AD-A133 960

1

INSTALLATION RESTORATION PROGRAM

PHASE I - RECORDS SEARCH

TRAVIS AFB, CALIFORNIA

ENGINEERING-SCIENCE

ES

PREPARED FOR

UNITED STATES AIR FORCE
AFESC/DEV
Tyndall AFB, Florida

and

HQ MAC/DEEV
Scott AFB, Illinois

AUGUST 1983

NOTICE

This report has been prepared for the United States Air Force by Engineering-Science for the purpose of aiding in the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

Copies of the report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Technical Information Center should direct requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

UNCLAS

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER N/A	2. GOVT ACCESSION NO. AD-A133960	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) INSTALLATION RESTORATION PROGRAM PHASE I - RECORDS SEARCH, TRAVIS AFB CA		5. TYPE OF REPORT & PERIOD COVERED FINAL
		6. PERFORMING ORG. REPORT NUMBER F0863637-80-G0009-~~5001~~
7. AUTHOR(s) D. G. Johnson, Environmental Engineer; Y. Nordhav, Geologist; E. J. Schroeder, Environmental Engineer/Project Manager; M. I. Spiegel, Environmental Scientist		8. CONTRACT OR GRANT NUMBER(s) NA
9. PERFORMING ORGANIZATION NAME AND ADDRESS Engineering-Science, Inc. 57 Executive Park South, N.E., Suite 590 Atlanta GA 30329		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NA
11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Air Force Headquarters, Military Airlift Command/SGPB Scott AFB IL 62225		12. REPORT DATE August 1983
		13. NUMBER OF PAGES 237
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) USAF, AFESC/DEV, Tyndall AFB FL and HQ MAC/DEEV Scott AFB IL		15. SECURITY CLASS. (of this report) UNCLAS
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE NA

16. DISTRIBUTION STATEMENT (of this Report)

[redacted]

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

[redacted]

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

18. SUPPLEMENTARY NOTES

N/A

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Groundwater	Hydrocarbons
Pollution	Hazardous Materials
IRP	Landfills
Pesticides	Waste Disposal
Chlorinated Organics	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report covers the first (Phase I) part of the Installation Restoration Program (IRP) confirmation study at Travis AFB, CA. This study was directed by the Department of Defense. The overall objective of the IRP is to identify and evaluate past disposal sites and to control the migration of hazardous environmental contamination resulting from such sites. This work will be followed by a Phase II effort to determine if migration is occurring and if so, in what quantities.

DD FORM 1 JAN 73 1473

UNCLAS

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

BLANK PAGE

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH
TRAVIS AFB, CALIFORNIA

Prepared For
United States Air Force
AFESC/DEV
Tyndall AFB, Florida
and
HQ MAC/DEEV
Scott AFB, Illinois

August 1983

By
ENGINEERING-SCIENCE, INC.
57 Executive Park South, N.E.
Suite 590
Atlanta, Georgia 30329

NOTICE

This report has been prepared for the United States Air Force by Engineering-Science for the purpose of aiding in the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

Copies of the report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Technical Information Center should direct requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation and Quantification; Phase III, Technology Base Development/Evaluation of Remedial Alternatives; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Travis AFB under Contract No. F086~~3~~637-80-G0009-5001.

INSTALLATION DESCRIPTION

Travis Air Force Base is located in Solano County, California. The nearest city to the base is Fairfield, located approximately three miles west of the base. The base is situated in an agricultural area midway between San Francisco and Sacramento. The study area for this project included the main base comprised of 5,025 acres and seven off-base areas which are under the jurisdiction of Travis AFB. These areas are as follows:

Golf Course Annex	206 acres
Outer Marker	< 1 acre
TVOR Site	316 acres (leased)
Potrero Hill Storage Annex	25 acres
Almaden AFS	119 acres
Mill Valley AFS	106 acres
Point Arena AFS	81 acres

Travis AFB was initially activated in May of 1943 as the Fairfield-Suisun Army Air Base. The name was officially changed to Travis AFB in April 1951. The initial mission of the base was the servicing and ferrying of tactical aircraft from California to the Pacific war zones. By 1945, the base had become the West Coast's largest aerial port. It was actively involved in airlifting troops and supplies to occupied Japan and Korea, and processing returning troops.

In 1948, the Military Air Transport Service (MATS) assumed jurisdiction. The control of the base shifted to the Strategic Air Command in 1949. From 1949 until 1958, airlift operations became secondary while the base served as home for SAC bombers. In 1958, MATS again resumed command of Travis AFB and the base became headquarters for the MATS Western Transport Air Force. The MATS was reorganized in the early 1960's to the Military Airlift Command (MAC). The 60th Military Airlift Wing became the base host unit at that time.

During the Vietnam era, Travis AFB was the principal aerial port for both troops and supplies destined for Southeast Asia. Travis AFB is presently still the largest and busiest base in MAC, operating one-half of MAC's total C-5 Galaxy force and one-sixth of the C-141 Starlifter force.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate the following major points that are relevant to the evaluation of past hazardous waste management practices at Travis AFB:

- Travis AFB is located within a semi-arid region receiving a mean annual precipitation of 15.9 inches. Annual net precipitation (rainfall less evaporation) is minus 31 inches each year.
- The predominant soils on Travis AFB are characterized as silts or clays with low permeabilities.
- Major faults in the area are all located more than twenty miles from the base. A small potentially active fault, the Vaca Fault System is suspected to traverse the eastern portion of the base. It does not appear that any known fault planes would inhibit ground-water movement downgradient from the base.

- The major portion of the base is underlain by shallow deposits of older alluvium (consisting of interfingling lenses of sands, gravels, silts, and clays). These shallow deposits extend off base where wells have been installed to a depth of about forty or fifty feet below surface and produce water for stock and domestic uses.
- No major water bearing strata are found directly beneath the base. Major ground-water resources are, however, found less than ten miles north and west of the base in deep alluvial deposits.
- The general ground-water flow direction is to the southwest.
- Surface and subsurface drainage from the base discharges to the Suisun Marsh which is a large coastal marsh situated one mile downgradient of the base.
- TCE has been detected in Union Creek as it leaves the base.
- No threatened or endangered species have been observed within the Travis AFB boundaries.

The Point Arena Air Force Station (PAAFS) is on an 81-acre site located two miles from the Pacific Ocean in Mendocino County, California. The site occupies a relatively flat area ranging from 2,380 feet above msl to 2,220 feet above msl. The average net annual precipitation for the area is around 5.5 inches. A large portion of the site is covered by trees. The predominant geologic unit at the PAAFS is the Lower Miocene marine deposits. It is likely that ground water exists in the surface soils and fissures in the rocks within the site boundaries. Ground water is suspected to flow in a westerly direction. Surface springs are found in several areas of the PAAFS.

METHODOLOGY

During the course of this project, interviews were conducted with base personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and Federal agencies; and field and helicopter reconnaissance inspections were conducted at past hazardous waste activity sites. Sixteen sites were identified as potentially containing hazardous contaminants resulting from past activities (Figure 1 and Figure 2). These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-on action.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team's field inspection, review of base records and files and interviews with base personnel.

The areas determined to have a high potential for environmental contamination are as follows:

Fire Protection Training Area No. 4
Fire Protection Training Area No. 3

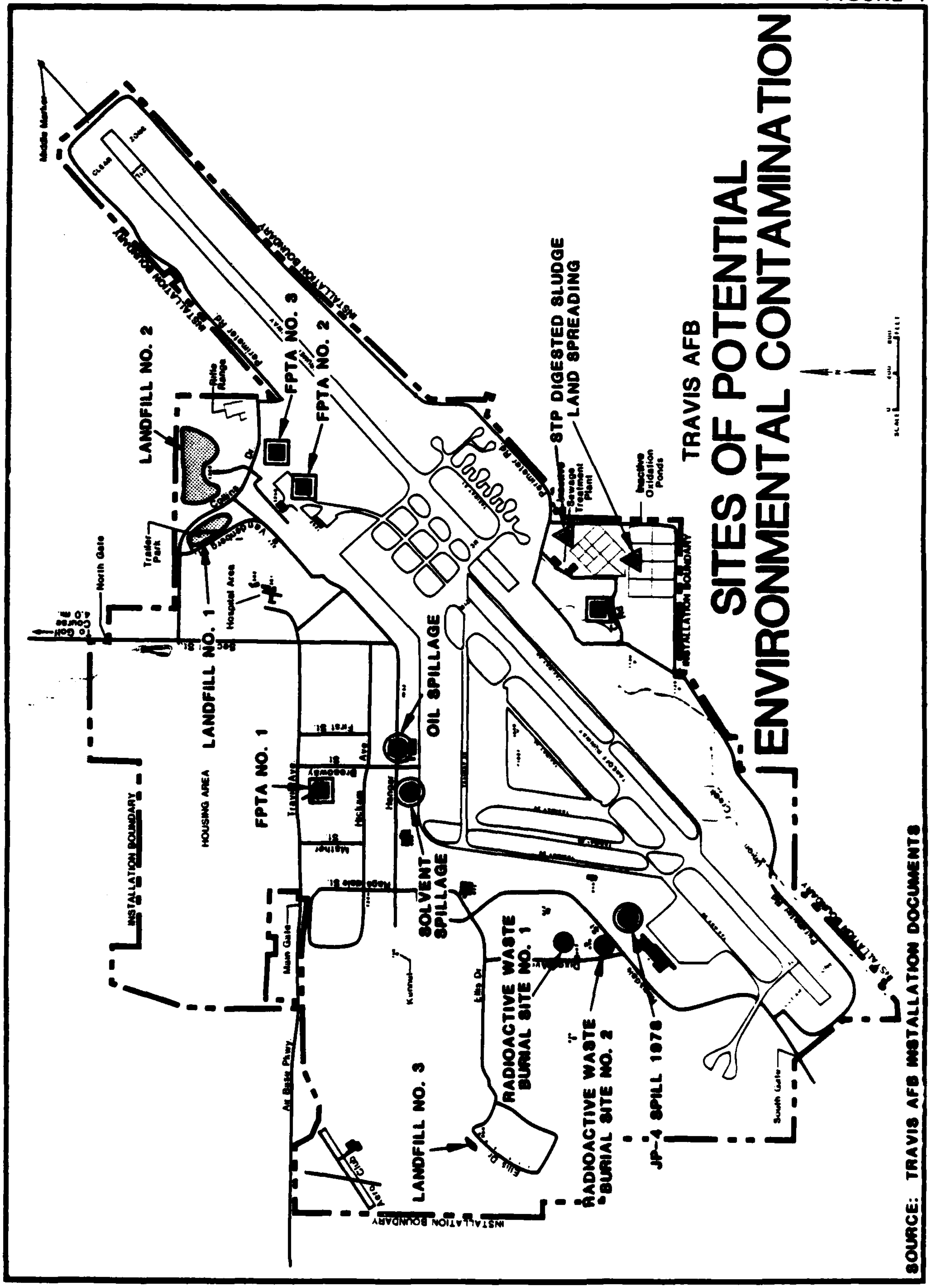
The areas determined to have a moderate potential for environmental contamination are as follows:

Disposal Site No. 1 (Point Arena AFS)
Landfill No. 2
Solvent Spillage
Landfill No. 3

The area determined to have a low potential for environmental contamination are as follows:

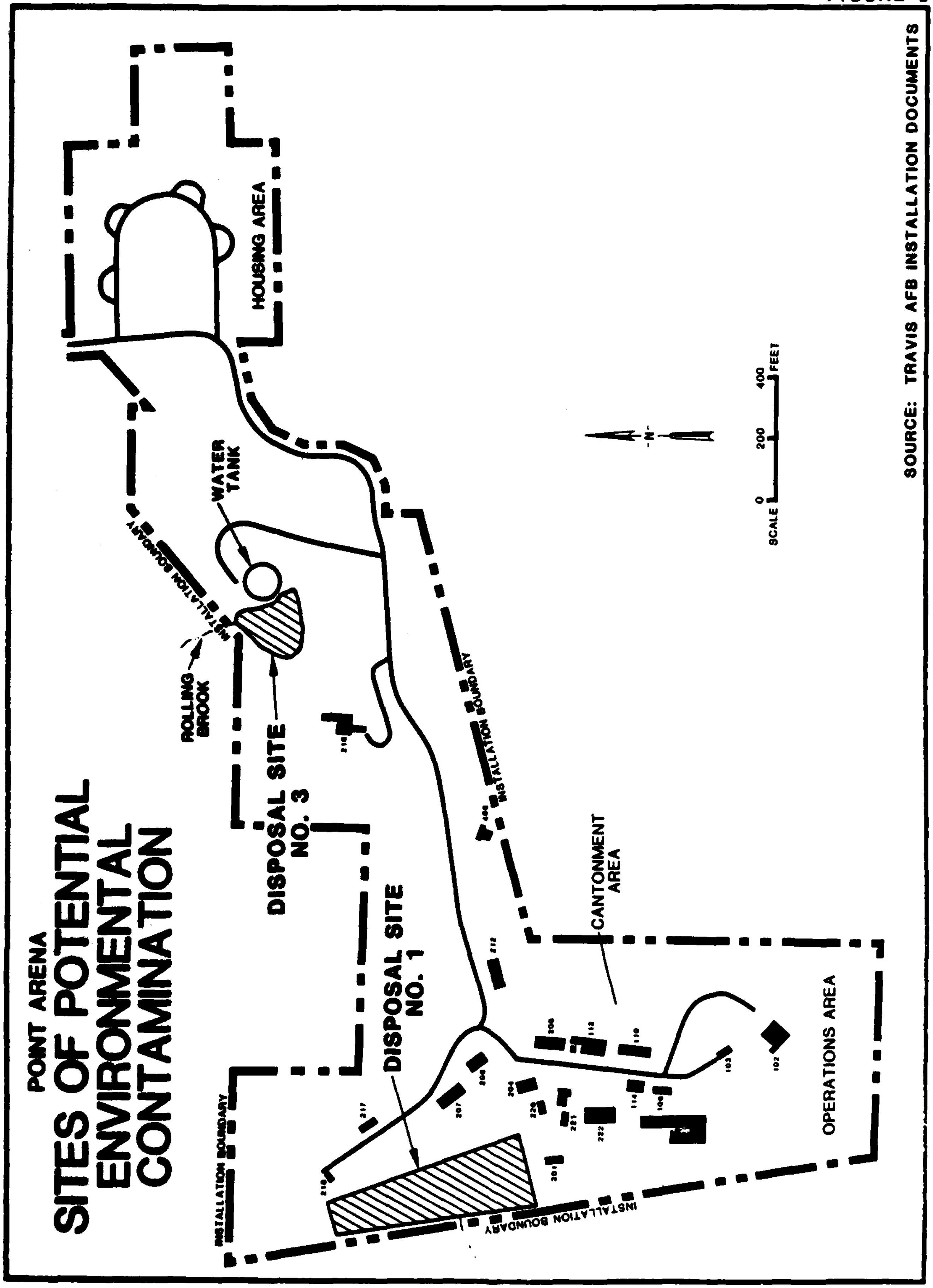
Fire Protection Traiing Area No. 2
Fire Protection Training Area No. 1
Disposal Site No. 3 (Point Arena AFS)
JP-4 Spill- 1978
Oil Spillage
Sewage Treatment Plant - Sludge Disposal Areas

FIGURE 1



SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

FIGURE 2



POINT ARENA
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION

SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

TABLE 1
PRIORITY RANKING OF POTENTIAL CONTAMINATION SOURCES
TRAVIS AFB

Rank	Site Name	Date of Operation or Occurrence	Overall Total Score
1	Fire Protection Training Area No. 4	1962 - Present	65
2	Fire Protection Training Area No. 3	1953 - 1962	63
3	Disposal Site No. 1 (Point Arena)	1951 - Present	58
4	Landfill No. 2	Late 1950's - 1974	53
4	Solvent Spillage	Prior to June 1981 - Length of Time Unknown	53
6	Landfill No. 3	1972 - 1977	51
7	Fire Protection Training Area No. 1	1943 - 1950	49
8	Fire Protection Training Area No. 2	1950 - 1952	48
9	Disposal Site No. 3 (Point Arena)	Unknown	47
10	JP-4 Spill - 1978	1978	44
11	Oil Spillage	1983 - Length of time unknown	43
12	Sewage Treatment Plant (STP) Sludge Disposal Areas	Early 1950's - Late 1970's	40
13	Sewage Treatment Plant (STP) Abandoned Oxidation Ponds	Early 1950's - Late 1970's	38
14	Radioactive Waste Burial Site No. 2 (RB-2)	Late 1940's - 1962	36
15	Landfill No. 1	1942 - Mid 1950's	35
16	Radioactive Waste Burial Site No. 1 (RB-1)	Late 1940's - 1962	4

Sewage Treatment Plant - Abandoned Oxidation Ponds

Radioactive Waste Burial Site No. 2

Landfill No. 1

Radioactive Waste Burial Site No. 1

RECOMMENDATIONS

Recommended guidelines for future land use restrictions at the sixteen sites identified in Table 1 are presented in Chapter 6. The detailed recommendations developed for further assessment of environmental concern areas at Travis AFB are also presented in Chapter 6. These recommendations are summarized as follows:

o Fire Protection Training Area No. 4	Install monitoring wells and implement ground-water monitoring program. Sample surface water in adjacent ditch during rainfall event.
o Fire Protection Training Area No. 3	Install monitoring wells and implement ground-water monitoring program.
o Disposal Site No. 1 (Point Arena AFS)	Install monitoring wells and implement ground-water monitoring program.
o Landfill No. 2	Install monitoring wells and implement ground-water monitoring program.
o Solvent Spillage	Install monitoring wells and implement ground-water monitoring program.
o Landfill No. 3	Install monitoring wells and implement ground-water monitoring program.
o Disposal Site No. 3 (Point Arena AFS)	Sediment sampling.

o Additional Monitoring	Conduct additional investigations of the storm sewer system on the base to pinpoint the source(s) of TCE contamination.

CHAPTER 1

INTRODUCTION

BACKGROUND

The United States Air Force, due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012 state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, DOD developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP will be the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

PURPOSE AND SCOPE OF THE ASSESSMENT

The Installation Restoration Program has been developed as a four-phased program as follows:

Phase I - Initial Assessment/Records Search

Phase II - Confirmation and Quantification

Phase III - Technology Base Development/Evaluation of Remedial Alternatives

Phase IV - Operations/Remedial Actions

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Travis Air Force Base under Contract No. F08637-80-G0009-5001. This report contains a summary and an evaluation of the information collected during Phase I of the IRP. The land areas included as part of the Travis AFB study are as follows:

Main Base Site	5,025 acres
Outer Marker	<1 acre
TVOR Site	316 acres (leased)
Golf Course Annex	206 acres
Potrero Hills Storage Annex	25 acres
Almaden AFS	109 acres
Mill Valley AFS	106 acres
Point Arena AFS	81 acres

The goal of the first phase of the program was to identify the potential for environmental contamination from past waste disposal practices at Travis AFB, and to assess the potential for contaminant migration. The activities that were performed in the Phase I study included the following:

- Reviewed site records
- Interviewed personnel familiar with past generation and disposal activities
- Inventoried wastes
- Determined estimated quantities and locations of current and past hazardous waste treatment, storage, and disposal
- Defined the environmental setting at the base
- Reviewed past disposal practices and methods

- Conducted field and aerial inspection
- Gathered pertinent information from Federal, state and local agencies
- Assessed potential for contaminant migration.

ES performed the field investigation portion of the records search during April 1983. The following core team of professionals were involved:

- D. G. Johnson, Environmental Engineer, M. S. Env. Eng., 5 years of professional experience
- Y. Nordhav, Geologist, M. S. Geology, 6 years of professional experience
- E. J. Schroeder, Environmental Engineer and Project Manager, MSCE, 16 years of professional experience
- M. I. Spiegel, Environmental Scientist, BS Environmental Science, 6 years of professional experience.

More detailed information on these individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Travis AFB Records Search began with a review of past and present industrial operations conducted at the base. Information was obtained from available records such as shop files and real property files, as well as interviews with 93 past and present base employees from the various operating areas. Those interviewed included current and past personnel associated with the Civil Engineering Squadron, Bioenvironmental Engineering Services, Organizational Maintenance Squadron, Transportation Squadron, Field Maintenance Squadron, Fuels Management Branch and Explosive Ordnance Disposal. Experienced personnel from present and past tenant organizations were also interviewed. In addition, interviews were conducted with personnel stationed at the Air Force stations supported by Travis AFB. A listing of Air Force interviewees by position and approximate period of service is presented in Appendix B.

Concurrent with the base interviews, the applicable Federal, state and local agencies were contacted for pertinent base related environmental data. The nine agencies contacted and interviewed are listed below as well as in Appendix B.

