chlordane	< 3.36	< 3.83	4.21	< 3.98	< 0.0050	< 0.0050	< 3.73	< 3.84
Aroclor-1260	130J	< 38	100	< 40	< 0.050	< 0.050	< 37	< 38
Total Recoverable Petroleum Hydrocarbons (mg/kg-Dry)								
Hydrocarbons,Petroleum	652J	NA	1770	NA	NA	NA	NA	NA
Oil And Grease (mg/kg-Dry)								
Oil&Gr,IR	1400	NA	3810	NA	NA	NA	NA	NA

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Sample Number	M-104C-000	Duplicate M-104C-000	M-105A-000	M-105B-000	M-106A-000	M-106A-003	M-107A-000	M-107A-002
Date Sampled	05/16/91	05/16/91	12/10/90	11/28/90	05/16/91	06/03/91	05/16/91	06/03/91
Depth of Sample	0.0 ft	0.0 ft	5.5 ft	0.5 ft	0.0 ft	2.0 ft	0.0 ft	0.5 ft
PARAMETER REPORTED								
Volatile Organics (µg/kg-Dry)								
Acetone	NA	NA	< 0.1	NA	NA	54UJ	NA	77
Semivolatile Organics (µg/kg-Dry)								
Acenaphthylene	< 72	< 71	< 0.17	< 0.17	< 70	< 85	< 71	< 72
Anthracene	< 72	< 71	< 0.17	< 0.17	< 70	< 85	< 71	< 72
Benzo(a)anthracene	< 100	< 100	< 0.17	< 0.17	< 100	< 120	< 100	< 100
Benzo(a)pyrene	< 140	< 140	< 0.17	< 0.17	< 140	< 170	< 140	< 140
Benzo(b)fluoranthene	< 100	< 100	< 0.17	< 0.17	< 100	< 120	< 100	< 100
Benzo(g,h,i)perylene	< 160	< 160	< 0.17	< 0.17	< 160	< 190	< 160	< 170
Benzo(k)fluoranthene	< 100	< 100	< 0.17	< 0.17	< 100	< 120	< 100	< 100
Bis(2-ethylhexyl)phthalate	170	< 100	< 0.17	< 0.17	< 100	< 120	< 100	< 100
Butylbenzylphthalate	< 100	< 100	< 0.17	< 0.17	< 100	< 120	< 100	< 100
Chrysene	< 100	< 100	< 0.17	< 0.17	< 100	< 120	< 100	< 100
Diben(a,h)anthracene	< 160	< 160	< 0.17	< 0.17	< 160	< 190	< 160	< 170
Fluoranthene	< 72	< 71	< 0.17	< 0.17	< 70	< 85	< 71	< 72
Indeno(1,2,3-cd)pyrene	< 160	< 160	< 0.17	< 0.17	< 160	< 190	< 160	< 170
Phenanthrene	< 72	< 71	< 0.17	< 0.17	< 70	< 85	< 71	< 72
Pyrene	< 72	< 71	< 0.17	< 0.17	< 70	< 85	< 71	< 72
Pesticides/PCBs/Herbicides (µg/kg-Dry)								
4,4'-DDD	< 6.85	< 6.80	< 0.010	< 0.010	< 6.70	< 8.07	< 6.76	< 6.88
4,4'-DDE	< 3.43	< 3.40	< 0.010	< 0.010	< 3.35	< 4.04	< 3.38	< 3.44
4,4'-DDT	< 6.85	< 6.80	< 0.010	< 0.010	< 6.70	< 8.07	< 6.76	< 6.88
Gamma-Chlordane	< 3.43	< 3.40	< 0.0050	< 0.0050	< 3.35	< 4.04	< 3.38	< 3.44
Aroclor-1260	< 34	< 34	< 0.050	< 0.050	< 34	< 40	< 34	< 34
Total Recoverable Petroleum Hydrocarbons (mg/kg-Dry)								
Hydrocarbons,Petroleum	2000	3450	NA	NA	965	NA	147	NA
Oil And Grease (mg/kg-Dry)								
Oil&Gr,IR	7690	10600	NA	NA	11600	NA	502	NA

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Sample Number Date Sampled Depth of Sample	M-108A-000 12/11/90 5.5 ft	M-108B-000 11/27/90 0.5 ft	M-37 (DUP) 11/27/90 0.5 ft	M-109A-000 05/16/91 0.0 ft	M-109A-007 05/30/91 5.5 ft	M-110A-003 05/30/91 1.5 ft	M-111A-000 05/31/91 0.5 ft	M-111A-003 05/31/91 2.0 ft
PARAMETER REPORTED								
Volatile Organics (μg/kg-Dry)								
Acetone	< 0.1	NA	NA	NA	24UJ	110	NA	66
Semivolatile Organics (μg/kg-Dry)								
Acenaphthylene	< 0.17	< 3.4	< 3.4	< 74	< 84	< 88	< 74	< 75
Anthracene	< 0.17	< 3.4	< 3.4	< 74	< 84	< 88	< 74	< 75
Benzo(a)anthracene	< 0.17	< 3.4	< 3.4	< 110	< 100	< 110	< 110	< 110
Benzo(a)pyrene	< 0.17	< 3.4	< 3.4	< 150	< 150	< 150	< 150	< 150
Benzo(b)fluoranthene	< 0.17	< 3.4	< 3.4	< 110	< 100	< 110	< 110	< 110
Benzo(g,h,i)perylene	< 0.17	< 3.4	< 3.4	< 170	< 170	< 180	< 170	< 170
Benzo(k)fluoranthene	< 0.17	< 3.4	< 3.4	< 110	< 100	< 110	< 110	< 110
Bis(2-ethylhexyl)phthalate	< 0.17	< 3.4	< 3.4	< 110	250	220	< 110	< 110
Butylbenzylphthalate	< 0.17	< 3.4	< 3.4	< 110	< 100	< 110	< 110	< 110
Chrysene	< 0.17	< 3.4	< 3.4	< 110	< 100	< 110	< 110	< 110
Diben(a,h)anthracene	< 0.17	< 3.4	< 3.4	< 170	< 170	< 180	< 170	< 170
Fluoranthene	< 0.17	< 3.4	< 3.4	< 74	< 84	< 88	< 74	< 75
Indeno(1,2,3-cd)pyrene	< 0.17	< 3.4	< 3.4	< 170	< 170	< 180	< 170	< 170
Phenanthrene	< 0.17	< 3.4	< 3.4	< 74	< 84	< 88	< 74	< 75
Pyrene	< 0.17	< 3.4	< 3.4	< 74	< 84	< 88	< 74	< 75
Pesticides/PCBs/Herbicides (μg/kg-Dry)								
4,4'-DDD	< 0.010	< 0.010	< 0.010	< 7.04	< 7.00	< 7.33	< 7.06	< 7.18
4,4'-DDE	< 0.010	< 0.010	< 0.010	< 3.52	< 3.50	< 3.66	< 3.53	< 3.59
4,4'-DDT	< 0.010	< 0.010	< 0.010	< 7.04	< 7.00	< 7.33	< 7.06	< 7.18
Gamma-Chlordane	< 0.0050	< 0.0050	< 0.0050	< 3.52	< 3.50	< 3.66	< 3.53	< 3.59
Aroclor-1260	< 0.050	< 0.050	< 0.050	< 35	< 35	< 37	< 35	< 36
Total Recoverable Petroleum Hydrocarbons (mg/kg-Dry)								
Hydrocarbons,Petroleum	NA	NA	NA	2410	NA	NA	55.1	NA
Oil And Grease (mg/kg-Dry)								
Oil&Gr,IR	NA	NA		7200	NA	NA	126	NA

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Table 7-3 - Runway Area Summary of Organic Analytical Results for Soil in Fill

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/kg-Dry)									
Acetone	4	3	5	66	320	0	-	-	0
Semivolatile Organics (µg/kg-Dry)									
Acenaphthylene	23	0	1	350	350	0	-	-	0
Anthracene	23	0	1	660	660	0	-	-	0
Benzo(a)anthracene	23	0	1	2500	2500	0	-	-	0
Benzo(a)pyrene	23	0	1	2600	2600	0	-	-	0
Benzo(b)fluoranthene	22	0	2	130	4600	0	-	-	0
Benzo(g,h,i)perylene	23	0	1	3800	3800	0	-	-	0
Benzo(k)fluoranthene	23	0	1	970	970	0	-	-	0
Bis(2-ethylhexyl)phthalate	17	1	6	150	250	0	-	-	0
Butylbenzylphthalate	23	0	1	110	110	0	-	-	0
Chrysene	23	0	1	2300	2300	0	-	-	0
Diben(a,h)anthracene	23	0	1	510	510	0	-	-	0
Fluoranthene	22	0	2	140	2800	0	-	-	0
Indeno(1,2,3-cd)pyrene	23	0	1	3500	3500	0	-	-	0
Phenanthrene	23	0	1	1300	1300	0	-	-	0
Pyrene	22	0	2	110	2500	0	-	-	0
Pesticides/PCBs/Herbicides (µg/kg-Dry)									
4,4'-DDD	23	0	0	-	-	1	26.7	26.7	0
4,4'-DDE	23	0	1	5.38	5.38	0	-	-	0
4,4'-DDT	23	0	1	93.4	93.4	0	-	-	0
Gamma-Chlordane	23	0	1	4.21	4.21	0	-	-	0
Aroclor-1260	22	0	1	100	100	1	130	130	0
Total Recoverable Petroleum Hydrocarbons (mg/kg)	0	0	7	55.1	3450	1	652	652	0
Oil And Grease by IR (mg/kg-Dry)	0	0	8	126	11600	0	-	-	0

Table 7-4 - Runway Area Analyt... Results for Soil in Fill - Metals

Sample Number	M-101A-000	M-101A-004	M-102A-000	M-102A-004	M-103A-000	M-103B-000	M-104A-002
Date Sampled	05/30/91	06/03/91	05/30/91	06/03/91	12/12/90	11/28/90	05/30/91
Depth of Sample	0.0 ft	2.0 ft	0.0 ft	2.0 ft	5.5 ft	0.5 ft	0.5 ft
Parameters Reported							
Metals (Mg/Kg-Dry)							
Aluminum	5600J	2940J	5760J	2120J	3220	3780	4940J
Antimony	< 2.3UJ	< 2.9	3.6UJ	< 2.8	< 2.1	< 1.8	2.7UJ
Arsenic	5.43	2.37	1.19	1.31	4.5	7.4	1.2
Barium	43.2J	19.4	364J	25.4	35.0	32.4	22J
Beryllium	1.05	0.865	1.21	0.572	< 0.18	< 0.16	0.59
Cadmium	1.06	< 0.343	2.59	< 0.337	0.94	< 0.35	< 0.306
Calcium	3710J	66600J	3320J	997J	1570	1810	2950J
Chromium	41.1J	18.9	39.5J	15.6	24.0	27.7	30.1J
Cobalt	6.01	4.2	7.47	3.02	3.9	4.8	5.1
Copper	16.1	5.54	38.2	3.43	6.4	5.5	8.25
Iron	10800J	5890J	11900J	4660J	6080	7450	8940J
Lead	31.9	4.6	185	2.81	1.5	11.6	20
Magnesium	3270	2150	3170	1370	1980	2320	2370
Manganese	155J	179J	161J	55.5J	78.7	103	98.6J
Mercury	0.063	< 0.112	0.069	< 0.105	< 0.061	< 0.06	< 0.051
Nickel	31.8	22.2J	35.5	18J	21.3	25.1	25.5
Potassium	765	488	760	356	514	571	699
Selenium	< 0.212UJ	< 0.235UJ	< 0.161UJ	< 0.218UJ	< 1.6	< 1.2	< 0.226UJ
Silver	0.468J	< 0.560	1.11J	< 0.550	< 0.82	< 0.70	0.625J
Sodium	266	861	309	191	218	266	318
Thallium	< 0.272	< 0.303	< 0.206	< 0.280	< 0.14	< 0.11	< 0.291
Vanadium	23.9	14.4J	37.6	10.6J	12.4	16.8	25.7
Zinc	57.8	17.7	119	11.6	13.8	21.6	23

Note NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-4 - Runway Area Analytical Results for Soil in Fill - Metals

Sample Number	Duplicate M-104A-002	M-104C-000	Duplicate M-104C-000	M-105A-000	M-105B-000	M-106A-000	M-106A-003
Date Sampled	05/30/91	05/16/91	05/16/91	12/10/90	11/28/90	05/16/91	06/03/91
Depth of Sample	0.5 ft	0.0 ft	0.0 ft	5.5 ft	0.5 ft	0.0 ft	2.0 ft
Parameters Reported							
Metals (Mg/Kg-Dry)							
Aluminum	4290J	4050J	2800J	3340	4010	4570J	1760J
Antimony	< 2.6UJ	< 2.6UJ	< 2.5UJ	< 2.2	< 1.9	< 2.5UJ	< 2.8
Arsenic	1.26	2.1	2.26	4.7	8.1	1.69	1.66
Barium	27.6J	24.2	57.3	24.3	30.6	92.5	12.5
Beryllium	0.19	0.336	0.619	< 0.19	< 0.16	0.246	0.609
Cadmium	< 0.312	0.339	0.336	0.48	< 0.37	< 0.297	< 0.338
Calcium	2010J	2440J	1650J	1490	2110	4510J	816J
Chromium	27J	26.1J	22.2J	25.3	29.3	30.3J	15.8
Cobalt	5.44	4.87	3.86	3.7	4.7	4.69	3.67
Copper	5.67	11.1J	10.5J	8.0	7.0	6.12J	3.12
Iron	8130J	7800J	6030J	6710	7890	8030J	4500J
Lead	2.89	24.4	20.7	1.7	11.0	7.22J	1.83
Magnesium	2470	2270	1860	2040	2220	2400	1290
Manganese	92.4J	99.5	80.6	81.0	116.0	108	61J
Mercury	< 0.051	< 0.096UJ	< 0.095UJ	< 0.083	< 0.06	< 0.097UJ	< 0.103
Nickel	27.9	25.3J	22.7J	21.8	23.0	29.5J	17.1J
Potassium	605	686J	526J	541	480	654J	250
Selenium	< 0.206UJ	< 0.210UJ	< 0.213UJ	< 0.30	< 1.3	< 0.204UJ	< 0.223UJ
Silver	< 0.510	0.595	< 0.489	< 0.87	0.86	< 0.485	< 0.552
Sodium	272	367J	348J	443	311	247J	182
Thallium	< 0.265	< 0.271	< 0.274	< 0.13	< 0.11	< 0.262	< 0.286
Vanadium	18.7	20.4J	14.9J	14.1	17.8	22J	10.5J
Zinc	17.3	32.3J	28.6J	15.8	20.2	22.5J	9.98

Note NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-4 - Runway Area Analytical Results for Soil in Fill - Metals

Sample Number	M-107A-000	M-107A-002	M-108A-000	M-108B-000	M-37 (DUP)	M-109A-000	M-109A-007
Date Sampled	05/16/91	06/03/91	12/11/90	11/27/90	11/27/90	05/16/91	05/30/91
Depth of Sample	0.0 ft	0.5 ft	5.5 ft	0.5 ft	0.5 ft	0.0 ft	5.5 ft
Parameters Reported							
Metals (Mg/Kg-Dry)							
Aluminum	4580J	2230J	3260	6890	7480	8100J	3270J
Antimony	< 2.5UJ	< 2.6	< 2.2	< 1.9	< 1.8	< 2.6UJ	< 2.4UJ
Arsenic	1.68	1.56	5.3	15.6	9.4	1.46J	0.917
Barium	33.5	24.6	18.2	62.7	64.5	76	19.2J
Beryllium	0.263	0.531	< 0.19	< 0.17	0.17	1.01	0.832
Cadmium	< 0.299	< 0.305	2.5	< 0.38	< 0.36	< 0.313	< 0.288
Calcium	2010J	881J	1670	2280	2770	2380J	2260J
Chromium	30.4J	18	25.6	56.6	56.7	54.4J	22.7J
Cobalt	4.35	3.63	4.3	8.0	7.0	49.7	3.49
Copper	6.57J	3.79	6.0	13.8	14.1	18.6J	3.68
Iron	8010J	4910J	6280	13900	13100	16700J	6320J
Lead	24.4	3.49	1.6	4.7	5.0	5.63J	2
Magnesium	2380	1420	1990	6270	5980	8080	1870
Manganese	104	60.3J	79.0	370.0	362.0	435	91.5J
Mercury	< 0.098UJ	< 0.100	< 0.083	0.09	< 0.06	< 0.104UJ	< 0.050
Nickel	23.8J	18J	22.0	53.2	48.0	64.6J	18.5
Potassium	649J	304	429	968	1000	1100J	453
Selenium	< 0.211UJ	< 0.207UJ	< 0.30	< 2.5	< 1.3	< 0.217UJ	< 0.180UJ
Silver	< 0.489	< 0.499	< 0.85	< 0.76	< 0.72	1.36	< 0.470
Sodium	378J	319	224	353	450	325J	394
Thallium	< 0.271	< 0.266	< 0.14	< 0.11	< 0.12	< 0.279	< 0.231
Vanadium	21.7J	12.2J	13.5	16.3	16.8	20.3J	16.5
Zinc	29.1J	13.1	13.5	28.0	26.6	33.2J	12

Note NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-4 - Runway Area Analytical Results for Soil in Fill - Metals

Sample Number	M-110A-003	M-111A-000	M-111A-003
Date Sampled	05/30/91	05/31/91	05/31/91
Depth of Sample	1.5 ft	0.5 ft	2.0 ft
Parameters Reported			
Metals (Mg/Kg-Dry)			
Aluminum	6560J	4420J	4070J
Antimony	2.6J	< 2.5UJ	< 2.6UJ
Arsenic	1.09	0.435	0.92
Barium	26.1J	28.2J	30.2J
Beryllium	1.47	1.35	0.38
Cadmium	< 0.275	0.452	< 0.310
Calcium	3210J	2320J	1930J
Chromium	24.4J	23.4J	26.2J
Cobalt	6.38	7.3	4.18
Copper	8.79	6.91	4.68
Iron	12700J	12900J	7890J
Lead	3.19	3.01	2.5
Magnesium	3700	2800	2200
Manganese	179J	96.7J	78.5J
Mercury	< 0.049	< 0.051	< 0.052
Nickel	22	17	22.1
Potassium	660	674	680
Selenium	< 0.215UJ	< 0.179UJ	< 0.222UJ
Silver	0.476J	< 0.490	0.557J
Sodium	267	338	444
Thallium	< 0.277	< 0.231	< 0.285
Vanadium	27.7	23.9	18.8
Zinc	20	15	15

Note NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-5- Runway Area Summary of Metals Results for Soil Samples in Fill

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (mg/kg-Dry)									
Aluminum	0	0	7	3220	7480	17	1760	8100	0
Antimony	11	12	0	-	-	1	2.6	2.6	0
Arsenic	0	0	23	0.435	15.6	1	1.46	1.46	0
Barium	0	0	16	12.5	92.5	8	19.2	364	0
Beryllium	6	0	18	0.17	1.47	0	-	-	0
Cadmium	16	0	8	0.336	2.59	0	-	-	0
Calcium	0	0	7	1490	2770	17	816	66600	0
Chromium	0	0	11	15.6	56.7	13	22.2	54.4	0
Cobalt	0	0	24	3.02	49.7	0	-	-	0
Copper	0	0	19	3.12	38.2	5	6.12	18.6	0
Iron	0	0	7	6080	13900	17	4500	16700	0
Lead	0	0	22	1.5	185	2	5.63	7.22	0
Magnesium	0	0	24	1290	8080	0	-	-	0
Manganese	0	0	12	78.7	435	12	55.5	179	0
Mercury	16	5	3	0.063	0.09	0	-	-	0
Nickel	0	0	15	17	53.2	9	17.1	64.6	0
Potassium	0	0	19	250	1000	5	526	1100	0
Selenium	7	17	0	-	-	0	-	-	0
Silver	16	0	3	0.595	1.36	5	0.468	1.11	0
Sodium	0	0	19	182	861	5	247	378	0
Thallium	24	0	0	-	-	0	-	-	0
Vanadium	0	0	15	12.4	37.6	9	10.5	22	0
Zinc	0	0	19	9.98	119	5	22.5	33.2	0

TABLE 7-6

RANGES OF METAL CONCENTRATIONS FOUND IN TYPICAL SOILS

Metal	Typical Range (mg/kg)	Extreme Range (mg/kg)
Aluminum	10,000 to 300,000	--
Antimony	--	--
Arsenic	1.0 to 4.0	0.1 to 500
Barium	100 to 3,500	10 to 10,000
Beryllium	0.1 to 40	0.1 to 100
Cadmium	0.01 to 7	0.01 to 45
Chromium	5 to 3,000	0.5 to 10,000
Cobalt	1 to 40	0.01 to 500
Copper	2 to 100	0.1 to 14,000
Lead	2 to 200	0.1 to 3,000
Mercury	0.01 to 0.08	--
Nickel	5.0 to 1,000	0.8 to 6,200
Selenium	0.1 to 2	0.01 to 400
Silver	0.1 to 5	0.1 to 50
Thallium	0.1 to 12	--
Vanadium	20 to 500	1 to 1,000
Zinc	10 to 300	3 to 10,000

(Dragun, 1988)

Table 7-7 - Runway Area Analytical Results for Late Pleistocene and Holocene Alluvial/Eolian Deposits-Organic Compounds

Sample Number	**M-104C-062**
Date Sampled	**05/29/91**
Depth of Sample	**62.0 ft**
PARAMETER REPORTED	
Volatile Organics (µg/kg-Dry)	
Acetone	30UJ
Semivolatile Organics (µg/kg-Dry)	ND
Pesticides/PCBs (µg/kg-Dry)	ND
Total Recoverable Petroleum Hydrocarbons (mg/kg-Dry)	
Hydrocarbons,Petroleum	NA
Oil And Grease (mg/kg-Dry)	
Oil&Gr,IR	NA

Notes: NA = Not analyzed
ND = None Detected
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-8 - Runway Area Analytical Results for Late Pleistocene and Holocene Alluvial/Eolian Deposits - Metals

Sample Number	**M-104C-062**
Date Sampled	**05/29/91**
Depth of Sample	**62.0 ft**
Parameter Reported	
Metals (mg/kg-Dry)	
Aluminum	7870J
Antimony	< 2.6UJ
Arsenic	1.72
Barium	13.9J
Beryllium	1.4
Cadmium	< 0.310
Calcium	1880J
Chromium	36.2J
Cobalt	7.31
Copper	10.6
Iron	13300J
Lead	3.08
Magnesium	4230
Manganese	122J
Mercury	< 0.061
Nickel	32.6
Potassium	1280
Selenium	< 0.203
Silver	0.573J
Sodium	1800
Thallium	< 0.261
Vanadium	27.7
Zinc	25.1

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-9 - Runway Area Groundwater Analytical Results for "A" Wells - Organic Compounds

Sample Number	1st Qtr M-101A	2nd Qtr M-101A	3rd Qtr M-101A	4th Qtr M-101A	1st Qtr M-102A	2nd Qtr M-102A	3rd Qtr M-102A	4th Qtr M-102A
Date Sampled	06/23/91	09/23/91	02/05/92	4/14/92	06/24/91	09/23/91	02/07/92	4/21/92
PARAMETER REPORTED								
Volatile Organics (µg/L)								
1,1-Dichloroethane	< 1.0	17	59	27	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	< 1.0	< 10.0	< 10.0	< 10.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethene, Total	11	250	780	390	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 2.0	44	< 20	< 20	5.7	< 2.0	< 2.0	< 2.0
Chlorobenzene	< 1.0	< 10.0	< 10.0	< 10.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 10.0	< 10.0	< 10.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 10.0	10.0	< 10.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 10.0	< 10.0	< 10.0	< 10.0	< 1.0	< 1.0	< 1.0	2.4
Trichloroethene	< 1.0	< 10.0	16	< 10.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	2.9	150	390	260	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes	< 10.0	< 10.0	< 10.0	< 10.0	< 1.0	< 1.0	< 1.0	4.2
Semivolatile Organics (µg/L)								
4-Chloro-3-methylphenol	< 3.0	< 2.0	< 2.0	< 2.0	< 3.0	< 2.0	< 2.0	< 2.0
Bis(2-ethylhexyl)phthalate	< 4.0	41UJ	5J	99UJ	< 4.0	110UJ	4.7	31
Pyrene	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0
Pesticides/PCBs/Herbicides (µg/L)								
Dieldrin	< 0.053	< 0.050	< 0.050	< 0.050	< 0.051	< 0.050	< 0.050	< 0.050
Total Petroleum Hydrocarbons (mg/L)								
Hydrocarbons, Petroleum	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Table 7-9 - Runway Area Groundwater Analytical Results for "A" Wells - Organic Compounds

Sample Number	1st Qtr M-103A	2nd Qtr M-103A	3rd Qtr M-103A	4th Qtr M-103A	4th Qtr M-103A Duplicate	1st Qtr M-104A	2nd Qtr M-104A	3rd Qtr M-104A	4th Qtr M-104A
Date Sampled	07/16/91	10/08/91	02/07/92	4/23/92	4/23/92	07/19/91	10/04/91	02/06/92	3/25/92
PARAMETER REPORTED									
Volatile Organics (µg/L)									
1,1-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethene, Total	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes	< 1.0	< 1.0	< 1.0	1.1	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	< 1.5	< 1.5	< 2.0	< 2.0	< 2.0	< 1.5	< 2.0	< 2.0	< 1.5
Bis(2-ethylhexyl)phthalate	< 2.0	3.3	3.3UJ	42UJ	74UJ	< 2.0	2.2	1.3UJ	< 2.0
Pyrene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Total Petroleum Hydrocarbons (mg/L)									
Hydrocarbons, Petroleum	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Sample Number	1st Qtr M-105A	2nd Qtr M-105A	3rd Qtr M-105A	3rd Qtr M-105A Duplicate	4th Qtr M-105A	1st Qtr M-106A	2nd Qtr M-106A	3rd Qtr M-106A	4th Qtr M-106A
Date Sampled	06/26/91	10/10/91	02/05/92	02/05/92	4/13/92	07/19/91	10/07/91	02/08/92	04/17/92
PARAMETER REPORTED									
Volatile Organics (µg/L)									
1,1-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethene, Total	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	< 1.5	< 2.0	< 2.0	< 2.0	< 2.0	< 1.5	< 1.5	< 2.0	< 2.0
Bis(2-ethylhexyl)phthalate	< 2.0	< 1.0	1.7UJ	1.6	320UJ	< 2.0	4.5	7.1UJ	4.1UJ
Pyrene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	< 0.050	< 0.050	< 0.050	< 0.050	< 0.054	< 0.050UJ	< 0.050	< 0.050	< 0.050
Total Petroleum Hydrocarbons (mg/L)									
Hydrocarbons, Petroleum	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.3