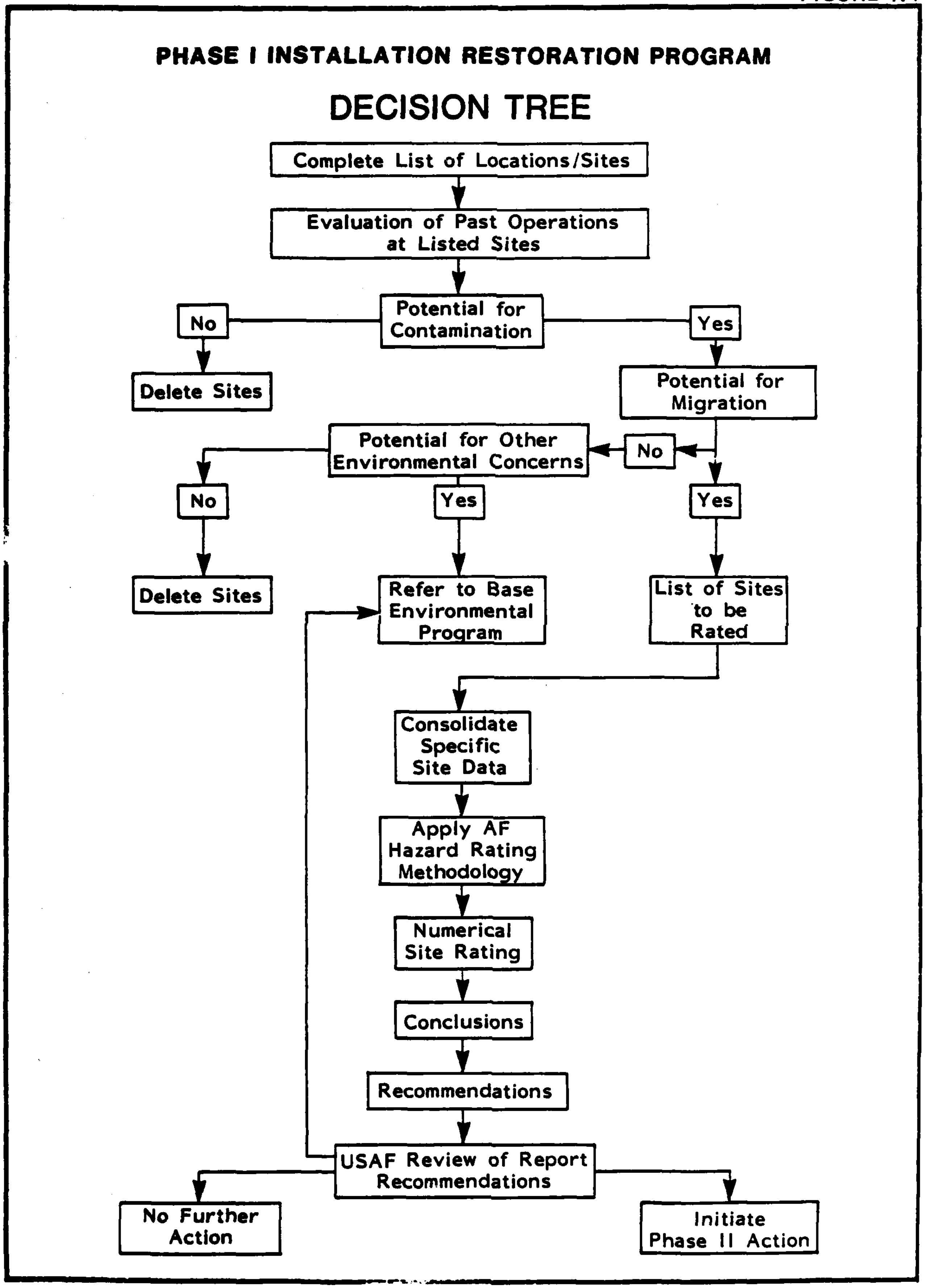
- o U.S. Geological Survey
- o U.S. Environmental Protection Agency
- o California Department of Health Services
- o California Department of Water Resources
- o California Regional Water Quality Control Board, San Francisco Bay Region
- o California Department of Fish and Game
- o California Natural Diversity Data Base
- o Solano Irrigation District
- o City of Vallejo, Water Department

The next step in the activity review was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various operations on the base. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour and a helicopter overflight of the sites identified on Travis AFB were then made by the ES Project Team to gather site-specific information including: (1) visual evidence of environmental stress; (2) the presence of nearby drainage ditches or surface water bodies; and (3) visual inspection of these water bodies for any obvious signs of contamination or leachate migration. Inspections of the Potrero Hills Storage Annex and Point Arena AFS were also conducted by the ES project team to assess the sites identified at these facilities.

A decision was then made, based on all of the above information, whether a potential exists for hazardous material contamination at any of the identified sites using the Decision Tree shown in Figure 1.1. If no potential existed, the site was deleted from further consideration. For those sites where a potential for contamination was identified, a

FIGURE 1.1



ES ENGINEERING-SCIENCE

determination of the potential for migration of the contamination was made by considering site-specific conditions. If there were no further environmental concerns, then the site was deleted. If the potential for contaminant migration was considered significant, then the site was evaluated and prioritized using the Hazard Assessment Rating Methodology (HARM). A discussion of the HARM system is presented in Appendix G. The sites that were evaluated using the HARM procedures were also reviewed with regard to future land use restrictions.

CHAPTER 2

INSTALLATION DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

Travis Air Force Base is located in Solano County, California (Figures 2.1 and 2.2). The nearest city to the base is Fairfield, located approximately three miles west of the Base. The Base is situated in an agricultural area midway between San Francisco and Sacramento. Figure 2.3 depicts the configuration of the 5,025 acres comprising Travis AFB. Several annexes under the jurisidction of Travis AFB were also included in this study. These are described below and their general locations are identified on Figure 2.2.

Golf Course Annex

Golf Course Annex has 206 acres located approximately 4 miles due north of the base. The site serves as both the golf course and well field providing a portion of the potable water supply to the base.

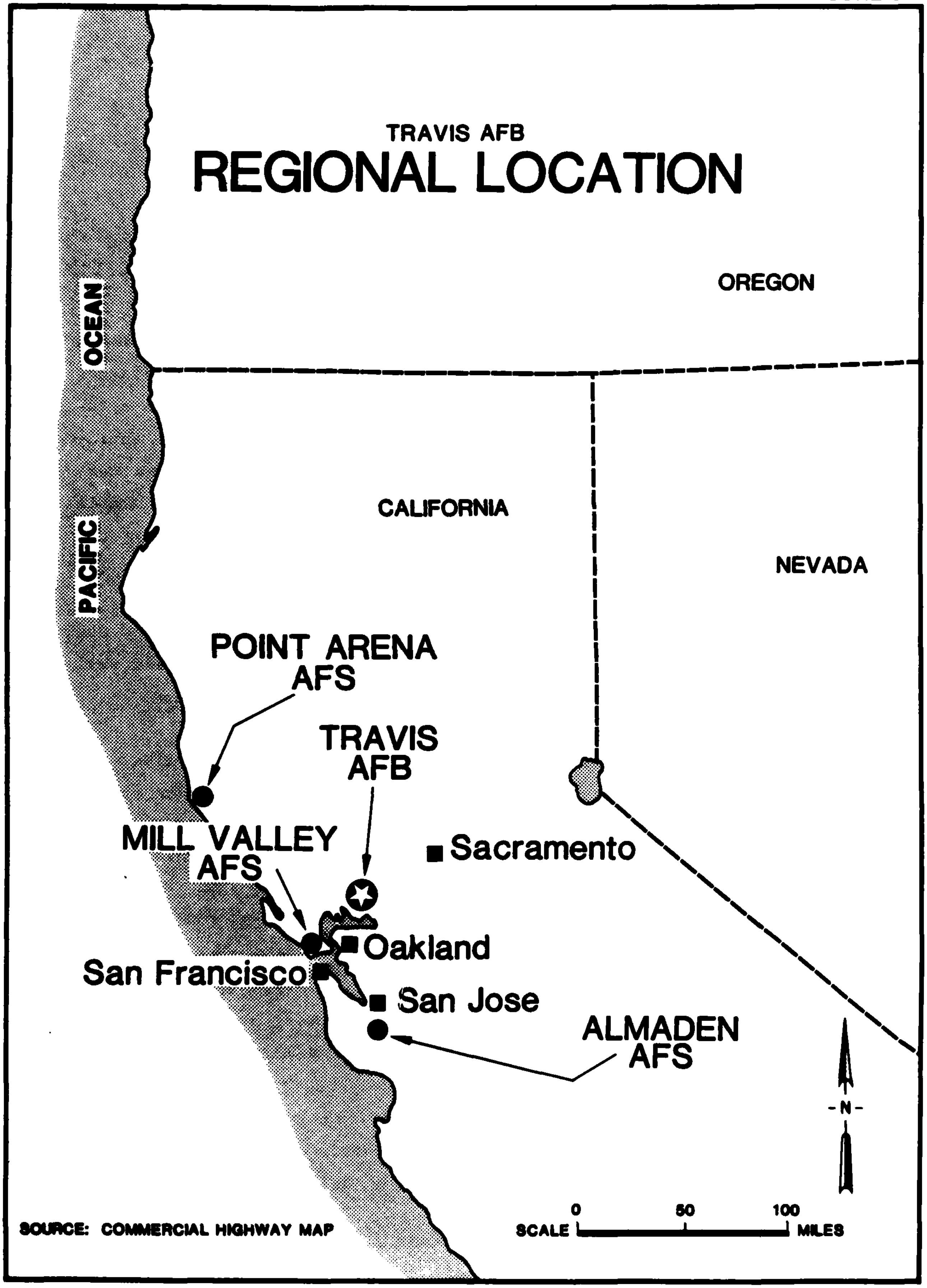
Outer Marker and TVOR Site

The Outer Marker and the TVOR Site are located 5 and 6 miles, respectively, from the north end of Runway 21L along the approach flight path. These facilities are equipped with electronic navigational aids. A small diesel generator is also located at the site to provide a back-up power source. The Outer Marker is less than one-half acre. The TVOR site is located on 316-acres of leased land.

Potrero Hills Storage Annex

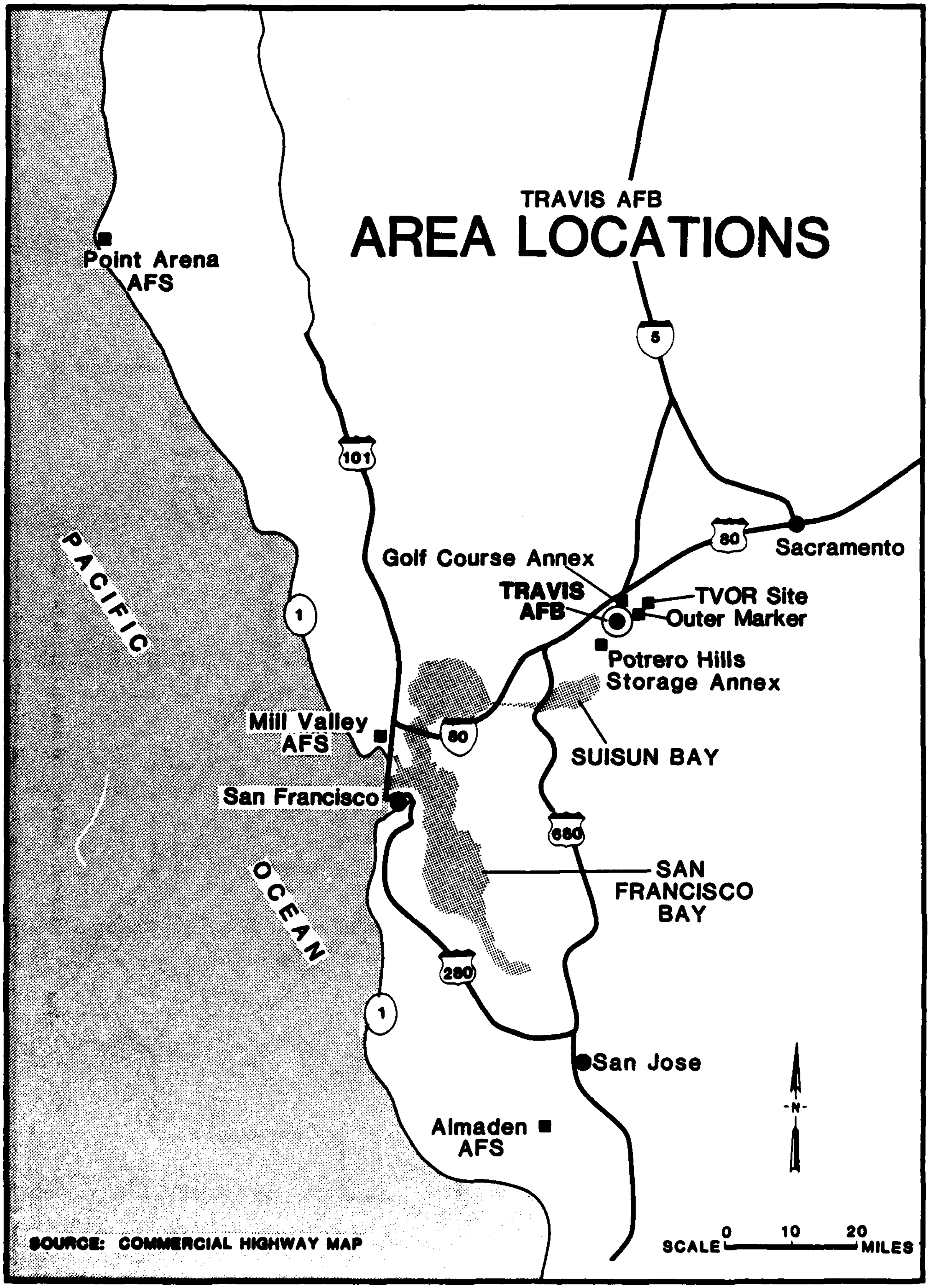
Potrero Hills Storage Annex is located about 2.5 miles south of Travis AFB and 7.5 miles from the central business district of Fairfield, California. The 25-acre facility is a portion of the former Travis Air Force Base Defense Area NIKE Battery 53. The site was transferred to the Air Force in 1964. Since 1967, the site has been leased to Explosive Technology, a government contractor which owns the areas adjacent to the site.

FIGURE 2.1



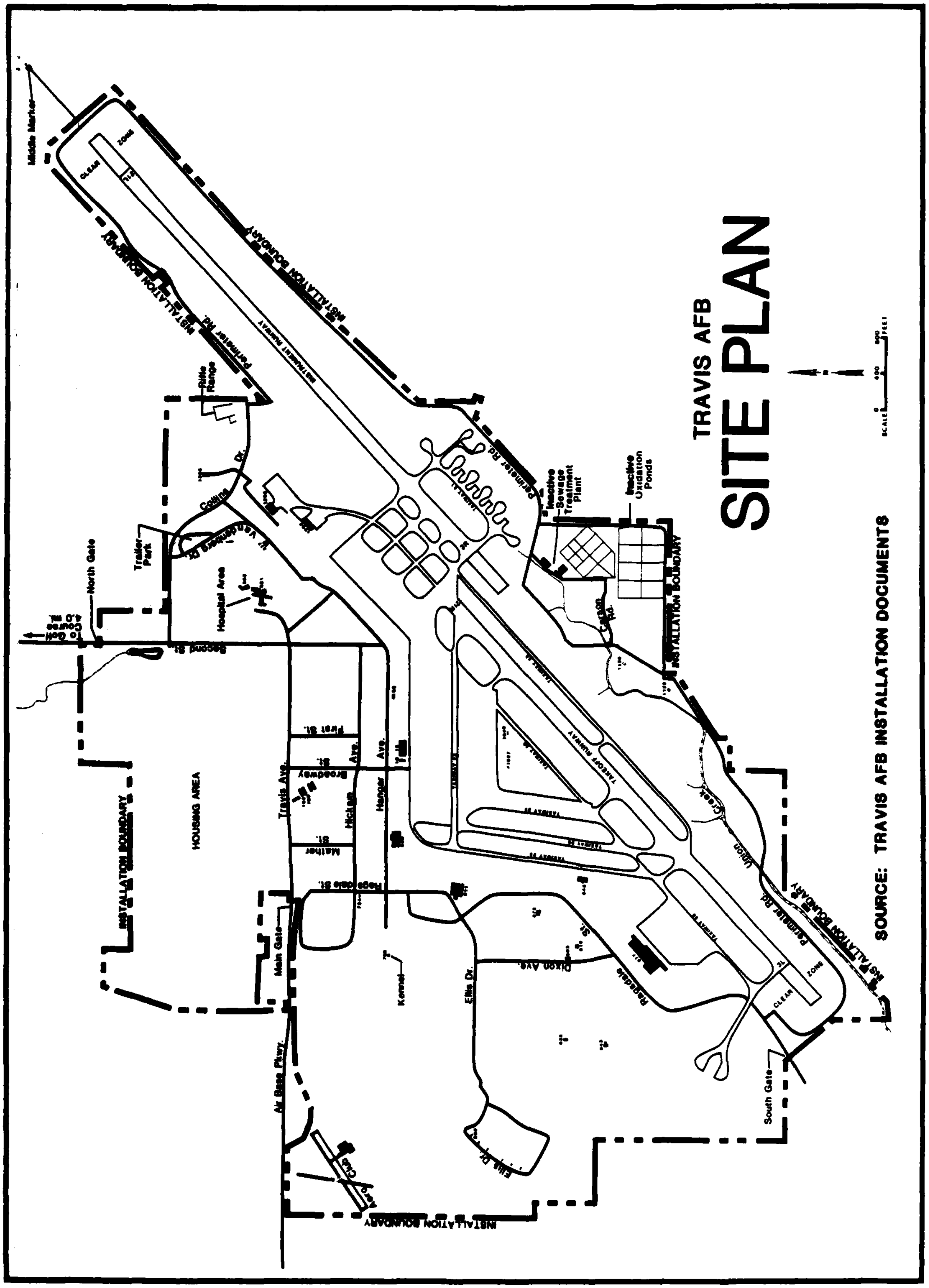
ES ENGINEERING-SCIENCE

FIGURE 2.2



ES ENGINEERING-SCIENCE

FIGURE 2.3



ES ENGINEERING-SCIENCE

Almaden Air Force Station

Almaden Air Force Station is located approximately 13 miles south of the City of San Jose, California on approximately 119 acres atop 3,500 foot Mount Umunhum. The site is divided into three sections; the radar station, the GATR, and the water system annexes. The facility was used as a long range radar installation to provide coverage of aircraft entering U.S. airspace during the late 1950's and early 1960's. The facility is presently under a caretaker status.

Mill Valley Air Force Station

Mill Valley Air Force Station is located in Marin County, approximately 9 miles from Mill Valley, California and 21 miles north of San Francisco. The site comprises a radar station support building and family housing units. The 106-acre site is situated on the west peak of Mount Tamalpais. The facility has been used as a radar surveillance center for various Air Force and Army commands. The facility was initially constructed in 1951 and was put under a caretaker status in 1980.

Point Arena Air Force Station

Point Arena Air Force Station is located 12 miles east of the town of Point Arena in Mendocino County, California. The site comprises 81 acres along the northern California coast, approximately 150 miles north of San Francisco. The facility has been used as a long range radar station to conduct air defense operations for various military commands. Point Arena AFS was initially activated in 1950. It has been supported by the 60th Air Base Group at Travis AFB since 1973.

BASE HISTORY

Travis AFB was initially activated in May of 1943 as the Fairfield-Suisun Army Air Base. The name was officially changed to Travis AFB in April 1951. Originally, the base comprised only a few temporary buildings and an isolated airstrip used for practicing landings and takeoffs. Shortly after the initial activation, the base was expanded and the primary mission became the servicing and ferrying of tactical aircraft from California to the Pacific war zones. By 1945, the base had become the West Coast's largest aerial port. It was actively involved in airlifting troops and supplies to occupied Japan and Korea, and processing returning troops.

In 1948, the Military Air Transport Service (MATS) assumed jurisdiction. The control of the base shifted to the Strategic Air Command in 1949. From 1949 until 1958, airlift operations became secondary while the base served as home for SAC bombers, such as the B-29, B-36, and eventually the B-52. During this period, new hangers were constructed, runways were added and widened, and permanent barracks and family living quarters were built.

In 1958, MATS again resumed command of Travis. The base became headquarters for the MATS Western Transport Air Force. In the early part of 1962 the C-135 and KC-135 stratotanker arrived at Travis AFB. These aircraft are still in use at the base by the SAC 307th Air Refueling Group.

The MATS was renamed in the early 1960's to the Military Airlift Command (MAC). The 60th Military Airlift Wing became the base host unit at that time.

During the Vietnam era, Travis AFB was the principal aerial port for both troops and supplies destined for Southeast Asia. Travis AFB is presently the largest and busiest base in MAC, operating one-half of MAC's C-5 Galaxy force and one-sixth of the C-141 Starlifter force.

ORGANIZATION AND MISSION

The present host organization at Travis AFB is the 60th Military Airlift Wing (MAW) whose primary mission is as a global strategic airlift. The Wing is also responsible for operating Travis AFB and supporting its various tenant units at the base.

The tenant organizations at Travis AFB are listed below. Descriptions of the major base tenant organizations and their mission are presented in Appendix C.

Air Force Audit Agency
AFOSI Detachment 1900
AFOSI District 19
American Red Cross
David Grant USAF Medical Center
Armed Forces Courier Service
Audiovisual Service Center

Civil Air Patrol, Sq 22
Defense Investigative Services
Defense Property Disposal Office
DOD Wage Fixing Authority
Military Air Traffic Coordinator Unit (MATCU)
Military Personnel Transportation Assistance Office
Navy Construction Office (ROICC)
Navy Quick Trans CPE Cargo
OL-K AFESC/CEMIRT
OL OH AF Commissary/FCS
Operating Loc L Hq MAC
US Customs
US Department of Agriculture
US Postal Service
USAF Trial Judiciary 5th Circuit
17th Weather Sq
Det 2, 17th Weather Sq
22nd Air Force
307th Air Refueling Gp, SAC
349th Military Airlift Wg
Det. 4, 375th Aeromedical Airlift Wg
Field Training Det. 524
Det. 2, 1600th Management Engineering Sq (MACMET)
1901st Communications Gp
3566th USAF Recruiting Sq
T 37 ACE Det.
USAF Scouting Liaison Office
2604 Reserve Recruiting Sq

CHAPTER 3

ENVIRONMENTAL SETTING

The environmental setting of Travis Air Force Base is described in this chapter. The primary emphasis is on those features which may affect or be affected by the past and present storage and disposal facilities on the Base. A summary of the environmental setting is included at the end of this chapter.