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Table 7-9 - Runway Area Groundwater Analy... Results for "A" Wells - Organic Compounds

Sample Number	1st Qtr M-107A	2nd Qtr M-107A	3rd Qtr M-107A	3rd Qtr M-107A Duplicate	4th Qtr M-107A	2nd Qtr M-108A	2nd Qtr M-108A Duplicate	3rd Qtr M-108A	4th Qtr M-108A
Date Sampled	07/17/91	10/07/91	02/08/92	02/08/92	04/17/92	10/07/91	10/07/91	02/06/92	03/24/92
PARAMETER REPORTED									
Volatile Organics (µg/L)									
1,1-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethene, Total	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.1UJ	< 2.0	< 2.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	< 1.5	< 1.5	< 2.0	< 2.0	< 2.0	< 1.5	< 1.5	< 2.0	< 2.0
Bis(2-ethylhexyl)phthalate	< 2.0	5.8UJ	5.0UJ	50	7.8UJ	4.7UJ	5.8UJ	4.0UJ	4.8UJ
Pyrene	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	< 0.050	< 0.050	< 0.050	1.66J	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Total Petroleum Hydrocarbons (mg/L)									
Hydrocarbons, Petroleum	< 0.2	0.3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Table 7-9 - Runway Area Groundwater Analytical Results for "A" Wells - Organic Compounds

Sample Number	1st Qtr M-109A	2nd Qtr M-109A	3rd Qtr M-109A	4th Qtr M-109A	1st Qtr M-110A	2nd Qtr M-110A	3rd Qtr M-110A	3rd Qtr M-110A Duplicate	4th Qtr M-110A
Date Sampled	07/16/91	10/04/91	02/07/92	04/27/92	07/17/91	10/09/91	02/08/92	02/08/92	04/22/92
PARAMETER REPORTED									
Volatile Organics (µg/L)									
1,1-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethylene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethene, Total	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	3.2UJ	< 2.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	< 1.5	< 2.0	4.3	< 2.0	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Bis(2-ethylhexyl)phthalate	< 2.0	1.2	3.9UJ	2.9	< 2.0	4.8	3.5UJ	7.6UJ	3.1UJ
Pyrene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.4	< 1.0	< 1.0	< 1.0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	< 0.050	< 0.050	< 0.050R	< 0.050	< 0.050	< 0.050	< 0.050	< 1.0	< 1.0
Total Petroleum Hydrocarbons (mg/L)									
Hydrocarbons, Petroleum	< 0.2	< 0.2	< 0.2	0.6	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Sample Number	1st Qtr M-111A	2nd Qtr M-111A	3rd Qtr M-111A	4th Qtr M-111A
Date Sampled	07/18/91	10/09/91	02/08/92	04/22/92
PARAMETER REPORTED				
Volatile Organics (µg/L)				
1,1-Dichloroethane	7.2	5.1	6.1	5.2
1,1-Dichloroethylene	4.7	4.1	3.7	3.3
1,2-Dichloroethene, Total	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 2.0	< 2.0	< 2.0	< 2.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes	< 1.0	< 1.0	< 1.0	1.2
Semivolatile Organics (µg/L)				
4-Chloro-3-methylphenol	< 1.7	< 1.5	< 1.5	< 1.5
Bis(2-ethylhexyl)phthalate	< 2.3	2.2	4.5UJ	13UJ
Pyrene	< 1.1	< 1.0	< 1.0	< 1.0
Pesticides/PCBs/Herbicides (µg/L)				
Dieldrin	< 0.050	< 0.050	< 0.050	< 1.0
Total Petroleum Hydrocarbons (mg/L)				
Hydrocarbons, Petroleum	< 0.2	< 0.2	< 0.2	< 0.2

Notes: NA = Not analyzed
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded areas highlight detections above detection limit

Table 7-10 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "A" Wells

First Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
1,1-Dichloroethane	9	0	1	7.2	7.2	0	-	-	0
1,1-Dichloroethylene	9	0	1	4.7	4.7	0	-	-	0
1,2-Dichloroethene, Total	9	0	1	11	11	0	-	-	0
Acetone	9	0	1	5.7	5.7	0	-	-	0
Chlorobenzene	9	0	1	1.7	1.7	0	-	-	0
Chloroform	9	0	1	1.4	1.4	0	-	-	0
Tetrachloroethene	10	0	0	-	-	0	-	-	0
Trichloroethene	10	0	0	-	-	0	-	-	0
Vinyl Chloride	9	0	1	2.9	2.9	0	-	-	0
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	10	0	0	-	-	0	-	-	0
Bis(2-ethylhexyl)phthalate	10	0	0	-	-	0	-	-	0
Pyrene	10	0	0	-	-	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	9	1	0	-	-	0	-	-	0
Total Recoverable Petroleum Hydrocarbons (mg/L)	10	0	0	-	-	0	-	-	0

Second Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
1,1-Dichloroethane	10	0	2	5.1	17	0	-	-	0
1,1-Dichloroethylene	11	0	1	4.1	4.1	0	-	-	0
1,2-Dichloroethene, Total	11	0	1	250	250	0	-	-	0
Acetone	10	1	1	44	44	0	-	-	0
Chlorobenzene	12	0	0	-	-	0	-	-	0
Chloroform	12	0	0	-	-	0	-	-	0
Tetrachloroethene	12	0	0	-	-	0	-	-	0
Trichloroethene	12	0	0	-	-	0	-	-	0
Vinyl Chloride	11	0	1	150	150	0	-	-	0
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	12	0	0	-	-	0	-	-	0
Bis(2-ethylhexyl)phthalate	1	5	6	1.2	4.8	0	-	-	0
Pyrene	11	0	1	3.4	3.4	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	12	0	0	-	-	0	-	-	0
Total Recoverable Petroleum Hydrocarbons (mg/L)	11	0	1	0.3	0.3	0	-	-	0

Table 7-10 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "A" Wells

Third Quarter

Sample Number Date Sampled PARAMETER REPORTED	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
1,1-Dichloroethane	12	0	2	6.1	59	0	-	-	0
1,1-Dichloroethylene	13	0	1	3.7	3.7	0	-	-	0
1,2-Dichloroethene, Total	13	0	1	780	780	0	-	-	0
Acetone	13	1	0	-	-	0	-	-	0
Chlorobenzene	14	0	0	-	-	0	-	-	0
Chloroform	14	0	0	-	-	0	-	-	0
Tetrachloroethene	13	0	1	10	10	0	-	-	0
Trichloroethene	13	0	1	16	16	0	-	-	0
Vinyl Chloride	13	0	1	390	390	0	-	-	0
Semivolatile Organics (µg/L)									
4-Chloro-3-methylphenol	13	0	1	4.3	4.3	0	-	-	0
Bis(2-ethylhexyl)phthalate	0	10	3	1.6	50	1	5	5	0
Pyrene	14	0	0	-	-	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)									
Dieldrin	13	0	0	-	-	1	1.66	1.66	0
Total Recoverable Petroleum Hydrocarbons (mg/L)	14	0	0	-	-	0	-	-	0

Table 7-10 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "A" Wells

Fourth Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
1,1-Dichloroethane	10	0	2	5.2	27	0	-	-	0
1,1-Dichloroethylene	11	0	1	3.3	3.3	0	-	-	0
1,2-Dichloroethene, Total	11	0	1	390	390	0	-	-	0
Toluene	11	0	1	2.4	2.4	0	-	-	0
Vinyl Chloride	11	0	1	260	260	0	-	-	0
Xylenes, Total	7	0	5	1.1	4.2	0	-	-	0
Semivolatile Organics (µg/L)									
Bis(2-ethylhexyl)phthalate	1	9	2	2.9	31	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)	12	0	0	-	-	0	-	-	0
Total Recoverable Petroleum Hydrocarbons (mg/L)	10	0	2	0.3	0.6	0	-	-	0

Table 7-11 - Runway Area Groundwater Analytical Results for "A" Wells - Metals

Sample Number	1st Qtr M-101A	2nd Qtr M-101A	3rd Qtr M-101A	4th Qtr M-101A	1st Qtr M-102A	2nd Qtr M-102A	3rd Qtr M-102A	4th Qtr M-102A
Date Sampled	**06/23/91**	**09/23/91**	**02/05/92**	**04/14/92**	**06/24/91**	**09/23/91**	**02/07/92**	**04/21/92**
PARAMETER REPORTED								
Metals (µg/L)								
Aluminum	< 31.0	< 31.0	< 40.7	< 40.7	37.1	< 31.0	55.1UJ	406
Antimony	< 25.1	< 25.1	< 37.5	< 37.5	< 25.1	< 25.1	< 37.5	< 37.5
Arsenic	4.0	3.9	2.8J	4.2	5.3	3.9J	< 1.9	< 1.9
Barium	100	103	150	135	22.0	44.3	23.9	23.2
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	< 1.3	< 1.3	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	< 3.0	< 3.0	< 3.9	< 3.9
Calcium	14900J	23500	63900	65700	29300J	61400	27000	37500
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	< 5.7	< 5.7	< 6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2	< 6.1	< 6.1	< 17.2	< 17.2
Copper	2.8	< 2.1	< 3.8	11.6	6.5	< 2.1	6.3	< 3.8
Iron	85.3	447	53.3UJ	17.3	33.4UJ	19.7UJ	52.1UJ	544
Lead	< 2.0UJ	2.7J	< 1.3	< 2.0	< 2.0	3.0	< 1.3	< 2.0
Magnesium	25500J	26800	37400	38400	13400J	21800	10900	7820
Manganese	115	270	886	909	112	240	70.2	53.7
Mercury	< 0.2UJ	< 0.2	< 0.2	< 0.2	< 0.2UJ	< 0.2	< 0.2	< 0.2
Nickel	< 13.2	< 13.2	< 13.2	< 13.2	< 13.2	< 13.2	< 13.2	< 13.2
Potassium	33800J	34900	27000	28900	9280J	11300	7380	3000
Selenium	< 2.1	< 2.1UJ	< 2.0UJ	< 10.0	< 2.1	< 2.1UJ	< 2.0	< 2.0
Silver	< 4.9	< 4.9	< 4.8	< 4.8	< 4.9	< 4.9	< 4.8	< 4.8
Sodium	940000	773000	587000	595000	40600	239000	149000	36800
Thallium	< 2.7UJ	< 2.7	< 1.7UJ	< 1.7	< 2.7	< 2.7	< 1.7UJ	< 1.7
Vanadium	8.0	< 4.2	< 6.0	8.3J	6.5	< 4.2	< 6.0	< 6.0UJ
Zinc	30.1	8.7	5.0	13.2	9.4	3.6	4.8	< 4.6

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-11 - Runway Area Groundwater Analytical Results for "A" Wells - Metals

Sample Number	1st Qtr M-103A	2nd Qtr M-103A	3rd Qtr M-103A	4th Qtr M-103A	4th Qtr M-103A Duplicate	1st Qtr M-104A	2nd Qtr M-104A	3rd Qtr M-104A	4th Qtr M-104A
Date Sampled	07/16/91	10/08/91	02/07/92	04/23/92	04/23/92	07/19/91	10/04/91	02/06/92	03/25/92
PARAMETER REPORTED									
Metals (µg/L)									
Aluminum	64.4	< 31.0	66.9UJ	< 40.7	< 40.7	< 31.0	< 31.0	65.7UJ	886
Antimony	< 25.1	< 25.1	< 37.5	< 37.5	< 37.5	< 25.1	< 25.1	< 37.5	< 37.5
Arsenic	4.4	9.8	7.7	8.8	9.0	7.0	4.3	2.6	7.9
Barium	30.7	13.3UJ	18.4	10.1	10.9	14.0UJ	32.1UJ	24.8	10.5
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	< 2.5	< 1.3	< 1.3	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	< 3.9	< 3.0	< 3.0	< 3.9	< 3.9
Calcium	7830	3530	4690	3470	3490	15700	15500	20400	14200
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	< 6.3	< 5.7	< 5.7	6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2	< 17.2	< 6.1	< 6.1	< 17.2	< 17.2
Copper	17.3	20.4	5.4	< 3.8	< 3.8	8.7	8.4	< 3.8	< 3.8
Iron	104	1080	225	27.7J	38.8UJ	18.2UJ	1980	90.2UJ	1100
Lead	< 2.0	< 2.0	1.3	< 2.0	< 2.0	< 2.0	< 2.0	< 1.3	< 1.3
Magnesium	6240	2290	3090	2540	2670	10600	10100	11900	8500
Manganese	50.3	24.7	29.5	26.8	28.9	40.1	48.4	43.3	41.4
Mercury	< 0.2	0.3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Nickel	< 13.2	< 13.2UJ	< 13.2	< 13.2	< 13.2	< 13.2	< 13.2UJ	< 13.2	< 13.2
Potassium	10500	8250	6420	6280	5940	16500	17100	14800	14300J
Selenium	< 2.1	< 2.1UJ	< 2.0	< 2.0UJ	< 2.0UJ	< 2.1	< 2.1UJ	< 2.0	< 2.0UJ
Silver	< 4.9	< 4.9	< 4.8	< 4.8	< 4.8	< 4.9	< 4.9	< 4.8	< 4.8
Sodium	77600	70700	67200	66900	61900	84700	60600	53800	172000
Thallium	< 2.7	< 2.7UJ	< 1.7	< 1.7	< 1.7	< 2.7	< 2.7UJ	< 1.7	< 1.7UJ
Vanadium	< 4.2	< 4.2	6.3	< 6.0	< 6.0	< 4.2	< 4.2	< 6.0	7.5
Zinc	3.4	10.5UJ	13.8	6.4J	< 4.6UJ	2.8UJ	18.1UJ	5.4	6.2

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Sample Number	1st Qtr M-105A	2nd Qtr M-105A	3rd Qtr M-105A	3rd Qtr M-105A Duplicate	4th Qtr M-105A	1st Qtr M-106A	2nd Qtr M-106A	3rd Qtr M-106A	4th Qtr M-106A
Date Sampled	06/26/91	10/10/91	02/05/92	02/05/92	04/13/92	07/19/91	10/07/91	02/08/92	04/17/92
PARAMETER REPORTED									
Metals (µg/L)									
Aluminum	57.7	42	75.2UJ	78.0UJ	2190	3710	381	404	< 40.7
Antimony	< 25.1	< 25.1	< 37.5	< 37.5	< 37.5	< 25.1	< 25.1	< 37.5	< 37.5
Arsenic	15.5	20.4	7.2	10.8	7.6J	7.7	8.0	< 1.9	2.2J
Barium	5.8	11.7UJ	6.1J	7.4J	16.1	19.5	7.1UJ	7.2	2.3
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	< 2.5	< 1.3	< 1.3	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	< 3.9	< 3.0	< 3.0	< 3.9	< 3.9
Calcium	1730J	1390	3330	1750	1620	1330	2600	4440	3830
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	11.5	14.1	< 5.7	< 6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2	< 17.2	< 6.1	< 6.1	< 17.2	< 17.2
Copper	4.5	21.6	6.4	5.4	< 3.8	17.9	24.6	12.9	7.0
Iron	97.2	303	79.8UJ	33.0UJ	3340	5370	560	549	< 7.7
Lead	< 2.0	< 2.0	< 1.3UJ	< 1.3UJ	< 2.0UJ	< 2.0	< 2.0	< 1.3	< 2.0
Magnesium	1030J	779	7540	958	1370	1750	1590	2540	2200
Manganese	3	4.2	9.1UJ	2.1UJ	24.0	47.9	9.7	7.8	1.9
Mercury	< 0.2UJ	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Nickel	< 13.2	< 13.2UJ	< 13.2	< 13.2	< 13.2	16.2	< 13.2UJ	< 13.2	< 13.2
Potassium	5010J	5990	6360	4380	4150	5050	7090	5490	4830
Selenium	< 2.1	< 2.1UJ	< 2.0UJ	< 2.0UJ	< 10.0	< 2.1	< 2.1UJ	< 2.0	< 2.0
Silver	< 4.9	< 4.9	< 4.8	< 4.8	< 4.8	< 4.9	< 4.9	< 4.8	< 4.8
Sodium	76800	75800	134000	79400	74000	25600	21600	14400J	12000
Thallium	< 2.7	< 2.7UJ	< 1.7UJ	< 1.7	< 1.7UJ	< 2.7	< 2.7UJ	< 1.7UJ	< 1.7
Vanadium	22.7	32.9	16.5	17.7	23.7J	50.8	25.0	6.9	10.3J
Zinc	4.3	7.0UJ	< 4.6	4.8	8.0	11.5UJ	10.3UJ	14.3UJ	< 4.6

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-11 - Runway Area Groundwater Analytical Results for "A" Wells - Metals

Sample Number	1st Qtr M-107A	2nd Qtr M-107A	3rd Qtr M-107A	3rd Qtr M-107A Duplicate	4th Qtr M-107A	1st Qtr M-108A	2nd Qtr M-108A	2nd Qtr M-108A Duplicate	3rd Qtr M-108A	4th Qtr M-108A
Date Sampled	7/17/91	10/7/91	02/08/92	02/08/92	04/17/92		10/07/91	10/07/91	02/06/92	03/24/92
PARAMETER REPORTED										
Metals (µg/L)										
Aluminum	< 31.0	32.4	< 40.7	< 40.7	616	NS	< 31.0	< 31.0	76.8UJ	< 40.7
Antimony	< 25.1	< 25.1	< 37.5	< 37.5	< 37.5	NS	< 25.1	< 25.1	< 37.5	< 37.5
Arsenic	6.1	7.6	4.7	5.7	2.5	NS	7.4	7.1	8.7	21.1
Barium	93.9	84.9	84.5	29.0	33.3	NS	49.4UJ	45.9UJ	41.6	33.6
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	< 2.5	NS	< 1.3	< 1.3	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	< 3.9	NS	< 3.0	< 3.0	< 3.9	< 3.9
Calcium	30500	24800	17500	25700	5450	NS	12300	11200	13300	8490
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	10.1	NS	< 5.7	< 5.7	< 6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2	< 17.2	NS	< 6.1	< 6.1	< 17.2	< 17.2
Copper	21.8	10.5	6.8	< 3.8	21.4	NS	18.9	8.3	12.5	< 3.8
Iron	36.8UJ	31.5UJ	15.7UJ	16.8UJ	1090	NS	409	736	60.1UJ	< 7.7
Lead	7.1	< 2.0	6.2	2.8UJ	< 2.0UJ	NS	3.7	< 2.0	< 1.3	< 1.3
Magnesium	21100	16400	13100	24600	3240	NS	15100	13100	13400	11800
Manganese	213	164	129	272	124	NS	108	93.3	96.0	65.7
Mercury	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	NS	< 0.2	< 0.2	< 0.2	< 0.2
Nickel	< 13.2	< 13.2UJ	< 13.2	< 13.2	41.9	NS	< 13.2UJ	< 13.2UJ	< 13.2	< 13.2
Potassium	22200	20100	18200	22700	5210	NS	16200	14800	11500	8070
Selenium	< 2.1	< 2.1UJ	< 2.0	< 2.0UJ	< 2.0	NS	< 2.1	< 2.1UJ	< 2.0	< 2.0
Silver	< 4.9	< 4.9	< 4.8	< 4.8	< 4.8	NS	< 4.9	< 4.9	4.8	< 4.8
Sodium	542000	472000	516000J	255000J	117000	NS	451000	420000	340000	278000
Thallium	< 2.7	< 2.7UJ	< 1.7UJ	< 1.7UJ	< 1.7	NS	< 2.7UJ	< 2.7UJ	< 1.7UJ	< 1.7
Vanadium	4.3	< 4.2	< 6.0	< 6.0	20.3J	NS	6.4	7.5	18.4	26.1
Zinc	< 2.3	10.8UJ	< 4.6	5.4UJ	7.2	NS	7.1UJ	5.9UJ	6.9	< 4.6

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-11 - Runway Area Groundwater Analytical Results for "A" Wells - Metals

Sample Number	1st Qtr M-109A	2nd Qtr M-109A	3rd Qtr M-109A	4th Qtr M-109A	1st Qtr M-110A	2nd Qtr M-110A	3rd Qtr M-110A	3rd Qtr M-110A Duplicate	4th Qtr M-110A
Date Sampled	07/16/91	10/04/91	02/07/92	04/27/92	07/17/91	10/09/91	02/08/92	02/08/92	04/22/92
PARAMETER REPORTED									
Metals (µg/L)									
Aluminum	< 31.0	57.6	80.7UJ	46.6	31.1	< 31.0	< 40.7	< 40.7	< 40.7
Antimony	< 25.1	< 25.1	41.0	< 37.5	< 25.1	< 25.1	< 37.5	< 37.5	< 37.5
Arsenic	7.9	10.2	7.0	14.3	7.8	7.8	5.1	4.9	5.9
Barium	14.5	12.8UJ	21.7	5.9	40.0	38.4UJ	28.4	87.3	42.6
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	< 1.3	< 1.3	< 2.5	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	< 3.0	< 3.0	< 3.9	< 3.9	< 3.9
Calcium	5760	5320	6500	3310	27800	26400	27400	17200	32300
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	< 5.7	< 5.7	< 6.3	< 6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2	< 6.1	< 6.1	< 17.2	< 17.2	< 17.2
Copper	17.9	11.5	4.0	< 3.8	27.3	7.1	< 3.8	7.2	< 3.8
Iron	22.2UJ	2110	33.4UJ	16.1	57.8	639	17.8UJ	17.3UJ	554J
Lead	< 2.0	< 2.0	< 1.3	< 2.0	< 2.0	< 2.0	6.3	2.5UJ	< 2.0
Magnesium	5670	4670	5820	3130	42600	34700	21800	13100	43300
Manganese	25.5	15.4	17.1	8.9	411	337	245	139	417
Mercury	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Nickel	< 13.2	< 13.2UJ	< 13.2	< 13.2	< 13.2	< 13.2UJ	< 13.2	< 13.2	< 13.2
Potassium	11800	11700	12200	8800	29000	27800	21200	18800	27800
Selenium	< 2.1	< 2.1UJ	< 2.0	< 2.0UJ	< 2.1	< 2.1UJ	< 2.0	< 2.0	< 2.0UJ
Silver	< 4.9	< 4.9	5.4	< 4.8	< 4.9	< 4.9	< 4.8	< 4.8	< 4.8
Sodium	373000	307000	363000	306000	454000	398000	168000J	548000J	441000
Thallium	< 2.7	< 2.7UJ	< 1.7UJ	< 1.7	< 2.7	< 2.7UJ	< 1.7UJ	< 1.7UJ	< 1.7UJ
Vanadium	18.4	22.6	29.7	24.2	4.5	< 4.2	< 6.0	< 6.0	< 6.0
Zinc	4.4	10.5UJ	8.1	6.2J	< 2.3	7.1UJ	11.2UJ	7.0UJ	< 4.6UJ

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Sample Number	1st Qtr M-111A	2nd Qtr M-111A	3rd Qtr M-111A	4th Qtr M-111A
Date Sampled	07/18/91	10/09/91	02/08/92	04/22/92
PARAMETER REPORTED				
Metals (µg/L)				
Aluminum	< 31.0	< 31.0	55.5	854
Antimony	< 25.1	< 25.1	< 37.5	< 37.5
Arsenic	9.2J	8.5	5.0	7.1
Barium	56.2	37.3UJ	48.4	35.2
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9
Calcium	19000	12400	13100	10500
Chromium	< 5.7	< 5.7	< 6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2
Copper	17.0	15.3	4.6	< 3.8
Iron	10.8UJ	1420	38.8UJ	884J
Lead	2.0	< 2.0	3.2	< 2.0
Magnesium	26600	14700	15700	9310
Manganese	179	118	119	72.8
Mercury	< 0.2	< 0.2	< 0.2	< 0.2
Nickel	< 13.2	< 13.2UJ	< 13.2	< 13.2
Potassium	25700	18600	16900	13200
Selenium	< 2.1	< 2.1UJ	< 2.0	< 2.0UJ
Silver	< 4.9	< 4.9	< 4.8	< 4.8
Sodium	805000	566000	561000J	451000
Thallium	< 2.7	< 2.7UJ	< 1.7UJ	< 1.7
Vanadium	< 4.2	< 4.2	< 6.0	< 6.0
Zinc	3.6UJ	8.3UJ	15.2UJ	< 4.6UJ

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-12 - Runway Area Summary of Metals Results for Quarterly Groundwater Samples in "A" Wells

First Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	5	0	5	31.1	3710	0	-	-	0
Antimony	10	0	0	-	-	0	-	-	0
Arsenic	0	0	9	4	15.5	1	9.2	9.2	0
Barium	0	1	9	5.8	100	0	-	-	0
Beryllium	10	0	0	-	-	0	-	-	0
Cadmium	10	0	0	-	-	0	-	-	0
Calcium	0	0	7	1330	30500	3	1730	29300	0
Chromium	9	0	1	14.1	14.1	0	-	-	0
Cobalt	10	0	0	-	-	0	-	-	0
Copper	0	0	10	2.8	27.3	0	-	-	0
Iron	0	5	5	57.8	5370	0	-	-	0
Lead	7	1	2	2	7.1	0	-	-	0
Magnesium	0	0	7	1750	42600	3	1030	25500	0
Manganese	0	0	10	3	411	0	-	-	0
Mercury	7	3	0	-	-	0	-	-	0
Nickel	9	0	1	16.2	16.2	0	-	-	0
Potassium	0	0	7	5050	29000	3	5010	33800	0
Selenium	10	0	0	-	-	0	-	-	0
Silver	10	0	0	-	-	0	-	-	0
Sodium	0	0	10	25600	940000	0	-	-	0
Thallium	9	1	0	-	-	0	-	-	0
Vanadium	3	0	7	4.3	50.8	0	-	-	0
Zinc	2	3	5	3.4	30.1	0	-	-	0

Second Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	8	0	4	32.4	381	0	-	-	0
Antimony	12	0	0	-	-	0	-	-	0
Arsenic	0	0	11	3.9	20.4	1	3.9	3.9	0
Barium	0	9	3	44.3	103	0	-	-	0
Beryllium	12	0	0	-	-	0	-	-	0
Cadmium	12	0	0	-	-	0	-	-	0
Calcium	0	0	12	1390	61400	0	-	-	0
Chromium	12	0	0	-	-	0	-	-	0
Cobalt	12	0	0	-	-	0	-	-	0
Copper	2	0	10	7.1	24.6	0	-	-	0
Iron	0	2	10	303	2110	0	-	-	0
Lead	9	0	2	3	3.7	1	2.7	2.7	0
Magnesium	0	0	12	779	34700	0	-	-	0
Manganese	0	0	12	4.2	337	0	-	-	0
Mercury	11	0	1	0.3	0.3	0	-	-	0
Nickel	2	10	0	-	-	0	-	-	0
Potassium	0	0	12	5990	34900	0	-	-	0
Selenium	1	11	0	-	-	0	-	-	0
Silver	12	0	0	-	-	0	-	-	0
Sodium	0	0	12	21600	773000	0	-	-	0
Thallium	2	10	0	-	-	0	-	-	0
Vanadium	7	0	5	6.4	32.9	0	-	-	0
Zinc	0	10	2	3.6	8.7	0	-	-	0

Table 7-12 - Runway Area Summary of Metals Results for Quarterly Groundwater Samples in "A" Wells

Third Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	5	7	2	55.5	404	0	-	-	0
Antimony	13	0	1	41	41	0	-	-	0
Arsenic	2	0	11	2.6	10.8	1	2.8	2.8	0
Barium	0	0	12	7.2	150	2	6.1	7.4	0
Beryllium	14	0	0	-	-	0	-	-	0
Cadmium	14	0	0	-	-	0	-	-	0
Calcium	0	0	14	1750	63900	0	-	-	0
Chromium	13	0	1	6.3	6.3	0	-	-	0
Cobalt	14	0	0	-	-	0	-	-	0
Copper	4	0	10	4	12.9	0	-	-	0
Iron	0	12	2	225	549	0	-	-	0
Lead	6	4	4	1.3	6.3	0	-	-	0
Magnesium	0	0	14	958	37400	0	-	-	0
Manganese	0	2	12	7.8	886	0	-	-	0
Mercury	14	0	0	-	-	0	-	-	0
Nickel	14	0	0	-	-	0	-	-	0
Potassium	0	0	14	4380	27000	0	-	-	0
Selenium	10	4	0	-	-	0	-	-	0
Silver	12	0	2	4.8	5.4	0	-	-	0
Sodium	0	0	8	53800	587000	6	14400	561000	0
Thallium	3	11	0	-	-	0	-	-	0
Vanadium	8	0	6	6.3	29.7	0	-	-	0
Zinc	2	5	7	4.8	13.8	0	-	-	0

Fourth Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Coun t	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	6	0	6	46.6	2190	0	-	-	0
Antimony	12	0	0	-	-	0	-	-	0
Arsenic	1	0	9	2.5	21.1	2	2.2	7.6	0
Barium	0	0	12	2.3	135	0	-	-	0
Beryllium	12	0	0	-	-	0	-	-	0
Cadmium	12	0	0	-	-	0	-	-	0
Calcium	0	0	12	1620	65700	0	-	-	0
Chromium	10	0	2	10.1	11.5	0	-	-	0
Cobalt	12	0	0	-	-	0	-	-	0
Copper	9	0	3	7	21.4	0	-	-	0
Iron	2	1	6	16.1	3340	3	27.7	884	0
Lead	10	2	0	-	-	0	-	-	0
Magnesium	0	0	12	1370	43300	0	-	-	0
Manganese	0	0	12	1.9	909	0	-	-	0
Mercury	12	0	0	-	-	0	-	-	0
Nickel	11	0	1	41.9	41.9	0	-	-	0
Potassium	0	0	11	3000	28900	1	14300	14300	0
Selenium	6	6	0	-	-	0	-	-	0
Silver	12	0	0	-	-	0	-	-	0
Sodium	0	0	12	12000	595000	0	-	-	0
Thallium	9	3	0	-	-	0	-	-	0
Vanadium	4	1	3	7.5	26.1	4	8.3	23.7	0
Zinc	3	3	4	6.2	13.2	2	6.2	6.4	0

Table 7-13 - Runway Area Groundwater Analytical Results for "A" Wells - General Chemicals

Sample Number	1st Qtr M-101A	2nd Qtr M-101A	3rd Qtr M-101A	4th Qtr M-101A	1st Qtr M-102A	2nd Qtr M-102A	3rd Qtr M-102A	4th Qtr M-102A	1st Qtr M-103A	2nd Qtr M-103A	3rd Qtr M-103A	4th Qtr M-103A	4th Qtr M-103A Duplicate
Date Sampled	06/23/91	09/23/91	02/05/92	04/14/92	06/24/91	09/23/91	02/07/92	04/21/92	07/16/91	10/08/91	02/07/92	04/23/92	04/23/92
PARAMETER REPORTED													
Physical Parameters-Lab													
Acidity, total (mg/L-CaCO3)	8.9	10.9	23.1	18.2	4.6UJ	12.4	6.9	6.3	2.6UJ	4.7UJ	2.1	2.6UJ	5.7
Alkalinity, total (mg/L-CaCO3)	840	633	607	200	216	435	233	163	152	129	161	358	130
COD (mg/L)	108	85.0	85.0	130	< 50.0	85.0	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0
Hardness (mg/L-CaCO3)	800	232	252	120	136	276	114	138	72.0	< 1.0	22.4	38	28
Total Dissolved Solids, TDS (mg/L)	2810	2630	2020	2120	434	878	544	285	313	343	282	257	263
Spec. cond., lab (umhos/cm)	4750	4820	3570	3550	649	1470	906	415	466	301	366	318	319
Physical Parameters-Field													
Spec. cond., field @25 C (umhos/cm)	3750	4000	2300	3000	345	1300	500	250	700	300	350	290	290
Water Temp (deg C)	15.7	21.0	17.0	17.9	18.6	20.0	17.0	18.2	19.4	20.0	15.1	17.2	17.2
pH, Field (Std units)	7.91	7.00	7.56	7.43	7.79	7.00	7.75	6.89	9.01	7.00	8.16	7.52	7.52
Total Organic Carbon (mg/L)													
Carbon, TOC	26.9	2	21.3	33.8	6.2	15.5	10.8	5	2.9	6.9	3.7	4.6UJ	9.9UJ
Asbestos													
Asbestos, Mass (ug/L)	0.322	0.0	0.00648	0.014	0.0462	0.00298	0.0263	0.00164	0.00615	0.0	0.0213	0.0327	0.00751
Asbestos, Total Structures (MAS/L)	1800	0.0	109	319	254	30.6	227	36.8	84.4	0.0	47.7	99.7	62.3
Anions													
Chloride (mg/L)	1209	1137	778.2	792.4	72.47	194.7	108.3	37.91	24.11	20.12	21.29	21.35	21.28
Cyanide (ug/L)	< 10.0	< 10.0	< 5.0	< 5.0	< 10.0	< 10.0	< 5.0	< 5.0	< 10.0	< 2.5	< 5.0	< 5.0	< 5.0
Fluoride (mg/L)	2.28	2.16	0.87	0.78	< 0.40	< 0.80	0.20UJ	< 0.10	0.30UJ	0.27UJ	0.27	0.22UJ	0.23UJ
Nitrogen, NO2+NO3 (mg/L-as N)	< 0.010	0.014	0.043	1.29	0.010	0.032	0.192	0.396	0.016	0.067	0.15	0.246	0.136J
Sulfate (mg/L)	13.16	21	46.19	41.14	31.25	42.66	35.57	20.08	7.379	7.031	6.787	7.692	7.772
Radiochemicals (pCi/L)													
Alpha, gross	< 0.1	< 0.1	5.9	16.1	1.6	< 0.1	< 0.1	0.7	2.6	8.5	3.3	5.2	3.6
Alpha, gross, ct.error (+/- pCi/L)	18.0	8.1	13.6	10.5	3.7	4.0	2.9	1.3	2.6	6.0	4.3	2	1.8
Beta, gross	40	23	14.5	24.2	3.4	5.0	< 0.3	4.9UJ	< 0.3	12	6.6	11.8	14.8
Beta, gross, ct.error (+/- pCi/L)	24.8	20.8	21.1	13.4	5.5	14.3	4.8	2.5	3.9	5.0	6.3	3.2	2.8
Radium 226	0.9	3.1	0.5	0.7	3.1	2.5	0.8	0.3	1.4UJ	6	0.8	1.2	0.4
Radium 226, ct.error (+/- pCi/L)	0.7	1.1	0.4	0.7	0.9	1.0	0.6	0.5	0.8	1.3	0.5	0.7	0.5
Radium 228	< 0.3	< 0.3	< 0.3	0.7UJ	< 0.3	0.4	< 0.3	0.6UJ	2.4	1.4UJ	< 0.3	1.7	0.9
Radium 228, ct.error (+/- pCi/L)	0.9	0.9	0.6	0.4	0.9	0.8	0.5	0.6	1.8	0.6	0.6	0.7	0.6

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-13 - Runway Area Groundwater Analytical Results for "A" Wells - General Chemicals

Sample Number	1st Qtr M-104A	2nd Qtr M-104A	3rd Qtr M-104A	4th Qtr M-104A	1st Qtr M-105A	2nd Qtr M-105A	3rd Qtr M-105A	3rd Qtr M-105A Duplicate	4th Qtr M-105A	1st Qtr M-106A	2nd Qtr M-106A	3rd Qtr M-106A	4th Qtr M-106A
Date Sampled	07/19/91	10/04/91	02/06/92	03/25/92	06/26/91	10/10/91	02/05/92	02/05/92	04/13/92	07/19/91	10/07/91	02/08/92	04/17/92
PARAMETER REPORTED													
Physical Parameters-Lab													
Acidity, total (mg/L-CaCO3)	< 1.0UJ	1.5UJ	3.5UJ	< 1.0	< 1.0UJ	< 1.0	1.6UJ	2.0UJ	2.5UJ	< 1.0UJ	< 1.0	1.3UJ	1.6UJ
Alkalinity, total (mg/L-CaCO3)	684	684	159	205	148	129	142	118	128	92	51.0	148	48
COD (mg/L)	63	< 50.0	< 50.0	< 50.0	63J	< 50.0	53.0	53.0	< 50.0	130	53	< 50.0	53
Hardness (mg/L-CaCO3)	92.0	92.0	92.0	56	24.0	4.0U	8.0	7.2	14	20.0	56.0	20.0	24
Total Dissolved Solids, TDS (mg/L)	404	316	332	514	352	450	346	355	333	238	237	210	256
Spec. cond., lab (umhos/cm)	674	519	493	902	572	533	426	409	366	375	249	177	224
Physical Parameters-Field													
Spec. cond., field @25 C (umhos/cm)	470	4200	400	680	320	410	350	350	280	135	120	40.0	85
Water Temp (deg C)	19.2	20.0	15.2	16.1	16.4	20.0	16.3	16.3	16.8	18.4	20.0	15.0	18.4
pH, Field (Std units)	8.27	7.00	7.81	8.51	8.36	7.00	9.09	9.09	7.52	9.21	7.00	7.65	7.8
Total Organic Carbon (mg/L)													
Carbon, TOC	4.0	5.1	3.0	12.7	5.1J	4.3	2.8	4.2	4.4	2.3J	3.2	7.2	9.6
Asbestos													
Asbestos, Mass (ug/L)	0.0382	0.000509	0.0404	0	0.0	0.0	0.0	0.0	0.000526	0.0	0.0	0.0	0.00829
Asbestos, Total Structures (MAS/L)	649	14.5	351	0	0.0	0.0	0.0	0.0	8.44	0.0	0.0	0.0	332
Anions													
Chloride (mg/L)	74.74	62.23	44.98	156.4	25.76	25.76	25.09	25.3	21.48	10.37	16.35	9.85	4.015
Cyanide (ug/L)	< 10.0	< 2.5	< 5.0	< 5.0	< 10.0	< 10.0	8.2	< 5.0	< 5.0	< 10.0	< 2.5	< 5.0	< 5.0
Fluoride (mg/L)	0.39UJ	0.33UJ	0.26	0.34	< 0.40	0.27UJ	0.20UJ	0.20UJ	0.17UJ	< 0.20	< 0.20	< 0.10	< 0.10
Nitrogen, NO2+NO3 (mg/L-as N)	0.618	0.016	0.011	0.475	1.89	1.11	1.58	1.62	3.48	0.077	0.133	0.416	0.018UJ
Sulfate (mg/L)	15.42	14.39	15.83	11.6	21.12	19.92	24.09	23.94	25.43	6.857	6.441	9.714	4.532
Radiochemicals (pCi/L)													
Alpha, gross	8.2	0.6	5.1	4.1	< 0.3	28.9	6.2	4.8	18.5	10.5	79.4	18.2	13.1
Alpha, gross, ct.error (+/- pCi/L)	5.2	3.9	3.4	5	10.4	8.6	3.4	4.0	24.9	15.9	25.4	7.3	3.5
Beta, gross	< 0.3	9.5	19.4	15.5	11	9.3	18.8	19.7	69.2	< 0.3	49	34.3	27
Beta, gross, ct.error (+/- pCi/L)	5.9	5.4	6.1	7.6	12.0	6.8	5.0	5.4	34.5	22.8	16.1	9.5	3.9
Radium 226	2.3	3.0	0.4	< 0.3	3.2	5.4	1.8J	2.6	0.5	18	7.3	3.5	0.5
Radium 226, ct.error (+/- pCi/L)	1.5	1.0	0.4	0.5	1.1	1.1	0.7	1.3	0.5	2.5	1.3	0.9	0.5
Radium 228	< 0.3	3.9	< 0.3	3.3UJ	1.0	2.2UJ	1.0	1.5	< 0.3	< 0.3	3.4UJ	0.6UJ	0.5UJ
Radium 228, ct.error (+/- pCi/L)	2.0	0.8	0.5	0.9	0.8	0.6	0.7	1.1	0.6	0.8	0.7	0.6	0.5

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Sample Number	1st Qtr M-107A	2nd Qtr M-107A	3rd Qtr M-107A	3rd Qtr M-107A Duplicate	4th Qtr M-107A	1st Qtr M-108A	2nd Qtr M-108A	2nd Qtr M-108A Duplicate	3rd Qtr M-108A	4th Qtr M-108A
Date Sampled	07/17/91	10/07/91	02/08/92	02/08/92	04/17/92		10/07/91	10/07/91	02/06/92	03/24/92
PARAMETER REPORTED										
Physical Parameters-Lab										
Acidity, total (mg/L-CaCO3)	6.7UJ	9.9	10.6	15.5	18.1	NS	4.1UJ	2.5UJ	3.4UJ	< 1.0
Alkalinity, total (mg/L-CaCO3)	748	668	352	451	173	NS	184	149	29	129
COD (mg/L)	85	< 50.0	74.0	63.0	252	NS	74	85J	74.0	63
Hardness (mg/L-CaCO3)	188	152	98.4	153	58	NS	100.0	100	88.8	82
Total Dissolved Solids, TDS (mg/L)	1670	1510	1560	2540	1120	NS	1390	1180	1140	927
Spec. cond., lab (umhos/cm)	3000	2530	2540	4610	519	NS	2370	2250	2060	1690
Physical Parameters-Field										
Spec. cond., field @25 C (umhos/cm)	2700	1900	70.0	70.0	450	NS	1900	1900	1800	1350
Water Temp (deg C)	17.2	19.0	16.0	16.0	17.3	NS	22.0	22.0	15.1	17.3
pH, Field (Std units)	7.67	7.00	7.52	7.52	6.8	NS	7.00	7.00	7.68	8.33
Total Organic Carbon (mg/L)										
Carbon, TOC	12.7	12.5	10.7	2.4	90	NS	7.3	13.3	4.9	11.3
Asbestos										
Asbestos, Mass (ug/L)	0.00961	0.0	0.0	0.0	0	NS	0.00662	0.0	0.00347	0.0015
Asbestos, Total Structures (MAS/L)	9.61	0.0	0.0	0.0	0	NS	27.5	0.0	89.5	69
Anions										
Chloride (mg/L)	416.3	404.7	415.1	1269	40.81	NS	650.8	503.7	519.3	403.1
Cyanide (ug/L)	< 10.0	< 2.5	< 5.0	< 5.0	< 5.0	NS	< 2.5	< 2.5	< 5.0	< 5.0UJ
Fluoride (mg/L)	1.07J	0.97	0.46	0.49	0.19UJ	NS	1	1.08	0.68	0.82
Nitrogen, NO2+NO3 (mg/L-as N)	0.012UJ	0.013	0.01	0.020	119J	NS	0.672	0.982	0.953	0.56
Sulfate (mg/L)	90.19	68.51	64.17	22.83	22.18	NS	93.1	67.16	71.53	54.68
Radiochemicals (pCi/L)										
Alpha, gross	2.0	9.5	6.3	2.5	20.8	NS	46.5	19.5	5.1	7.7
Alpha, gross, ct.error (+/- pCi/L)	14.2	10.9	8.8	6.6	7.6	NS	26.7	16.9	21.3	11.3
Beta, gross	< 0.3	1.9	20.9	5.7	13.6	NS	8.5	15	18.2	8.1
Beta, gross, ct.error (+/- pCi/L)	18.1	10.3	14.3	12.1	9.1	NS	23.6	20.3	29.8	23.2
Radium 226	4.4UJ	2.3	2.1	0.3	4.5	NS	3.1	8.7	1.2	3.1
Radium 226, ct.error (+/- pCi/L)	1.4	0.9	0.7	0.3	1.4	NS	0.9	2.2	0.6	1.3
Radium 228	< 0.3	1.7	0.8UJ	3	1.1UJ	NS	2.7	< 0.3	< 0.3	6.1
Radium 228, ct.error (+/- pCi/L)	0.9	0.6	0.6	1.3	0.6	NS	0.8	1.4	0.6	1.1

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Sample Number	1st Qtr M-109A	2nd Qtr M-109A	3rd Qtr M-109A	4th Qtr M-109A	1st Qtr M-110A	2nd Qtr M-110A	3rd Qtr M-110A	3rd Qtr M-110A Duplicate	4th Qtr M-110A	1st Qtr M-111A	2nd Qtr M-111A	3rd Qtr M-111A	4th Qtr M-111A
Date Sampled	07/16/91	10/04/91	02/07/92	04/27/92	07/17/91	10/09/91	02/08/92	02/08/92	04/22/92	07/18/91	10/09/91	02/08/92	04/22/92
PARAMETER REPORTED													
Physical Parameters-Lab													
Acidity, total (mg/L-CaCO3)	< 1.0UJ	< 1.0UJ	< 1.0	1.5UJ	6.3UJ	15.9	11.1	11.4	20.9	3.2UJ	3.3UJ	5.7	4.1
Alkalinity, total (mg/L-CaCO3)	616	608	500	334	956	415	262	500	427	520	430	177	500
COD (mg/L)	74	< 50.0	< 50.0	< 50.0	194	85	130.0	53.0	< 50.0	126	< 50.0	53.0	< 50.0
Hardness (mg/L-CaCO3)	64.0	40.0	50.4	38	272	600	139	94.4	278	160	114	78.4	80
Total Dissolved Solids, TDS (mg/L)	1230	1200	1190	849	1020	2530	981	1720	1620	1770	1660	1580	1290
Spec. cond., lab (umhos/cm)	2050	1930	1620	1370	1730	3900	1800	2920	2760	3250	2880	2840	2260
Physical Parameters-Field													
Spec. cond., field @25 C (umhos/cm)	2100	1200	1200	1000	4800	1300	2000	2000	1000	3750	1800	1000	2300
Water Temp (deg C)	20.5	20.0	15.3	19.4	22.3	24.0	15.2	15.2	19.1	19.7	21.0	16.1	19.3
pH, Field (Std units)	8.26	7.00	8.02	7.73	7.37	7.00	7.30	7.30	7.46	7.84	7.00	7.66	8.04
Total Organic Carbon (mg/L)													
Carbon, TOC	15.3	10.9	7.3	14.9UJ	5.6	8	3.8J	2.9	6.9UJ	8.4	9.3	9.1	12.7UJ
Asbestos													
Asbestos, Mass (ug/L)	0.0	0.0	0.0	0.000309	0.0	0.00590	0.0269	0.0	0	0.00303	0.0	0.0	0.0019
Asbestos, Total Structures (MAS/L)	0.0	0.0	0.0	8.5	0.0	62.8	112	0.0	0	37.8	0.0	0.0	15.4
Anions													
Chloride (mg/L)	145.7	131.5	68.81	58.43	408.7	1146	376.5	496.6	697.2	727.5	653.6	638.9	491
Cyanide (ug/L)	< 10.0	< 2.5	< 5.0	< 5.0	< 10.0	< 10.0	< 5.0	< 5.0	< 5.0	< 10.0	< 10.0	< 5.0	< 5.0
Fluoride (mg/L)	2.27J	2.07	2.01	2.64	< 1.00	1.37	0.53	0.51	0.57	1.92J	1.83	1.19	1.11
Nitrogen, NO2+NO3 (mg/L-as N)	0.207	0.623	0.135	0.092J	0.011UJ	0.022	0.019	< 0.010	0.047J	< 0.010	0.016	0.016	0.023J
Sulfate (mg/L)	72.93	72.89	59.75	47.79	34.1	25.47	29.06	69.5	39.92	51.99	53.22	58.46	54.85
Radiochemicals (pCi/L)													
Alpha, gross	7.6	2.8	46.4	7.7	10.9	33.2	< 0.1	31.2	6.9	33.3	26.3	4.0	15.9
Alpha, gross, ct.error (+/- pCi/L)	7.9	10.1	87.3	7.7	12.8	21.7	9.0	14.0	5.8	19.0	13.6	10.7	7.3
Beta, gross	< 0.3	23	133	12.4	15	21	< 0.3	32.4	28.6	23	< 0.3	32.4	31.2
Beta, gross, ct.error (+/- pCi/L)	13.7	13.6	141	11.4	21.8	24.1	17.0	19.4	15.2	22.8	10.8	21.8	11.3
Radium 226	6.0UJ	3.0	0.7UJ	0.5	12	5	1.4	1.6	< 0.1	4.0UJ	1.5	0.4UJ	0.3
Radium 226, ct.error (+/- pCi/L)	1.5	1.1	0.4	0.5	2.2	1.2	0.7	0.6	0.4	1.2	0.8	0.4	0.4
Radium 228	0.4	1.4UJ	0.7UJ	4.4	< 0.3	3.9	0.6UJ	0.6UJ	1.1	< 0.3	4.5	0.3UJ	0.7
Radium 228, ct.error (+/- pCi/L)	0.9	0.7	0.6	0.8	1.0	0.8	0.6	0.6	0.7	1.3	0.7	0.5	0.6

Notes: NS = Not sampled

UJ = Qualified, estimated not detected

J = Qualified, estimated value

R = Qualified, not usable

< = Analyte reported below detection limit

Table 7-14 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Sampling in "A" Wells

First Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	0	9	1	8.9	8.9	0	-	-	0
Alkalinity, total (mg/L-CaCO3)	0	0	10	92	956	0	-	-	0
COD (mg/L)	2	0	7	63	194	1	63	63	0
Hardness (mg/L-CaCO3)	0	0	10	20	800	0	-	-	0
Residue, Dissolved (mg/L)	0	0	10	238	2810	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	10	375	4750	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	10	135	4800	0	-	-	0
Water Temp (deg C)	0	0	10	15.7	22.3	0	-	-	0
pH, Field (Std units)	0	0	10	7.37	9.21	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	0	8	2.9	26.9	2	2.3	5.1	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	10	0	0.322	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	10	0	1800	0	-	-	0
Anions									
Chloride (mg/L)	0	0	10	10.37	1209	0	-	-	0
Cyanide (ug/L)	10	0	0	-	-	0	-	-	0
Fluoride (mg/L)	4	2	1	2.28	2.28	3	1.07	2.27	0
Nitrogen, NO2+NO3 (mg/L-as N)	2	2	6	0.01	1.89	0	-	-	0
Sulfate (mg/L)	0	0	10	6.857	90.19	0	-	-	0

Table 7-14 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Samples in "A" Wells

Second Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	2	6	4	9.9	15.9	0	-	-	0
Alkalinity, total (mg/L-CaCO3)	0	0	12	51	684	0	-	-	0
COD (mg/L)	6	0	5	53	85	1	85	85	0
Hardness (mg/L-CaCO3)	1	1	10	40	600	0	-	-	0
Residue, Dissolved (mg/L)	0	0	12	237	2630	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	12	249	4820	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	12	120	4200	0	-	-	0
Water Temp (deg C)	0	0	12	19	24	0	-	-	0
pH, Field (Std units)	0	0	12	7	7	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	0	12	2	15.5	0	-	-	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	12	0	0.00662	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	12	0	62.8	0	-	-	0
Anions									
Chloride (mg/L)	0	0	12	16.35	1146	0	-	-	0
Cyanide (ug/L)	12	0	0	-	-	0	-	-	0
Fluoride (mg/L)	2	3	7	0.97	2.16	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	0	0	12	0.013	1.11	0	-	-	0
Sulfate (mg/L)	0	0	12	6.441	93.1	0	-	-	0

Table 7-14 - Runway Area Summary of General Chemical Results for Quarterly Groundwater in "A" Wells