METEOROLOGY

Temperature, precipitation, and snowfall data furnished by the Det. 2 17th Weather Squadron (MAC), Travis AFB, California is summarized on Table 3.1. The period of record is 39 years (January, 1943 to June 1983). As indicated in the table, the mean annual precipitation is 16.1 inches, with a maximum 24-hour precipitation of 4.8 inches. Evaporation averages about 47 inches per year (U.S.D.A. Soil Conservation Service 1977), resulting in an average annual net precipitation of minus 31 inches. Snowfall is an infrequent event.

GEOGRAPHY

Travis AFB is located along the western boundary of the Sacramento Valley in the Suisun-Fairfield basin. The basin is bordered to the north and west by the foothills of the Coast Ranges, and to the east by the Sacramento Valley. To the south is the Suisun Marsh, a part of the San Francisco Bay Estuary System directing flow from the Sacramento and San Joaquin Rivers through the Delta, and Carquinez Strait for eventual discharge through the San Francisco Bay to the Pacific Ocean. The Fairfield-Suisun basin is characterized by gently sloping hills to the north stretching into an alluvial plain with a gradational contact southward into the Suisun Marsh.

TABLE 3.1
SUMMARY OF TRAVIS AIR FORCE BASE CLIMATIC CONDITIONS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°F)												
Average Maximum	53	59	63	68	75	81	86	86	84	76	64	54
Average Minimum	38	42	44	47	51	55	57	58	57	52	45	39
Record Maximum	78	77	86	95	101	111	117	111	112	102	89	76
Record Minimum	19	29	28	30	34	42	49	49	45	35	26	22
Yearly Mean - Maximum 71 - Minimum 49												
Relative Humidity (%)	70	63	53	45	41	38	36	36	37	42	55	66
Precipitation (inches)												
Average Monthly	3.6	2.3	2.1	1.2	0.3	0.1	T	T	0.2	1.0	2.2	3.0
Record Maximum	9.2	8.3	9.4	4.4	1.7	1.2	0.5	0.6	2.8	4.7	7.4	11.9
Percent of Days with Precipitation	32.2	28.5	25.8	16.7	6.4	3.3	--	--	3.3	9.6	23.3	29.0
Yearly Mean - 16.1 - Maximum 24-hour precipitiation 4.8 inches - Maximum 24-hour snowfall 2.0 inches												
Snowfall Average	T	T	0	T	T	0	0	0	0	T	0	T

T=Trace
Source: Det. 2 17th Weather Squadron (Travis AFB)
Period of Record: 1943-1983

Topography

The local topography surrounding the base (Figure 3.1) has elevations ranging from 800 to 1,100 feet above mean sea level (msl) in the Coast Ranges to the north and west, and reaches sea level in the marshes to the south. The base is at elevation 100 feet (msl) at the northern boundary and elevation 20 feet (msl) at the southern boundary, with an average slope of 30 feet per mile.

Drainage

Surface drainage at Travis AFB is controlled by diversion ditches and storm sewers for discharge to Union and Denverton creeks along the southern base boundaries. The northeastern part of the base drains into Denverton Creek drainage area, and the southern southwestern part of the base drains into Union; drainage into Union Creek is from the major portion of the base, including surfaced streets, industrial and residential areas, and runways. (See Figure 3.2.) Flows from both Union and Denverton creeks empty into Montezuma Slough in the Suisun Marsh.

Travis AFB is not located within the 100-year flood plain, (defined as the flood event that has a one percent chance of occurring in any given year (U.S. Army Corps of Engineers, 1975). The 100-year flood plain as delineated by the U.S. Army Corps of Engineers (1975) may occur at the mouth of Union Creek south of the base.

Surface Soils

Travis Air Force Base soils have been mapped by USDA, Soil Conservation Service (1977). The major soil types relevant to this study are illustrated on Figure 3.3 and significant soil properties for each unit listed on Table 3.2. In general, the soils are described as silts as clays possessing typically low permeabilities, poor drainage characteristics and low water tables.

GEOLOGY

The geology of the Suisun-Fairfield area has been mapped by Sims et. al. (1973), Jenkins (1966), Jenkins (1951), Dickinson (1972), Page (1965), Blake and Jones (1974), Bailey (1931), among others; these publications have been reviewed and form the basis for the discussion below.

FIGURE 3.1

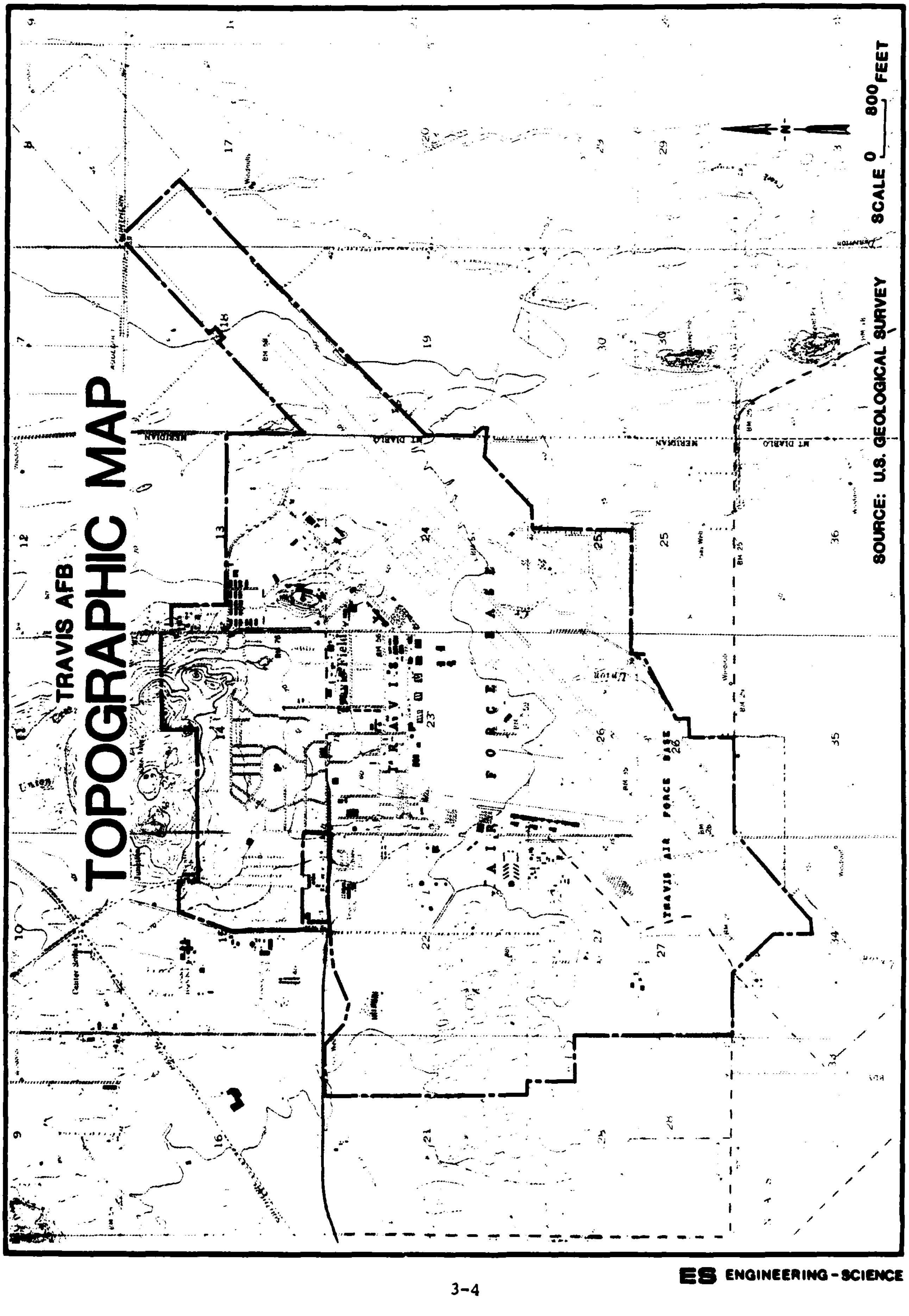

TRAVIS AFB
TOPOGRAPHIC MAP
SCALE 0 800 FEET
SOURCE: U.S. GEOLOGICAL SURVEY
TRAVIS AIR FORCE BASE
MERIDIAN
MT DIABLO

FIGURE 3.2

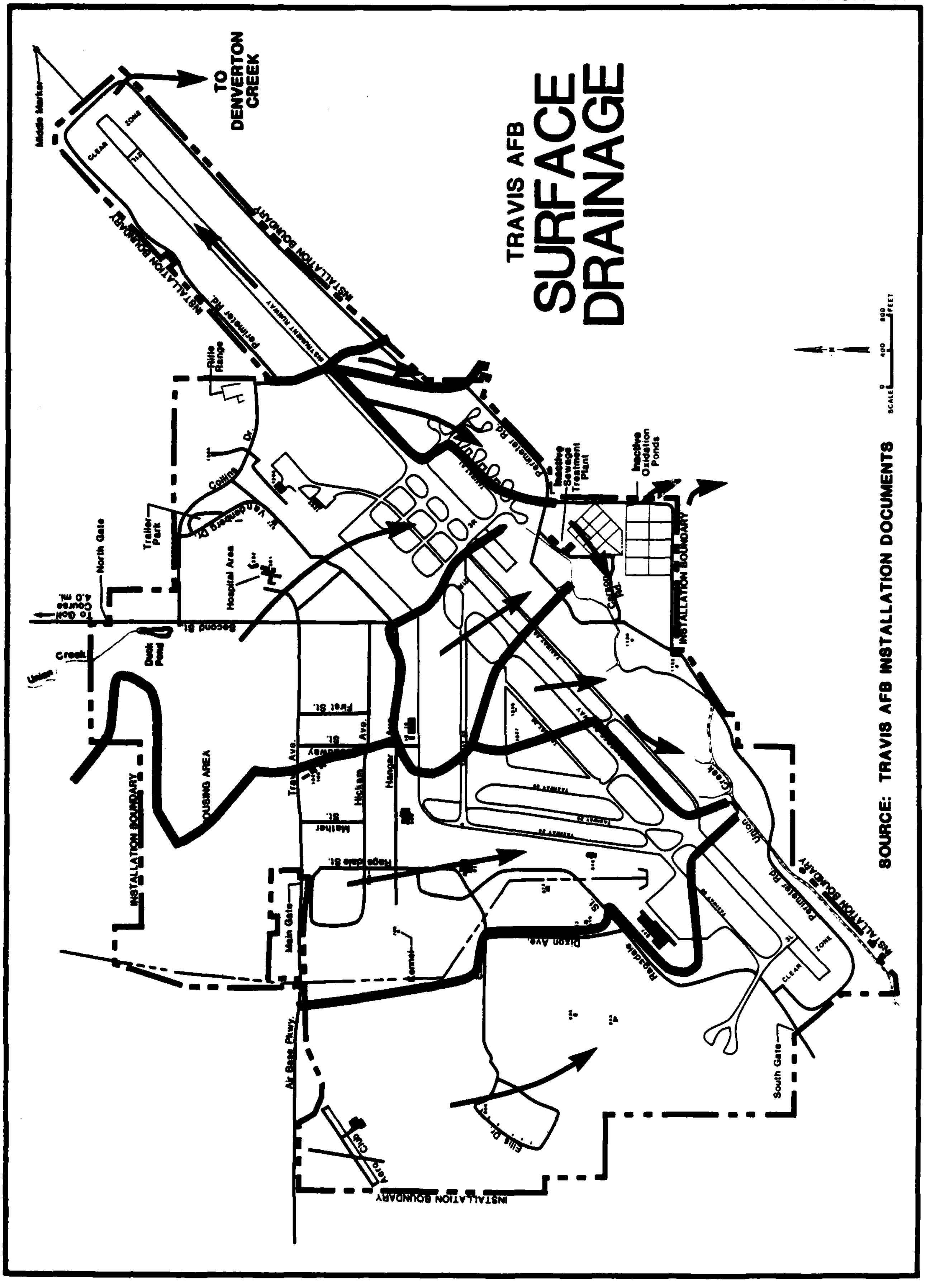

TRAVIS AFB
SURFACE DRAINAGE
TO DENVERTON CREEK
INSTALLATION BOUNDARY
Perimeter Rd.
Rifle Range
Inactive Sewage Treatment Plant
Inactive Oxidation Ponds
Collins Dr.
Trailer Park
North Gate
Hospital Area
Second St.
Duck Pond
Union Creek
First St.
Travis Ave.
Hickam Ave.
Hangar Ave.
Mather St.
Hagedale St.
Main Gate
Dixon Ave.
Air Base Pkwy.
Ellis Dr.
Aero Club
South Gate
CLEAR ZONE
SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

FIGURE 3.3

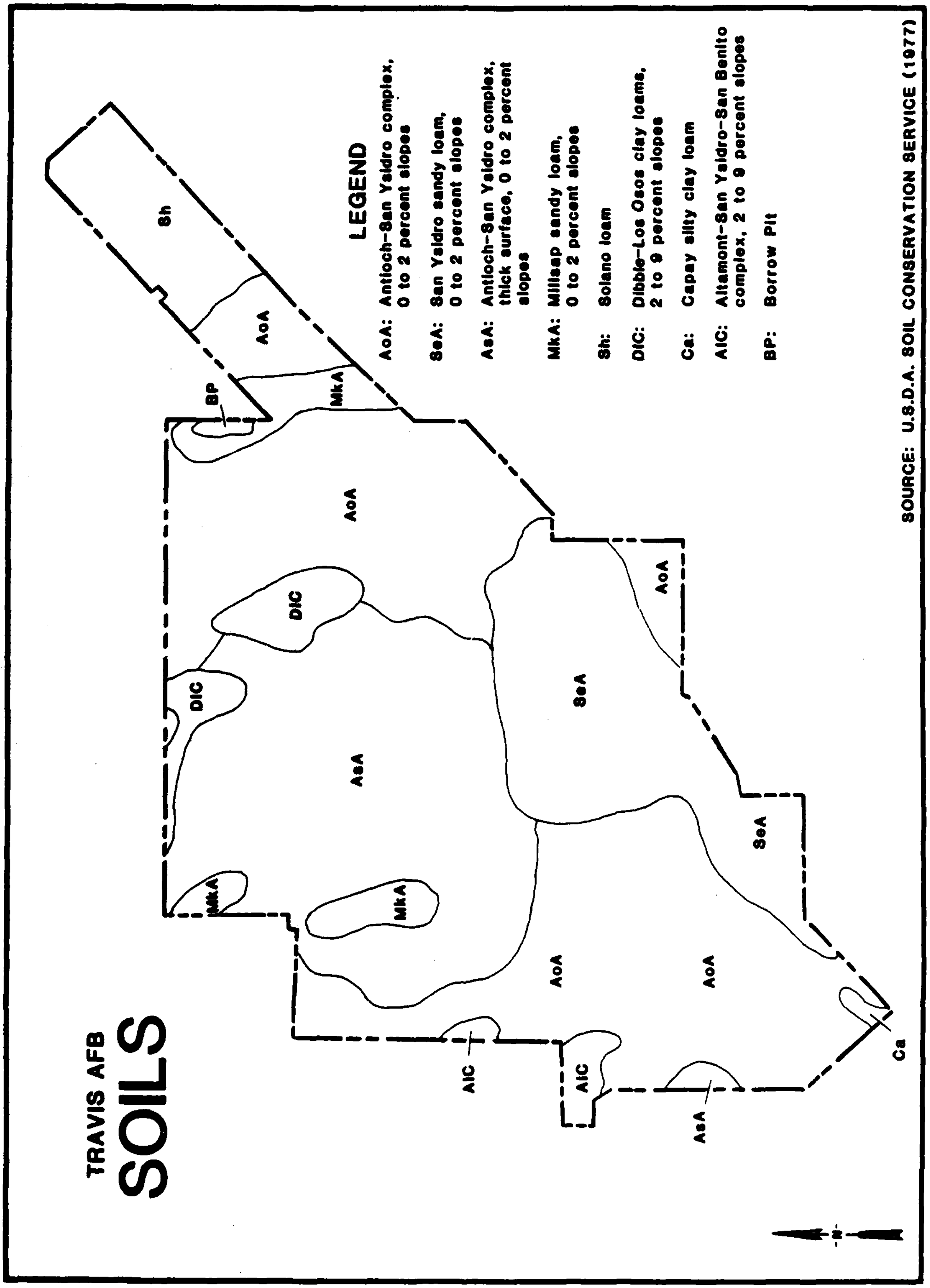

TRAVIS AFB
SOILS
LEGEND
AoA: Antioch–San Ysidro complex, 0 to 2 percent slopes
SeA: San Ysidro sandy loam, 0 to 2 percent slopes
AsA: Antioch–San Ysidro complex, thick surface, 0 to 2 percent slopes
MkA: Millsap sandy loam, 0 to 2 percent slopes
Sh: Solano loam
DIC: Dibble–Los Osos clay loams, 2 to 9 percent slopes
Ca: Capay silty clay loam
AIC: Altamont–San Ysidro–San Benito complex, 2 to 9 percent slopes
BP: Borrow Pit
SOURCE: U.S.D.A. SOIL CONSERVATION SERVICE (1977)
Sh
AoA
BP
MkA
AoA
DIC
DIC
AsA
SeA
AoA
SeA
MkA
MkA
AoA
AoA
AIC
AIC
AsA
Ca

TABLE 3.2
SOIL CHARACTERISTICS AT TRAVIS AIR FORCE BASE

Map Symbol	Unit Name	USDA Texture (Major Fraction)	Thickness (inches)	Unified Classification (Major Fraction)	Permeability (Inches/Hours)	Waste Disposal Facility Use Constraints
AoA	Antioch-San Ysidro, 0-2% slopes	Loam Clay	0-19 19-60	ML or CL CL	0.63-2.0 <0.06	Slight: very slow permeability
SeA	San Ysidro, 0-2% slopes	Sandy Loam Clay Loam	0-14 14-68	SM or ML CL or ML	2.0-6.3 <0.06	Slight: very slow permeability
AsA	Antioch-San Ysidro, thick surface, 0-2% slopes	Loam Clay	0-19 19-60	ML or CL CL	0.63-2.0 <0.06	Slight: very slow permeability
MkA	Millsap, 0-2% slopes	Sandy Loam Clay	0-16 16-28	SM CL	2.0-6.3 <0.06	Slight: very slow permeability; sandstone at a depth of 1 1/2 to 2 1/2 feet
Sn	Solano, 0-2% slopes	Loam Clay Loam	0-9 9-62	ML or CL CL or CH	0.63-2.0 <0.06	Moderate: very slow permeability
DIC	Dibble-Los Osos, 2-9% slopes	Loam Light Clay	0-18 18-36	ML or CL CH	0.63-2.0 0.06-0.20	Moderate: slow permeability; sandstone at a depth of 1 1/2 to 3 1/2 feet
Ca	Capay, 0-2% slopes	Silty Clay Loam	60	CL	0.06-0.2	Moderate: slow permeability
AIC	Altamont-San Ysidro-San Benito, 2-9% slopes	Clay Silty Clay Loam	0-28 28-38	CH CL	0.06-0.2 0.06-0.2	Slight: slow permeability; siltstone at a depth of 2 to 3 1/2 feet

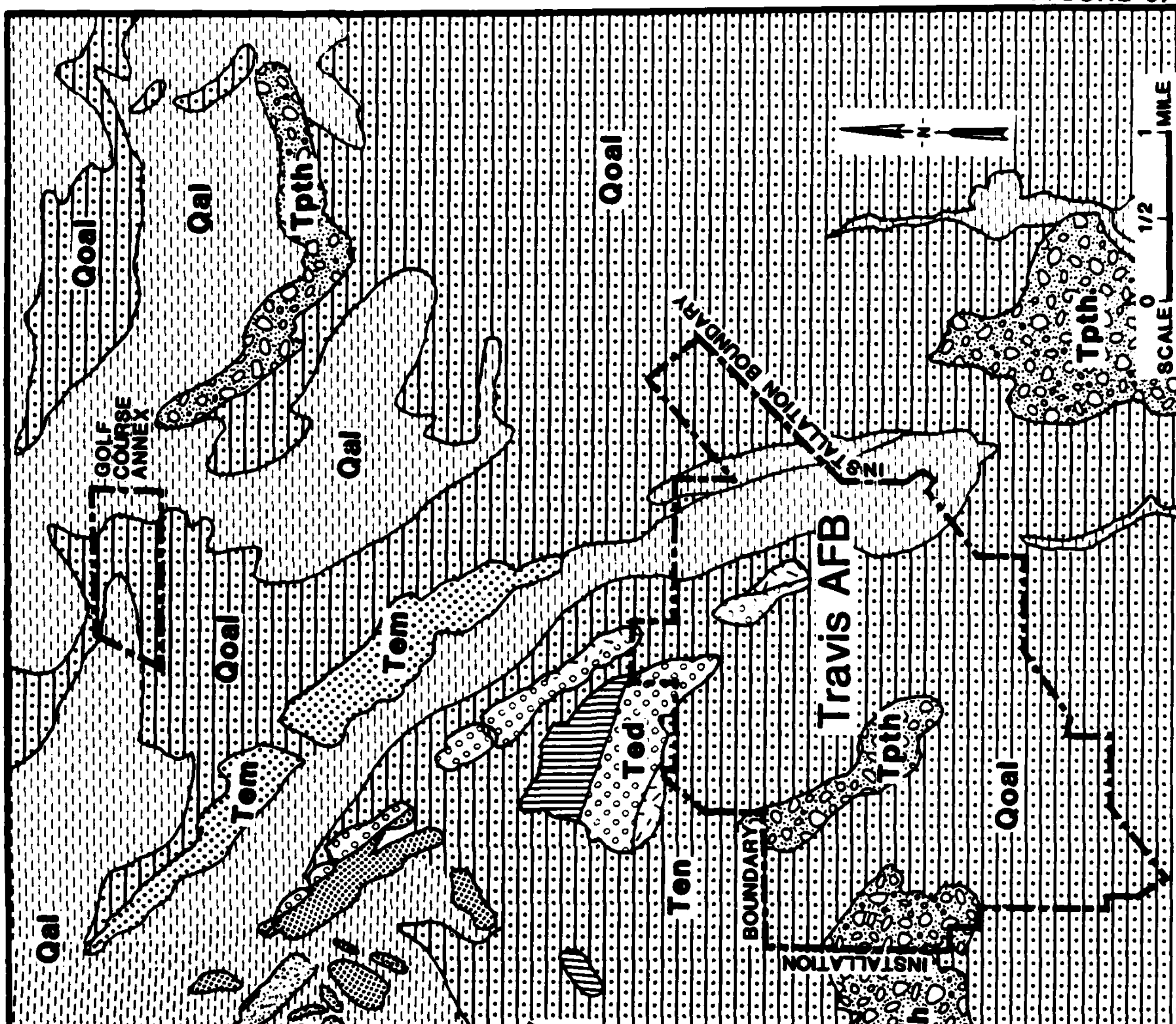
Geologic History

The geology of the Suisun-Fairfield basin is influenced by the geologic history of the area. The rocks and sediments found in the area date back to Cretaceous time when the present Coast Ranges were locally occupied by a shallow marine basin receiving sediments from the east. Deposition of sands, silts, and clays continued with only slight interruption throughout the subsequent Paleocene and Eocene epochs. During Pliocene, the Coast Ranges were formed, while the Cretacean, Paleocene, and Cocene marine deposits, which had become consolidated, were faulted and folded. These rocks were then subjected to erosion. Later, during Pliocene time, eroded and truncated sedimentary deposits were overlain by airborne debris from volcanic activity from the north and east. Within the Pleistocene epoch, the Coast Ranges were repeatedly faulted and folded while at the same time the ancestral Sacramento and San Joaquin Rivers eroded and carved a trough across rising ranges from the Great Central Valley to the sea. Alluvial, lagoonal, and transitional deposition has continued in the Fairfield-Suisun area throughout Late Pleistocene time to the recent. The San Francisco Bay, which was an ancient valley, was drowned by the rise in sea level and tectonic subsidence in Late Pleistocene.