Third Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	1	6	8	2.1	23.1	0	-	-	0
Alkalinity, total (mg/L-CaCO3)	0	0	15	29	684	0	-	-	0
COD (mg/L)	6	0	9	53	130	0	-	-	0
Hardness (mg/L-CaCO3)	0	0	15	7.2	252	0	-	-	0
Residue, Dissolved (mg/L)	0	0	15	210	2540	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	15	177	4610	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	15	40	4200	0	-	-	0
Water Temp (deg C)	0	0	15	15	20	0	-	-	0
pH, Field (Std units)	0	0	15	7	9.09	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	0	14	2.4	21.3	1	3.8	3.8	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	15	0	0.0404	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	15	0	351	0	-	-	0
Anions									
Chloride (mg/L)	0	0	15	9.85	1269	0	-	-	0
Cyanide (ug/L)	14	0	1	8.2	8.2	0	-	-	0
Fluoride (mg/L)	1	4	10	0.26	2.01	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	1	0	14	0.01	1.62	0	-	-	0
Sulfate (mg/L)	0	0	15	6.787	71.53	0	-	-	0

Table 7-14 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Samples in "A" Wells

Fourth Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	2	4	6	4.1	20.9	0	-	-	0
Alkalinity, total (mg/L-CaCO3)	0	0	12	48	500	0	-	-	0
COD (mg/L)	8	0	4	53	252	0	-	-	0
Hardness (mg/L-CaCO3)	0	0	12	14	278	0	-	-	0
Total Dissolved Solids (mg/L)	0	0	12	256	2120	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	12	224	3550	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	12	85	3000	0	-	-	0
Water Temp (deg C)	0	0	12	16.1	19.4	0	-	-	0
pH, Field (Std units)	0	0	12	6.8	8.51	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	5	7	4.4	90	0	-	-	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	12	0	0.0327	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	12	0	332	0	-	-	0
Anions									
Chloride (mg/L)	0	0	12	4.015	792.4	0	-	-	0
Cyanide (ug/L)	11	1	0	-	-	0	-	-	0
Fluoride (mg/L)	2	4	6	0.34	2.64	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	0	1	6	0.246	3.48	5	0.023	119	0
Sulfate (mg/L)	0	0	12	4.532	54.85	0	-	-	0

Table 7-15 - Runway Area Groundwater Analytical Results for "B" and "C" Wells - Organic Compounds

Sample Number	1st Qtr M-103B	2nd Qtr M-103B	3rd Qtr M-103B	4th Qtr M-103B	1st Qtr M-104C	2nd Qtr M-104C	3rd Qtr M-104C	4th Qtr M-104C
Date Sampled	07/16/91	10/08/91	02/07/92	04/23/92	07/19/91	10/04/91	02/06/92	03/25/92
PARAMETER REPORTED								
Volatile Organics (µg/L)								
Acetone	2.9	3.0UJ	5.8UJ	17	< 2.0	< 2.0	< 2.0	< 2.0
Carbon Disulfide	< 1.0	< 1.0	1.7	2.1	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Ethyl Ketone	< 2.0	< 2.0	< 2.0	3.6	< 2.0	< 2.0	< 2.0	< 2.0
Semivolatile Organics (µg/L)								
Bis(2-ethylhexyl)phthalate	< 2.2	2.2J	1.8	5.8UJ	< 2.0	8.0	3.8	< 2.0
Dimethylphthalate	< 2.2	< 2.2	< 2.0	59	< 2.0	< 1.0	< 2.0	< 2.0
Pesticides/PCBs/Herbicides (µg/L)	ND	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (mg/L)	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes: ND = None detected
NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded ares highlight detections above detection limit

Table 7-15 - Runway Area Groundwater Analytical Results for "B" and "C" Wells - Organic Compounds

Sample Number	1st Qtr M-105B	2nd Qtr M-105B	3rd Qtr M-105B	4th Qtr M-105B	1st Qtr M-108B	2nd Qtr M-108B	3rd Qtr M-108B	4th Qtr M-108B	4th Qtr M-108B Duplicate
Date Sampled	06/27/91	10/10/91	02/05/92	04/13/92		10/08/91	02/06/92	03/25/92	03/25/92
PARAMETER REPORTED									
Volatile Organics (µg/L)									
Acetone	< 2.0	< 2.0	< 2.0	< 2.0	NS	< 2.0	< 2.0	2.4UJ	< 2.0
Carbon Disulfide	< 1.0	< 1.0	< 1.0	< 1.0	NS	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	< 1.0	< 1.0	< 1.0	< 1.0	NS	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Ethyl Ketone	< 2.0	< 2.0	< 2.0	< 2.0	NS	< 2.0	< 2.0	< 2.0	< 2.0
Semivolatile Organics (µg/L)									
Bis(2-ethylhexyl)phthalate	< 2.0	< 1.0	4.9UJ	700	NS	7.1	< 1.0	2.5UJ	11UJ
Dimethylphthalate	< 2.0	< 2.0	< 1.0	< 1.0	NS	< 2.0	< 2.0	< 2.0	< 2.0
Pesticides/PCBs/Herbicides (µg/L)	ND	ND	ND	ND	NS	ND	ND	ND	ND
Total Petroleum Hydrocarbons (mg/L)	< 0.2	< 0.2	< 0.2	< 0.2	NS	< 0.2	< 0.2	< 0.2	< 0.2

Notes: ND = None detected
NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit
Shaded ares highlight detections above detection limit

Table 7-16 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "B" and "C" Wells

First Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
Acetone	2	0	1	2.9	2.9	0	-	-	0
Carbon Disulfide	3	0	0	-	-	0	-	-	0
Semivolatile Organics (µg/L)									
Bis(2-ethylhexyl)phthalate	3	0	0	-	-	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)	3	0	0	-	-	0	-	-	0
Total Petroleum Hydrocarbons (mg/L)	3	0	0	-	-	0	-	-	0

Table 7-16 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "B" and "C" Wells

Second Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
Acetone	3	1	0	-	-	0	-	-	0
Carbon Disulfide	4	0	0	-	-	0	-	-	0
Semivolatile Organics (µg/L)									
Bis(2-ethylhexyl)phthalate	1	0	1	7.1	7.1	2	2.2	8	0
Pesticides/PCBs/Herbicides (µg/L)	4	0	0	-	-	0	-	-	0
Total Petroleum Hydrocarbons (mg/L)	4	0	0	-	-	0	-	-	0

Table 7-16 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "B" and "C" Wells

Third Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
Acetone	3	1	0	-	-	0	-	-	0
Carbon Disulfide	3	0	1	1.7	1.7	0	-	-	0
Semivolatile Organics (µg/L)									
Bis(2-ethylhexyl)phthalate	1	1	2	1.8	3.8	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)	4	0	0	-	-	0	-	-	0
Total Petroleum Hydrocarbons (mg/L)	4	0	0	-	-	0	-	-	0

Table 7-16 - Runway Area Summary of Organic Analytical Results for Quarterly Groundwater Samples in "B" and "C" Wells

Fourth Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Volatile Organics (µg/L)									
Acetone	3	1	1	17	17	0	-	-	0
Carbon Disulfide	4	0	1	2.1	2.1	0	-	-	0
Chloromethane	4	0	1	1.2	1.2	0	-	-	0
Methyl Ethyl Ketone	4	0	1	3.6	3.6	0	-	-	0
Semivolatile Organics (µg/L)									
Bis(2-ethylhexyl)phthalate	1	3	1	700	700	0	-	-	0
Dimethylpthalate	4	0	1	59	59	0	-	-	0
Pesticides/PCBs/Herbicides (µg/L)	5	0	0	-	-	0	-	-	0
Total Recoverable Petroleum Hydrocarbons (mg/L)	5	0	0	-	-	0	-	-	0

Table 7-17 - Runway Area Groundwater Analytical Results for "B" and "C" Wells - Metals

Sample Number	1st Qtr M-103B	2nd Qtr M-103B	3rd Qtr M-103B	4th Qtr M-103B	1st Qtr M-104C	2nd Qtr M-104C	3rd Qtr M-104C	4th Qtr M-104C
Date Sampled	07/16/91	10/08/91	02/07/92	04/23/92	07/19/91	10/04/91	02/06/92	03/25/92
PARAMETER REPORTED								
Metals (µg/L)								
Aluminum	< 31.0	< 31.0	78.8UJ	< 40.7	< 31.0	49.7	69.7UJ	67.1
Antimony	< 251	< 251	< 37.5	< 375	< 25.1	< 25.1	< 37.5	< 37.5
Arsenic	13.5UJ	8.4	10.5J	10.5	3.6	< 2.6	< 3.8UJ	3.2
Barium	74.2	58.7	67.9	70.3	120	135	113J	138
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	< 1.3	< 1.3	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	< 3.0	< 3.0	< 3.9	< 3.9
Calcium	224000	208000	222000	226000	136000	126000	129000	136000
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	< 5.7	< 5.7	< 6.3	< 6.3
Cobalt	< 6.1	< 6.1	< 17.2	< 17.2	< 6.1	< 6.1	< 17.2	< 17.2
Copper	< 2.1	5.0	< 3.8	10.2	18.3	12.3	< 3.8	< 3.8
Iron	< 6.2	< 6.2	< 7.7	< 77.0	1720	11400	3800J	5150
Lead	< 10.0UJ	< 10.0UJ	< 6.5	< 4.0UJ	< 2.0UJ	< 2.0UJ	1.5UJ	< 2.6
Magnesium	1090000	1240000	1420000	1420000	576000	529000	549000	574000
Manganese	57.3	< 0.9	< 1.0	7.6	591	569	594J	582
Mercury	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2UJ	< 0.2	< 0.2
Nickel	< 13.2	< 13.2UJ	< 13.2	< 13.2	< 13.2	< 13.2UJ	< 13.2	< 13.2
Potassium	239000	231000	231000	240000	202000	184000	187000	199000J
Selenium	< 10.5	< 10.5UJ	< 10.0UJ	< 2.0UJ	< 10.5	< 10.5UJ	< 10.0UJ	< 10.0UJ
Silver	6.3	< 4.9	6.2	< 4.8	< 4.9	< 4.9	< 4.8	6.3
Sodium	6040000	7010000	7910000	7960000	2010000	4780000	5430000	5550000
Thallium	< 13.5	< 13.5UJ	< 8.5UJ	< 6.8UJ	< 13.5	< 13.5UJ	< 8.5UJ	< 8.5UJ
Vanadium	< 42.0	100.0	< 6.0	< 6.0	< 4.2	< 4.2	< 6.0	13.8
Zinc	< 23.0	< 23.0	< 4.6	< 4.6UJ	25.7	< 2.3	< 4.6	< 4.6

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-17 - Runway Area Groundwater Analytical Results for "B" and "C" Wells - Metals

Sample Number	1st Qtr M-105B	2nd Qtr M-105B	3rd Qtr M-105B	4th Qtr M-105B	1st Qtr M-108B	2nd Qtr M-108B	3rd Qtr M-108B	4th Qtr M-108B	4th Qtr M-108B Duplicate
Date Sampled	06/27/91	10/10/91	02/05/92	04/13/92		10/08/91	02/06/92	03/25/92	03/25/92
PARAMETER REPORTED									
Metals (µg/L)									
Aluminum	32.2	32.8	63.9UJ	< 40.7	NS	48.6	88.2J	< 40.7	< 40.7
Antimony	< 25.1	< 251	< 37.5	< 113	NS	< 251	< 37.5	< 37.5	< 37.5
Arsenic	< 2.6	< 2.6	< 3.8	< 9.5	NS	< 2.6	< 9.5UJ	< 9.5UJ	< 9.5UJ
Barium	49.9	50.0UJ	71.6	64.0	NS	52.7UJ	56.2J	52.0	55.1
Beryllium	< 1.3	< 1.3	< 2.5	< 2.5	NS	< 1.3	< 2.5	< 2.5	< 2.5
Cadmium	< 3.0	< 3.0	< 3.9	< 3.9	NS	< 3.0	< 3.9	< 3.9	< 3.9
Calcium	453000J	429000	458000	468000	NS	294000	313000	304000	312000
Chromium	< 5.7	< 5.7	< 6.3	< 6.3	NS	< 5.7	< 6.3	< 6.3	< 6.3
Cobalt	8.6	6.3	< 17.2	< 17.2	NS	10.2	< 17.2	< 17.2	< 17.2
Copper	2.2	23.7	< 3.8	< 3.8	NS	30.6	< 3.8	21.2	24.8
Iron	49.0UJ	363	< 7.7	147	NS	60.4UJ	< 7.7UJ	< 7.7	< 7.7
Lead	< 10.0	< 10.0UJ	< 2.6UJ	< 10.0	NS	< 10.0UJ	< 6.5	< 5.2	< 5.2
Magnesium	925000J	868000	910000	983000	NS	780000	838000	817000	843000
Manganese	8770	8510	8840	8750	NS	8260	8670J	8250	8500
Mercury	< 0.2	< 0.2	< 0.2	< 0.2	NS	< 0.2	< 0.2	< 0.2	< 0.2J
Nickel	< 13.2	18.4	18.1	14.0	NS	24.7J	23.6	< 13.2	17.2
Potassium	116000J	110000	106000	108000	NS	138000	147000	145000J	152000J
Selenium	< 21.0	< 10.5UJ	< 10.0UJ	< 20.0UJ	NS	< 10.5UJ	< 10.0UJ	< 10.0UJ	< 10.0UJ
Silver	7.1	6.8	< 4.8	< 4.8	NS	7.9	< 4.8	< 4.8	< 4.8
Sodium	7030000	6350000	7750000	7420000	NS	7270000	7890000	8060000	7850000
Thallium	< 27.0	< 13.5UJ	< 17.0UJ	< 8.5	NS	< 13.5UJ	< 8.5UJ	< 8.5UJ	< 8.5UJ
Vanadium	< 4.2	< 4.2	< 6.0	< 6.0UJ	NS	< 4.2	< 6.0	< 6.0	< 6.0
Zinc	78.8	< 2.3	130	102	NS	106	90.3	< 4.6	< 4.6

Notes: NS = Not sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-18 - Runway Area Summary of Metals Results for Quarterly Groundwater Samples in "B" and "C" Wells

First Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	2	0	1	32.2	32.2	0	-	-	0
Antimony	3	0	0	-	-	0	-	-	0
Arsenic	1	1	1	3.6	3.6	0	-	-	0
Barium	0	0	3	49.9	120	0	-	-	0
Beryllium	3	0	0	-	-	0	-	-	0
Cadmium	3	0	0	-	-	0	-	-	0
Calcium	0	0	2	136000	224000	1	453000	453000	0
Chromium	3	0	0	-	-	0	-	-	0
Cobalt	2	0	1	8.6	8.6	0	-	-	0
Copper	1	0	2	2.2	18.3	0	-	-	0
Iron	1	1	1	1720	1720	0	-	-	0
Lead	1	2	0	-	-	0	-	-	0
Magnesium	0	0	2	576000	1090000	1	925000	925000	0
Manganese	0	0	3	57.3	8770	0	-	-	0
Mercury	3	0	0	-	-	0	-	-	0
Nickel	3	0	0	-	-	0	-	-	0
Potassium	0	0	2	202000	239000	1	116000	116000	0
Selenium	3	0	0	-	-	0	-	-	0
Silver	1	0	2	6.3	7.1	0	-	-	0
Sodium	0	0	3	2010000	7030000	0	-	-	0
Thallium	3	0	0	-	-	0	-	-	0
Vanadium	3	0	0	-	-	0	-	-	0
Zinc	1	0	2	25.7	78.8	0	-	-	0

Table 7-18 - Runway Area Summary of Metals Results for Quarterly Groundwater Samples in "B" and "C" Wells

Second Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	1	0	2	32.8	49.7	0	-	-	0
Antimony	3	0	0	-	-	0	-	-	0
Arsenic	2	0	1	8.4	8.4	0	-	-	0
Barium	0	1	2	58.7	135	0	-	-	0
Beryllium	3	0	0	-	-	0	-	-	0
Cadmium	3	0	0	-	-	0	-	-	0
Calcium	0	0	3	126000	429000	0	-	-	0
Chromium	3	0	0	-	-	0	-	-	0
Cobalt	2	0	1	6.3	6.3	0	-	-	0
Copper	0	0	3	5	23.7	0	-	-	0
Iron	1	0	2	363	11400	0	-	-	0
Lead	0	3	0	-	-	0	-	-	0
Magnesium	0	0	3	529000	1240000	0	-	-	0
Manganese	1	0	2	569	8510	0	-	-	0
Mercury	2	1	0	-	-	0	-	-	0
Nickel	0	2	1	18.4	18.4	0	-	-	0
Potassium	0	0	3	110000	231000	0	-	-	0
Selenium	0	3	0	-	-	0	-	-	0
Silver	2	0	1	6.8	6.8	0	-	-	0
Sodium	0	0	3	4780000	7010000	0	-	-	0
Thallium	0	3	0	-	-	0	-	-	0
Vanadium	2	0	1	100	100	0	-	-	0
Zinc	3	0	0	-	-	0	-	-	0

Table 7-18 - Runway Area Summary of Metals Results for Quarterly Groundwater Samples in "B" and "C" Wells

Third Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	0	3	0	-	-	1	88.2	88.2	0
Antimony	4	0	0	-	-	0	-	-	0
Arsenic	1	2	0	-	-	1	10.5	10.5	0
Barium	0	0	2	67.9	71.6	2	56.2	113	0
Beryllium	4	0	0	-	-	0	-	-	0
Cadmium	4	0	0	-	-	0	-	-	0
Calcium	0	0	4	129000	458000	0	-	-	0
Chromium	4	0	0	-	-	0	-	-	0
Cobalt	4	0	0	-	-	0	-	-	0
Copper	4	0	0	-	-	0	-	-	0
Iron	2	1	0	-	-	1	3800	3800	0
Lead	2	2	0	-	-	0	-	-	0
Magnesium	0	0	4	549000	1420000	0	-	-	0
Manganese	1	0	1	8840	8840	2	594	8670	0
Mercury	4	0	0	-	-	0	-	-	0
Nickel	2	0	2	18.1	23.6	0	-	-	0
Potassium	0	0	4	106000	231000	0	-	-	0
Selenium	0	4	0	-	-	0	-	-	0
Silver	3	0	1	6.2	6.2	0	-	-	0
Sodium	0	0	4	5430000	7910000	0	-	-	0
Thallium	0	4	0	-	-	0	-	-	0
Vanadium	4	0	0	-	-	0	-	-	0
Zinc	2	0	2	90.3	130	0	-	-	0

Fourth Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Metals (µg/L)									
Aluminum	4	0	1	67.1	67.1	0	-	-	0
Antimony	5	0	0	-	-	0	-	-	0
Arsenic	1	2	2	3.2	10.5	0	-	-	0
Barium	0	0	5	52	138	0	-	-	0
Beryllium	5	0	0	-	-	0	-	-	0
Cadmium	5	0	0	-	-	0	-	-	0
Calcium	0	0	5	136000	468000	0	-	-	0
Chromium	5	0	0	-	-	0	-	-	0
Cobalt	5	0	0	-	-	0	-	-	0
Copper	2	0	3	10.2	24.8	0	-	-	0
Iron	3	0	2	147	5150	0	-	-	0
Lead	4	1	0	-	-	0	-	-	0
Magnesium	0	0	5	574000	1420000	0	-	-	0
Manganese	0	0	5	7.6	8750	0	-	-	0
Mercury	4	1	0	-	-	0	-	-	0
Nickel	3	0	2	14	17.2	0	-	-	0
Potassium	0	0	2	108000	240000	3	145000	199000	0
Selenium	0	5	0	-	-	0	-	-	0
Silver	4	0	1	6.3	6.3	0	-	-	0
Sodium	0	0	5	5550000	8060000	0	-	-	0
Thallium	1	4	0	-	-	0	-	-	0
Vanadium	3	1	1	13.8	13.8	0	-	-	0
Zinc	3	1	1	102	102	0	-	-	0

Table 7-19 - Runway Area Groundwater Analytical Results for "B" and "C" Wells - General Chemicals

Sample Number	1st Qtr M-103B	2nd Qtr M-103B	3rd Qtr M-103B	4th Qtr M-103B	1st Qtr M-104C	2nd Qtr M-104C	3rd Qtr M-104C	4th Qtr M-104C	1st Qtr M-105B	2nd Qtr M-105B	2nd Qtr M-105B	4th Qtr M-105B
Date Sampled	07/16/91	10/08/91	02/07/92	04/23/92	07/19/91	10/04/91	02/06/92	03/25/92	06/27/91	10/10/91	02/05/92	04/13/92
PARAMETER REPORTED												
Physical Parameters-Lab												
Acidity, total (mg/L-CaCO3)	39.8J	167	206	236	202J	291	231	232	89.7	110	129	167
Alkalinity, total (mg/L-CaCO3)	1490	1760	339	500	652	576	351	295	760	817	500	279
COD (mg/L)	1508	1496	956.0	1830	844	926	890.0	690	1008J	1466	1024	926
Hardness (mg/L-CaCO3)	7700	7200	5220	7300	4500	3500	2740	3300	7600	6800	6920	6800
Total Dissolved Solids, TDS (mg/L)	28500	29100	29000	1040	18100	17800	17800	19700	28200	27300	27400	30400
Spec. cond., lab (umhos/cm)	46100	40000	41500	44300	29300	25500	29400	30500	37200	38900	41400	41700
Physical Parameters-Field												
Spec. cond., field @25 C (umhos/cm)	390	39000	30000	39500	24000	23000	22000	22000	34000	37000	32000	36000
Water Temp (deg C)	19.1	20.0	16.2	19.8	17.9	20.0	15.5	17	14.1	20.0	17.4	18.6
pH, Field (Std units)	7.62	7.00	7.40	6.33	7.19	7.00	7.10	6.93	6.99	7.00	7.45	6.42
Total Organic Carbon (mg/L)												
Carbon, TOC	22.7J	22.2	15.2	14UJ	45.5	51.7	41.3	56.9	16.8J	9.9	3.5	9.4
Asbestos												
Asbestos, Mass (ug/L)	0.691	0.0	0.0	0.101	0.00123	0.0	0.0346	0	0.00990	0.0	0.000453	0
Asbestos, Total Structures (MAS/L)	7120	0.0	0.0	2490	28.5	0.0	522	0	49.4	0.0	45.3	0
Anions												
Chloride (mg/L)	17600	17250	17590	17540	10080	9444	9716	9774	16000	15770	15590	15850
Cyanide (ug/L)	47.3	5.4	33.3J	10.1	< 10.0	< 2.5	< 5.0	< 5.0	< 10.0	< 10.0R	< 5.0	< 5.0
Fluoride (mg/L)	< 5.00	< 5.00	< 2.50	< 2.50	< 0.20	< 0.20	< 1.00	< 2.50	< 5.00	< 5.00	< 2.50	< 2.50
Nitrogen, NO2+NO3 (mg/L-as N)	< 0.250	0.052	< 0.100	< 0.010	0.013UJ	< 0.010	< 0.010	0.02	< 0.010	0.027	0.019	0.25
Sulfate (mg/L)	223.4	264.9	255.7	282.5	0.86	< 0.500	18.83	23.42	1688	1670	1650	1666
Radiochemicals (pCi/L)												
Alpha, gross	< 0.3	106	< 0.1	29.4	< 0.3	< 0.3	< 0.1	68.5	< 0.3	170	10.9	137
Alpha, gross, ct.error (+/- pCi/L)	332	171	98.0	115	50.2	6.1	60.3	79.1	129	184	88.4	126
Beta, gross	250	69	184	218	< 0.3	25	143	337	< 0.3	110	73.6	342
Beta, gross, ct.error (+/- pCi/L)	252	142	137	185	132	9.2	104	137	142	151	129	159
Radium 226	7.1	4.3	1.2	2.1	3.7	2.4	3.1	3	2.2	4.5	2.4	1.9
Radium 226, ct.error (+/- pCi/L)	1.7UJ	1.1	0.7	0.9	1.2	0.9	1.0	1.3	0.8	1.0	0.9	0.9
Radium 228	0.9	2.8UJ	1.0	0.7	3.3	3	1.3	4.8UJ	< 0.3	3.8UJ	2.9	1.9UJ
Radium 228, ct.error (+/- pCi/L)	0.9	0.7	0.6	0.8	2.1	0.7	0.7	0.8	0.8	0.7	0.7	0.6

Notes: NS = Not Sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-19 - Runway Area Groundwater Analytical Results for "B" and "C" Wells - General Chemicals

Sample Number	1st Qtr M-108B	2nd Qtr M-108B	3rd Qtr M-108B	4th Qtr M-108B	4th Qtr M-108B Duplicate
Date Sampled		10/08/91	02/06/92	03/25/92	03/25/92
PARAMETER REPORTED					
Physical Parameters-Lab					
Acidity, total (mg/L-CaCO3)	NS	119	122	112	156J
Alkalinity, total (mg/L-CaCO3)	NS	676	470	371	470
COD (mg/L)	NS	1090	426.0	212	718
Hardness (mg/L-CaCO3)	NS	5900	3540	5750	5730
Total Dissolved Solids, TDS (mg/L)	NS	28000	28100	28800	29100
Spec. cond., lab (umhos/cm)	NS	36400	42400	43500	41800
Physical Parameters-Field					
Spec. cond., field @25 C (umhos/cm)	NS	34000	32000	33900	33900
Water Temp (deg C)	NS	20.0	16.4	19.6	19.6
pH, Field (Std units)	NS	7.00	6.60	6.65	6.65
Total Organic Carbon (mg/L)					
Carbon, TOC	NS	13.8	5.1	25.6	16.6
Asbestos					
Asbestos, Mass (ug/L)	NS	0.0	0.0	0	0
Asbestos, Total Structures (MAS/L)	NS	0.0	0.0	0	0
Anions					
Chloride (mg/L)	NS	15820	16190	16010	15570
Cyanide (ug/L)	NS	< 2.5	< 5.0	< 5.0UJ	< 5.0UJ
Fluoride (mg/L)	NS	< 5.00	< 2.50	< 2.50	< 2.50UJ
Nitrogen, NO2+NO3 (mg/L-as N)	NS	0.013	0.012	0.033	0.023
Sulfate (mg/L)	NS	1636	1634	1598	1566
Radiochemicals (pCi/L)					
Alpha, gross	NS	64.8	43.4	27.1	41.5
Alpha, gross, ct.error (+/- pCi/L)	NS	185	85.1	119	118
Beta, gross	NS	36	69.8	502	389
Beta, gross, ct.error (+/- pCi/L)	NS	144	120	221	178
Radium 226	NS	4.8	4.1	4.7	1.2
Radium 226, ct.error (+/- pCi/L)	NS	1.0	1.0	1.7	0.9
Radium 228	NS	6.4	2.3	4.7UJ	1.3
Radium 228, ct.error (+/- pCi/L)	NS	0.8	0.7	0.9	2