Subsurface Materials

The geologic units on Travis AFB are shown on Figure 3.4. Part of the northern portion of the base is underlain by alluvium (QaL) of recent origin, consisting of sand, gravel, silt, and clays, in irregular lenticular and interfingering patterns. Their thicknesses vary from 5 feet to 60 feet; the fine-grained portion of these deposits appear to dominate. Water-bearing lenses of coarser material are present which yield only small quantities of water to wells penetrating this zone. The major portion of the base is underlain by older alluvium (Qoal) of Pleistocene Age, consisting of interfingering lenses of sands, gravels, silts, and clays. The thickness of these deposits reach up to 200 feet southwest of Fairfield. However, at Travis AFB these deposits are quite shallow, overlying the basement rocks that are part of the outcropping that are evident at Potrero Hill to the south. The older alluvium constitute the major water-bearing units in the base vicinity to the east

FIGURE 3.4



ES ENGINEERING-SCIENCE

and west and sustain wells which average about 200 gallons per minute (gpm) in discharge. The permeability of this unit is moderate.

Underlying the alluvium, but in places cropping out at the surface through the unconsolidated sediments, is Tertiary consolidated sediments with some interbedded volca-debris; the Tehama Formation, Pleistocene-Pliocene non-marine sediments, and the Markley Formation, Eocene marine sediments. The total thickness of these deposits reaches 7,500 feet in the Fairfield-Suisun area. The Tehama Formation yields in places more than 500 gpm to wells, whereas the Markley Formation generally yields little water to wells.

The San Francisco Bay Area is an area of historic and recent seismic activity primarily due to the presence of the San Andreas, the Hayward, and the Calaveras fault zones. These faults are all located more than twenty miles from the base. A smaller potentially active fault (defined as a fault that has shown evidence of activity within the past 2 million years, but not within the past 11,000 years), the Green Valley Fault is located about 10 miles west of the base (Jenneings, 1975). The Vaca Fault System, consisting of a number of separate lineaments, has been inferred from photo lineaments, but no surface evidence has been identified in the field; earthquakes in 1892, 1928, and 1965 in the area have been attributed to the Vaca Fault System. The System is generally located east and northeast of Travis AFB; the Vaca Fault, part of the System, most probably traverses the base to the east (Woodward-Clyde Consultants, 1983).

The Vaca System is considered active (Woodward-Clyde Consultants, 1983), and the maximum probable earthquake (an earthquake of maximum magnitude occurring within 100 years) is estimated as 6 on the Richter Scale within 10 miles of Travis; the maximum credible earthquake (the maximum earthquake in Woodward-Clyde's judgement that appears capable of being produced with current geologic knowledge) is estimated to be 7 on the Richter Scale. It does not appear that any known fault planes would inhibit ground-water movement downgradient from the base.

GROUND-WATER HYDROLOGY

Introduction

The ground-water hydrology of the Suisun-Fairfield area has been described by Department of Water Resources (1978) and (1980), and Bureau of Reclamation (1979), and has been reviewed for the following discussions. In addition, more recent data was obtained through interviews with scientists and officials from the following agencies: California Department of Water Resources, California Regional Water Quality Control Board, City of Vallejo, Water Department, Solano Irrigation District, California Department of Health Services.

General Discussion

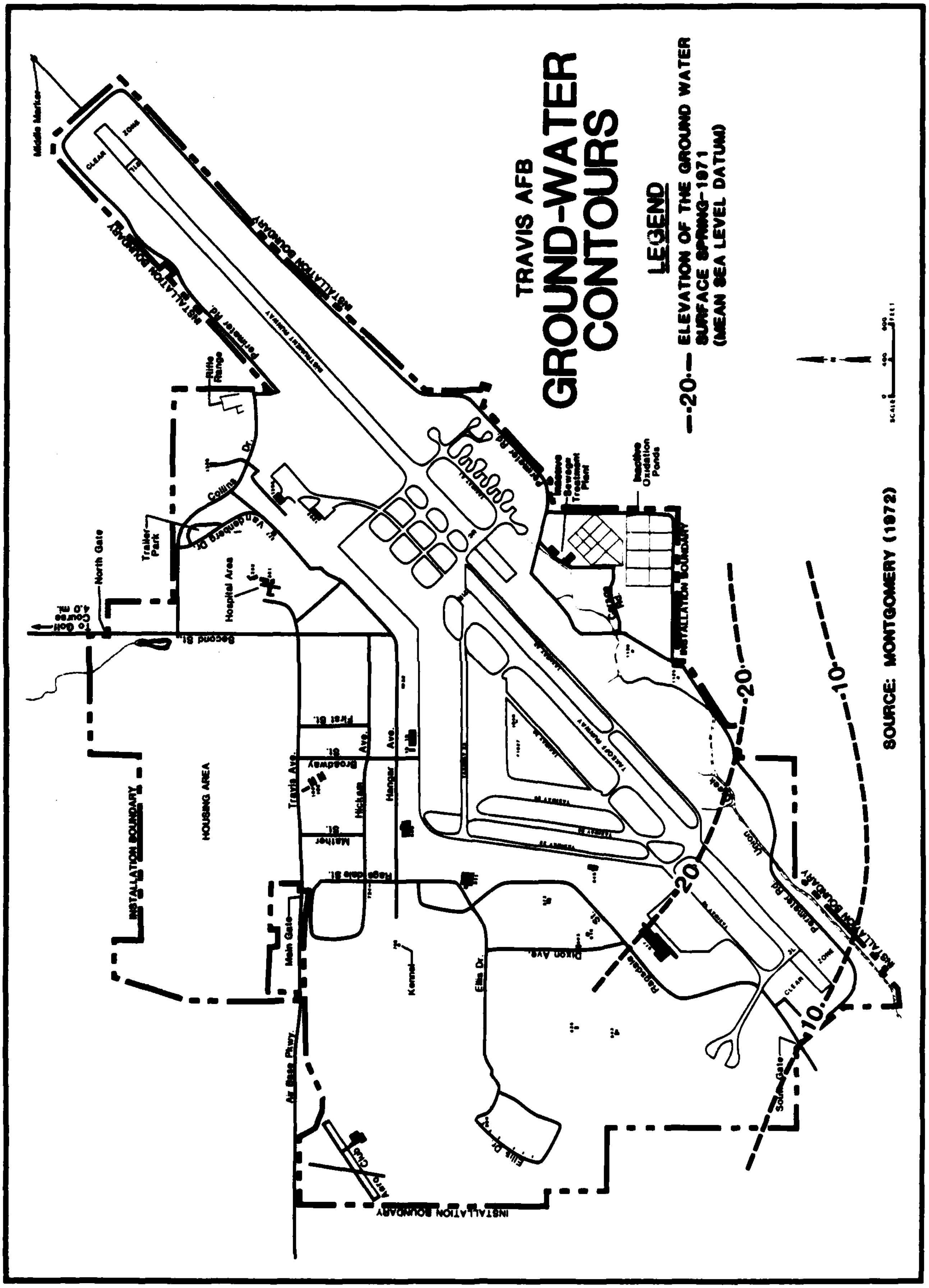
Travis AFB is within the San Francisco Bay Hydrologic Study Area (DWR 1980). The base is not underlain by extensive water-bearing materials compared to the deposits of the Great Valley (Putah Plain Area) to the northeast and Fairfield/Green Valley to the west. This is evidenced by the absence of major water supply wells in the base vicinity and the presence of extensive well fields to the northeast and west. Ground-water level contours for spring of 1971 are shown in Figure 3.5 for the base area. Ground-water occurrence at the base is in shallow deposits and flows to the south into the Suisun Marsh and the San Francisco Bay, generally following the surface topography.

Recharge to the shallow ground-water table is from the foothills of Cement Hill to the north, in-channel infiltration from the creeks draining the area, i.e. Union Creek, Denverton Creek, and smaller unnamed creeks northwest of the base, and through direct precipitation.

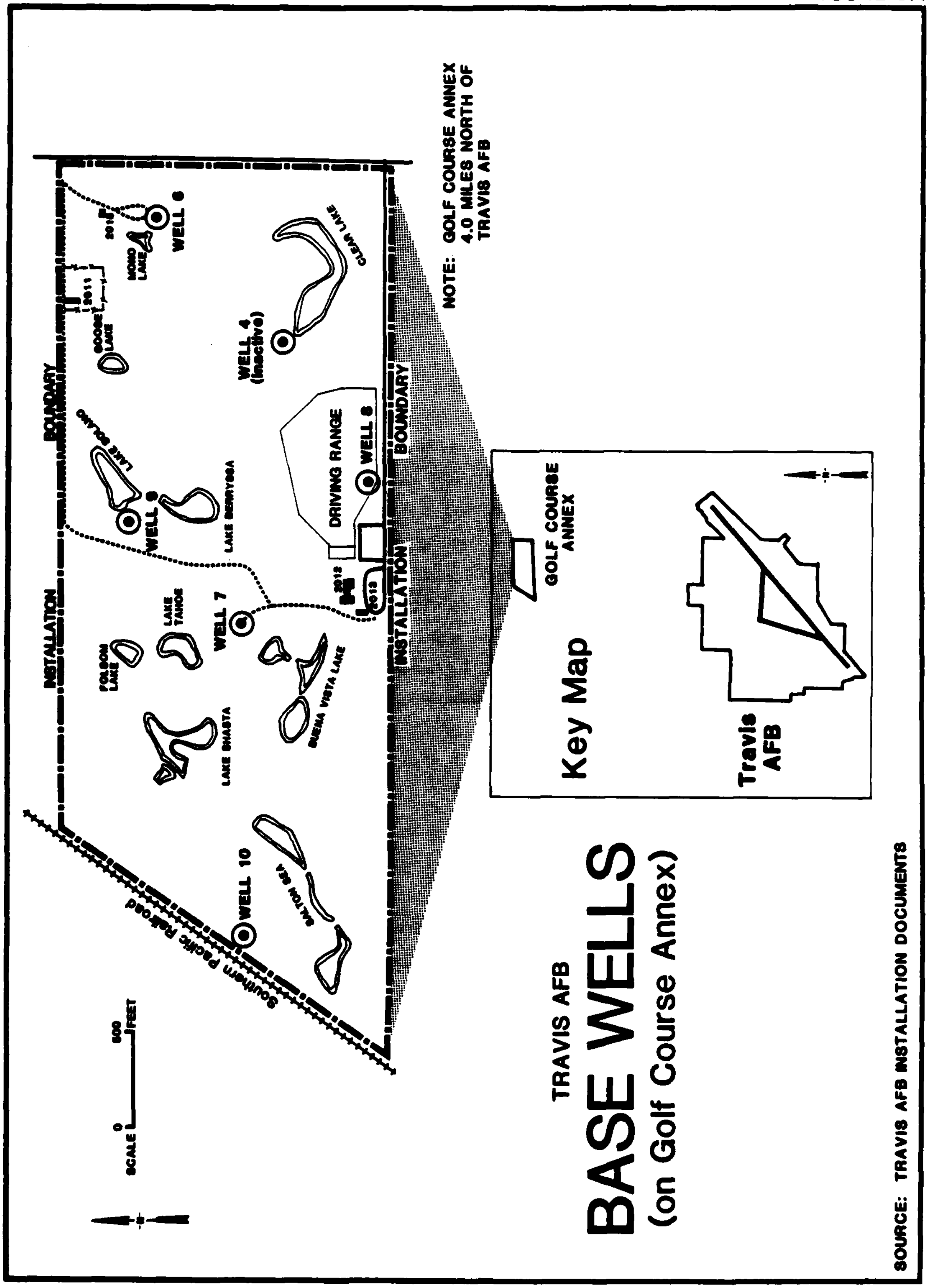
Base and Off-Base Wells

Due to limited occurrence of ground-water resources at the base and in its immediate surroundings, water supply for Travis is provided by a combination of purchased water from the City of Vallejo Water Department and off-site wells, owned and operated by the Travis AFB at a golf course approximtely 4 miles to the north (Figure 3.6). The base receives a maximum of 750 million gallons per year from Vallejo; this is surface water diverted from the Delta via Cache Slough. The purchased water is treated at a Vallejo treatment plant north of the base.

The base wells, located at the golf course north of the base, also supplement potable water supplies for Travis AFB. These base wells



ES ENGINEERING-SCIENCE



TRAVIS AFB
BASE WELLS
(on Golf Course Annex)

SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

provide between 400 and 500 million gallons per year of potable water. There are 10 wells at the golf course, five of which were taken out of service in 1957 or 1958. No data is available on the construction or design of these wells. The remaining 5 wells were constructed between 1949 and 1968. The depth of the wells range from about 500 to 900 feet. The available construction and design details of these wells are presented in Table 3.3. (Appendix D, Table D.1 and D.2 contain the well logs from Wells 6 and 7.) The golf course well water is pumped to Reservoir No. 3 on the base where it is chlorinated and mixed with the purchased water from Vallejo.

Private wells downgradient from the base are shown on Figure 3.7 and available well data from these wells are shown in Table 3.4. The wells are used for both stock ponds and domestic purposes. They range in depth from 21.7 feet to 90 feet and are thus quite shallow, compared to the depth of major water supply wells outside of base, which extend to depths of over 900 feet. Department of Water Resources collects water samples from selected wells for analysis, including such parameters as pH, cadmium, magnesium, sodium, calcium carbonate, sulfate, nitrate, and chloride. The results of water analyses for selected wells are presented in Appendix D, Table D.3.

WATER QUALITY

Ground-water Quality

Ground-water samples obtained from deep aquifers upgradient from the base indicate a generally good quality. In January 1981 copper was detected in base wells Nos. 6 (56 ug/l), 7 (112 ug/l), and 10 (131 ug/l) located at the golf course. These concentrations are all below EPA water qualtiy criteria. At that same sampling event arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver tests were conducted and concentrations were found to be below detection limits. Nitrate levels were found to be within the 10 mg/l drinking water standard. Chloride was identified in base wells Nos. 6 (32 mg/l), 7 (60 mg/l), and 8 (28 mg/l). Trichloroethylene (TCE) analyses were performed on water samples collected from the golf course wells; however, no TCE was detected.

TABLE 3.3
TRAVIS AIR FORCE BASE WATER SUPPLY WELLS

Well Number	Year of Construction	Depth (Feet)	Perforation Intervals (Feet)	Diameter of Casing (Inches)	Capacity (gpm)	Comment
1*						
2*						
3*						
4*						
5*						
6	1949	480	160-184 216-248 264-312 336-360 408-480	14	550	
7	1957-1959	522	178-258 306-354 450-522	14	N.D.	
8	1951	984	129-150 351-369 417-423 447-458 470-482 530-536 548-560 572-585 590-596 621-633 650-656 722-728 740-746 758-764 788-806 824-830 842-890	14	N.D.	70% of perforations are encrusted
9	1965	670	N.D.	8	450	
10	1968	650	N.D.	N.D.	900	

Note: N.D. indicates no data
*Wells abandoned about 1957-1958 by capping. It is not known if the wells were grouted.
Source: Travis Air Force Base Installation Documents

FIGURE 3.7

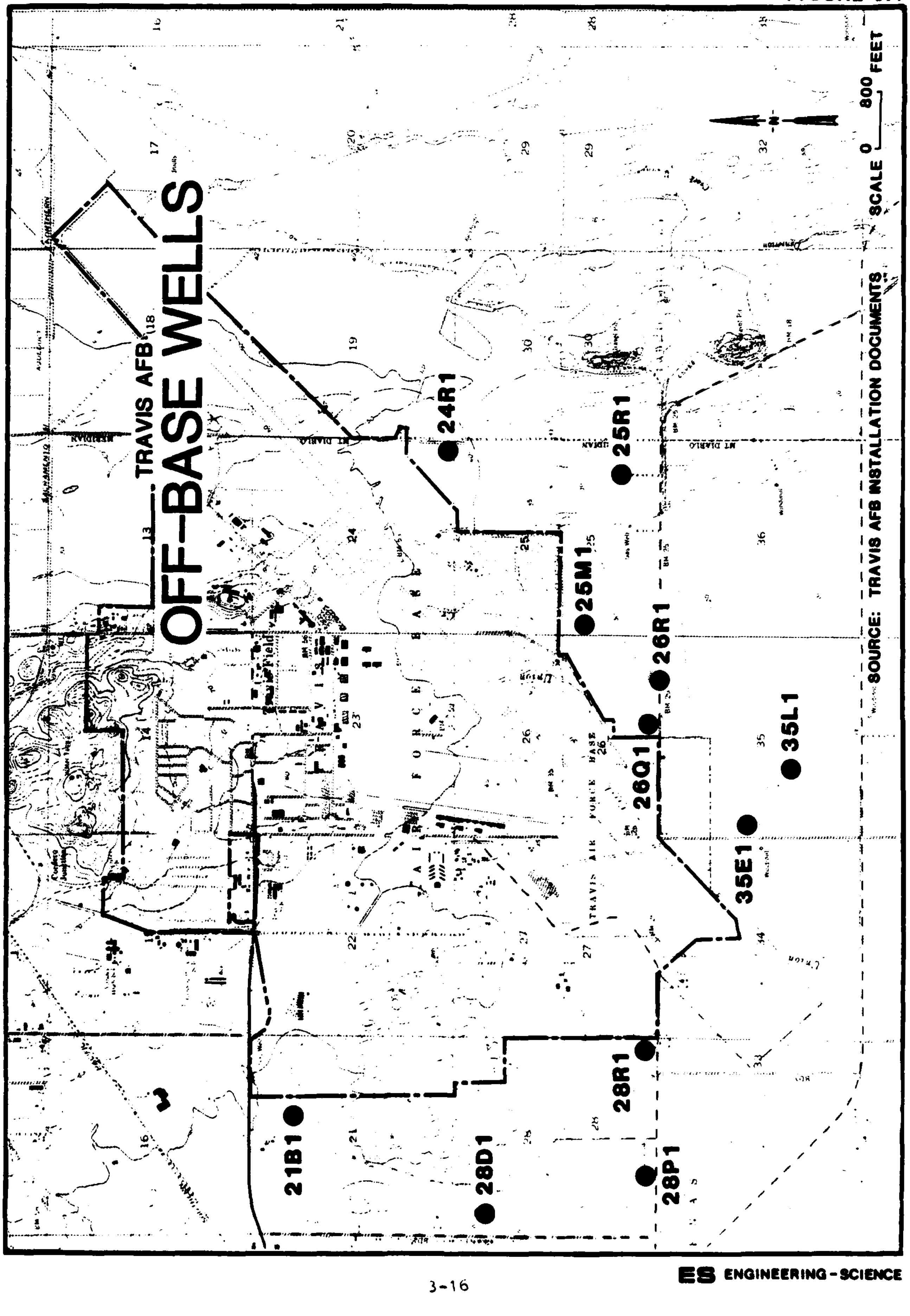

TRAVIS AFB
OFF-BASE WELLS
24R1
25R1
25M1
26R1
26Q1
35L1
35E1
28R1
21B1
28D1
28P1
N
SCALE 0 800 FEET
SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS
TRAVIS AIR FORCE BASE

TABLE 3.4
OFF-BASE WELLS

Well Location	Depth (feet)	Water Level (feet below surface)	(date)	Use	Water Quality Data Available (See Appendix D)
5N1W/21B1	N.D.*	6.84	(5/1949)	Stock	
5N1W/24R1	21.7	10.5	(5/1949)	Stock	
5N1W/25M1	28	12.74	(5/1949)	N.D.*	
5N1W/25R1				Domestic	Yes
5N1W/26Q1	44	22	(6/1950)	Domestic	
5N1W/26R1	90	8.85	(5/1949)	Domestic	
5N1W/28D1	31	22.37	(5/1949)	Stock	
5N1W/28P1	40	9.06	(5/1949)	Domestic/ Stock	Yes
5N1W/28R1	48	15.35	(5/1949)	Stock	
5N1W/35E1	35	N.D.*		Stock	Yes
5N1W/35L1	N.D.*	4.13	(5/1949)	Stock	

NOTE: See Figure 3.7 for well locations.

*N.D. indicates no data available.

Source: Travis Air Force Base Installation Documents

Water quality data for off-base wells are contained in Appendix D, Table D.3. Over a period of years water from well 5N1W/25R1 (see Figure 3.7 for location) has contained consistently high (>10mg/l) levels of nitrate. Concentrations of nitrate ranged from 14.0 to 18.0 mg/l from 1975 to 1981. These high concentrations are likely attributable to the agricultural activity occurring in the area. That same well contained chloride levels that ranged from 418 to 569 mg/l from 1971 to 1981. The secondary drinking water standard is 250 mg/l for chloride. Water from 5N1W/28P1 contained levels of nitrate that were less than 10 mg/l and contained chloride levels that ranged 87 to 112 mg/l for a four year sampling period ending in 1981. The reason for elevated chloride levels may be the advance of salty tidal water from Suisun Marsh. No data were available for off-base wells for trace metal or priority pollutant organics.

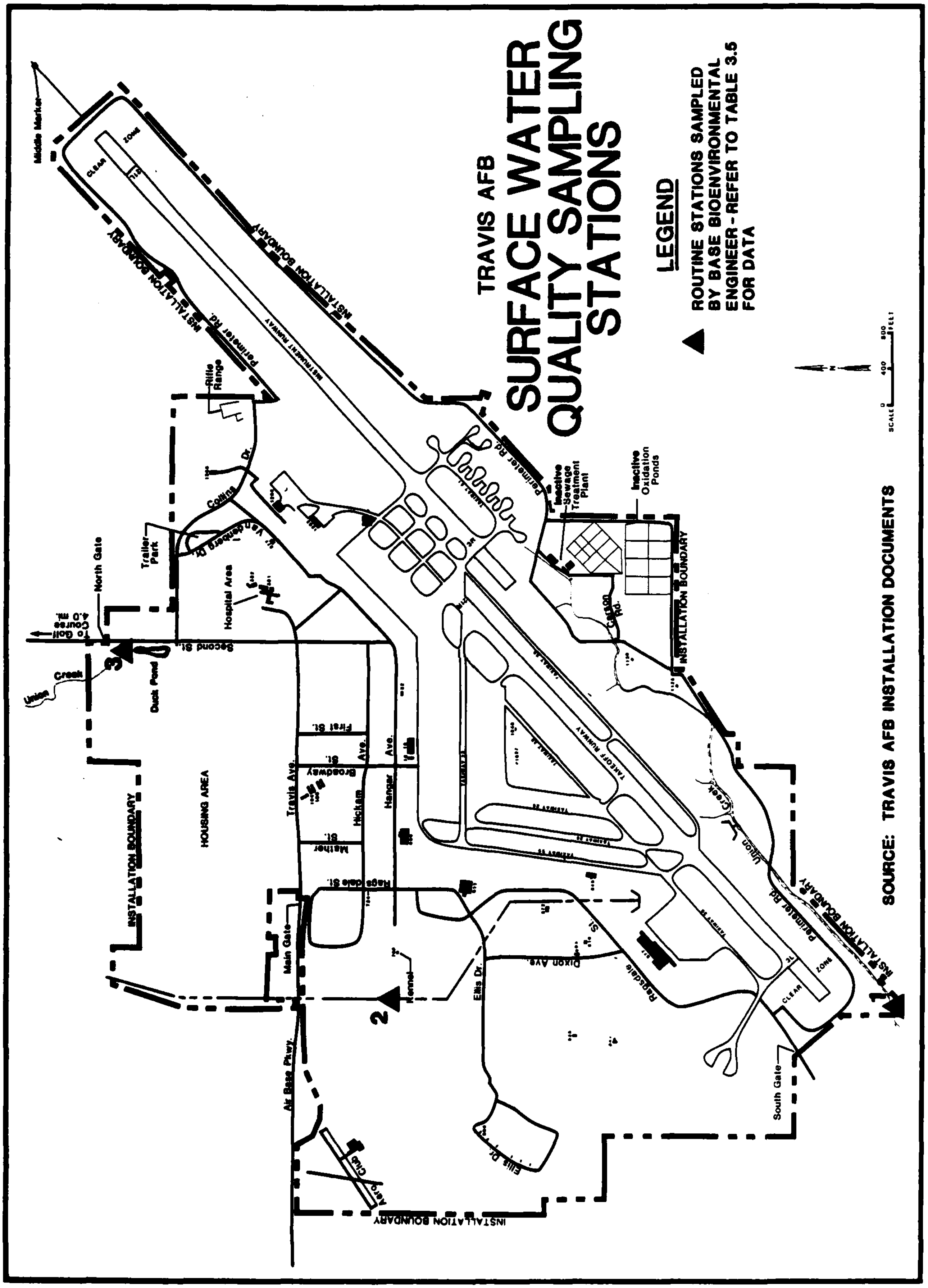
Surface Water Quality

Travis AFB has collected water samples quarterly, since 1978 from three locations on base. In 1981, trichloroethylene (TCE) was added to the list of parameters analyzed duirng the quarterly sampling. Figure 3.8 identifies the sampling locations. Table 3.5 summarizes selected analytical results from seven sampling events. Low levels of TCE have been consistently detected in Union Creek leaving the base (1.2 to 11.3 ug/l). Since the chemical has not been used on base for several years, the source of the TCE found in Union Creek may be from surface runoff or shallow ground-water discharge into the creek.

Examination of Table 3.5 also shows that trichloroethane and polychlorinated biphenyls (PCB's) were not detected in the surface waters of the base. Except for a sample taken on February 2, 1983, Freon 11 was not measured in detectable quantities. At that sampling, however, Freon 11 was detected at concentrations of 4.4 ug/l and 14.6 ug/l in the stream entering the base near the duck pond and near the dog kennel, respectively. No data were available for Freon 11 in water leaving the base.

Phenol was detected in the samples on two occasions. In May 1982, phenol was measured at 27.0 mg/l entering the base north of the dog kennel and at 25.0 mg/l in Union Creek leaving the base. In May 1983,

FIGURE 3.8



ES ENGINEERING-SCIENCE

TABLE 3.5
SELECTED ANALYTICAL RESULTS SURFACE AND STORMWATER RUNOFF
SAMPLING LOCATIONS AT TRAVIS AIR FORCE BASE
(all values in ug/l)

	1981	1982				1983		
	12/16	2/02	5/18	8/11	11/23	2/09	4/19	5/23
Union Creek Leaving Base (Station No. 1)								
TCE	*	3.3	5.1	1.2	11.3	5.7	5.1	2.2
TCA	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1
Phenol	<10.0	<10.0	25.0	<10.0	<10.0	<10.0	--	<10.0
Freon II	--	--	--	--	--	--	--	--
PCB's	<0.025	<0.25	*	<0.5	<0.25	<0.5	--	--
Stream Entering North of Dog Kennel (Station No. 2)								
TCE	<0.5	<0.1	<0.1	3.9	<0.1	<0.1	<0.5	0.3
TCA	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1
Phenol	10.0	<10.0	27.0	<10.0	<10.0	<10.0	--	17.0
Freon II	--	14.6	--	--	--	--	--	--
PCB's	<0.025	<0.25	<0.5	<5.0	<0.25	<0.5	--	*
Stream Entering Near Duck Pond (Station No. 3)								
TCE	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
TCA	--	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1
Phenol	12.0	<10.0	<10.0	<10.0	<10.0	<10.0	--	15.0
Freon II	--	4.4	--	--	--	--	--	--
PCB's	--	<0.25	<0.5	<0.5	<0.25	<0.5	<0.5	<0.2

*Broken in transit.
--Indicates no data.
< Indicates less than the quantitative detection limit.
NOTE: See Figure 3.8 for sampling locations.

phenol was detected both at Sampling Station No. 2 and No. 3. The data indicates that the source of phenol is upstream of the base.

BIOTIC ENVIRONMENT

Travis AFB is located at the edge of the foothills of the coast ranges and the Sacramento Valley just north of the Suisun Marsh. The vegetation in the area comprises two basic communities, grassland and riparian consisting of shrubs, grasses, and herbaceous plants. There are few trees in the area. A non-native eucalyptus grove, however, is found on base.

Union Creek supports an abundant riparian community. Vegetation found on base includes artichoke thistle, wild rose, coyote bush, yarrow wild oats, rye grass, foxtail, cattail, rush, and bull thistle (U.S. Army Corps of Engineers 1975).

Because of limited habitat, the base does not support large numbers or a wide variety of wildlife. Common avian species include meadowlarks, ducks, mourning doves, sparrows, ring-necked pheasants, swallows, and western king birds which forage on grassland seeds. Avian predators, such as the red-tailed hawk, sparrow hawk, great horned owl, and short-eared owl prey upon rodents which also forage on grassland seeds.

Mammalian wildlife common to the base includes black-tailed hare, ornate shrew, ground squirrel, stripped skunk, botta pocket gopher, western harvest mouse, deer and meadow mice. Predators that may, at times, be found on Base include coyote, grey fox and long-tailed weasel.

Amphibians and reptiles found at Travis AFB include those commonly found in California grasslands. None are thought to be abundant. These may include California tiger salamander, western toad, western fence lizzard, western skink, Pacific ringnecked snake, gopher snake, kingsnake, western terrestrial garter snake, common garter snake, and western rattlesnake.

No unique natural areas exi_ . on the base. Neither are there any reports of threatened or endangered species habitating Travis AFB. Three species of plants classified as rare by the California Natural Diversity Data Base have been identified on property outside ot the base. However, the accuracy of the plant locations is one mile and, therefore, it is possible that the plants could be located on the base. The species are listed below:

1. Downingia Humilis
2. Trifolium Amoenum
3. Lasthenia Conjugens

Travis AFB is part of a regional biological system that includes the Suisun Marsh. The Suisun March is an area of expansive flat open space - 84,000 acres consisting of marshes, bays, and sloughs, and is the largest contiguous marsh in the continental United States. It is an important recreational area, located in close proximity to the urban area of San Francisco, and is used primarily for duck hunting but also for pheasant hunting, fishing, boating, sailing, and other water-related activities (Montgomery, 1972). Suisun Marsh is one of the major migratory waterfowl wintering grounds in the Pacific Coast Flyway. In addition, marshes constitute an important link in the food-chain for aquatic life in the San Francisco estuary with its high replenishable nutrient load.

ENVIRONMENTAL SETTING AT POINT ARENA AFS

Point Arena Air Force Station (PAAFS) is located about forty miles southwest of Ukiah, California, approximately two miles from the Pacific Ocean in Mendocino County (refer to Figure 2.2). Access to the facility is from U.S. Highway 1. The general layout of the 81-acre site is illustrated on Figure 2 of the Executive Summary.

While the general topography of the area is that of the coastal mountain ranges, the Air Force Station itself occupies a relatively flat area consisting of gently rolling hills having a maximum elevation of 2,380 feet of mean sea level (msl) in the eastern part of the AFS. The western portion of the PAAFS slopes to a minimum elevation of 2,220 feet above msl. Mean annual precipitation is 41.5 inches, with a maximum 24-hour precipitation of 6 inches. Evaporation averages about 36 inches per year resulting in an average net annual precipitation of 5.5 inches. Trees cover a large portion of the facility property. The predominant geologic unit at the PAAFS, the Lower Miocene marine deposits, consists of marine terrace sediments. These rocks are made up of foraminiferal clay shales, bituminous sandstone, and cherry shale. The sandstones on Point Arena may be in part Oligocene. Little is known about ground water; however, it probably exists in surface soils and fissures in the rocks. Surface springs are found throughout the site. Discoloration of spring water due west of the PAAFS landfill probably indicates ground water flows generally in a westerly direction.

The facility obtains its drinking water from an impoundment on Rolling Brook and from springs in the vicinity of the water treatment plant. During the low flow of the summer months, the entire flow of Rolling Brook may be used. Water treatment consists of ammonium alum dosing, pressure sand filtration, and chlorination. There are two 75,000-gallon treated water storage tanks. Except for occasional problems with turbidity, color, and odor, the chemical and bacterial quality of the water supply has been satisfactory.

SUMMARY OF ENVIRONMENTAL SETTING

Several key environmental setting conditions should be considered when evaluating past hazardous materials handling storage and disposal practices at Travis AFB. These are as follows:

- Travis AFB is located within a semi-arid region receiving a mean annual precipitation of 15.9 inches. Annual net precipitation (rainfall less evaporation) is minus 31 inches each year.
- The predominant soils on Travis AFB are characterized as silts or clays with low permeabilities.
- Major faults in the area are all located more than twenty miles from the base. A small, potentially active fault, the Vaca Fault System is suspected to traverse the eastern portion of the base. It does not appear that any known fault planes would inhibit ground-water movement downgradient from the base.
- The major portion of the base is underlain by shallow deposits of older alluvium (consisting of interfingling lenses of sands, gravels, silts, and clays). These shallow deposits extend off base where off-base wells have been installed to a depth of

about forty or fifty feet below surface and produce water for stock and domestic uses.

- o No major water bearing strata are found directly beneath the base. Major ground-water resources are, however, found less than ten miles north and west of the base in deep alluvial deposits (500 to 900 feet).
- o The general ground-water flow direction is to the southwest.
- o Surface and subsurface drainage from the base discharges to the Suisun Marsh which is a large coastal marsh situated one mile downgradient of the base.
- o TCE has been detected in Union Creek as it leaves the base.
- o No threatened or endangered species have been observed within the Travis AFB boundaries.

The Point Arena Air Force Station (PAAFS) is on an 81-acre site located two miles from the Pacific Ocean in Mendocino County, California. The site occupies a relatively flat area ranging from 2,380 feet above msl to 2,220 feet above msl. The average net annual precipitation for the area is around 5.5 inches. A large portion of the site is covered by trees. The predominant geologic unit at the PAAFS is the Lower Miocene marine deposits. It is likely that ground water exists in the surface soils and fissures in the rocks within the site boundaries. Ground water is suspected to flow in a westerly direction. Surface springs are found in several areas on the PAAFS.

CHAPTER 4
FINDINGS

To assess hazardous waste management at Travis Air Force Base, past activities of waste generation and disposal methods were reviewed. This chapter summarizes the hazardous waste generated by activity; describes waste disposal methods; identifies the disposal sites located on the base; and evaluates the potential for environmental contamination. Additional sections have been included in this chapter which describe the annex facilities associated with Travis AFB and discuss the areas of potential contamination found within those annexes.

PAST SHOP AND BASE ACTIVITY REVIEW

To identify past activities that resulted in generation and disposal of hazardous waste, a review was conducted of current and past waste generation and disposal methods. This activity consisted of a review of files and records, interviews with current and former base employees, and site inspections.

The source of most hazardous wastes on Travis AFB can be associated with one of the following activities:

- Industrial shops
- Fire protection training
- Pesticide utilization
- Heat and power production
- Fuels management
- Defense Property Disposal Office (DPDO) storage

The following discussion addresses only those wastes generated on Travis AFB which are either hazardous or potentially hazardous. In this discussion a hazardous waste is defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980

(CERCLA) or a potentially hazardous waste is one which is suspected of being hazardous, although insufficient data are available to fully characterize the waste material.

INDUSTRIAL SHOPS

Industrial operations at Travis AFB consist primarily of aircraft and vehicle maintenance and repair activities. These and other mission support operations generate potentially hazardous materials at a number of industrial shops. The Bioenvironmental Engineering (BEE) Office provided a listing of industrial shops which was used as a basis for evaluating past waste generation and hazardous material disposal practices. The BEE individual shop files were also examined for information on hazardous material usage, and hazardous waste generation and disposal practices. From this information, a master list of industrial shops was prepared showing building locations, hazardous materials handlers, hazardous waste generators, and typical treatment, storage, and disposal methods. The list appears as Appendix E.

Those shops which were determined to be generators of hazardous wastes and pose a potential for ground-water or surface water contamination were selected for further investigation and evaluation. During the site visit, interviews were conducted with personnel from many of these industrial shops, including the shops that generate the largest amounts of hazardous wastes. Additional shops generating lesser amounts of hazardous wastes were contacted by telephone. Shop inteviews focused on hazardous waste materials, waste quantities, and disposal methods. Disposal timelines were prepared for each major hazardous waste from information provided by shop personnel and others familiar with the shop's operations and activities.

Table 4.1 summarizes the information obtained from the detailed shop review including information on present and past shop locations, identification of hazardous wastes, waste quantities, and disposal methods. Disposal timelines are also shown for major wastes. Table 4.1 does not include the shops which generate insignificant quantities of hazardous wastes.

Prior to 1960, waste materials such as used oils, contaminated fuels, used hydraulic fluid, spent solvents and spent paint thinners,

TABLE 4.1

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
60 SUPPLY				
FUELS LABORATORY	707	JP-4	10 GALS./MO.	61 CONTRACT DISPOSAL
60 TRANSPORTATION				
ALLIED TRADES	144	PAINT LACQUER, THINNER	50 GALS./6 MOS.	[illegible] TO FIRE TRAINING; 59 TO FIRE TRAINING, STORM SEWER OR CONTRACT DISPOSAL; 65 TO FIRE TRAINING OR CONTRACT DISPOSAL; 73 CONTRACT DISPOSAL
GENERAL EQUIPMENT MAINTENANCE	139	ENGINE OIL, TRANSMISSION FLUID, ANTIFREEZE, SPENT SOLVENTS	50 GALS./WK.	CONTRACT DISPOSAL
HEAVY EQUIPMENT MAINTENANCE	139	WASTE OIL	100 GALS./MO.	CONTRACT DISPOSAL
		WASTE SOLVENTS	10 GALS./MO.	CONTRACT DISPOSAL
REFUELING VEHICLE MAINTENANCE	1202	TRANSMISSION FLUID, ENGINE OIL	40 GALS./MO.	CONTRACT DISPOSAL
		WASTE FUELS	250 GALS./MO.	CONTRACT DISPOSAL
60 AVIONICS MAINTENANCE SQUADRON				
BATTERY SHOP	755 (P 16 1942-1964 S-12 1964-1968)	SULFURIC ACID	10 GALS./WK.	68 NEUTRALIZED IN PIT SPREAD ON GROUND; 77 NEUTRALIZED TO SANITARY SEWER
60 FIELD MAINTENANCE SQUADRON				
COMFORT PALLET SECTION	1201	PD-680	10 GALS./YR.	82 CONTRACT DISPOSAL

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
60 FIELD MAINTENANCE SQUADRON (cont'd)				
PNEUDRAULIC SYSTEMS SHOP	819	HYDRAULIC FLUID	100 GALS./MO.	CONTRACT DISPOSAL
		PD-680	50 GALS./MO.	CONTRACT DISPOSAL
		TRICHLOROETHANE	30 GALS./MO.	CONTRACT DISPOSAL
WHEEL AND TIRE SHOP	819 (S-35 PRIOR TO 1974)	PD-680	200 GALS./MO.	CONTRACT DISPOSAL
CORROSION CONTROL	550 AND OTHER LOCATIONS	SPENT SOLVENTS, PAINT THINNERS, PAINT SLUDGE, PHOSPHORIC ACID	50 GALS./WK.	TO FIRE TRAINING AREA; 75 CONTRACT DISPOSAL
MACHINE SHOP	550	WASTE OIL	5 GALS./MO.	TO FIRE TRAINING AREA; 75 CONTRACT DISPOSAL
NDI LABORATORY	550	PENETRANT	55 GALS./YR.	66 CONTRACT DISPOSAL
		EMULSIFIER	55 GALS./YR.	66 CONTRACT DISPOSAL
		KEROSENE	35 GALS./YR.	66 CONTRACT DISPOSAL
AGE REPAIR SECTION	41	SPENT SOLVENTS, WASTE FUEL, ANTIFREEZE, HYDRAULIC FLUID, STRIPPERS	100 GALS./MO.	WASHRACK TO SANITARY SEWER; 76 CONTRACT DISPOSAL
		WASTE OIL	200 GALS./MO.	61 CONTRACT DISPOSAL
C-5 ISO DOCK	809	HYDRAULIC FLUID	30 GALS./MO.	CONTRACT DISPOSAL