Notes: NS = Not Sampled
UJ = Qualified, estimated not detected
J = Qualified, estimated value
R = Qualified, not usable
< = Analyte reported below detection limit

Table 7-20 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Samples in "B" and "C" Wells

First Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	0	0	1	89.7	89.7	2	39.8	202	0
Alkalinity, total (mg/L-CaCO3)	0	0	3	652	1490	0	-	-	0
COD (mg/L)	0	0	2	844	1508	1	1008	1008	0
Hardness (mg/L-CaCO3)	0	0	3	4500	7700	0	-	-	0
Total Dissolved Solids (mg/L)	0	0	3	18100	28500	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	3	29300	46100	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	3	390	34000	0	-	-	0
Water Temp (deg C)	0	0	3	14.1	19.1	0	-	-	0
pH, Field (Std units)	0	0	3	6.99	7.62	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	0	1	45.5	45.5	2	16.8	22.7	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	3	0.00123	0.691	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	3	28.5	7120	0	-	-	0
Anions									
Chloride (mg/L)	0	0	3	10080	17600	0	-	-	0
Cyanide (ug/L)	2	0	1	47.3	47.3	0	-	-	0
Fluoride (mg/L)	3	0	0	-	-	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	2	1	0	-	-	0	-	-	0
Sulfate (mg/L)	0	0	3	0.86	1688	0	-	-	0

Table 7-20 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Samples in "B" and "C" Wells

Second Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	0	0	4	110	291	0	-	-	0
Alkalinity, total (mg/L-CaCO3)	0	0	4	576	1760	0	-	-	0
COD (mg/L)	0	0	4	926	1496	0	-	-	0
Hardness (mg/L-CaCO3)	0	0	4	3500	7200	0	-	-	0
Total Dissolved Solids (mg/L)	0	0	4	17800	29100	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	4	25500	40000	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	4	23000	39000	0	-	-	0
Water Temp (deg C)	0	0	4	20	20	0	-	-	0
pH, Field (Std units)	0	0	4	7	7	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	0	4	9.9	51.7	0	-	-	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	4	0	0	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	4	0	0	0	-	-	0
Anions									
Chloride (mg/L)	0	0	4	9444	17250	0	-	-	0
Cyanide (ug/L)	3	0	1	5.4	5.4	0	-	-	0
Fluoride (mg/L)	4	0	0	-	-	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	1	0	3	0.013	0.052	0	-	-	0
Sulfate (mg/L)	1	0	3	264.9	1670	0	-	-	0

Table 7-20 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Samples in "B" and "C" Wells

Third Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	0	0	4	122	231	0	-	-	0
Alkalinity, total (mg/L-CaCO3)	0	0	4	339	500	0	-	-	0
COD (mg/L)	0	0	4	426	1024	0	-	-	0
Hardness (mg/L-CaCO3)	0	0	4	2740	6920	0	-	-	0
Total Dissolved Solids (mg/L)	0	0	4	17800	29000	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	4	29400	42400	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	4	22000	32000	0	-	-	0
Water Temp (deg C)	0	0	4	15.5	17.4	0	-	-	0
pH, Field (Std units)	0	0	4	6.6	7.45	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	0	4	3.5	41.3	0	-	-	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	4	0	0.0346	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	4	0	522	0	-	-	0
Anions									
Chloride (mg/L)	0	0	4	9716	17590	0	-	-	0
Cyanide (ug/L)	3	0	0	-	-	1	33.3	33.3	0
Fluoride (mg/L)	4	0	0	-	-	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	2	0	2	0.012	0.019	0	-	-	0
Sulfate (mg/L)	0	0	4	18.83	1650	0	-	-	0

Table 7-20 - Runway Area Summary of General Chemical Results for Quarterly Groundwater Samples in "B" and "C" Wells

Fourth Quarter

	Not Detected		Not Qualified			Qualified as Estimates			Rejected
	Unqualified Sample Count	Qualified Sample Count	Sample Count	Minimum Value	Maximum Value	Sample Count	Minimum Value	Maximum Value	Sample Count
Physical Parameters-Lab									
Acidity, total (mg/L-CaCO3)	0	0	4	112	236	1	156	156	0
Alkalinity, total (mg/L-CaCO3)	0	0	5	279	500	0	-	-	0
COD (mg/L)	0	0	5	212	1830	0	-	-	0
Hardness (mg/L-CaCO3)	0	0	5	3300	7300	0	-	-	0
Total Dissolved Solids (mg/L)	0	0	5	1040	30400	0	-	-	0
Spec. cond., lab (umhos/cm)	0	0	5	30500	44300	0	-	-	0
Physical Parameters-Field									
Spec. cond., field @25 C (umhos/cm)	0	0	5	22000	39500	0	-	-	0
Water Temp (deg C)	0	0	5	17	19.8	0	-	-	0
pH, Field (Std units)	0	0	5	6.33	6.93	0	-	-	0
Total Organic Carbon (mg/L)									
Carbon, TOC	0	1	4	9.4	56.9	0	-	-	0
Asbestos									
Asbestos, Mass (ug/L)	0	0	5	0	0.101	0	-	-	0
Asbestos, Total Structures (MAS/L)	0	0	5	0	2490	0	-	-	0
Anions									
Chloride (mg/L)	0	0	5	9774	17540	0	-	-	0
Cyanide (ug/L)	2	2	1	10.1	10.1	0	-	-	0
Fluoride (mg/L)	4	1	0	-	-	0	-	-	0
Nitrogen, NO2+NO3 (mg/L-as N)	1	0	4	0.02	0.25	0	-	-	0
Sulfate (mg/L)	0	0	5	23.42	1666	0	-	-	0

Table 7-21 Statistical Analysis of Metals Results from Runway Area Soil Samples

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (mg/kg)	Upper Limit (mg/kg)
Aluminum	4396.11	1788.80	2.83	0.00	9458.42
Antimony	1.25	0.37	2.83	0.19	2.31
Arsenic	3.99	3.93	2.83	0.00	15.13
Barium	37.96	22.59	2.83	0.00	101.88
Beryllium	0.41	0.39	2.83	0.00	1.51
Cadmium	0.37	0.57	2.83	0.00	1.97
Chromium	30.37	12.40	2.83	0.00	65.45
Cobalt	7.31	10.65	2.83	0.00	37.45
Copper	8.17	4.09	2.83	0.00	19.74
Lead	8.49	8.24	2.83	0.00	31.80
Mercury	0.04	0.02	2.83	0.00	0.09
Nickel	28.29	13.13	2.83	0.00	65.46
Selenium	0.30	0.34	2.83	0.00	1.26
Silver	0.45	0.28	2.83	0.00	1.24
Thallium	0.11	0.04	2.83	0.00	0.21
Vanadium	17.68	4.65	2.83	4.53	30.84
Zinc	21.14	7.28	2.83	0.53	41.76

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factore) (Taylor, 1990)

Table 7-22 Statistical Analysis of Metals Results from Runway Area "A" Wells

First Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (μg/L)	Upper Limit (μg/L)
Aluminum	558.53	1389.82	4.41	0.00	6687.63
Antimony	12.55	0.00	4.41	12.55	12.55
Arsenic	8.06	3.51	4.41	0.00	23.54
Barium	31.20	29.90	4.41	0.00	163.08
Beryllium	0.65	0.00	4.41	0.65	0.65
Cadmium	1.50	0.00	4.41	1.50	1.50
Chromium	4.46	4.25	4.41	0.00	23.21
Cobalt	3.05	0.00	4.41	3.05	3.05
Copper	16.49	7.68	4.41	0.00	50.37
Lead	1.87	2.31	4.41	0.00	12.04
Mercury	0.10	0.00	4.41	0.10	0.10
Nickel	7.97	3.63	4.41	0.00	23.97
Selenium	1.05	0.00	4.41	1.05	1.05
Silver	2.45	0.00	4.41	2.45	2.45
Thallium	1.35	0.00	4.41	1.35	1.35
Vanadium	14.99	17.84	4.41	0.00	93.67
Zinc	4.10	3.52	4.41	0.00	19.64

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-22 Statistical Analysis of Metals Results from Runway Area "A" Wells

Second Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	65.61	119.24	3.73	0.00	510.39
Antimony	12.55	0.00	3.73	12.55	12.55
Arsenic	9.18	4.53	3.73	0.00	26.09
Barium	32.84	25.20	3.73	0.00	126.83
Beryllium	0.65	0.00	3.73	0.65	0.65
Cadmium	1.50	0.00	3.73	1.50	1.50
Chromium	2.85	0.00	3.73	2.85	2.85
Cobalt	3.05	0.00	3.73	3.05	3.05
Copper	14.59	6.73	3.73	0.00	39.68
Lead	1.30	0.90	3.73	0.00	4.66
Mercury	0.12	0.07	3.73	0.00	0.37
Nickel	6.60	0.00	3.73	6.60	6.60
Selenium	1.05	0.00	3.73	1.05	1.05
Silver	2.45	0.00	3.73	2.45	2.45
Thallium	1.35	0.00	3.73	1.35	1.35
Vanadium	11.42	12.04	3.73	0.00	56.31
Zinc	9.70	3.69	3.73	0.00	23.45

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-22 Statistical Analysis of Metals Results from Runway Area "A" Wells

Third Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	71.24	112.29	3.38	0.00	450.77
Antimony	20.77	6.71	3.38	0.00	43.45
Arsenic	5.94	2.77	3.38	0.00	15.29
Barium	32.40	28.57	3.38	0.00	128.96
Beryllium	1.25	0.00	3.38	1.25	1.25
Cadmium	1.95	0.00	3.38	1.95	1.95
Chromium	3.44	0.95	3.38	0.23	6.65
Cobalt	8.60	0.00	3.38	8.60	8.60
Copper	6.03	3.84	3.38	0.00	19.00
Lead	1.85	2.20	3.38	0.00	9.27
Mercury	0.10	0.00	3.38	0.10	0.10
Nickel	6.60	0.00	3.38	6.60	6.60
Selenium	1.00	0.00	3.38	1.00	1.00
Silver	2.89	1.10	3.38	0.00	6.61
Thallium	0.85	0.00	3.38	0.85	0.85
Vanadium	10.05	9.10	3.38	0.00	40.81
Zinc	5.69	3.36	3.38	0.00	17.04

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-22 Statistical Analysis of Metals Results from Runway Area "A" Wells

Fourth Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	426.71	735.37	3.73	0.00	3169.62
Antimony	18.75	0.00	3.73	18.75	18.75
Arsenic	8.81	5.87	3.73	0.00	30.70
Barium	18.37	14.35	3.73	0.00	71.89
Beryllium	1.25	0.00	3.73	1.25	1.25
Cadmium	1.95	0.00	3.73	1.95	1.95
Chromium	4.85	3.39	3.73	0.00	17.50
Cobalt	8.60	0.00	3.73	8.60	8.60
Copper	4.63	6.51	3.73	0.00	28.91
Lead	0.92	0.15	3.73	0.35	1.50
Mercury	0.10	0.00	3.73	0.10	0.10
Nickel	10.52	11.77	3.73	0.00	54.41
Selenium	1.44	1.33	3.73	0.00	6.42
Silver	2.40	0.00	3.73	2.40	2.40
Thallium	0.85	0.00	3.73	0.85	0.85
Vanadium	13.46	10.00	3.73	0.00	50.77
Zinc	4.80	2.44	3.73	0.00	13.89

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-23 Statistical Analysis of Metals Results from Runway Area "B" and "C" Wells

First Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	21.07	9.64	9.92	0.00	116.71
Antimony	50.20	65.21	9.92	0.00	697.10
Arsenic	6.13	6.48	9.92	0.00	70.44
Barium	81.37	35.60	9.92	0.00	434.47
Beryllium	0.65	0.00	9.92	0.65	0.65
Cadmium	1.50	0.00	9.92	1.50	1.50
Chromium	2.85	0.00	9.92	2.85	2.85
Cobalt	4.90	3.20	9.92	0.00	36.69
Copper	7.18	9.64	9.92	0.00	102.86
Lead	3.67	2.31	9.92	0.00	26.58
Mercury	0.10	0.00	9.92	0.10	0.10
Nickel	6.60	0.00	9.92	6.60	6.60
Selenium	7.00	3.03	9.92	0.00	37.07
Silver	5.28	2.49	9.92	0.00	29.95
Thallium	9.00	3.90	9.92	0.00	47.66
Vanadium	8.40	10.91	9.92	0.00	116.65
Zinc	38.67	35.47	9.92	0.00	390.57

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-23 Statistical Analysis of Metals Results from Runway Area "B" and "C" Wells

Second Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	36.65	16.08	6.37	0.00	139.05
Antimony	97.26	56.48	6.37	0.00	457.01
Arsenic	3.08	3.55	6.37	0.00	25.69
Barium	74.10	40.76	6.37	0.00	333.76
Beryllium	0.65	0.00	6.37	0.65	0.65
Cadmium	1.50	0.00	6.37	1.50	1.50
Chromium	2.85	0.00	6.37	2.85	2.85
Cobalt	5.65	3.40	6.37	0.00	27.30
Copper	17.90	11.44	6.37	0.00	90.78
Lead	4.00	2.00	6.37	0.00	16.74
Mercury	0.10	0.00	6.37	0.10	0.10
Nickel	14.08	9.01	6.37	0.00	71.45
Selenium	5.25	0.00	6.37	5.25	5.25
Silver	4.90	2.86	6.37	0.00	23.15
Thallium	6.75	0.00	6.37	6.75	6.75
Vanadium	26.58	48.95	6.37	0.00	338.39
Zinc	29.95	50.93	6.37	0.00	354.40

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-23 Statistical Analysis of Metals Results from Runway Area "B" and "C" Wells

Third Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	57.31	26.28	6.37	0.00	224.70
Antimony	18.75	0.00	6.37	18.75	18.75
Arsenic	4.76	4.05	6.37	0.00	30.59
Barium	77.18	24.77	6.37	0.00	234.95
Beryllium	1.25	0.00	6.37	1.25	1.25
Cadmium	1.95	0.00	6.37	1.95	1.95
Chromium	3.15	0.00	6.37	3.15	3.15
Cobalt	8.60	0.00	6.37	8.60	8.60
Copper	1.90	0.00	6.37	1.90	1.90
Lead	2.14	1.30	6.37	0.00	10.44
Mercury	0.10	0.00	6.37	0.10	0.10
Nickel	13.73	8.53	6.37	0.00	68.05
Selenium	5.00	0.00	6.37	5.00	5.00
Silver	3.35	1.90	6.37	0.00	15.45
Thallium	5.31	2.13	6.37	0.00	18.85
Vanadium	3.00	0.00	6.37	3.00	3.00
Zinc	56.23	64.34	6.37	0.00	466.08

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

Table 7-23 Statistical Analysis of Metals Results from Runway Area "B" and "C" Wells

Fourth Quarter

	Average	Standard Deviation	Statistical Tolerance Factor	95%/95% Statistical Tolerance Interval Lower Limit (µg/L)	Upper Limit (µg/L)
Aluminum	29.70	20.91	6.37	0.00	162.88
Antimony	60.05	73.10	6.37	0.00	525.68
Arsenic	5.59	2.83	6.37	0.00	23.59
Barium	75.88	35.47	6.37	0.00	301.84
Beryllium	1.25	0.00	6.37	1.25	1.25
Cadmium	1.95	0.00	6.37	1.95	1.95
Chromium	3.15	0.00	6.37	3.15	3.15
Cobalt	8.60	0.00	6.37	8.60	8.60
Copper	12.00	10.67	6.37	0.00	79.99
Lead	2.70	1.39	6.37	0.00	11.57
Mercury	0.10	0.00	6.37	0.10	0.10
Nickel	10.20	5.06	6.37	0.00	42.42
Selenium	5.20	3.19	6.37	0.00	25.54
Silver	3.18	1.74	6.37	0.00	14.29
Thallium	4.08	0.38	6.37	1.66	6.50
Vanadium	5.16	4.83	6.37	0.00	35.93
Zinc	22.24	44.59	6.37	0.00	306.26

Tolerance Interval = Average ± (Standard Deviation * Statistical Tolerance Factor) (Taylor, 1990)

8.0 SITE 1 - 1943-1956 DISPOSAL AREA

8.1 SITE DESCRIPTION AND BACKGROUND

The 1943-1956 Disposal Area (Site 1) was a landfill that operated from 1943 until 1956. During its years of operation, Site 1 was the base's main site for waste disposal, and the site reportedly received all waste generated at NAS Alameda except liquid waste, which was discharged directly to the seaplane lagoon (E&E, 1983). The site is located in the extreme northwestern corner of NAS Alameda (Figure 8-1).

Canonie reported Site 1 to be approximately 120 acres (Canonie, 1990d). Based on the aerial photographs obtained from Pacific Aerial Surveys, the portion of Site 1 where material was buried may be as small as 12 acres. The photographic evidence also suggests that approximately 15 acres were used for the storage of construction and military materials.

The exact quantity of waste disposed of at this site is not known. E&E estimated that 15,000 to 200,000 tons of solid wastes had been disposed of at the site (Canonie, 1990d). According to Canonie, waste known to have been buried at the site includes old aircraft engines, cooked garbage from ships in port, cables, scrap metal, waste oil, waste paint, waste solvents, cleaning compounds, medical wastes, construction debris, dredge spoils, and low-level radiological material (Canonie, 1990d).

8.1.1 Fill History

Historic maps, nautical charts, and aerial photographs indicate that the area that is now Site 1 was covered by the waters of San Francisco Bay until the early 1940s.

An 1859 U.S. Coast and Geodetic Survey Chart of San Francisco Bay shows what is now Site 1 to be completely covered by the San Francisco Bay (USCGS, 1859). By 1884 a breakwater protecting the shipping channel to the north and a railroad pier were constructed along what is now the northern edge of NAS Alameda. Docks at the end of the railroad pier occupy the area directly beyond what is now the northwestern corner of Site 1. (USCGS, 1884). With the exception of filling along the railroad pier, U.S. Geologic Survey and U.S. Coast and Geodetic Survey maps from 1899, 1903, and 1915 show basically the same configuration as the 1884 map (USGS 1899, 1915; USCGS, 1903). According to the USCGS 1903 map, land had been filled to approximately half of the railroad pier length before 1903. The 1915 map shows the narrow strip of land extending the entire length of the railroad pier had been completed.

A 1930 U.S. Coast and Geodetic Survey Chart shows that the narrow strip of land along the railroad spur had been widened and a small airport and yacht club were built on fill (USCGS, 1930). The airport and yacht club were located on what is now the border between Sites 1 and 2 and the Runway Area. An oblique aerial photograph from November 18, 1930, a 1937 U.S. Coast and Geodetic Survey chart, and an oblique aerial photograph from February 25, 1938 show no significant changes on the site from the 1930 USCGS map (Pacific Aerial Surveys 1930; USCGS, 1937; Pacific Aerial Surveys, 1938).

The 1942 US Coast and Geodetic Survey nautical chart titled "San Francisco Bay, Candlestick Point to Angel Island" shows, with the exception of the railroad spur along the northern edge, the area now occupied by Site 1 covered by 2 to 20 feet of water (USCGS, 1942). Consequently, hydraulic filling must have occurred between the time the 1942 chart was surveyed and the end of 1943.

8.1.2 Disposal History

Disposal activities reportedly began at the site in 1943. The disposal method at the site consisted of digging trenches in the hydraulic fill to the water table, filling the trenches with waste, and compacting the material with a bulldozer. Cover material was applied to the compacted wastes on an irregular basis. Combustion of waste drums occurred often during bulldozing operations, suggesting that flammable material were disposed of in this area (E&E, 1983).

An aerial photograph from March 24, 1947, shows that disposal activities were underway in the northern one-third of the site (Pacific Aerial Surveys, 1947). The southern two-thirds of the site appears to be freshly filled in the 1947 photograph and no disposal activities are evident.

In Figure 8-2 the disposal activities suggested by the 1947 photograph are superimposed on a current site map of Site 1. The disposal activities appear to be concentrated in the five "cells" of approximately 300 feet by 300 feet and surrounded by access roads. Trench and fill techniques were used within the "cells." However, the northern edge of the site (near the breakwater for the shipping channel to the north) appears to have been used for materials and vehicle storage (Pacific Aerial Surveys, 1947).

The disposal activities indicated in the 1949 photograph are shown on Figure 8-3. The disposal techniques appear to be the same as described above for the 1947 photograph. A sixth "cell" located to the south of the previous five cells was in service for waste disposal (Pacific Aerial Surveys, 1949).

In the early 1950s, the Navy Public Works Department employed open burning as the primary disposal method. This practice was continued until 1954. A burning pit was located adjacent to the northern end of what is now Runway 13-31 in the extreme northwestern corner of Site 1 (Figure 8-4). Materials received for disposal during this time were burned during the night and the burnt residue was disposed into San Francisco Bay during the day (E&E, 1983). Aerial photographs from August 14, 1953 and May 3, 1957, show that the 400-foot-long shoreline near the burning area was extended approximately 130 feet westward into San Francisco Bay between these dates (Pacific Aerial Surveys, 1953 and 1957). Logs of borings drilled for the SWAT program within this area indicate that the shoreline was extended with burned and unburned refuse with a thin covering of clean sand.

In 1952, the construction of Runway 13-31 and the extension of Runway 7-25 necessitated covering the northern portion of Site 1. Spoils stockpiled during the dredging operations of the late 1940s were used as fill for the 1952 runway development (E&E, 1983). By 1956 the entire Disposal Area was covered with fill and disposal activities were moved to the West Beach Landfill located immediately to the south.

In the mid-1950s, the western edge of Site 1 was developed as the West Beach Fleet Recreation Area. Activities in this area included a skeet and target range, baseball diamond, picnic area, and recreation building.

8.2 CURRENT USE

Most of Site 1 has been paved and has become part of the still-active Runways 13-31 and 7-25. Other current uses of Site 1 include military storage and communication, and elements of the West Beach Fleet Recreation Area (a skeet range, a target range, and a picnic area). Site personnel frequently use the Perimeter Road, which traverses the perimeter of Site 1, as a running path.

8.3 PREVIOUS INVESTIGATIONS

Wahler Associates completed an investigation of Site 1 in late 1984 under the NACIP program. During the 1984 investigation, Wahler Associates installed five groundwater monitoring wells and collected one soil and one groundwater sample from each monitoring well. According to the Wahler Associates report, the monitoring wells were installed within the hydraulic fill along the western edge of Site 1 (Figure 8-5) (Wahler, 1985). Each soil and groundwater sample was analyzed for purgeable hydrocarbons, SVOC, CAM-17 metals (Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Mo, Ni, Se, Ag, Tl, V, Zn), and radiation (gross alpha and gross beta) (Wahler Associates, 1985). The results of the chemical analyses reported by Wahler Associates are included in Table 8-1 for soil samples and Table 8-2 for groundwater samples.

Wahler Associates (1985) presented the following conclusions and recommendations:

- Elevated concentrations of heavy metals (copper, lead, and zinc) and organic compounds were found in soils near the western boundary of Site 1.

- The metals do not appear to be moving into groundwater, although elevated concentrations of organic compounds, including chlorinated solvents not seen in the soil samples, were found in the groundwater.

- The material found in the soil and groundwater do not appear to pose an immediate threat to human health or safety.

- The installation of a more thorough groundwater monitoring network is recommended to further characterize the contamination found at the site.

Canonie collected 69 surface soil samples at Site 1 as part of the SWAT investigation. The samples were analyzed for SVOC, pesticides/PCBs, metals, and radionuclides. When this report was being prepared, QA/QC data were not available for the samples collected by Canonie; therefore, the data could not be qualified. The Canonie data will be presented in the Phases 1 and 2A report after qualification.

8.4 SWAT INVESTIGATION

The SWAT investigation performed at Site 1 focussed on surface and subsurface soils and groundwater. The field work for the SWAT investigation was completed in two phases. Canonie performed the first phase. The PRC team performed the second phase.

During the first phase, Canonie collected 69 surface soil samples for chemical analysis, discussed above. The samples were collected from a grid with nodes approximately 200 feet apart. The grid was adjusted to account for runways and other features where soil could not be accessed. Canonie also drilled two exploratory soil borings on the northern border of Site 1. Soil samples were collected from the soil borings for geotechnical analysis. Chemical analyses were not performed on the soil samples from the exploratory borings.

The second phase consisted of installing 25 groundwater monitoring wells (20 in the first water-bearing zone and five in the second water-bearing zone), collecting soil samples for chemical and geotechnical analyses during drilling, collecting four quarterly groundwater samples from each well for chemical analyses, conducting surface geophysics, slug testing at each groundwater monitoring well, and performing a tidal influence study in the groundwater monitoring wells. Fourteen of the groundwater wells were screened to straddle the water table of the first water-bearing zone ("A" wells); six of the wells were screened in the lowermost portion of the first water-bearing zone ("E" wells); two wells were screened in the uppermost part of the second water-bearing zone ("B" wells); and three wells were screened in the lowermost portion of the second water-bearing zone ("C" wells).

8.4.1 Site Geology/Hydrogeology

Figures 2-3 and 2-4 are a series of geologic cross sections across Sites 1, 2, and the Runway Area. The upper 20 to 30 feet of material is artificial fill consisting of silty sands and clays. In the western portion of Site 1 refuse has been buried in the fill. In these locations, the fill contains gravel, concrete rubble, asphaltic material, glass shards, and municipal and industrial wastes. Aerial photographic evidence and trace shell and clay fragments found throughout the fill indicate that the hydraulic fill was derived from nearby dredging activities.

The Holocene Bay Mud Unit is found below the fill. In the western portion of Site 1, the Holocene Bay Mud Unit is 20 to 50 feet thick and consists of predominantly silt and clay with sand lenses and layers. The Holocene Bay Mud Unit along the eastern edge of the site consists of 10 to 30 feet of silty and/or clayey sand containing some clay lenses. The clayey portion of the Holocene Bay Mud Unit is not found along the eastern edge of Site 1 at well cluster M-007.