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
60 FIELD MAINTENANCE SQUADRON (cont'd)				
C-141 ISO DOCK	841	ENGINE OIL, HYDRAULIC FLUID	3000 GALS./YR.	CONTRACT DISPOSAL
		ENGINE OIL	2000 GALS./YR.	CONTRACT DISPOSAL
CLEANING AND DEGREASING SHOP	18	CLEANING SOLVENTS, PHOSPHORIC ACID, CARBON REMOVER, SODIUM HYDROXIDE	6000 GALS./YR.	TO SURFACE DRAINAGE OR FIRE TRAINING 60 CONTRACT DISPOSAL
		WASTE OILS, FUELS	1000 GALS./2 MOS.	TO SURFACE DRAINAGE OR FIRE TRAINING 60 OIL/WATER SEPARATOR OR CONTRACT DISPOSAL
COMPONENT REPAIR	16	HYDRAULIC FLUID	10 GALS./WK.	64 CONTRACT DISPOSAL
		ENGINE OIL	150 GALS./WK.	64 CONTRACT DISPOSAL
		JP-4	20 GALS./WK.	64 CONTRACT DISPOSAL
		WASHWATER	200 GALS./DAY	64 TO SURFACE DRAINAGE SYSTEM 79 TO OIL/WATER SEPARATOR
GTU SECTION	12 (Also in 16 and 563 in the past.)	ENGINE OIL, HYDRAULIC FLUID	400 GALS./YR.	CONTRACT DISPOSAL
INTERIOR ELECTRIC/MOTOR SHOPS	873, 874	PCB TRANSFORMERS	VARIABLE	STORED IN BLDG. 956
		WASTE OIL	50 GALS./MO.	CONTRACT DISPOSAL
TF 33 SECTION	839	WASTE OIL	21 GALS./MO.	61 CONTRACT DISPOSAL
		JP-4 FUEL, HYDRAULIC FLUID, PD-680	48 GALS./WK.	61 TO MAC WASHRACK

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 / 1960 / 1970 / 1980)
60 FIELD MAINTENANCE SQUADRON (cont'd)				
TF-33 TEST CELL	1022	WASTE OILS, FUELS	5 GALS./MO.	CONTRACT DISPOSAL
TF 39 SECTION	16	JP-4	50 GALS./MO.	CONTRACT DISPOSAL
		WASTE OILS	50 GALS./MO.	CONTRACT DISPOSAL
		HYDRAULIC FLUID	50 GALS./MO.	CONTRACT DISPOSAL
		PD-680	50 GALS./MO.	CONTRACT DISPOSAL
TF-39 TEST CELL	1001	WASTE OILS, FUELS	5 GALS./MO.	CONTRACT DISPOSAL
60 ORGANIZATIONAL MAINTENANCE SQUADRON				
INSPECTION ISO DOCK	809	HYDRAULIC FLUID, ENGINE OIL, JP-4 FUEL, SOLVENTS	300 GALS./5 MOS.	CONTRACT DISPOSAL
602 ORGANIZATIONAL MAINTENANCE SQUADRON				
INSPECTION ISO DOCK	841	JP-4	300 GALS./WK. COMBINED TOTAL OF BOTH WASTE STREAMS	CONTRACT DISPOSAL OR TO FIRE TRAINING
		HYDRAULIC FLUID, WASTE OIL		CONTRACT DISPOSAL
60 AIR BASE GROUP				
AUTO HOBBY SHOP	226	ENGINE OIL, SOLVENTS	<250 GALS./MO.	CONTRACT DISPOSAL
PHOTO HOBBY SHOP	226	FIXER	5 GALS./MO.	SANITARY SEWER

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
60 CIVIL ENGINEERING SQUADRON				
ELECTRIC POWER PRODUCTION	931	LUBE OIL, DIESEL FUEL	1000 GALS./YR.	53 TO FIRE TRAINING OR CONTRACT DISPOSAL
ENTOMOLOGY	872 (Behind 148 prior to 1965, adjacent to 873 1965 to1967)	PESTICIDE CONTAINERS	45/MO.	ON SITE LANDFILL; 72 ON-SITE LANDFILL AFTER RINSE; 77 CONTRACT DISPOSAL
		RINSATE	30 GALS./DAY	TO SANITARY SEWER; 67 REUSED FOR MAKEUP WATER
PROTECTIVE COATING	874	PAINT THINNER, PAINT SLUDGE	55 GALS./MO.	TO ON-SITE LANDFILL OR FIRE TRAINING; 70 CONTRACT DISPOSAL
REFRIGERATION/AIR CONDITIONING	882	HYDROCHLORIC ACID SOLUTION	300 LB/YR. (DRY WT.)	TO SANITARY SEWER
AUDIO VISUAL SERVICE CENTER				
BASE PHOTO LAB	235	FIXER	10 GALS./MO.	TO SANITARY SEWER; 73 TO SANITARY SEWER AFTER SILVER RECOVERY
		DEVELOPER	5 GALS./MO.	TO SANITARY SEWER
		SILVER RECOVERY CARTRIDGES	4/YR.	73 TO DPDO; 79 SENT OFF SITE FOR SILVER RECOVERY
AIR FORCE ENGINEERING SERVICE CENTER				
CEMIRT	1205	LUBE OIL	55 GALS./MO.	76 CONTRACT DISPOSAL
		PD-680	55 GALS./MO.	76 CONTRACT DISPOSAL
		HYDRAULIC FLUID	55 GALS./YR.	76 CONTRACT DISPOSAL

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
DAVID GRANT MEDICAL CENTER				
BASE DENTAL CLINIC, X-RAY, AND LABORATORY	117	FIXER	3 GALS./MO.	TO SANITARY SEWER; 73 TO SANITARY SEWER AFTER SILVER RECOVERY
		DEVELOPER	3 GALS./MO.	TO SANITARY SEWER
		SILVER RECOVERY CARTRIDGES	4/YR.	73 TURNED INTO HOSPITAL SUPPLY
HOSPITAL DENTAL CLINIC, X-RAY, AND LABORATORY	379	FIXER	3 GALS./MO.	TO SANITARY SEWER; 80 TO SANITARY SEWER AFTER SILVER RECOVERY
		DEVELOPER	2 GALS./MO.	TO SANITARY SEWER
		SILVER RECOVERY CARTRIDGES	4/YR.	80 TO HOSPITAL SUPPLY FOR SILVER RECOVERY
MEDICAL PHOTOGRAPHY	381	FIXER	20 GAL. /MO.	58 TO SANITARY SEWER; 80 TO SANITARY SEWER AFTER SILVER RECOVERY
		DEVELOPER	20 GALS./MO.	58 TO SANITARY SEWER
		SILVER RECOVERY CARTRIDGES	4/YR.	80 TO HOSPITAL SUPPLY FOR SILVER RECOVERY
DIAGNOSTIC RADIOLOGY, NUCLEAR MEDICINE	381	FIXER	100 GALS./WK.	TO SANITARY SEWER; 80 TO SANITARY SEWER AFTER SILVER RECOVERY
		DEVELOPER	60 GALS./WK.	TO SANITARY SEWER
		SILVER RECOVERY CARTRIDGES	6/YR.	80 TO HOSPITAL SUPPLY FOR SILVER RECOVERY
CONSOLIDATED AIRCRAFT MAINTENANCE SQUADRON				
FUEL SYSTEMS SHOP	838	JP-4 FUEL	100 GALS./MO.	61 CONTRACT DISPOSAL
AGE SECTION	842	PD-680	24 GALS./YR.	CONTRACT DISPOSAL

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY (CURRENT USAGE)	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
CONSOLIDATED AIRCRAFT MAINTENANCE SQUADRON (cont'd)				
AGE SECTION (cont'd)		ENGINE OIL	110 GALS./YR.	CONTRACT DISPOSAL
		TURBINE OIL	55 GALS./2 YRS.	CONTRACT DISPOSAL
		SYNTHETIC JET ENGINE OIL	55 GALS./2 YRS.	CONTRACT DISPOSAL
CORROSION CONTROL	847	PAINT THINNER, PAINT SOLIDS	100 GALS./YR.	61 CONTRACT DISPOSAL 81 CONTRACT DISPOSAL
ENGINE CONDITIONING	843	WASTE OILS	25 GALS./MO.	61 CONTRACT DISPOSAL OR TO FIRE TRAINING 73 CONTRACT DISPOSAL
		WASTE FUELS	25 GALS./YR.	61 CONTRACT DISPOSAL OR TO FIRE TRAINING 73 CONTRACT DISPOSAL
		PD-680	25 GALS./2 MOS.	61 CONTRACT DISPOSAL OR TO FIRE TRAINING 73 CONTRACT DISPOSAL
POTRERO HILLS STORAGE ANNEX				
EXPLOSIVES TECHNOLOGY	OLD NIKE LAUNCH SITE	PERCHLOROETHANE	200 GALS./YR.	65 CONTRACT DISPOSAL
		USED OIL	55 GALS./YR.	65 CONTRACT DISPOSAL
		FIXER	20 GALS./MO.	65 CONTRACT DISPOSAL
POINT ARENA AFS				
VEHICLE MAINTENANCE	217	WASTE OILS	50 GALS./YR.	51 BURNED IN LANDFILL AREA 78 TO TRAVIS AFB, THEN TO OFF SITE CONTRACT DISPOSAL
PAINT SHOP	203	PAINT THINNER, PAINT RESIDUE	50 GALS./YR.	51 BURNED IN LANDFILL AREA 78 TO TRAVIS AFB, THEN TO OFF SITE CONTRACT DISPOSAL

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

were burned in the fire training area, landfilled, or discharged to the sewage treatment plant or surface drainage system. Beginning in the early 1960s, a program of collecting and recycling or disposing of these wastes materials was implemented. From this time until March 1983; a large percentage of these waste was collected in bowsers or drums located in the individual shop areas. The bowsers or drums were hauled to storage tanks or drum storage areas on base where the wastes were picked up by an outside contractor and hauled off-site for reuse or disposal. The contracts were typically arranged by the Defense Property Disposal Office (DPDO) although in some cases Civil Engineering (CE) arranged for contract disposal of particlar waste materials.

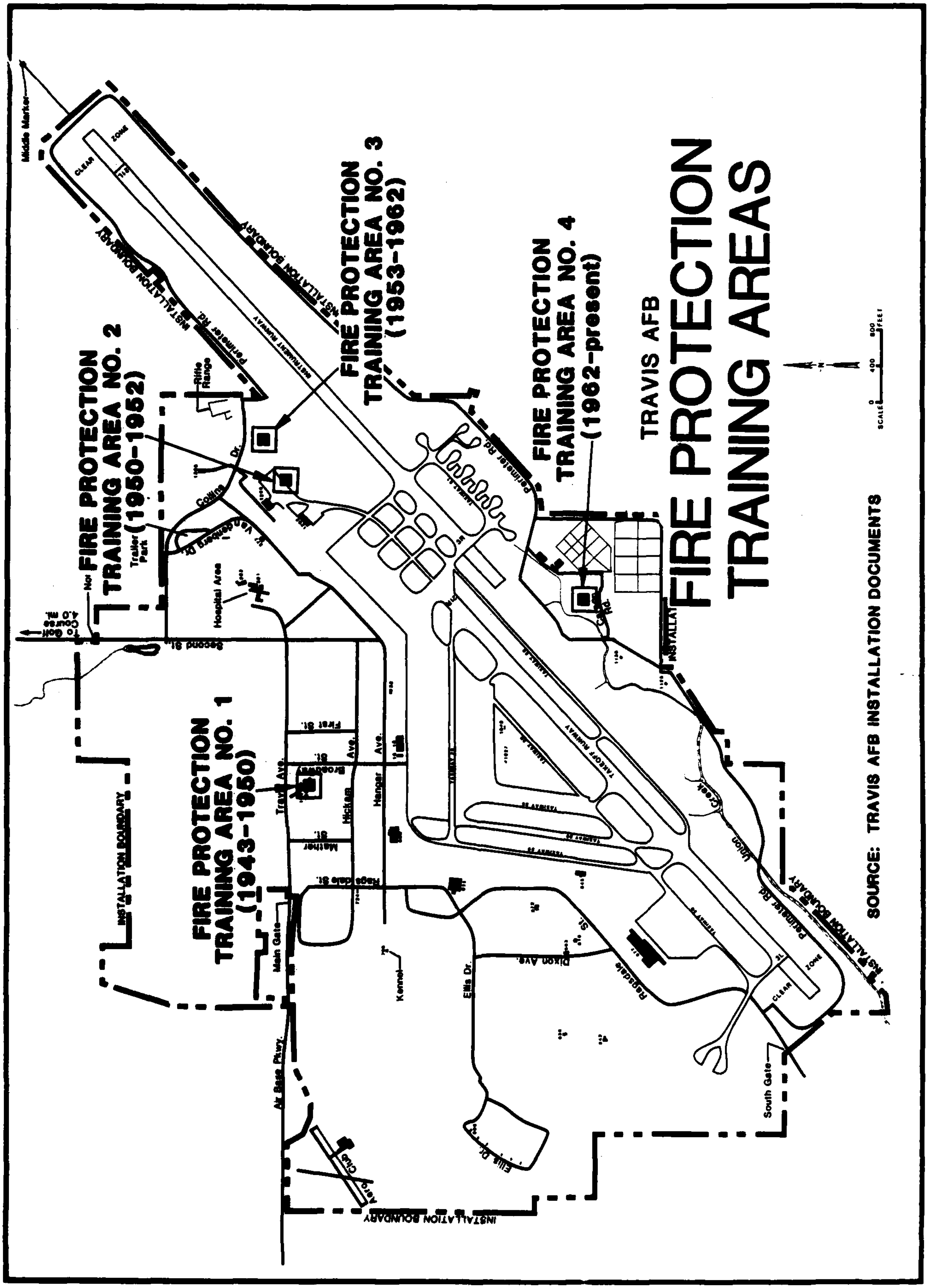
Hazardous waste materials have been stored in several locations at Travis AFB depending on the nature of the waste material. In March 1983, several waste storage areas ceased to accept wastes, including the drum storage areas at Buildings 550 and 872 and the storage tanks at Buildings 377, 935, 943, and 1027. At present, most waste materials from individual shops are being drummed and stored in a new drum storage in Building 1365 prior to off-site contract disposal. Facilities 956 and 1754 are continuing to be utilized for the storage of PCBs and hydraulic fluid, respectively. Tanks and oil/water separators in Buildings 18 and 811 are also continuing to be used for waste storage.

Although most waste materials have been disposed of by contractor since the eary 1960's, some waste fuels, oils, hydraulic fluid, spent solvents, and paint thinners, continued to be burned in the fire training area until the mid 1970's. Small quantities of waste oils have also been disposed of on the ground south of Building 16.

<u>Fire Protection Training</u>

The Fire Department at Travis AFB has conducted training exercises in four (4) areas since the activation of Travis AFB. The following list give specific designations for these Fire Protection Training Areas (FPTA) and identifies their approximate period of use. Figure 4.1 depicts their locations.

FIGURE 4.1



TRAVIS AFB
FIRE PROTECTION TRAINING AREAS
FIRE PROTECTION TRAINING AREA NO. 1 (1943-1950)
FIRE PROTECTION TRAINING AREA NO. 2 (1950-1952)
FIRE PROTECTION TRAINING AREA NO. 3 (1953-1962)
FIRE PROTECTION TRAINING AREA NO. 4 (1962-present)
SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS
INSTALLATION BOUNDARY
Perimeter Rd.
INSTRUMENT RUNWAY
TAKEOFF RUNWAY
CLEAR ZONE
Middle Marker
Rifle Range
Collins Dr.
Vandenberg Dr.
Trailer Park
Hospital Area
To Golf Course 4.0 mi.
Second St.
First St.
Broadway
Travis Ave.
Hickam Ave.
Hanger Ave.
Mather St.
Ragsdale St.
Main Gate
Kennel
Dixon Ave.
Ellis Dr.
Ragsdale St.
Union Creek
South Gate
Air Base Pkwy.
Aero Club
SCALE 0 400 800 FEET
N

Fire Protection Training Areas	Period of Operation
No. 1	1943-1950
No. 2	1950-1952
No. 3	1953-1962
No. 4	1962-Present

Fire Protection Training Area No. 1

The first area where fire protection training exercises were known to have taken place is located along Travis Avenue and Airmen Drive (FPTA No. 1) in the area now occupied by barracks (Bldgs. 103 through 109). Fuels used for the exercises consisted of waste fuel, oil, solvents and any other combustible wastes which could be obtained. Water was used as the primary extinguishing agent. The site was utilized from 1943 until 1950 when it was moved to construct the barracks which are now located at the site. It is suspected that the contaminated surface soils would have been removed during the construction operations. Any potential contaminants which may still exist in the area would be unlikely to migrate since the concrete pad would eliminate any driving force for contaminant migration.

Fire Protection Training Area No. 2

The second fire protection training area (FPTA No. 2) was used for short period between 1950 and 1952. The site was located in the northeast section of the base between Building 1205 and the runway. Waste fuels, oils and solvents were reported to have been burned in the areas. Water and foam were used as as extinguishing agents. The site is now covered by a concrete pad; therefore, it is suspected that the contaminated surface soils were removed prior to construction.

Fire Protection Training Area No. 3

In 1953, the fire protection training area was moved approximately 1000 feet north of FPTA No. 2. A considerable amount of waste fuel, oil and solvents were reportedly burned at this site (FPTA No. 3). The waste was brought in the site in bowsers and drums. Approximately 20 to 30 55-gallon drums per week were delivered to the site. Typically, burning operations occurred on the weekends. Protein foam and water were used as extinguishing agents. Any runoff generated from the operation was released to the adjacent surface areas. In 1962, the site was relocated so that the smoke would not blow into the shop areas. The area is presently graded and covered with grass.

Fire Protection Training Area No. 4

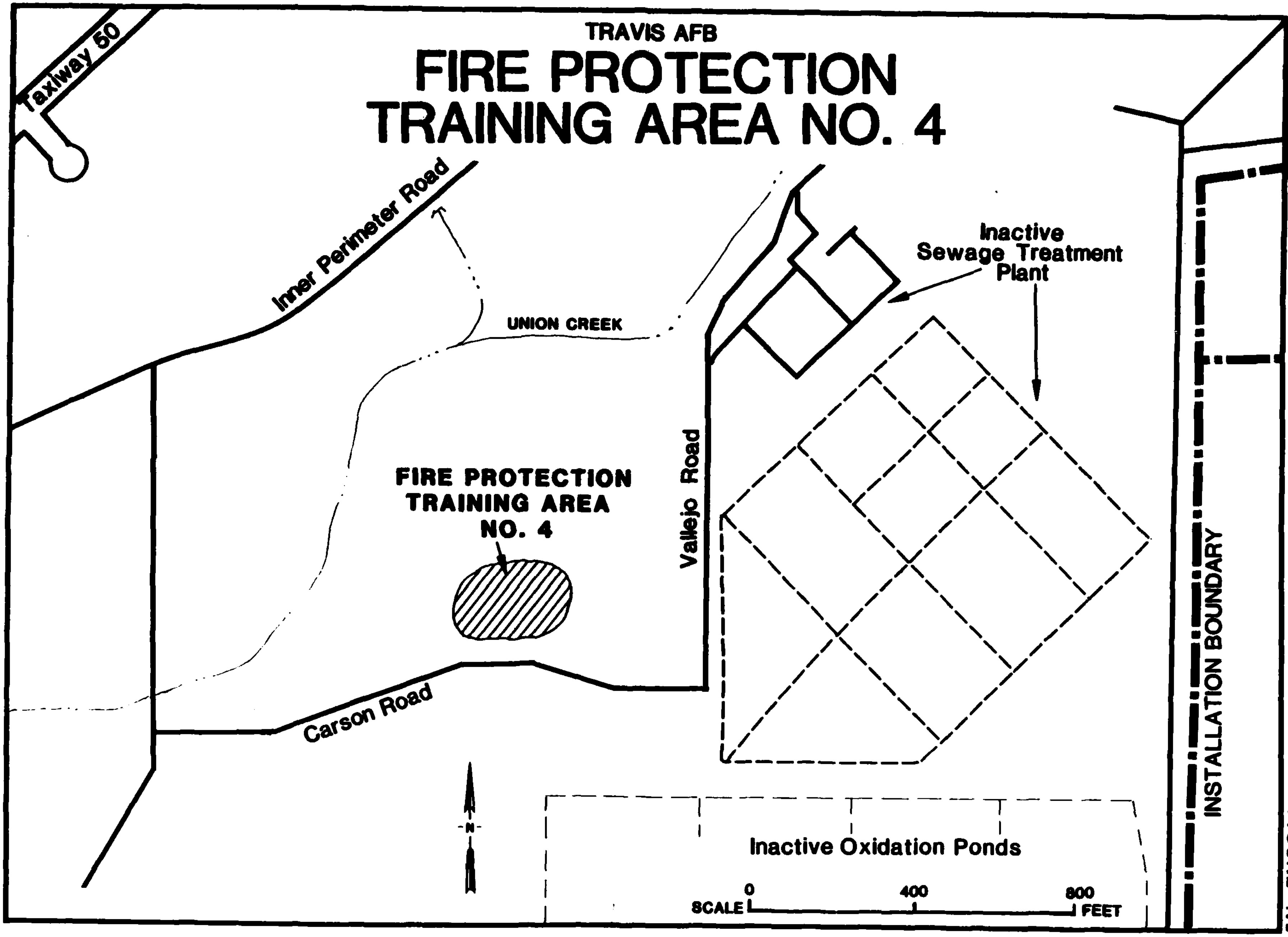
In 1962, fire training exercises (FPTA No. 4) were conducted in an area on the east side of the base near the old sewage treatment plant (Figure 4.2). During the period from 1962 until the early 1970's, waste fuel, oils and solvents were still used for fueling the training fires. The wastes were delivered to the site in 55-gallon drums. Beginning in the early 1970's only contaminated fuel (e.g., JP-4) was used during training exercises. About 1976, an above-ground storage tank was installed in the area to accept the waste fuels. The extinguishing agents used at the site comprised, AFFF, protein foam and water. The site has no berms or dikes to contain the runoff. Surface runoff from the site has to flowed over the adjacent areas into ditches leading to Union Creek. During the field investigation conducted for this study, some dead vegetation was observed in the drainage swales around the site.