The late Pleistocene/Holocene alluvial/eolian deposits are found beneath the Holocene Bay Mud Unit. The late Pleistocene/Holocene eolian deposits consist of clean sand that is 25 to 50 feet thick, with a 4- to 5-foot clayey sand layer at the top. The late Pleistocene/Holocene alluvial deposits consist of fine-grained material, silts and clays interbedded with sand lenses. Stratigraphically, the contact between the two units is difficult to determine in locations where sandy portions of the Holocene Bay Mud Unit lie directly over the alluvial deposits.

Late Pleistocene estuarine deposits (equivalent to the San Antonio formation) are found below the late Pleistocene/Holocene alluvial/eolian deposits. The upper portion of the late Pleistocene estuarine deposits consist of clays. The borings for this study were terminated in clay of the late Pleistocene estuarine deposits.

Geotechnical sample results are summarized in Table 8-3. Undisturbed geotechnical samples were collected in brass sleeves from the fill in the first water-bearing zone, the Holocene Bay Mud Unit, the late Pleistocene/Holocene alluvial/eolian deposits in the second water-bearing zone, and the late Pleistocene estuarine deposits (San Antonio formation). Selected geotechnical samples were analyzed. The results generally corroborate field descriptions of soils at Site 1. The vertical hydraulic conductivity of the clayey zones in the Holocene Bay Mud Unit ranges from 2.53E-08 cm/sec to 3.16E-08 cm/sec. The clayey zone in the late Pleistocene estuarine deposits have a vertical hydraulic conductivity ranging from 3.13E-09 cm/sec to 4.64E-09 cm/sec. The clayey portions of the Holocene Bay Mud Unit and the late Pleistocene estuarine deposits are considered aquitards because of their extremely low hydraulic conductivities and their large areal extent. The hydraulic conductivities of the water-bearing zones were estimated using in situ permeability tests.

Over most of Site 1, groundwater is found in two distinct zones. The first water-bearing zone is unconfined and occurs above the Holocene Bay Mud Unit. The second water-bearing zone occurs between the late Pleistocene estuarine deposits and the Holocene Bay Mud Unit (Figure 2-7). The clayey portion of the Holocene Bay Mud Unit is not found along the eastern edge of Site 1 (M-007 cluster for example). The hydraulic separation between the two water-bearing zones may be incomplete in areas where the clayey portion of the Holocene Bay Mud Unit is not found. As described earlier, aerial photograph and boring log evidence indicate that disposal activities were concentrated in the western portion of Site 1, where the clayey portion of the Holocene Bay Mud Unit is present in the subsurface and was encountered during drilling. The eastern extent of the clayey portion of the Holocene Bay Mud Unit is unknown at this time.

In situ permeability tests were conducted in the wells at Site 1. The horizontal hydraulic conductivity of the first water-bearing zone, as determined by the rising-head slug test method for unconfined aquifers of Bouwer and Rice, ranges from 5.48E-04 cm/sec to 1.86E-03 cm/sec (Bouwer and Rice, 1976; Bouwer, 1989). The horizontal hydraulic conductivity of the second water-bearing zone, as determined by the rising-head slug test method of Cooper et al. for confined aquifers ranges from 7.9E-04 cm/sec to 1.2E-03 cm/sec (Cooper et al., 1967). The in situ permeability test data are presented in Appendix G.

Groundwater in the vicinity of the site is influenced by fluctuations in the tides. Groundwater elevation data are included in Appendix J. Figure 2-11 shows the average groundwater elevations for the first water-bearing zone as computed by the filtering method described in Section 2.4. Groundwater flow directions and gradients can be estimated from these figures; the flow direction in the first water-bearing zone appears to be outward from the area around well M-109A in the Runway Area to the north, south, and west, with an estimated gradient of 0.0006 feet/foot near the eastern boundary of Site 1 and the Runway Area. The relatively low gradient suggests that very low groundwater velocities are likely and, hence, groundwater discharge rates from this zone are likely to be low.

Figure 2-12 presents the estimated water level contours in the second water-bearing zone for the average groundwater elevations generated by the filtering method described in Section 2.4. Groundwater flow directions and gradients can be estimated from these figures; the flow direction in the second water-bearing zone appears to flow outward from the area around the wells in the Runway Area (vicinity of wells M-103-B, M-105-B, and M-108-B), to the north, south, and west, toward Sites 1 and 2, with a gradient of 0.001 feet/foot. The relatively low gradient suggests very low groundwater velocities are likely and, hence, groundwater discharge rates from this zone are likely to be low.

The fluctuations in the water levels measured in the second water-bearing zone were more uniform in range than those measured in the first water-bearing zone. The water levels in all monitored wells in the second water-bearing zone located along the western seawall fluctuated from 1 to 2 feet during the daily tidal cycle. The second water-bearing zone is semi-confined, and therefore the water level response in the semi-confined "B" and "C" wells is caused by pressure changes, from tidal rise and fall, applied to the semi-confined zone. This occurs because the semi-confined second water-bearing zone experiences hydraulic pressure changes rather than the slower infiltration/drain process observed in the first water-bearing zone wells. These responses also imply a hydraulic communication between the bay and the second water-bearing zone, a hydraulic communication that may have been enhanced by the periodic dredging in the estuary and the channel or turning basin, located on the southern side of the air station.

8.4.2 Analytical Results - Soil Samples from Fill

Forty soil samples were collected from the fill. Fourteen of the samples were collected from the surface. Twenty-six of the 40 samples were collected from depths ranging from 2 feet to 22 feet below ground surface. Soil samples from the fill were analyzed for VOC, SVOC, pesticides/PCBs, TRPH, O&G, metals, asbestos, radionuclides, and various physical parameters. The surface samples were not analyzed for VOC. Organic compounds and metals detected in soil samples from fill are listed in Tables 8-4 and 8-6, respectively. Analytical results for organic compounds and metals are summarized in Tables 8-5 and 8-7, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 8-4 and 8-6. Laboratory QA/QC data are summarized in the QCSR.

8.4.2.1 Volatile Organic Compounds. Two VOC were detected in the soil samples collected from the fill. These are acetone and carbon disulfide (Table 8-4). VOC results are summarized in Table 8-5. Acetone was detected in 11 samples. There is no apparent pattern to the distribution of acetone detected in the soil samples. Carbon disulfide was detected in one soil sample (M-001A-013) at a concentration of 11 μg/kg.

8.4.2.2 Semivolatile Organic Compounds. Twenty SVOC were detected in the soil samples collected from the fill (Table 8-4). Four of the compounds are phthalates and 15 of the compounds are PAH (Table 8-5).

Bis(2-ethylhexyl)phthalate was detected in 19 of the soil samples, four of which were qualified as estimates. The highest concentration of bis(2-ethylhexyl)phthalate was detected in the soil sample collected at the depth of 13 feet from well M-001A with a concentration of 9,600 μg/kg (estimated). Di-n-butylphthalate was detected in six samples at concentrations ranging from 440 μg/kg to 13,000 μg/kg. One of the di-n-butylphthalate detections was qualified as an estimate. Di-n-octylphthalate, diethylphthalate, and butylbenzylphthalate were detected in one sample each at concentrations of 420 μg/kg, 410 μg/kg (estimated), and 9,500 μg/kg, respectively (Table 8-4).

Fifteen PAH compounds were detected in soil samples at Site 1 (Table 8-4). The concentrations of PAH (acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene) are summarized in Table 8-5. The highest concentrations of PAH were detected in the surface soil sample from monitoring well M-028A.

8.4.2.3 Pesticides/PCBs. Six pesticides were detected in soil samples from the fill (Table 8-4). The range of concentrations of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, alpha-chlordane, and gamma-chlordane are summarized in Table 8-5. The highest concentrations of each pesticide were detected in the shallow soil samples from wells M-029A and M-029E.

One PCB was detected in soil samples from the fill. The PCB Aroclor-1260 was detected in 16 samples, six of which were qualified as estimates (Table 8-4). The concentrations of Aroclor-1260 ranged from 59 μg/kg (estimated) to 750 μg/kg (Table 8-5). The PCB was only detected in shallow soil samples (less than 3 feet) without an apparent pattern to the areal distribution.

8.4.2.4 Total Recoverable Petroleum Hydrocarbons. Fourteen soil samples and two duplicate samples were analyzed for TRPH (Table 8-4). The samples were collected from the surface at each boring location. The concentration in the 16 samples ranged from 68.7 mg/kg to 4,480 mg/kg (Table 8-5). There is no apparent pattern to the areal distribution of detected TRPH.

8.4.2.5 Oil and Grease. Fourteen soil samples and two duplicate samples were analyzed for oil and grease (Table 8-4). The samples were collected from the surface at each boring location. The concentrations in the samples ranged from 146 mg/kg to 9,750 mg/kg (Table 8-5). As with TRPH, there is no apparent pattern to the areal distribution of detected oil and grease.

8.4.2.6 Metals. Results from metals analyses are compared to the upper limit of the 95 percent/95 percent statistical tolerance interval of background concentrations measured in the upgradient Runway Area samples. The 95 percent/95 statistical tolerance interval is the range within which the measured concentration of 95 percent of the samples is expected to fall 95 percent of the time. Samples that have a concentration greater than the upper limit of the 95 percent/95 percent statistical tolerance interval may exceed background conditions. A summary of this comparison is presented in Table 8-7. The number of qualified detections, non-qualified detections, and non-detected values are listed along with the minimum and maximum values reported and the number of samples with concentrations exceeding background. The highest concentration of metals was consistently found in well borings at the M-001 and M-029 clusters.

8.4.2.7 Asbestos. Asbestos was identified in two samples (M-001E-005 and M-028E-006) at a concentration of 6 percent and trace asbestos was identified in two samples (M-029A-004 and M-029E-002). The results are presented in Appendix D.

8.4.2.8 Radionuclides. Nineteen surface (depth 0.0 to 0.5 foot) soil samples were collected at Site 1. A discussion of the radionuclide data is presented in Appendix K. The range of radionuclide values is:

Gross alpha	0.6 ± 0.5	to	5.5 ± 1.2 pCi/g
Gross beta	< 0.3 ± 0.6	to	5.1 ± 0.8 pCi/g
Radium 226	< 0.1 ± 0.1	to	4.0 ± 0.6 pCi/g
Radium 228	< 0.3 ± 0.4	to	< 0.3 ± 0.5 pCi/g

Twenty subsurface soil samples were collected from 12 wells at depths of 1.0 to 22.0 feet. All of these samples were of fill. The range of radionuclide values is:

Gross alpha	0.5 ± 0.5	to	7.0 ± 1.9 pCi/g
Gross beta	< 0.3 ± 0.5	to	4.6 ± 5.7 pCi/g
Radium 226	< 0.1 ± 0.1	to	9.0 ± 1.0 pCi/g
Radium 228	< 0.3 ± 0.4	to	1.0 ± 0.6 pCi/g

8.4.3 Analytical Results - Soil Samples Late Pleistocene/Holocene Alluvial/Eolian Deposits

Four soil samples and one duplicate sample were collected from the native horizon beneath the Holocene Bay Mud Unit. The sample depth varied between 57 feet below ground surface to 90 feet below ground surface. Soil samples from late Pleistocene/Holocene alluvial/eolian deposits were analyzed for VOC, SVOC, pesticides/PCBs, metals, asbestos, and radionuclides. Organic compounds and metals detected in soil samples from the late Pleistocene/Holocene alluvial/eolian deposits are listed in Tables 8-8 and 8-10, respectively. Analytical results for organic compounds and metals are summarized in Tables 8-9 and 8-11, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 8-8 and 8-10. Laboratory QA/QC data are summarized in the QCSR.

8.4.3.1 Volatile Organic Compounds. Acetone was detected in one soil sample (M-025C-080).

8.4.3.2 Semivolatile Organic Compounds. SVOC detected in these soil samples are summarized in Table 8-9. Bis(2-ethylhexyl)phthalate was the only SVOC detected. It was detected only in sample M-001B-057.

8.4.3.3 Pesticides/PCBs. Pesticides and PCBs were not detected in any of the soil samples from the late Pleistocene/Holocene alluvial/eolian deposits (Table 8-8).

8.4.3.4 Metals. Table 8-10 shows analytical results for metals from the late Pleistocene/Holocene alluvial/eolian deposits. All of the soil samples from the second water-bearing zone (Table 8-11) fall within the limits of metal concentrations found in typical soils (Table 7-2) as defined by Dragun (1988).

8.4.3.5 Asbestos. Asbestos was not detected in any of the soil samples.

8.4.3.6 Radionuclides. Five subsurface soil samples were collected from the second water-bearing zone at depths of 57 to 88 feet. A discussion of the radionuclide data is presented in Appendix K. The range of values is:

Gross alpha	1.0 ± 0.7	to	5.7 ± 1.4 pCi/g
Gross beta	0.5 ± 0.6	to	4.9 ± 0.9 pCi/g
Radium 226	2.0 ± 0.5	to	7.0 ± 0.8 pCi/g
Radium 228	< 0.3 ± 0.4	to	< 0.3 ± 0.4 pCi/g

8.4.4 Analytical Results - Groundwater Samples "A" and "E" Wells

Groundwater samples from "A" and "E" wells were analyzed for VOC, SVOC, pesticides/PCBs, TRPH, metals, general chemicals, and radionuclides. Organic compounds, metals, and general chemicals detected in groundwater samples from "A" and "E" wells are listed in Tables 8-12, 8-14, and 8-16, respectively. Analytical results for organic compounds, metals, and general chemicals are summarized in Tables 8-13, 8-15, and 8-17, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 8-12, 8-14, and 8-16. Laboratory QA/QC data are summarized in the QCSR.

8.4.4.1 Volatile Organic Compounds. Twelve VOC were detected in groundwater from Site 1 in at least one of the four quarterly sampling events (Table 8-12). The compounds are 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloroethene, acetone, benzene, chlorobenzene, ethylbenzene, methylene chloride, toluene, trichloroethene, vinyl chloride, and xylenes. VOC detected in the first water-bearing zone are summarized in Table 8-13.

Figure 8-6 presents the concentration of benzene, toluene, ethylbenzene, and xylenes (BTEX), acetone, and chlorobenzene for the wells where at least one of those compounds was detected during any one of the sampling rounds. Figure 8-7 presents the concentration of the chlorinated hydrocarbons 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloroethene, trichloroethene, and vinyl chloride for wells where at least one of the compounds was detected during any sampling round. The highest concentrations of VOC were detected in wells located along the western edge of the site. VOC concentrations were by far the highest in well M-028A during the first and second quarterly sampling rounds. The concentration of VOC decreased dramatically between the second and third sampling rounds in well M-028A, and then increased slightly between the third and fourth quarterly sampling. Three groundwater samples were collected from well M-028A during the fourth quarterly sampling event. An evaluation to determine if the sampling procedure was over purging the well was performed on well M-028A due to the dramatic decrease in concentrations of VOC between the second quarter and third quarter of sampling. The first was collected after purging one well-bore volume. The normal sample and duplicate samples were collected after three well-bore volumes. These three samples were analyzed and are presented in Table 8-12. It appears the sampling procedure is not over purging the well. VOC concentrations have increased in well M-028E between the third and fourth quarterly sampling. The concentration of trichloroethene and 1,2-dichloroethene increased slightly in well M-002A between the second and third quarterly sampling rounds, and have remained static during the fourth quarterly sampling. The concentrations remain relatively static in other wells where VOC were detected.

Acetone was detected in four samples after QC review (Table 8-12). The highest concentration of acetone was 1,600 μg/L in the second quarter sample from well M-028A. Acetone was not detected during the fourth quarterly sampling. Methylene chloride was detected in eight samples at concentrations ranging from 1.0 μg/L to 1.4 μg/L. There is no apparent pattern to the spatial distribution of acetone of methylene chloride.

8.4.4.2 Semivolatile Organic Compounds. The concentrations of the SVOC that were detected in the groundwater at Site 1 are presented in Table 8-12 and on Figure 8-8, and summarized in Table 8-13.

There are several subsets of SVOC that were detected in the groundwater from the first water-bearing zone and are summarized in Table 8-13, these include: aromatic hydrocarbons (1,2-dichlorobenzene), PAH (2-methylnaphthalene, acenaphthene, anthracene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene), phthalates (bis(2-ethylhexyl)phthalate and diethylphthalate), ethers (Bis(2-chloroisopropyl)ether and bis(2-chloroethyl)ether), and phenols(2,4-dimethylphenol, 2-methylphenol, and 4-dimethylphenol).

There is no apparent pattern to the distribution of bis(2-ethylhexyl)phthalate. All of the rest of the SVOC were detected in wells found along the western edge of the site. The greatest number of SVOC were detected in wells M-001E, M-029A, and M-029E. The highest concentration of an SVOC detected was an estimate of 4,000 μg/L of 2,4-dimethylphenol during the second quarter in well M-028A.

8.4.4.3 Pesticides/PCBs. Neither pesticides nor PCBs were detected in the groundwater collected from "A" and "E" wells at Site 1 (Table 8-12).

8.4.4.4 Total Recoverable Petroleum Hydrocarbons. TRPH were detected in 20 samples during the quarterly groundwater sampling (Table 8-12). The concentrations in the samples ranged from 0.2 mg/L to 7.9 mg/L (Table 8-13). TRPH was detected in groundwater samples from wells M-028A and M-029A during all three quarterly sampling events. For the first four rounds of groundwater sampling, the quarterly concentrations in well M-028A were 0.6 mg/L, 0.2 mg/L, 0.6 mg/L, and 0.6 mg/L, respectively. For the first four rounds of groundwater sampling, the quarterly concentrations in well M-029A were 1.9 mg/L, 0.9 mg/L, 7.9 mg/L, and 4.0 mg/L, respectively.

8.4.4.5 Metals. Table 8-15 is a summary of the comparison of the groundwater samples from the first water-bearing zone at Site 1 with the groundwater samples from the upgradient "A" wells at the Runway Area. Results from the metals analyses from each quarter's groundwater samples are compared to the upper limit of the 95 percent/95 percent statistical tolerance interval of background concentrations measured in upgradient Runway Area samples for that quarter. The tolerance interval is calculated independently for each quarterly sampling event in order to take seasonal fluctuations into account. Table 8-15 presents the number of qualified detections, non-qualified detections, and non-detected values are listed along with the minimum and maximum values reported and the number of samples with concentrations exceeding background.

8.4.4.6 General Chemicals. General chemical analyses performed on the groundwater samples from the "A" and "E" wells include total acidity, total alkalinity, chemical oxygen demand, hardness, TDS, specific conductance, pH, temperature, total organic carbon, asbestos, chloride, cyanide, fluoride, nitrogen (nitrite and nitrate), and sulfate. Results of the general chemical analyses are listed in Table 8-16 and summarized in Table 8-17.

Based on TDS values, the groundwater in the first water-bearing zone is fresh to brackish. There appears to be elevated concentrations of sulfate and chloride along the western edge of the site.

8.4.4.7 Radionuclides. Wells at 14 locations were used to obtain 93 water samples from the first water-bearing zone, 63 samples from the "A" wells and 30 from the "E" wells. A discussion of the radionuclide data is presented in Appendix K. The range of values is:

Gross alpha	< 0.1 ± 3.0	to	189 ± 87.7 pCi/L
Gross beta	< 0.3 ± 10.7	to	300 ± 178 pCi/L
Radium 226	0.1 ± 0.6	to	39.0 ± 3.9 pCi/L
Radium 228	< 0.3 ± 0.5	to	6.6 ± 1.1 pCi/L

8.4.5 Analytical Results - Groundwater Samples "B" and "C" Wells

Groundwater samples from "B" and "C" wells were analyzed for VOC, SVOC, pesticides/PCBs, TRPH, metals, general chemicals, and radionuclides. Organic compounds, metals, and general chemicals detected in groundwater samples from "A" and "E" wells are listed in Tables 8-18, 8-20, and 8-22, respectively. Analytical results for organic compounds, metals, and general chemicals are summarized in Tables 8-19, 8-21, and 8-23, respectively. The summary tables list the number of detected, non-detected, rejected, and qualified results for each analyte listed in Tables 8-18, 8-20 and 8-22. Laboratory QA/QC data are summarized in the QCSR.

8.4.5.1 Volatile Organic Compounds. Five volatile organic compounds were detected in the groundwater from the "B" and "C" wells at Site 1 (Table 8-18). Table 8-19 summarizes the reported concentrations of acetone, carbon disulfide, chloroform, chloromethane, and toluene.

Acetone was detected in four samples at concentrations ranging from 2.6 µg/L to 29 µg/L. Acetone was not detected in consecutive sampling events in any of the wells. Carbon disulfide was detected in the second quarterly groundwater sample from well M-001B at a concentration of 7.3 µg/L (7.2 µg/L for the duplicate). Chloroform was detected in the first two quarterly sampling events of well M-001B at the same concentration of 1.8 µg/L (1.5 µg/L for the second round duplicate sample), and detected in the fourth quarter sampling event in well M-025C at a concentration of 1.1 µg/L. Chloromethane was detected at a concentration of 3 µg/L during the third quarterly sampling of well M-027B. Toluene was detected during the fourth quarterly sampling in well M-007C and M-027C in concentrations of 2.5 µg/L and 2.0 µg/L, respectively.

8.4.5.2 Semivolatile Organic Compounds. Bis(2-ethylhexyl)phthalate and butylbenzylphthalate were detected in groundwater from "B" and "C" wells during the quarterly sampling program (Table 8-18).

Bis(2-ethylhexyl)phthalate was detected in seven samples without an apparent pattern to the spatial or temporal distribution Butylbenzylphthalate was detected in the second round duplicate sample from well M-001B.

8.4.5.3 Pesticides/PCBs. Neither pesticides nor PCBs were detected in the groundwater from "B" and "C" wells at Site 1.

8.4.5.4 Total Recoverable Petroleum Hydrocarbons. TRPH was not detected in any of the samples.

8.4.5.5 Metals. Results from the metals analyses from each quarter's groundwater samples are compared to the upper limit of the 95 percent/95 percent statistical tolerance interval of background concentrations measured in upgradient Runway Area samples for that quarter. The tolerance interval is calculated independently for each quarterly sampling event in order to take seasonal fluctuations into account. A summary of this comparison is presented in Table 8-21. The number of qualified detections, non-qualified detections, and non-detected values are listed along with the minimum and maximum values reported and the number of samples with concentrations exceeding background.

8.4.5.6 General Chemicals. General chemical analyses performed on the groundwater samples from the "B" and "C" wells include total acidity, total alkalinity, chemical oxygen demand, hardness, TDS, specific conductance, pH, temperature, total organic carbon, asbestos, chloride, cyanide, fluoride, nitrogen (nitrite and nitrate), and sulfate. Results of the general chemical analyses are listed in Table 8-22 and summarized in Table 8-23

Based on TDS data, groundwater in the second water-bearing zone is brackish to saline. Sulfate and chloride concentrations appear to be elevated in all wells.

8.4.5.7 Radionuclides. Wells at four locations were used to obtain 24 water samples from the second water-bearing zone, 10 samples from the "B" wells and 14 from the "C" wells. A discussion of the radionuclide data is presented in Appendix K. The range of values is:

Gross alpha	< 0.1 ± 41.3	to	269 ± 106 pCi/L
Gross beta	< 0.3 ± 3.0	to	247 ± 172 pCi/L
Radium 226	0.6 ± 0.4	to	4.3 ± 1.8 pCi/L
Radium 228	< 0.3 ± 0.7	to	4.1 ± 1.0 pCi/L

8.5 SUMMARY AND CONCLUSIONS

Aerial photographs indicate that disposal activities were conducted primarily at the northwestern corner of Site 1 (Figures 8-2 through 8-4). The landfill is underlain by the hydraulic fill unit.

Generally, both the Holocene Bay Mud Unit and the late Pleistocene estuarine deposits are good aquitards with low vertical hydraulic conductivities and large areal distribution. However, according to the boring log of well M-007C along the eastern perimeter of the site, the Holocene Bay Mud Unit becomes coarser grained (sandy) towards the east and does not appear to be a complete aquitard. Therefore, the first and second water-bearing zones may not be hydraulically separated along the eastern portion of Site 1. At present, no information is available to locate the eastern boundary of the clayey portion of the Holocene Bay Mud Unit. Results of the investigation concluded the following:

8.5.1 Soils

Forty soil samples were collected from the fill. Fourteen of the samples were collected from the surface. Twenty-six of the forty samples were collected from depths ranging from 2 feet to 22 feet below ground surface.

Four soil samples and one duplicate sample were collected from the native horizon beneath the Holocene Bay Mud Unit. The sample depth varied between 57 feet below ground surface to 90 feet below ground surface.

8.5.1.1 Fill Samples. SVOC and pesticides/PCBs were detected in soil samples collected from well clusters M-027, M-028, M-029, and M-001. Well cluster M-001 is located near the burn area (Figure 8-4). The highest concentration of PAH, a subset of SVOC, were detected in the surface sample from boring M-028. The highest concentration of pesticides/PCBs (DDD, DDE, DDT, dieldrin, chlordane, and Aroclor-1260) were detected in borings at well clusters M-028 and M-029 between 2.0 and 2.5 feet. The pesticides/PCB found in shallow soil samples may be related to past weed control practices. Pesticides/PCBs were not detected in deeper soil samples.

TRPH and O&G were detected in surface soil samples collected from borings at Site 1. Similar to the discussion presented in Section 7.5.1, results of the TRPH analysis included both light and heavy fractions of petroleum hydrocarbons. Therefore, any assessment and conclusions of the extent of petroleum hydrocarbons in subsurface soil under this area that are based on these results would not be appropriate.

Metals detected in soil samples from the fill were compared to the upper limit of the 95 percent/95 percent statistical tolerance interval of background soil samples collected upgradient in the Runway Area. Metals found at concentrations exceeding this limit may exceed background. Consistently, soil samples collected from well cluster M-001 had the highest concentration of metals. The M-001 cluster is located in the burn area that was used in the early 1950s as the primary disposal location for base refuse. The significance of the presence of metals above the background levels will be further evaluated during the risk assessment to be performed during the comprehensive RI/FS process.