Pesticide Utilization

Pest management has been the responsibility of the host Civil Engineering Squadron since the base was constructed. Herbicide applications were performed by the Pavement and Grounds Shop until 1969, at which time these responsibilities were transferred to the Entomology Shop. The pest management program has entailed routine and specific job-order chemical applications.

The Pesticide Shop was originally located in Bldg. 148. In the mid-1960's it was moved to a temporary exterior location on the north side of Bldg. 873. In 1967, the shop was moved to its present location in Bldg. 872. While the shop was located in Bldg. 148, small quantities of rinse water from hand-held spray application equipment was discharged to the sanitary sewer. Pesticide usage during this period included small quantities of DDT, chlordane and dieldrin. When the shop was relocated to the site adjacent to Bldg. 873, similar procedures were used for cleaning the spray equipment. Around 1967, when the shop was relocated to Bldg. 872, new motorized equipment was utilized for pesticide

FIGURE 4.2



ES ENGINEERING-SCIENCE

applications. At that time, rinsate from cleaning application equipment was recycled as make-up water for new batches of pesticide.

Empty pesticide containers were typically disposed of with general refuse up until the early 1970's. Between 1972 and 1977, the empty pesticide containers including cans, glass and bags were accumulated and disposed of in a trench located near the munitions storage area in the southwest corner of the base (refer to Landfill No. 3 discussion). Trench dimensions were reported to be 18"x30'x10'. The containers were rinsed prior to disposal. Rinse water from cleaning the containers and equipment was also disposed of within the site. After the use of the disposal site ceased, the containers were disposed of by contract in an off-base Class I landfill. Rinsate from cleaning empty containers and application equipment was once again recycled as make-up water for new batches of pesticide.

Heat and Power Production

Travis AFB has been utilizing commercial sources of power to supply the electrical needs of the base since the early 1960's. Diesel generators located in Building 916 were used to supply electric power to the base prior to the conversion to commercial power sources. The generators are now utilized as a back-up power source. No fuel spills or leaks have been observed at Building 916.

Heat for the base is provided by two central steam boiler plants and various smaller steam and forced air heating systems located in isolated buildings throughout the base. The two central heating plants are located in Building 382, providing heat to the hospital and Building 32, providing heat to the flightline buildings. These boilers are fueled by natural gas and are equipped to burn fuel oil as an alternate fuel. The smaller heating systems also utilize natural gas as their primary fuel source. No fuel spills or leaks have been observed at either Building 382 or 32.

Fuels Management

The fuels management system at Travis AFB consists of a central storage area which receives incoming fuel and several smaller bulk storage areas linked by pipeline. The smaller bulk storage areas are used to supply the hydrant systems and trucks which deliver the fuel to the aircraft flightlines. Aircraft fuel arrives at the base via the Southern Pacific Pipeline orginating in Martinez, California. Prior to the early 1970's a portion of the fuel was barged up the Suisun Channel to the Travis Dock Annex and pumped directly from the dock to the base. Travis AFB has since discontinued its lease of the Dock Annex.

Fuel is delivered to the aircraft either by tanker truck or more often by the various hydrant systems located along the flightline areas. A listing of the locations of the fuel storage tanks and their products, capacities, date of construction and type of tank (i.e., underground or above ground) is provided in Appendix D, Table D.4. Fuels stored at Travis include AVGAS, JP-4, Diesel, MOGAS, Fuel Oil No. 2 and Liquid Propane.

The fuel offloading facilities, storage tanks, fuel transfer and hydrant system are maintained by the Civil Engineering Squadron's Liquid Fuels Maintenance shop. The systems undergo routine inspection. The tanks were cleaned approximately every three years and the sludge generated from the cleaning operations have been disposed of since 1974 by an off-base contractor. Prior to 1974, the sludge was weathered and disposed of within Landfill No. 2.

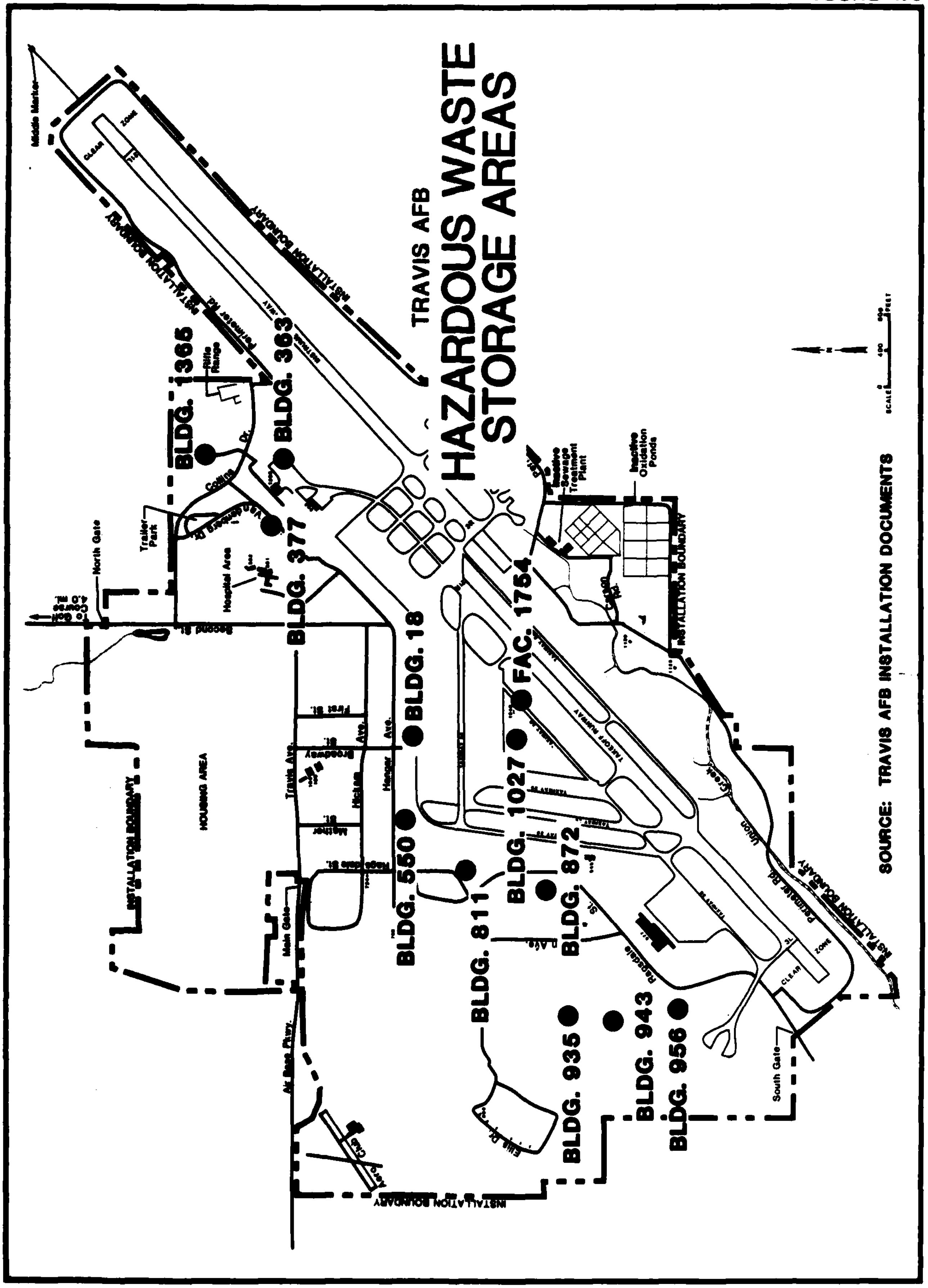
Hazardous Waste Storage Facilities

Hazardous waste materials have been stored in several locations at Travis AFB (Figure 4.3). Storage facilities used in the recent past as well as at present are tabulated in Table 4.2. Prior to March 1983, many waste materials were collected in bowsers or drums and hauled to storage tanks or drum storage areas and picked up by an outside contractor and hauled off-site for disposal. During March 1983, several waste storage areas were discontinued, including the drum storage areas at Buildings 550 and 872 and the storage tanks at Buildings 377, 935, 943, and 1027. At present, most waste materials from individual shops are being drummed and stored in a new drum storage area in Building 1365 prior to off-site contract disposal. Facilities 956 and 1754 are continuing to be utilized for storage of transformers containing PCBs and hydraulic fluid, respectively. Tanks and oil/water separators in Buildings 18 and 811 are also continuing to be used for waste storage.

Defense Property Disposal Office (DPDO)

The Defense Property Disposal Office (DPDO) is presently located at Building 724. The storage yard is located in an area adjacent to the main office. DPDO has been located in this facility since 1964. Various salable used chemicals were stored in the yard. These chemicals

FIGURE 4.3



ES ENGINEERING-SCIENCE

TABLE 4.2
HAZARDOUS WASTE STORAGE AT TRAVIS AIR FORCE BASE

Storage Location	Storage Material	Waste Material in Storage
Bldg. 18	12,500 gallon tank	Water, Solvents.
Bldg. 363	25,000 gallon tank	Automotive Oil
*Bldg. 377	5,000 gallon tank	Water, Solvents, Engine Oil
*Bldg. 550	55 gallon drums	Paint Sludge, MEK, Thinners, Strippers
Bldg. 811	6,000 gallon tank	Water, Soap, Solvents
*Bldg. 872	55 gallon drums	Empty Pesticide Containers
*Bldg. 935	6,000 gallon tank	Engine Oil
*Bldg. 943	2,000 gallon tank	Hydraulic Fluid
Bldg. 956	55 gallon drums	PCB Oils, PCB Transformers and Capacitors
*Bldg. 1027	2,000 gallon tank	Solvents
Bldg. 1365	55 gallon drums	Solvents, Thinners, Paint Sludge, Empty Pesticide Containers
Facility 1754	25,000 gallon tank	Hydraulic Fluid

*The use of these facilities for waste storage has been discontinued.

have included oils, hydraulic fluid and solvents. No major spills were known to have occurred in the area; however, minor leaks from drums were reported to have occurred.

Prior to 1964, DPDO was located in the northeast section of the base in an area adjacent to what is now the rifle range. The area was also used for storage of used oils, hydraulic fluid and solvents. No major spills where known to have occurred in this area.

One of DPDO's responsibilities has been to arrange for the contract disposal of oils and other used chemicals. These materials have typically been stored at central collection points (see discussion Hazardous Waste Storage Facilities). Arrangements are made for the contractor to pick up the materials from the various storage areas located throughout the base.

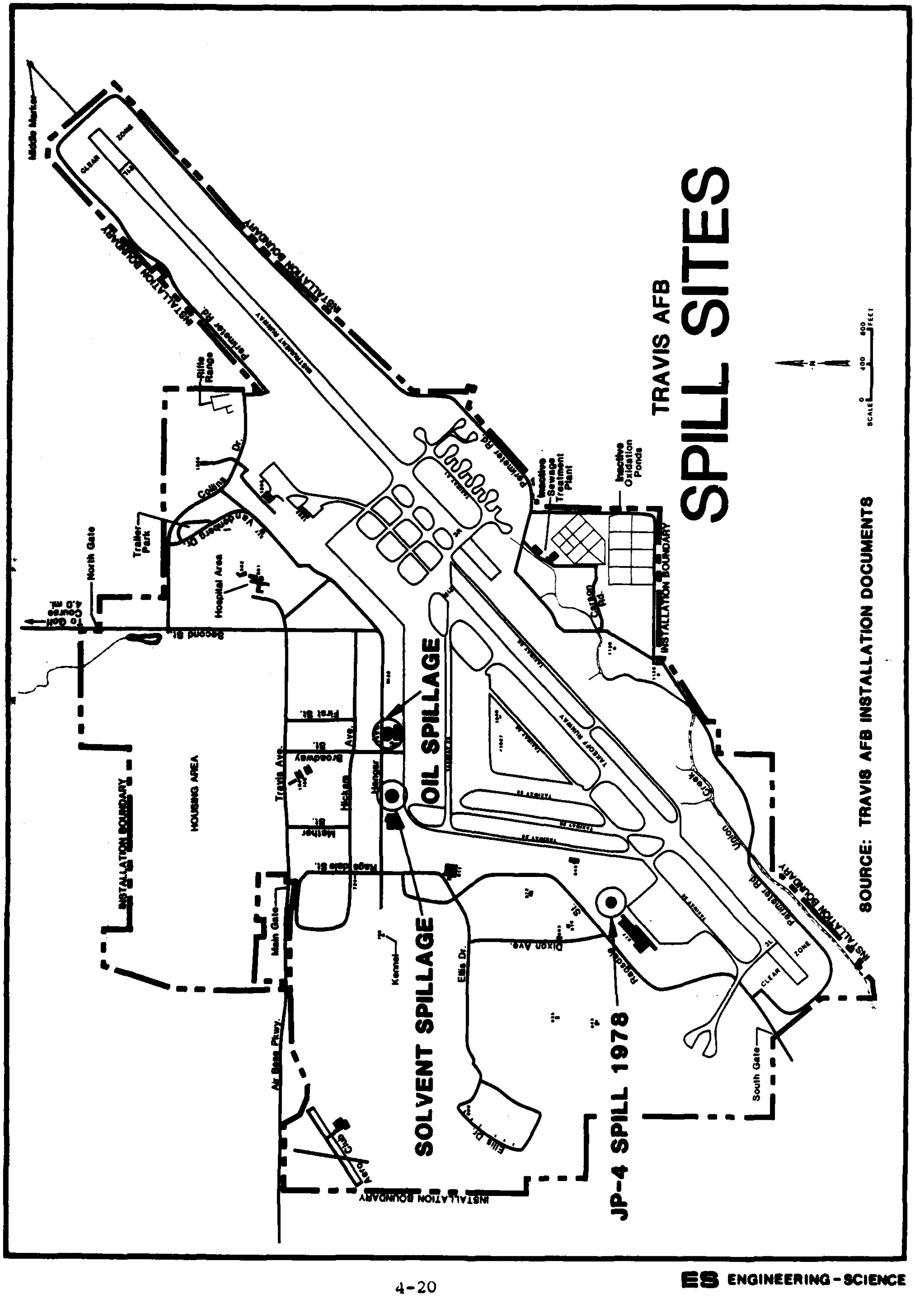
Spills

Small fuel spills have occurred in several areas throughout the base. The spills are primarily attributed to fuel transfer and aircraft refueling operations. They typically occurred on paved areas and evaporated or were immediately cleaned up. No significant environmental contamination is attributed to these spills.

There have been several larger fuel spills which have occurred at Travis AFB. During the early 1960's a 3,000 to 4,000 gallon AVGAS spill occurred near Building 1040. The fuel flowed into the surface drainage system. In May 1978, a major JP-4 spill occurred at the fuel tank located east of Building 977 (Figure 4.4). Approximately 15,000 gallons of JP-4 was reported to have spilled into a drainage ditch which connected with Union Creek. The spill was reported to have killed the aquatic wildlife in a two mile area along Union Creek. The wildlife included water fowl, minnows, carp, crayfish and various insects and worms. Vacuum pumps, dams and absorbent materials were used in the clean-up effort to remove the spilled fuel.

On occasions the SAC/National Guard Unit, a tenant at Travis AFB, has dumped excess fuel from KC-135 tankers. The fuel was dumped prior to take-off during emergency refueling operatons. The discharge of fuel occurred on the parking apron and surrounding areas at the end of the runway. It is suspected that no greater than 5,000 gallons of fuel was

FIGURE 4.4



ES ENGINEERING-SCIENCE

dumped at any one time in any one place and most of the fuel was allowed to evaporate.

Solvent spillage has occurred in an area located east of Building 550. This site was used for the stripping of radomes (aircraft nose pieces). The spillage was detected in June of 1981 and the length of time the leakage occurred is not known. Approximately 55 gallons per day of methyl ethyl ketone (MEK), toluene or tetraethylene glycol dimethyl ether was leaking from a collection tray in a work shed. The chemicals either evaporated or soaked into the ground. A slight solvent odor was detected in the area at the time of the site visit. However, a chemical drum storage was located near this site and may have contributed to the solvent odor.

An additional area which was the site of past oil spillage is located behind Building 16. The area was apparently used to discard waste oil onto the soil. Significant amounts of oil residue were observed on the surface of the soil at the time of the site visit.

DESCRIPTION OF PAST ON-BASE TREATMENT AND DISPOSAL METHODS

The facilities on Travis AFB which have been used for the management and disposal of waste can be categorized as follows:

- Landfills
- Low-Level Radioactive Waste Disposal Areas
- Sewage Treatment System and Sludge Disposal Areas
- Storm Drainage System

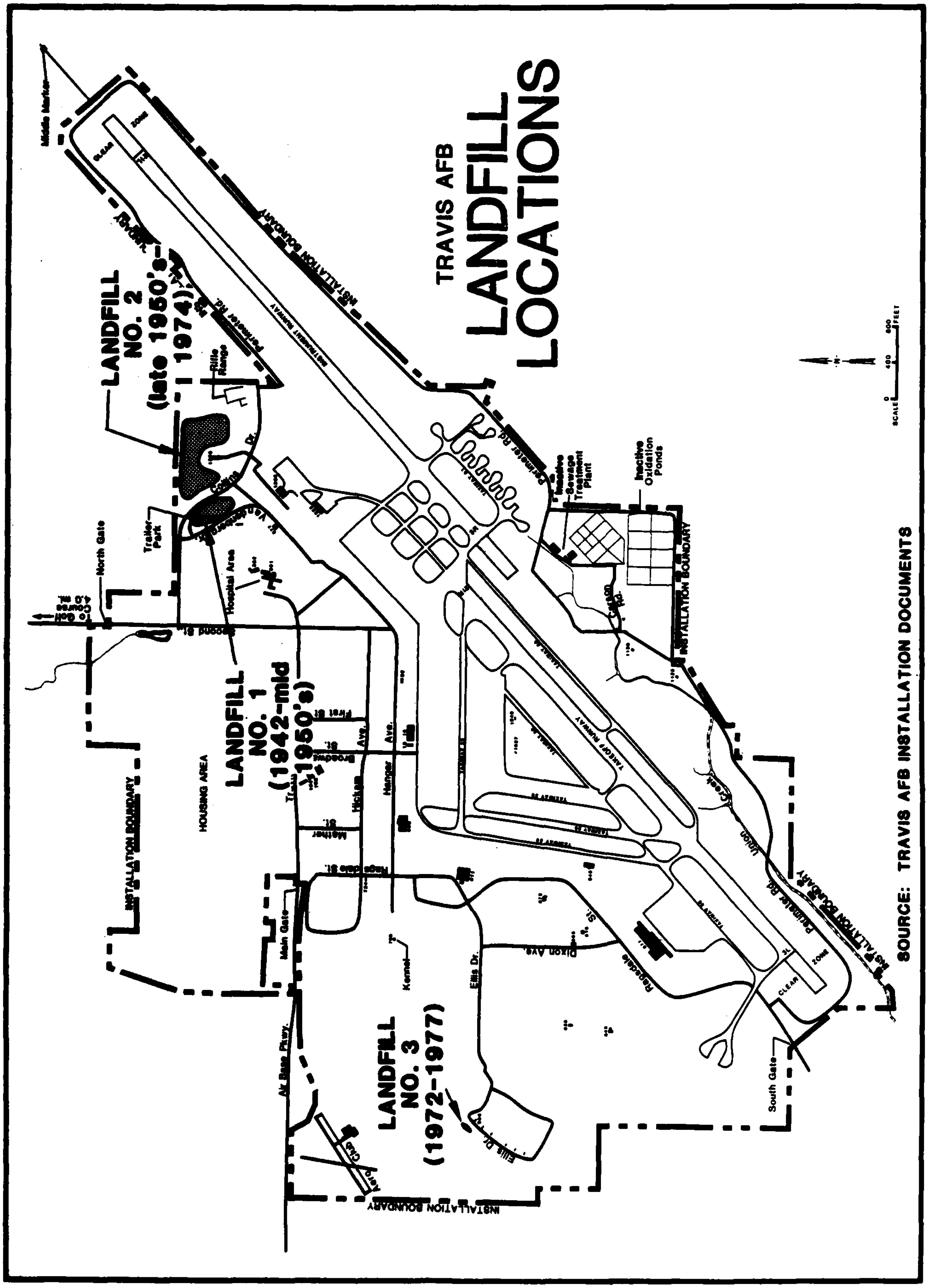
Landfills

Three landfills used for the disposal of refuse were identified at Travis AFB. Landfill locations have been identified on Figure 4.5 and a summary of pertinent information concerning each landfill has been presented in Table 4.3.