8.5.1.2 Late Pleistocene/Holocene Alluvial/Eolian Deposits Samples. With the exception of acetone and bis(2-ethylhexyl)phthalate, organic compounds were not detected in soil samples collected in late Pleistocene/Holocene alluvial/eolian deposits. Bis(2-ethylhexyl)phthalate was detected in one sample. Bis(2-ethylhexyl)phthalate is commonly found in material made of plastic, and it is a common laboratory contaminant. It also may be found in plastic implements and gloves used to decontaminate field sampling equipment. Furthermore, it was only detected in a single sample and there is no apparent source. Therefore, the unqualified bis(2-ethylhexyl)phthalate is thought to be either a laboratory contaminant or a sampling artifact. Based on the results of the chemical analyses, there is no evidence to indicate that subsurface soils of the late Pleistocene/Holocene alluvial/eolian deposits have been impacted by compounds found in the artificial fill.

8.5.2 Groundwater

The shallow or first aquifer consists of the first water-bearing zone and the second water-bearing zone. The first water-bearing zone is found in the hydraulic fill above the Holocene Bay Mud Unit whereas the second water-bearing zone is encountered in the sand and clayey sand unit located between the Holocene Bay Mud Unit and the late Pleistocene estuarine deposits.

General groundwater gradients in both the first and second water-bearing zones at Site 1 are to the north and east (toward the Oakland Inner Harbor and San Francisco Bay). Tidal fluctuations do not appear to significantly reverse groundwater gradients in either water-bearing zone.

8.5.2.1 First Water-Bearing Zone. Based on the RWQCB's TDS criteria, groundwater in the first water-bearing zone is classified as fresh to brackish. The upper portion of the first water-bearing zone is generally fresher while the lower portion tends to be brackish. The lower TDS groundwater found in the upper portion of the first water-bearing zone is believed influenced by infiltration of surface or rain water through unpaved or grassy areas around the site. Saltwater from the nearby San Francisco Bay would likely replace the perched fresh water if it were to be pumped. Because of probable saltwater intrusion, the shallow portion of the first water-bearing zone is not a practical drinking water source.

Groundwater for chemical samples was collected, quarterly for one year, from a total of 21 "A" and "E" wells in Site 1.

VOC detected in "A" and "E" wells include 1,1-DCA, 1,2-DCA, 1,2-DCE, TCE, vinyl chloride, chlorobenzene, BTEX, and acetone. Downgradient wells that appeared to have been impacted by chemicals disposed in the landfill are M-027A, M-028A, M-028E, M-029A, M-029E, M-001A, and M-001E. The concentrations of VOC decrease dramatically between the second and third quarterly sampling event in M-028A and increase slightly with time in M-001A. The VOC concentrations in the rest of the wells remain relatively constant with time.

With the exception of bis(2-ethylhexyl)phthalate, SVOC were detected only in well clusters M-028, M-029, and M-001. SVOC detected in these wells include PAH, phenols and phthalates. All of these wells are downgradient wells from the landfill. Bis(2-ethylhexyl)phthalate was detected in wells throughout the site. It is a plasticizer used commonly in laboratory and field sampling equipment, and the detections are thought to be laboratory contaminants or sampling artifacts. The concentration of SVOC decrease with time in M-028A and remain relatively constant with time in the rest of the wells.

Only a few of the metals were detected in groundwater samples at concentrations above the upper limit of the 95 percent/95 percent statistical tolerance interval for background concentrations for this site. However, there are no trends to indicate that these metals are consistently detected in groundwater samples collected from any well exceeding the background concentrations. Radionuclides were found at concentrations above the background levels. The significance of the presence of metals and radionuclides above the background levels will be further evaluated during the risk assessment to be performed during the comprehensive RI/FS process.

8.5.2.2 Second Water-Bearing Zone. Based on the RWQCB's TDS criteria, groundwater in the second water-bearing zone is classified as brackish to saline.

Groundwater samples were collected from five "B" and "C" wells for chemical analyses. Low levels of VOC (<29 µg/l) and SVOC (<10 µg/L) were detected in these groundwater samples. These VOC and SVOC are acetone, carbon disulfide, chloroform, chloromethane, toluene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate. Acetone and bis(2-ethylhexyl)phthalate detections that were not qualified after QC review are attributable to laboratory contamination or sampling artifacts. Carbon disulfide and chloroform were only detected in samples from well M-001B at concentrations less than 7.3 µg/L and 1.8 µg/L, respectively. Chloromethane was only detected once in well M-27B at a concentration of 3.0 µg/L. Carbon disulfide and chloromethane are commonly found in reducing environments (Dragun, 1988). Toluene was detected in two wells at 2.5 µg/L and 2.0 µg/L, respectively. Pesticides/PCBs and TRPH were not detected in any of the samples from wells at Site 1. There are no apparent time trends to the concentration of organic compounds detected in the second water-bearing zone.

Only a few of the metals are detected in groundwater samples at concentrations above the upper limit of the 95 percent/95 percent statistical tolerance interval for background concentrations for this site. However, there are no trends to indicate that these metals are consistently detected in groundwater samples collected from any well exceeding the background concentrations. Radionuclides were found at concentrations above the background levels. The significance of the presence of metals and radionuclides above the background levels will be further evaluated during the risk assessment to be performed during the comprehensive RI/FS process.

8.5.3 Landfill Leakage

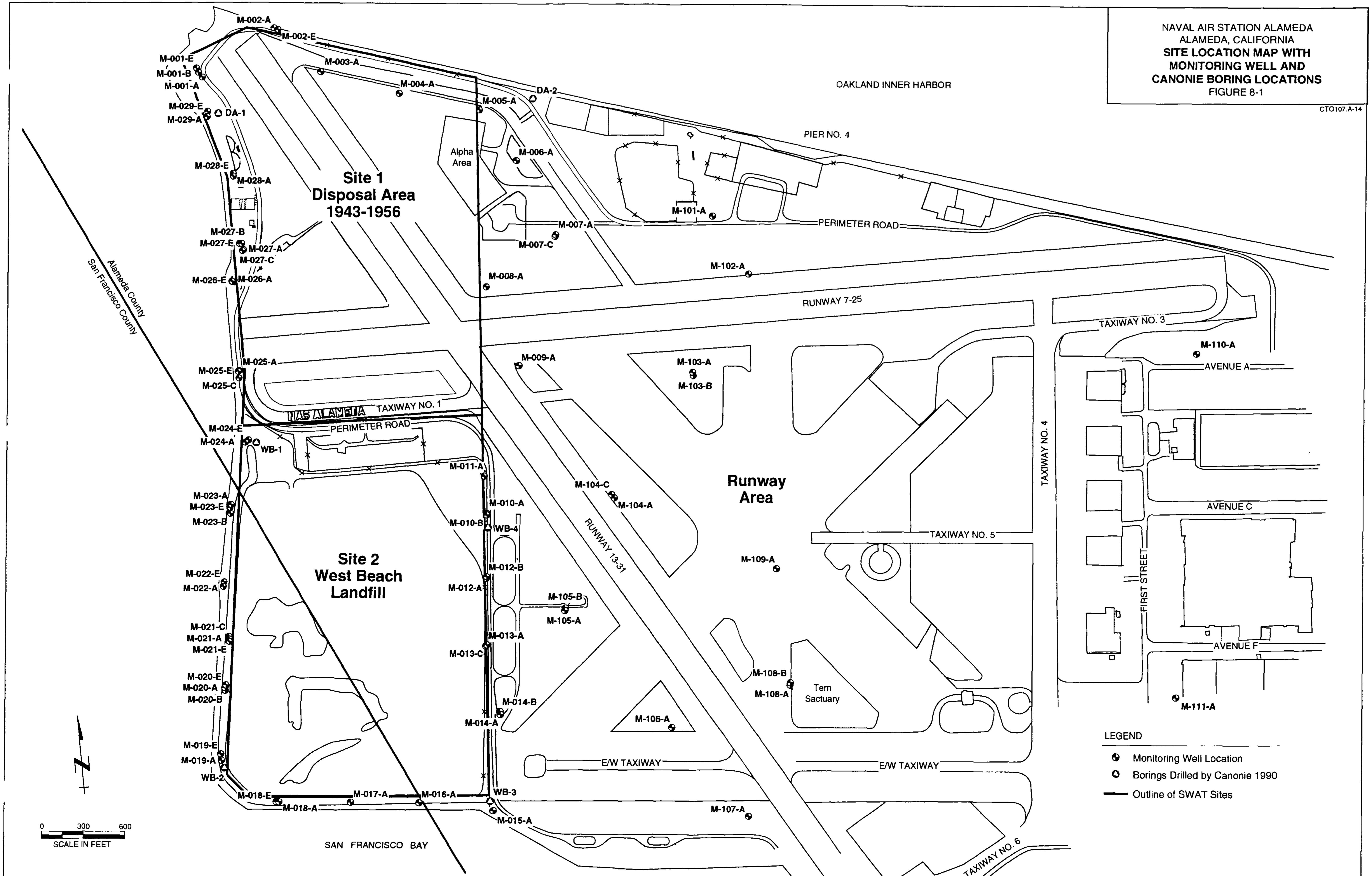
Localized groundwater in the first water-bearing zone in the downgradient direction (wells along the western edge of the landfill) appears to have been impacted by VOC and SVOC, whereas groundwater in the second water-bearing zone in this downgradient direction does not appear to contain elevated levels of organic compounds.

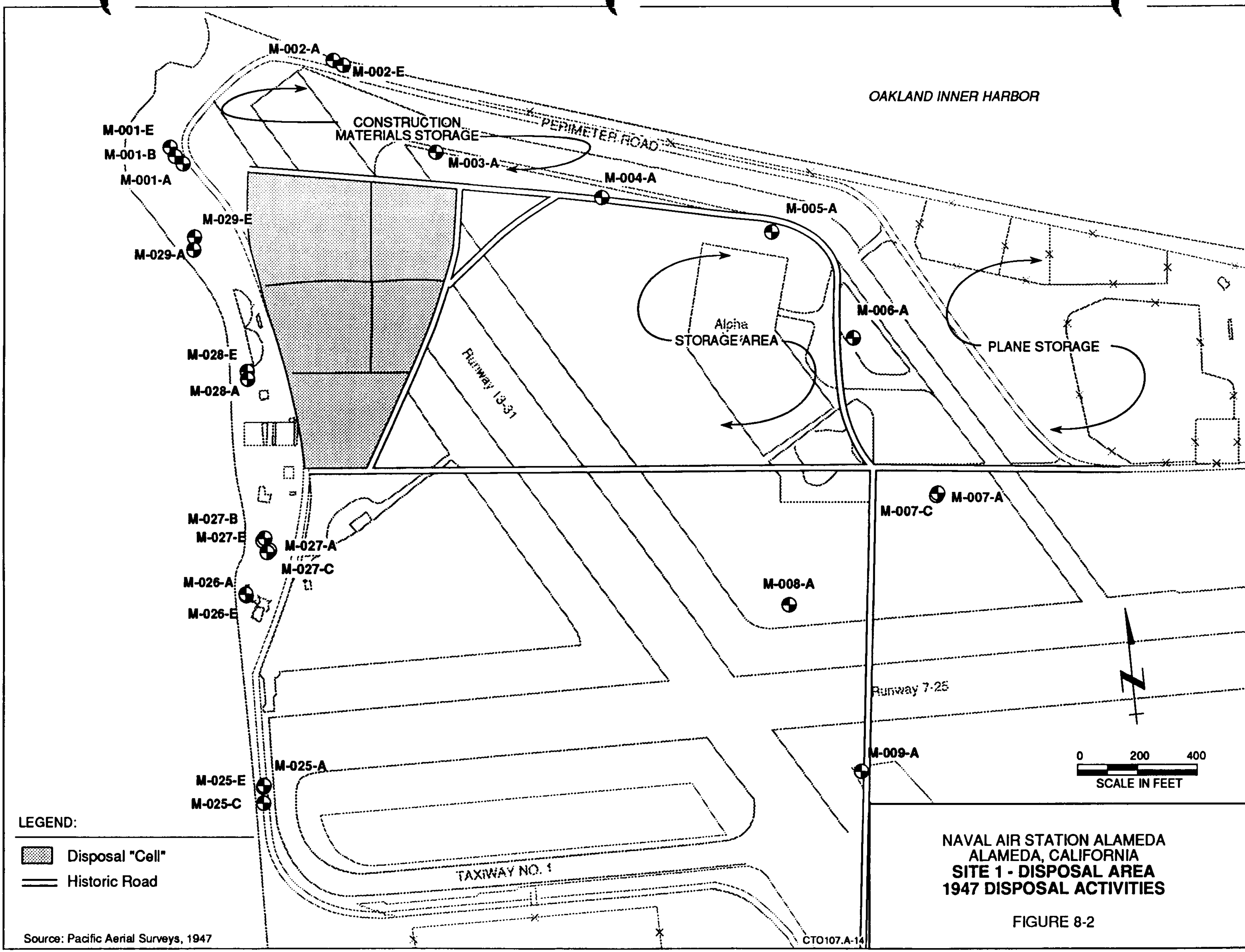
It is believed that the current groundwater monitoring network is adequate to monitor the quality of groundwater in the first and second water-bearing zones leaving Site 1. With the exception of TRPH, adequate soil data for VOC, SVOC, pesticides/PCBs, metals, and general chemicals are available to initiate preliminary risk assessment study. Additional soil sampling may be required at Site 1 to supplement the TRPH data.

FIGURES

FINAL
SOLID WASTE WATER QUALITY ASSESSMENT TEST AND DATA SUMMARY REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY FOR PHASES 5 AND 6

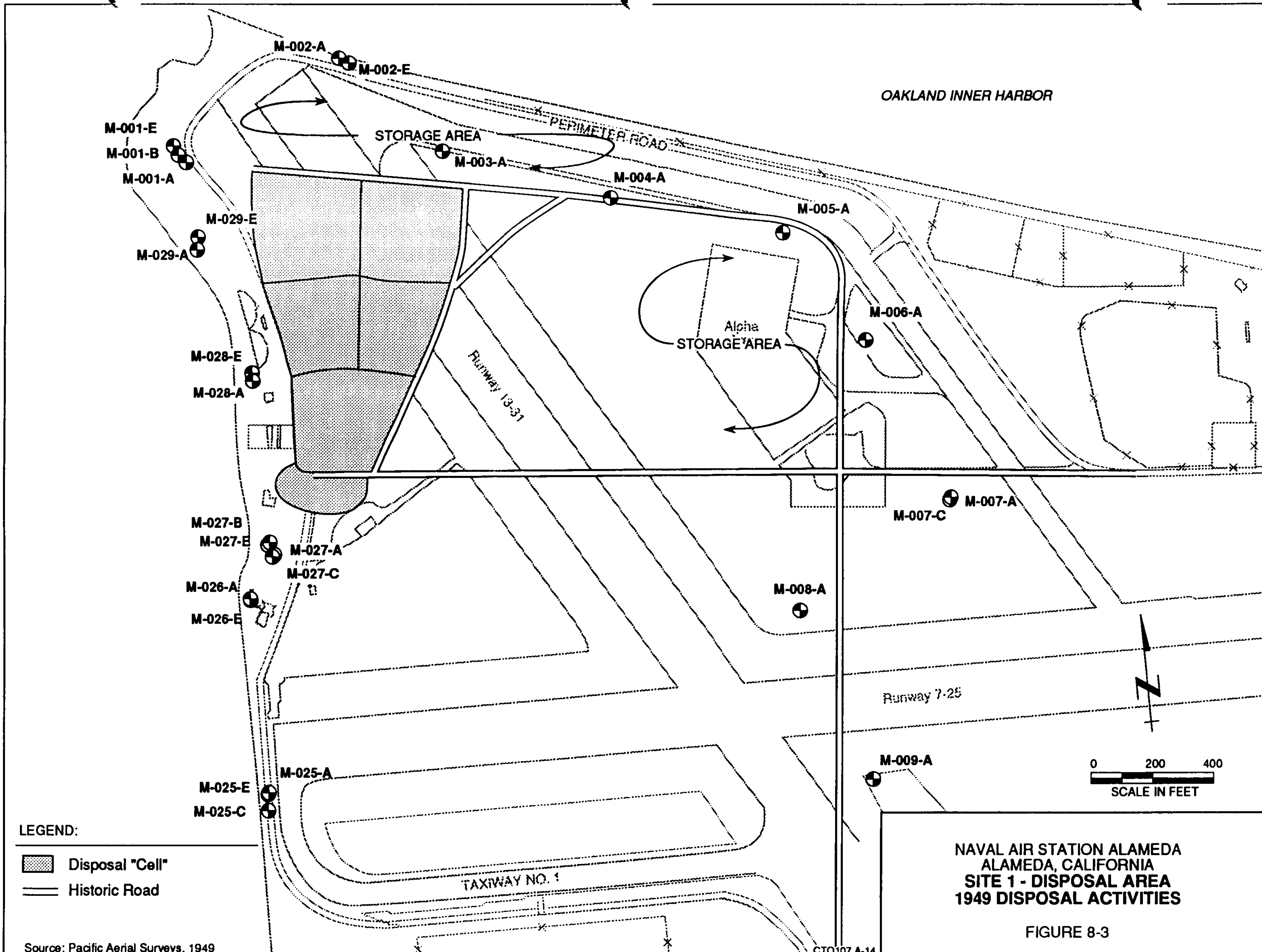
DATED 30 APRIL 1993


NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE LOCATION MAP WITH
MONITORING WELL AND
CANONIE BORING LOCATIONS
FIGURE 8-1
CTO107.A-14
OAKLAND INNER HARBOR
PIER NO. 4
PERIMETER ROAD
Site 1
Disposal Area
1943-1956
Alpha Area
RUNWAY 7-25
TAXIWAY NO. 1
TAXIWAY NO. 3
TAXIWAY NO. 4
TAXIWAY NO. 5
TAXIWAY NO. 6
AVENUE A
AVENUE C
AVENUE F
FIRST STREET
Runway Area
RUNWAY 13-31
Site 2
West Beach
Landfill
Tern Sactuary
E/W TAXIWAY
SAN FRANCISCO BAY
Alameda County
San Francisco County
NAS ALAMEDA
M-001-E
M-001-B
M-001-A
M-002-A
M-002-E
M-003-A
M-004-A
M-005-A
M-006-A
M-007-A
M-007-C
M-008-A
M-009-A
M-010-A
M-010-B
M-011-A
M-012-A
M-012-B
M-013-A
M-013-C
M-014-A
M-014-B
M-015-A
M-016-A
M-017-A
M-018-A
M-018-E
M-019-A
M-019-E
M-020-A
M-020-B
M-020-E
M-021-A
M-021-C
M-021-E
M-022-A
M-022-E
M-023-A
M-023-B
M-023-E
M-024-A
M-024-E
M-025-A
M-025-C
M-025-E
M-026-A
M-026-E
M-027-A
M-027-B
M-027-C
M-027-E
M-028-A
M-028-E
M-029-A
M-029-E
M-101-A
M-102-A
M-103-A
M-103-B
M-104-A
M-104-C
M-105-A
M-105-B
M-106-A
M-107-A
M-108-A
M-108-B
M-109-A
M-110-A
M-111-A
DA-1
DA-2
WB-1
WB-2
WB-3
WB-4
0 300 600
SCALE IN FEET
LEGEND
Monitoring Well Location
Borings Drilled by Canonie 1990
Outline of SWAT Sites



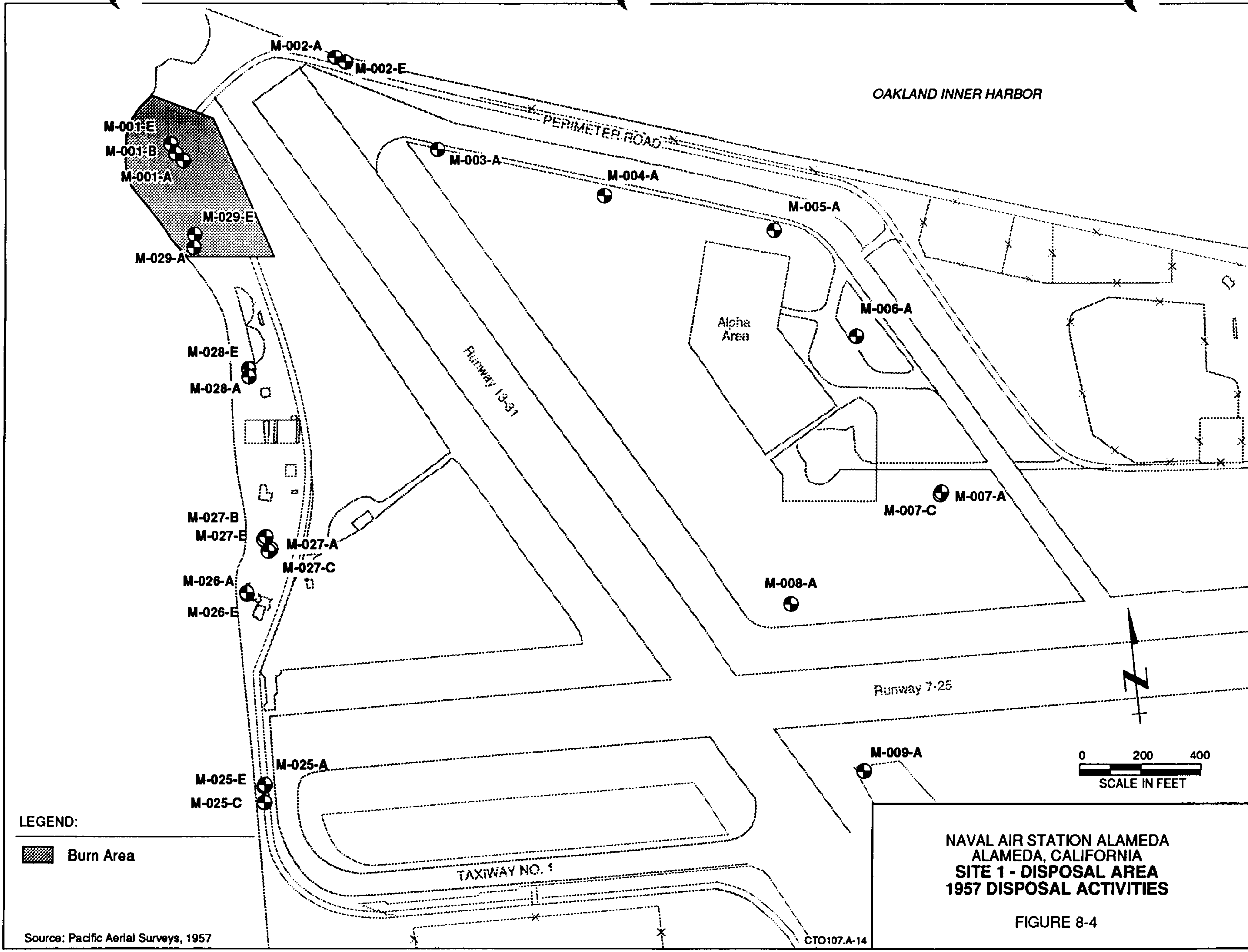
NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 - DISPOSAL AREA
1947 DISPOSAL ACTIVITIES

FIGURE 8-2



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 - DISPOSAL AREA
1949 DISPOSAL ACTIVITIES

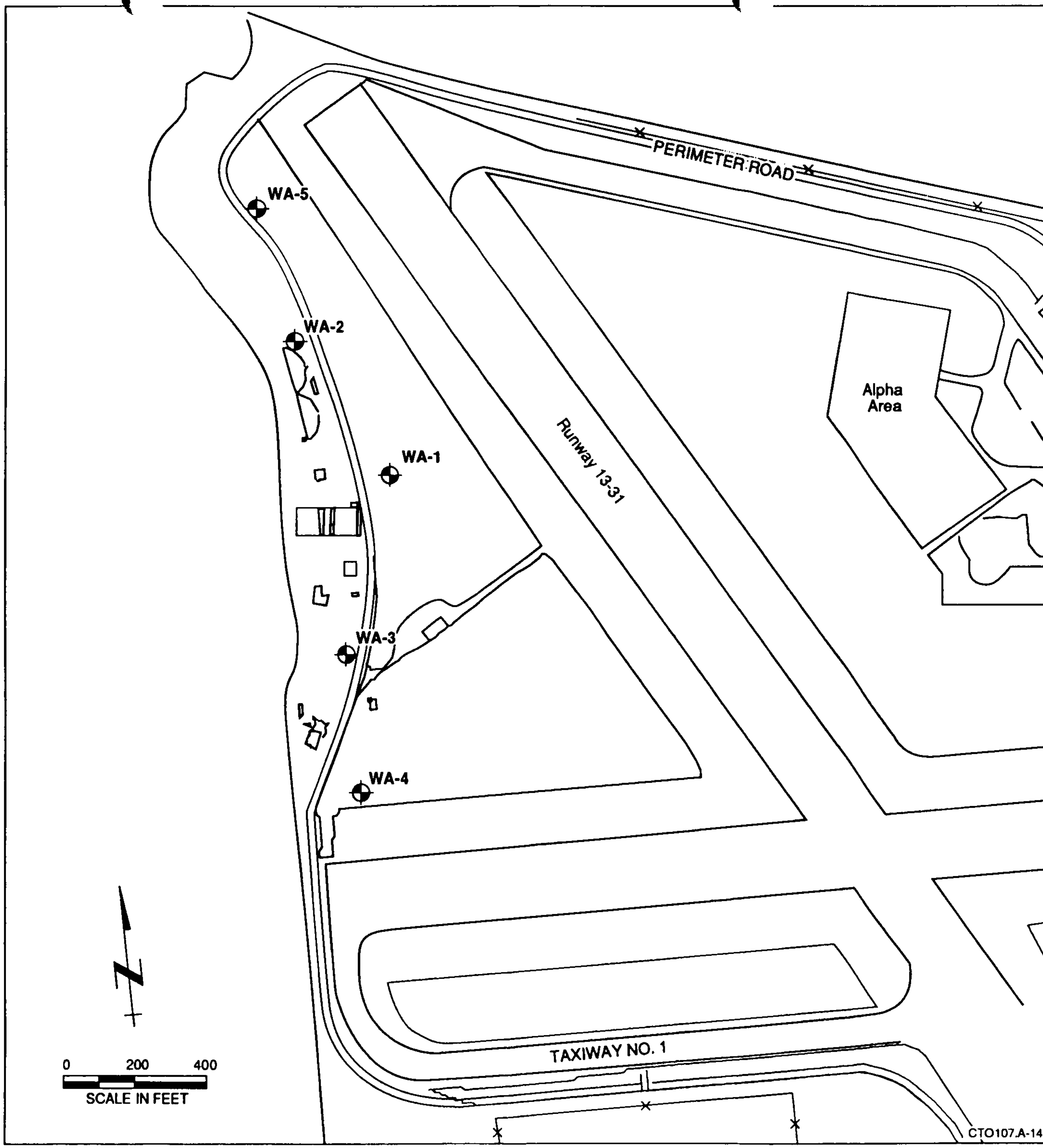
FIGURE 8-3



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 - DISPOSAL AREA
1957 DISPOSAL ACTIVITIES

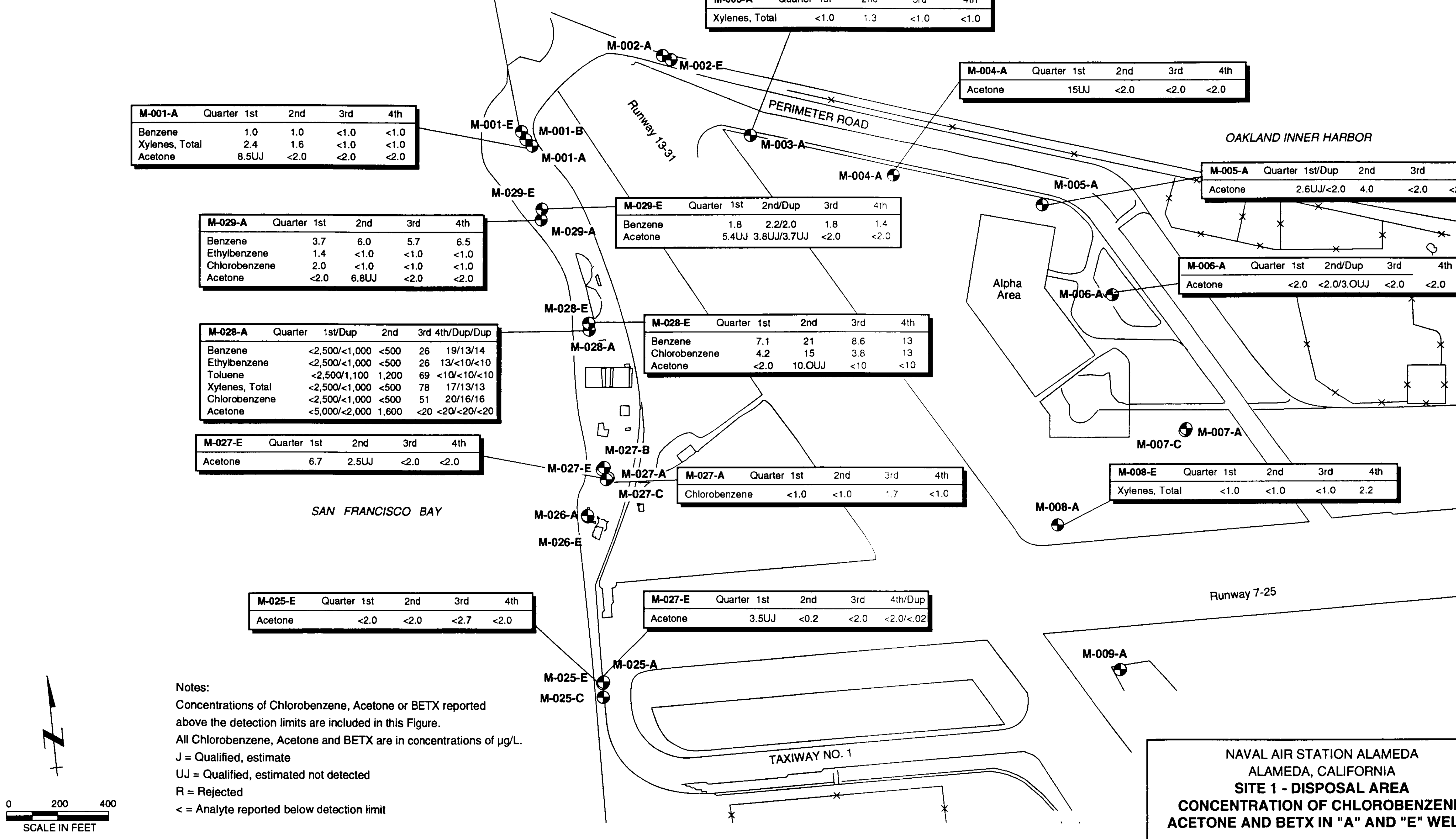
FIGURE 8-4

Source: Pacific Aerial Surveys, 1957



NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 - DISPOSAL AREA
LOCATION OF
WAHLER ASSOCIATES WELLS

FIGURE 8-5



M-001-E	Quarter 1st	2nd	3rd	4th
Benzene	3.1	2.6	3.4	4.9
Ethylbenzene	2.1	1.7	2.2	4.7
Toluene	1.2	1.1	1.3	1.6
Xylenes, Total	12	8.9	12	23
Chlorobenzene	6.2	3.8	6.6	12
Acetone	2.8UJ	<2.0	<2.0	<2.0

M-003-A	Quarter 1st	2nd	3rd	4th
Xylenes, Total	<1.0	1.3	<1.0	<1.0

M-004-A	Quarter 1st	2nd	3rd	4th
Acetone	15UJ	<2.0	<2.0	<2.0

M-001-A	Quarter 1st	2nd	3rd	4th
Benzene	1.0	1.0	<1.0	<1.0
Xylenes, Total	2.4	1.6	<1.0	<1.0
Acetone	8.5UJ	<2.0	<2.0	<2.0

M-005-A	Quarter 1st/Dup	2nd	3rd	4th
Acetone	2.6UJ/<2.0	4.0	<2.0	<2.0

M-029-E	Quarter 1st	2nd/Dup	3rd	4th
Benzene	1.8	2.2/2.0	1.8	1.4
Acetone	5.4UJ	3.8UJ/3.7UJ	<2.0	<2.0

M-029-A	Quarter 1st	2nd	3rd	4th
Benzene	3.7	6.0	5.7	6.5
Ethylbenzene	1.4	<1.0	<1.0	<1.0
Chlorobenzene	2.0	<1.0	<1.0	<1.0
Acetone	<2.0	6.8UJ	<2.0	<2.0

M-006-A	Quarter 1st	2nd/Dup	3rd	4th
Acetone	<2.0	<2.0/3.0UJ	<2.0	<2.0

M-028-A	Quarter 1st/Dup	2nd	3rd	4th/Dup/Dup
Benzene	<2,500/<1,000	<500	26	19/13/14
Ethylbenzene	<2,500/<1,000	<500	26	13/<10/<10
Toluene	<2,500/1,100	1,200	69	<10/<10/<10
Xylenes, Total	<2,500/<1,000	<500	78	17/13/13
Chlorobenzene	<2,500/<1,000	<500	51	20/16/16
Acetone	<5,000/<2,000	1,600	<20	<20/<20/<20

M-028-E	Quarter 1st	2nd	3rd	4th
Benzene	7.1	21	8.6	13
Chlorobenzene	4.2	15	3.8	13
Acetone	<2.0	10.0UJ	<10	<10

M-027-E	Quarter 1st	2nd	3rd	4th
Acetone	6.7	2.5UJ	<2.0	<2.0

M-027-A	Quarter 1st	2nd	3rd	4th
Chlorobenzene	<1.0	<1.0	1.7	<1.0

M-008-E	Quarter 1st	2nd	3rd	4th
Xylenes, Total	<1.0	<1.0	<1.0	2.2

M-025-E	Quarter 1st	2nd	3rd	4th
Acetone	<2.0	<2.0	<2.7	<2.0

M-027-E	Quarter 1st	2nd	3rd	4th/Dup
Acetone	3.5UJ	<0.2	<2.0	<2.0/<.02

Notes:

Concentrations of Chlorobenzene, Acetone or BETX reported above the detection limits are included in this Figure.

All Chlorobenzene, Acetone and BETX are in concentrations of µg/L.

J = Qualified, estimate

UJ = Qualified, estimated not detected

R = Rejected

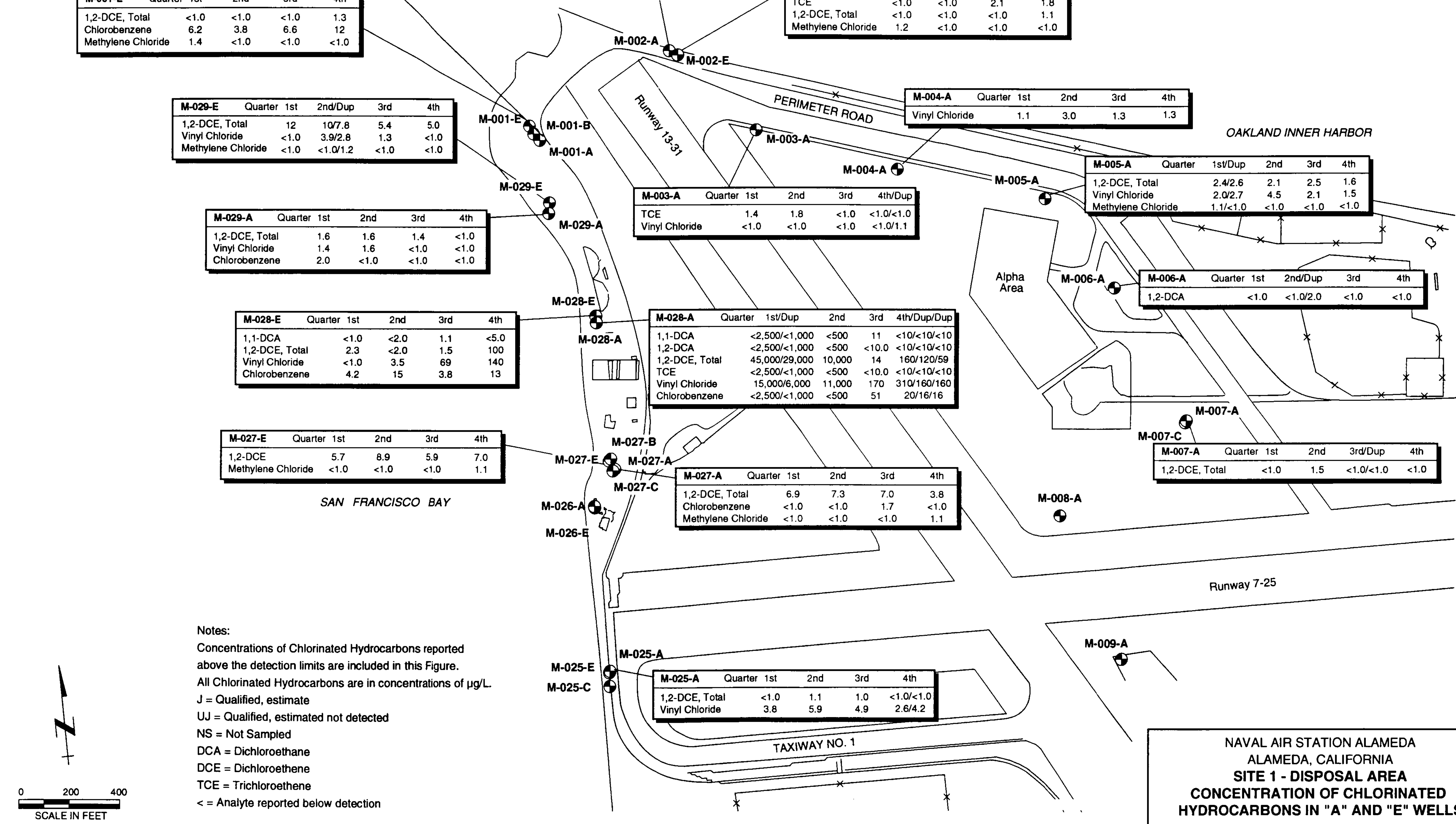
< = Analyte reported below detection limit

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA

SITE 1 - DISPOSAL AREA
CONCENTRATION OF CHLOROBENZENE ACETONE AND BETX IN "A" AND "E" WELLS

FIGURE 8-6

CTO107.A-13



M-001-A	Quarter 1st	2nd	3rd	4th
Methylene Chloride	<1.0	<1.0	<1.0	1.2

M-001-E	Quarter 1st	2nd	3rd	4th
1,2-DCE, Total	<1.0	<1.0	<1.0	1.3
Chlorobenzene	6.2	3.8	6.6	12
Methylene Chloride	1.4	<1.0	<1.0	<1.0

M-002-A	Quarter 1st	2nd	3rd	4th
1,2-DCE, Total	17	17	47	44
TCE	18	13	39	45
Methylene Chloride	1.2	<1.0	<2.0	<2.0

M-002-E	Quarter 1st	2nd	3rd	4th
TCE	<1.0	<1.0	2.1	1.8
1,2-DCE, Total	<1.0	<1.0	<1.0	1.1
Methylene Chloride	1.2	<1.0	<1.0	<1.0

M-004-A	Quarter 1st	2nd	3rd	4th
Vinyl Chloride	1.1	3.0	1.3	1.3

M-029-E	Quarter 1st	2nd/Dup	3rd	4th
1,2-DCE, Total	12	10/7.8	5.4	5.0
Vinyl Chloride	<1.0	3.9/2.8	1.3	<1.0
Methylene Chloride	<1.0	<1.0/1.2	<1.0	<1.0

M-005-A	Quarter 1st/Dup	2nd	3rd	4th
1,2-DCE, Total	2.4/2.6	2.1	2.5	1.6
Vinyl Chloride	2.0/2.7	4.5	2.1	1.5
Methylene Chloride	1.1/<1.0	<1.0	<1.0	<1.0

M-003-A	Quarter 1st	2nd	3rd	4th/Dup
TCE	1.4	1.8	<1.0	<1.0/<1.0
Vinyl Chloride	<1.0	<1.0	<1.0	<1.0/1.1

M-029-A	Quarter 1st	2nd	3rd	4th
1,2-DCE, Total	1.6	1.6	1.4	<1.0
Vinyl Chloride	1.4	1.6	<1.0	<1.0
Chlorobenzene	2.0	<1.0	<1.0	<1.0

M-006-A	Quarter 1st	2nd/Dup	3rd	4th
1,2-DCA	<1.0	<1.0/2.0	<1.0	<1.0

M-028-E	Quarter 1st	2nd	3rd	4th
1,1-DCA	<1.0	<2.0	1.1	<5.0
1,2-DCE, Total	2.3	<2.0	1.5	100
Vinyl Chloride	<1.0	3.5	69	140
Chlorobenzene	4.2	15	3.8	13

M-028-A	Quarter 1st/Dup	2nd	3rd	4th/Dup/Dup
1,1-DCA	<2,500/<1,000	<500	11	<10/<10/<10
1,2-DCA	<2,500/<1,000	<500	<10.0	<10/<10/<10
1,2-DCE, Total	45,000/29,000	10,000	14	160/120/59
TCE	<2,500/<1,000	<500	<10.0	<10/<10/<10
Vinyl Chloride	15,000/6,000	11,000	170	310/160/160
Chlorobenzene	<2,500/<1,000	<500	51	20/16/16

M-007-A	Quarter 1st	2nd	3rd/Dup	4th
1,2-DCE, Total	<1.0	1.5	<1.0/<1.0	<1.0

M-027-E	Quarter 1st	2nd	3rd	4th
1,2-DCE	5.7	8.9	5.9	7.0
Methylene Chloride	<1.0	<1.0	<1.0	1.1

M-027-A	Quarter 1st	2nd	3rd	4th
1,2-DCE, Total	6.9	7.3	7.0	3.8
Chlorobenzene	<1.0	<1.0	1.7	<1.0
Methylene Chloride	<1.0	<1.0	<1.0	1.1

M-025-A	Quarter 1st	2nd	3rd	4th
1,2-DCE, Total	<1.0	1.1	1.0	<1.0/<1.0
Vinyl Chloride	3.8	5.9	4.9	2.6/4.2

Notes:
Concentrations of Chlorinated Hydrocarbons reported above the detection limits are included in this Figure.
All Chlorinated Hydrocarbons are in concentrations of µg/L.
J = Qualified, estimate
UJ = Qualified, estimated not detected
NS = Not Sampled
DCA = Dichloroethane
DCE = Dichloroethene
TCE = Trichloroethene
< = Analyte reported below detection

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 - DISPOSAL AREA
CONCENTRATION OF CHLORINATED HYDROCARBONS IN "A" AND "E" WELLS

FIGURE 8-7

CTO107.A-13

Continue

M-002-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<4.0	<2.0	<2.0	6.1UJ

M-001-E Quarter	1st	2nd	3rd	4th
2,4-Dimethylphenol	53	39	45	42
2-Methynaphthalene	3.1	3.5	3.4	3.8
2-Methylphenol	2.2	<4.0	<4.0	2.8
Acenaphthene	3.4	3.7	3.1	3.5
Fluorene	1.2	<2.0	<2.0	1.5
Naphthalene	99	100	110	100
Phenanthrene	1.8	<2.0	<2.0	2.0
Bis(2-chloroisopropyl)ether	<1.0	4.4	3.3	<1.0
Bis(2-ethylhexyl)phthalate	<2.0	4.6	<4.0	7.4UJ
Diethylphthalate	<1.0	<2.0	<2.0	180
Phenol	<2.0	<2.0	<2.0	2.2

M-002-E Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<4.0	2.9	20UJ	3.8UJ
Diethylphthalate	<2.0	<1.0	<2.0	24

M-005-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0/<2.0	2.3	<5.0	6.5UJ
Fluoranthene	<1.0/<1.0	1.0	<2.5	<1.0
Pyrene	<1.0/<1.0	1.0	<2.5	<1.0

M-003-A Quarter	1st	2nd	3rd	4th/Dup
Bis(2-ethylhexyl)phthalate	<2.0	<2.0	4.6	72UJ/64UJ

M-004-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	4.0	7.3	120UJ

M-001-A Quarter	1st	2nd	3rd	4th
Bis(2-chloroisopropyl)ether	<1.0	<1.0	2.0	2.1
Bis(2-ethylhexyl)phthalate	<2.0	3.0UJ	<4.0	2.9UJ
Diethylphthalate	<1.0	<1.0	<2.0	110

M-029-E Quarter	1st	2nd/Dup	3rd	4th
Acenaphthene	<2.0	1.4/1.4	1.6	1.3
Bis(2-ethylhexyl)phthalate	<4.0	<1.0/1.5J	3.0	2.7UJ
Chrysene	<5.0	<1.0/1.1	<1.0	<1.0
Fluoranthene	<2.0	1.7/4.1	2.0	<1.0
Naphthalene	<2.0	1.1/<1.0	1.8	1.4
Phenanthrene	<2.0	1.5/1.6	1.9	1.1
Pyrene	<2.0	2.1/4.2J	2.5	<1.0
Diethylphthalate	<2.0	<1.0/<1.0	<1.0	85

M-029-A Quarter	1st	2nd	3rd	4th
Acenaphthene	<2.0	4.0	4.0	3.2
Bis(2-chloroisopropyl)ether	<2.0	6.3	5.9	6.4
Bis(2-chloroethyl)ether	<3.0	1.3	1.6	<1.0
Bis(2-ethylhexyl)phthalate	<4.0	3.4	5.8	2.9UJ
Fluorene	<2.0	1.4	1.4	1.1
Phenanthrene	<2.0	<1.0	1.4	<1.0
Diethylphthalate	<2.0	<1.0	<1.0	11

M-006-A Quarter	1st	2nd/Dup	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	3.7UJ/45UJ	11	6.5UJ
Diethylphthalate	<1.0	<1.0/<1.0	<2.0	5.4
Napthalene	<1.0	<1.0/<1.0	<2.0	1.2

M-028-E Quarter	1st	2nd	3rd	4th
1,2-Dichlorobenzene	<2.0	1.1	1.1	1.3
Acenaphthylene	<2.0	1.2	<1.0	<1.0
1,4-Dichlorobenzene	<1.0	<1.0	<1.0	1.3
Bis(2-ethylnoryl)phthalate	<4.0	<1.0	8.9UJ	26

M-028-A Quarter	1st/Dup	2nd	3rd	4th/Dup
2,4-Dimethylphenol	1,600/2,100J	4,000J	260	<2.0/4.8
2-Methylphenol	210J/190J	480J	<20	<2.0/<2.0
Naphthalene	<40/<80R	<100R	15	2.1/6.5
1,2-Dichlorobenzene	<40/<80R	<100R	<10	3.1/8.9
1,4-Dichlorobenzene	<100/<100	<100	<10	<1.0/2.3
4-Methylphenol	<80/390J	<200R	<20	<2.0/<2.0
Bis(2-chloroisopropyl)ether	<40/<80R	<100R	<10	<1.0/2.1
Bis(2-ethylhexly)phthalate	<80/<160R	<100R	<10	3.7/1.5

M-007-A Quarter	1st	2nd	3rd/Dup	4th
Bis(2-ethylhexyl)phthalate	<2.0	26UJ	6.7UJ/3.5	840

M-027-E Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	1.5	2.8	5.6UJ

M-008-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	2	14UJ	<4.0	2.4UJ

M-027-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	1.7	4.1	8.7UJ

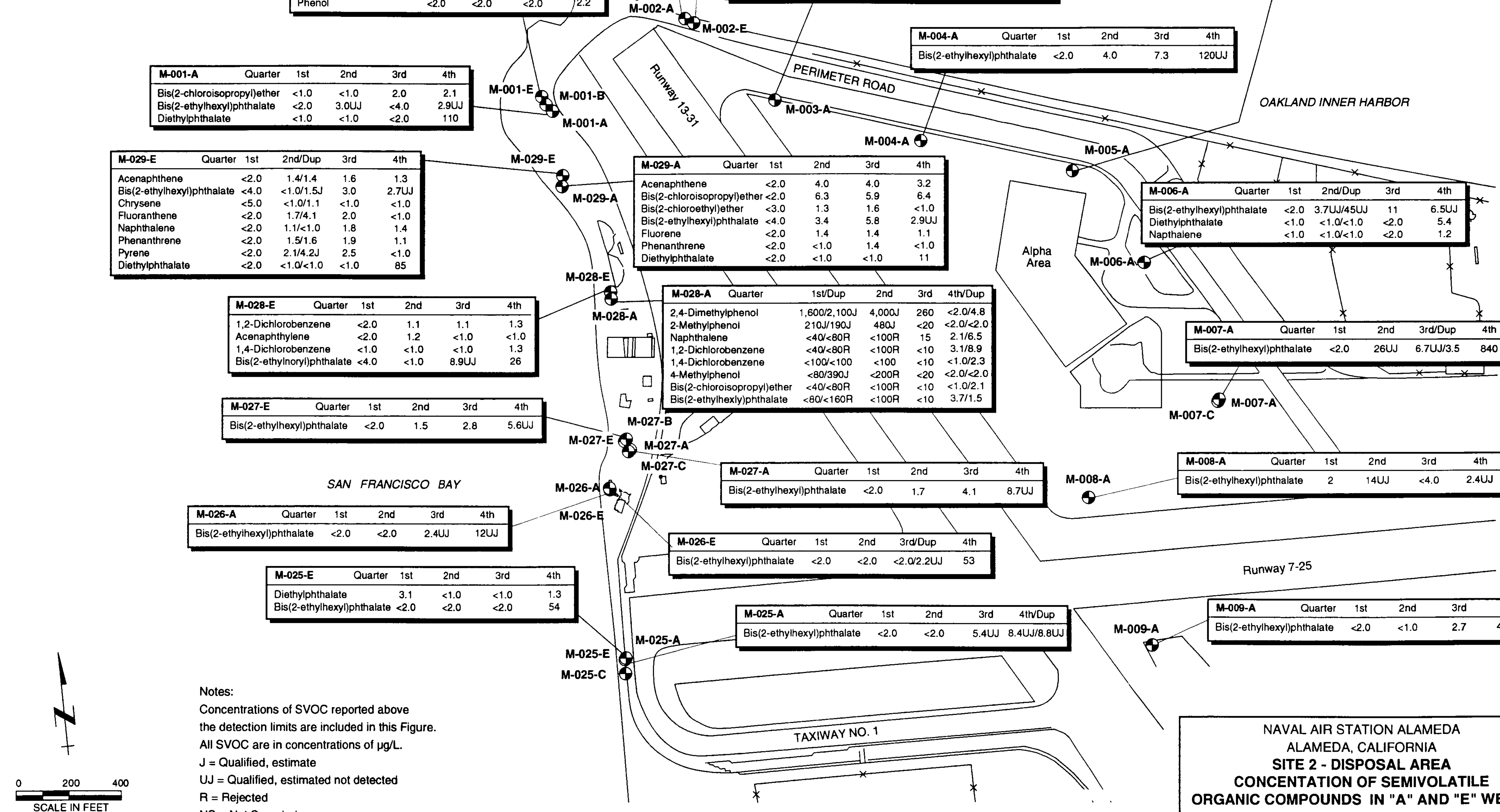
M-026-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	<2.0	2.4UJ	12UJ

M-026-E Quarter	1st	2nd	3rd/Dup	4th
Bis(2-ethylhexyl)phthalate	<2.0	<2.0	<2.0/2.2UJ	53

M-025-E Quarter	1st	2nd	3rd	4th
Diethylphthalate	3.1	<1.0	<1.0	1.3
Bis(2-ethylhexyl)phthalate	<2.0	<2.0	<2.0	54

M-009-A Quarter	1st	2nd	3rd	4th
Bis(2-ethylhexyl)phthalate	<2.0	<1.0	2.7	4.8UJ

M-025-A Quarter	1st	2nd	3rd	4th/Dup
Bis(2-ethylhexyl)phthalate	<2.0	<2.0	5.4UJ	8.4UJ/8.8UJ



Notes:
Concentrations of SVOC reported above the detection limits are included in this Figure.
All SVOC are in concentrations of μg/L.
J = Qualified, estimate
UJ = Qualified, estimated not detected
R = Rejected
NS = Not Sampled
< = Analyte reported below detection limit

CTO107.A-13

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 2 - DISPOSAL AREA
CONCENTATION OF SEMIVOLATILE ORGANIC COMPOUNDS IN "A" AND "E" WELLS

FIGURE 8-8