Landfill No. 1

Landfill No. 1 is located in the northeast sector of the Base in the area now occupied by the Base Trailer Park (Figure 4.6). The landfill is suspected to have been first used when the base was activated in 1942. The landfill was situated in an excavated area. It was operated as a fill and burn area. Burning usually occurred on a daily basis or

FIGURE 4.5

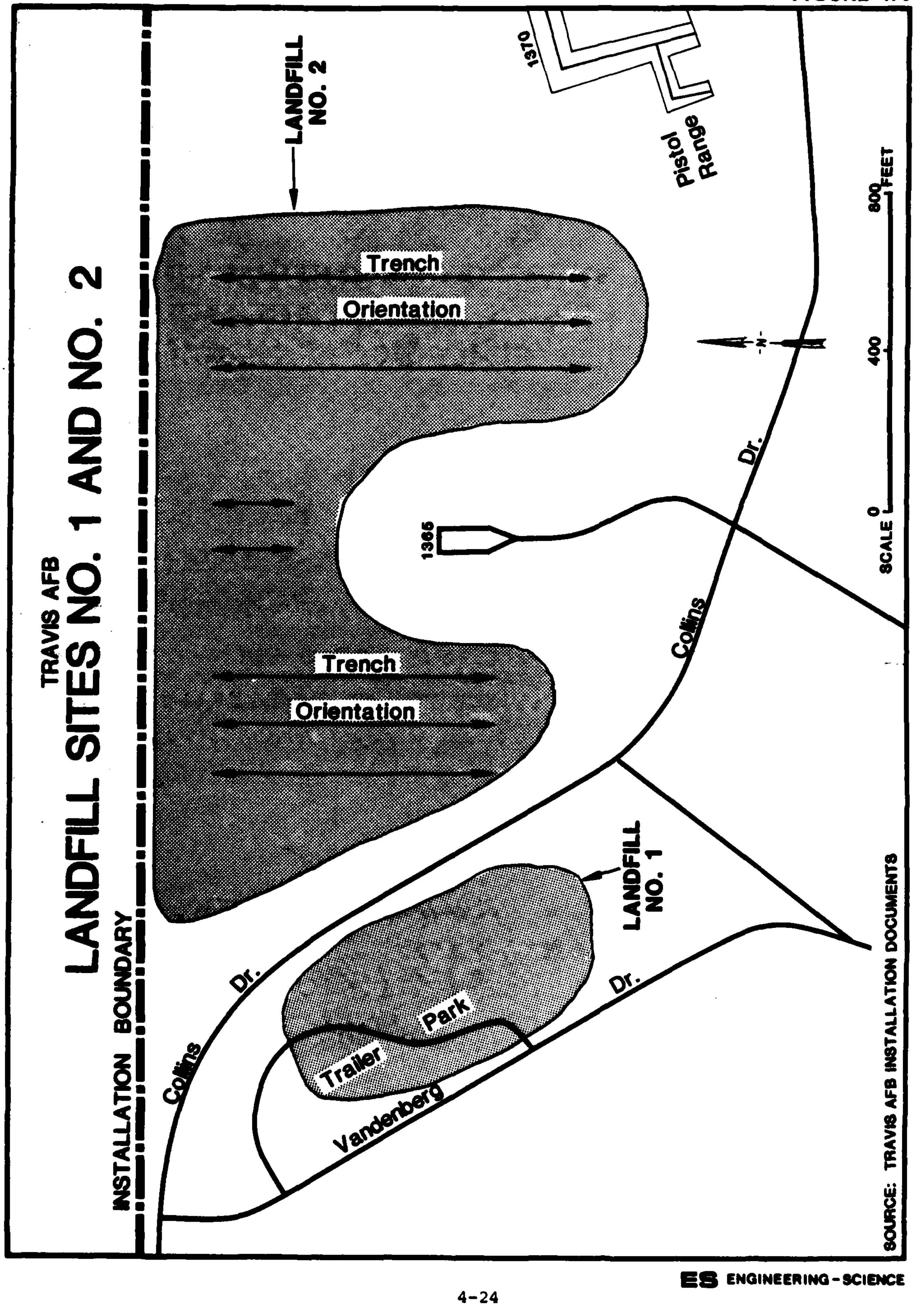


ES ENGINEERING-SCIENCE

TABLE 4.3
SUMMARY OF LANDFILL DISPOSAL SITES

Landfill	Operation Period	Approximate Size (Acres)	Depth (feet)	Type of Waste	Estimated Waste Quantity (Cu. Yd.)	Method of Operation	Closure Status	Surface Drainage
Landfill No. 1	1942-mid 1950's	7	Unknown	General refuse; minor amounts of industrial wastes.	37,000	Fill; daily burning	Closed; now supports trailer park.	To Union Creek
Landfill No. 2	Late 1950's-1974	40	10 to 15 feet	General refuse; fuel sludge minor amounts of other industrial wastes.	Unknown	Trench and fill occasional burning	Closed; uneven settling, ponding	To Union Creek
Landfill No. 3	1972-1977	<1	6 feet	Pesticide containers and rinsate.	30	Trench and fill	Closed; covered with grass.	To Union Creek

FIGURE 4.6



TRAVIS AFB
LANDFILL SITES NO. 1 AND NO. 2

SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

ES ENGINEERING-SCIENCE

at least several times per week. The landfill received primarily general refuse; however, some industrial wastes likely entered the landfill. Burning operations likely reduced any long term hazards associated with any disposal of solvents or oils. The area directly west of the landfill was reported to have been used for the disposal of hardfill materials. Landfill No. 1 was closed during the mid 1950's. The area was covered and compacted and now supports a trailer park community.

<u>Landfill No. 2</u>

Landfill No. 2 is also located in the northeast sector of the base, directly east of Landfill No. 1. The landfill was opened in the late 1950's. It was operated in a trench and fill manner. Trench dimensions were estimated to have been 400 to 500 feet long, 40 feet wide and 10 to 15 feet deep. The landfill received primarily general refuse; however, it is likely that some minor amounts of industrial waste also entered the landfill. Most liquid industrial wastes would have likely been taken to the fire protection training area. Fuel sludge from tank cleaning operations was however reported to have been disposed of in the landfill. No routine burning operations were conducted in this landfill; but occasional fires were known to have occurred at the site. The waste disposed of within the landfill were compacted and usually covered twice per week. Landfill No. 2 was closed around 1974 and covered with three feet of compacted soil. The trench locations are still evident due to uneven settling in the area. The clay soils were used to cover the landfill and ponding occurs in the depressed areas during wet periods.

<u>Landfill No. 3</u>

Landfill No. 3 is located in the western portion of the base adjacent to the munitions storage bunkers. The landfill was used between 1972 and 1977 to dispose of crushed pesticide containers and bags. The containers were rinsed. The rinsate was also disposed of within the landfill. It has been reported that approximately 30 cubic yards of material was buried in this area. The materials were buried in several trenches with dimensions estimated to be 120 feet long, 3 feet wide and 6 feet deep. The trenches were covered with 3 feet of fill. No apparent signs of the disposal site were observed during the site inspection.

Low-Level Radioactive Waste Storage and Disposal Sites

Two sites at Travis AFB have been used for storage and disposal of low-level radioactive wastes. These sites, RB-1 and RB-2, are located north of Ragsdale Street and east of Dixon Avenue and are shown on Figures 4.7 and 4.8. The low-level radioactive wastes at these sites were generated by the activities of an Atomic Energy Commission (AEC) unit that operated in the area from the late 1940s until 1962. These activities included the handling of nuclear weapons which were stored in the area.

A liquid storage tank, site RB-1, is located just northeast of Building 903. The 5,000 gallon underground steel tank formerly received washwater used to clean protective clothing and other equipment used in the handling and servicing of nuclear weapons, as well as area washdown from Building 903 where these activities occurred. The washwater was carried by a pipeline to the underground storage tank. The use of this site for radioactive liquid storage was discontinued sometime between 1962 and 1965. Since that time, the site has been kept fenced and locked and has been posted with radioactivity warning signs.

Periodic monitoring of the liquid disposal area since 1962 indicates that surface alpha, beta, and gamma radiation does not exceed background levels. Surface soil samples taken in October 1980 also showed radioactivity levels comparable to background levels. Samples of the liquid inside the tank indicated alpha radioactivity within the limits for drinking water (U.S. EPA, 40 CFR 141), and low levels of beta and gamma radiation. Swipe samples in Building 903 indicated very low levels of radioactivity, with the exception of the plug in Room 4 which covers the drain line to the liquid disposal site. The plug exhibited significant alpha, beta, and Pb-210 radioactivity. The plug is covered with an additional cap to prevent radiation exposure to persons working in the building.

Contaminated solid materials, such as clothing and gloves, have been disposed of at the radioactive solid waste disposal site, RB-2. The disposal site is located south of Building 906, and is shown in Figure 4.8. The site is fenced and posted with radioactive waste burial warning signs.

FIGURE 4.7

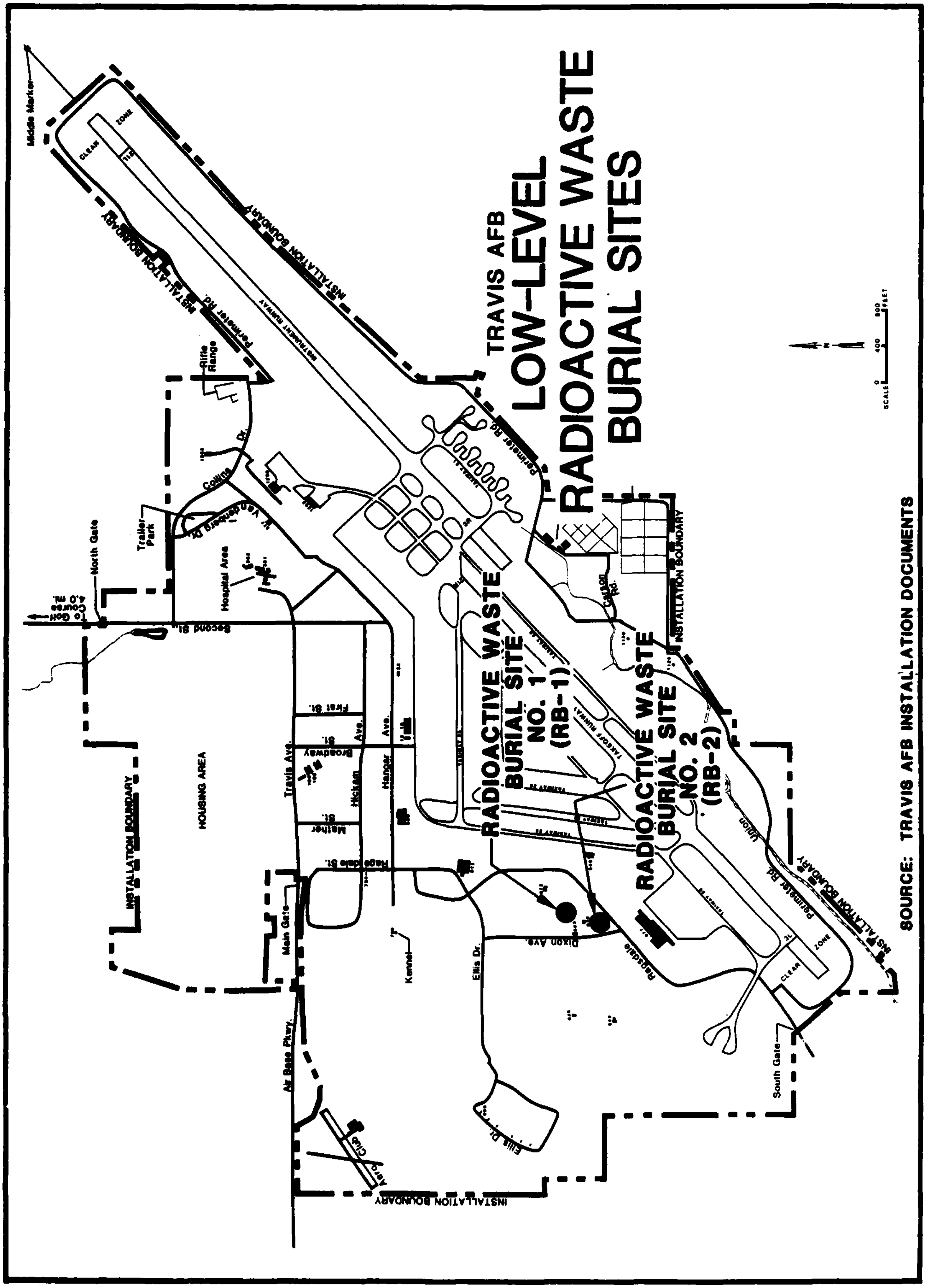
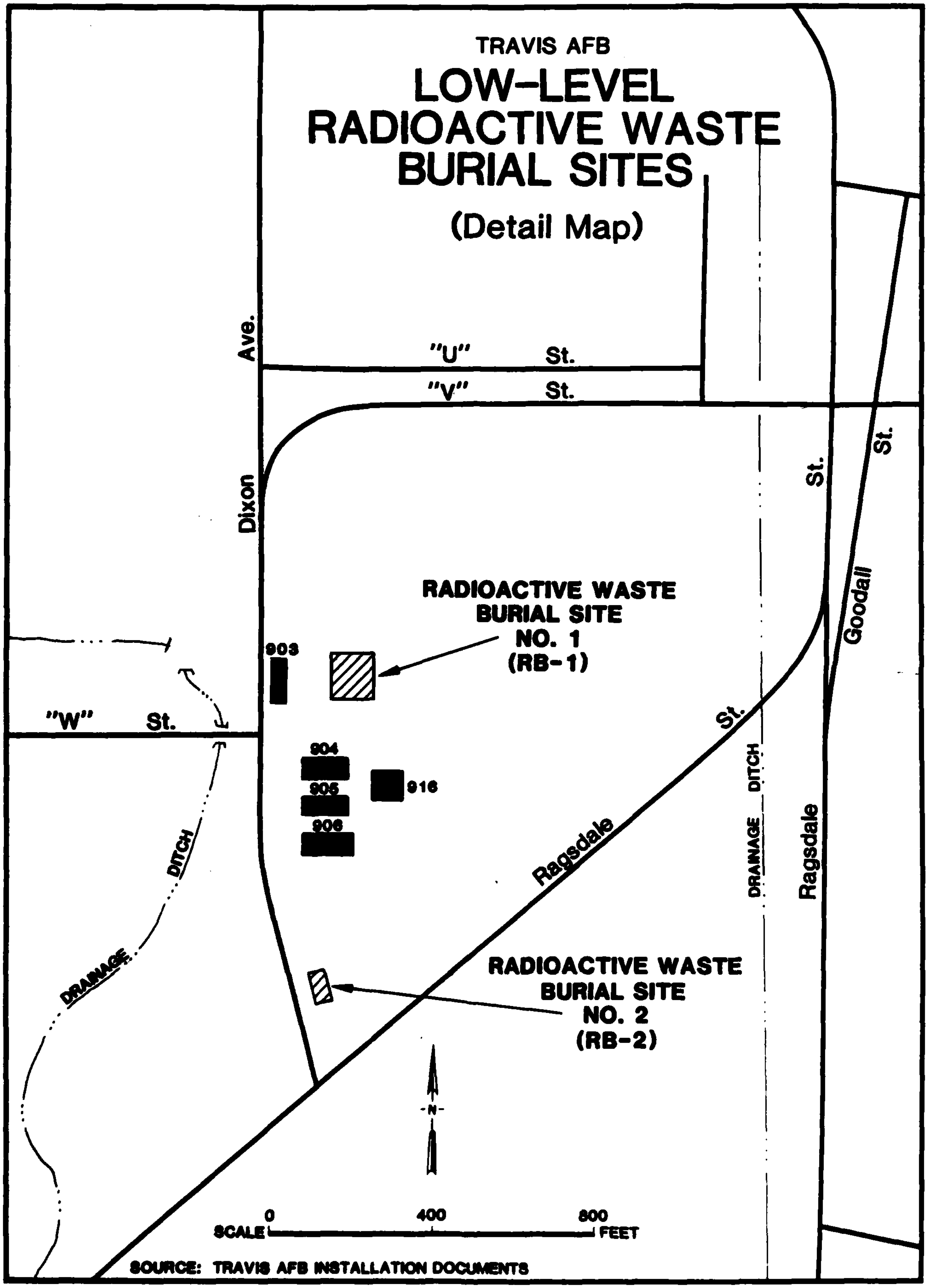

TRAVIS AFB
LOW-LEVEL
RADIOACTIVE WASTE
BURIAL SITES
RADIOACTIVE WASTE
BURIAL SITE
NO. 1
(RB-1)
RADIOACTIVE WASTE
BURIAL SITE
NO. 2
(RB-2)
INSTALLATION BOUNDARY
Perimeter Rd.
Middle Marker
CLEAR ZONE
INSTRUMENT RUNWAY
TAKEOFF RUNWAY
Rifle Range
Collins Dr.
Trailer Park
North Gate
To Golf Course 4.0 mi.
Hospital Area
Second St.
First St.
Broadway St.
Mather St.
Travis Ave.
Hickam Ave.
Hangar Ave.
Hagerdale St.
HOUSING AREA
Main Gate
Kennel
Ellis Dr.
Dixon Ave.
Ragsdale
Union
Carlson Rd.
Air Base Pkwy.
Aero Club
South Gate
SCALE 0 400 800 FEET
SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

FIGURE 4.8



ES ENGINEERING-SCIENCE

Surface radiation monitoring and soil samples taken during 1980 indicate that alpha, beta, and gamma radiation levels are at background levels. A portion of the site was excavated in 1980, and swipe samples of uncovered materials, including a plastic bag, surgical gloves, and clothing, indicated negligible low level alpha, beta, and gamma radiation.

Sewage Treatment Plant and Sludge Disposal Areas

Travis AFB operated a sewage treatment plant (STP) from the early 1950's until the late 1970's. The plant was located in the southeast section of the base (see Figure 4.5). The treatment system comprised of a settling basin, oxidation ponds and a chlorine contact chamber. The oxidation ponds were constructed of soils with a high clay content. The ponds were reported to have retained water without any apparent losses. The system was used to treat primarily domestic and some industrial wastes generated at the base. The effluent from the STP was discharged to Union Creek.

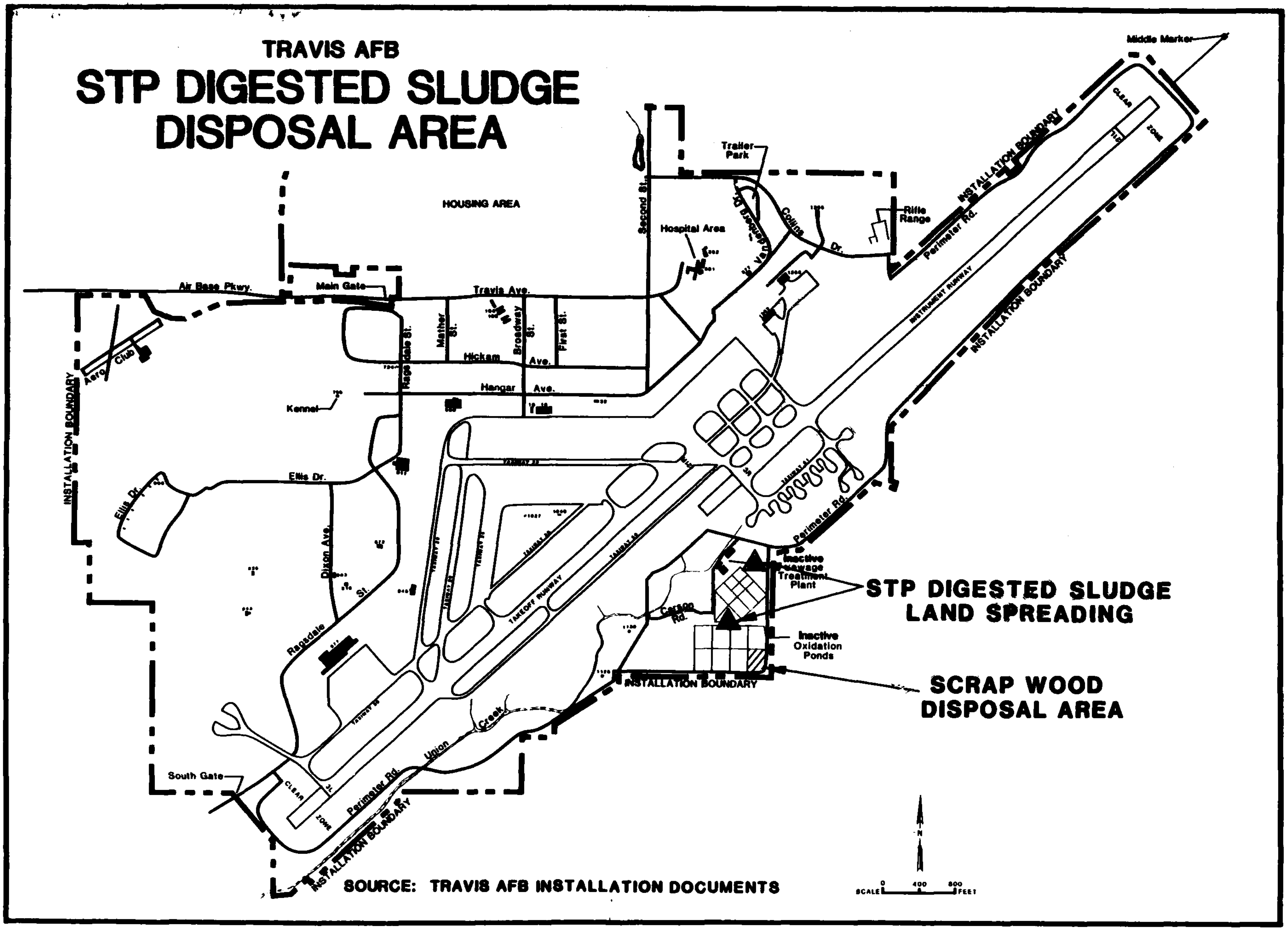
Sludge from the settling basin was pumped to a digester system. Digested sludge was spread over areas located adjacent to the STP (Figure 4.9). It has been estimated that approximately 100 cubic yards of digested sludge were disposed of per year.

During the late 1970's, Travis AFB began pumping its domestic wastes to the Fairfield-Susiun Sewer District Treatment Plants. The sewage treatment plant at Travis now lies idle. However, one of the abandoned oxidation ponds located in the southeast most corner of the base is used for disposing of wood refuse.

Storm Drainage System

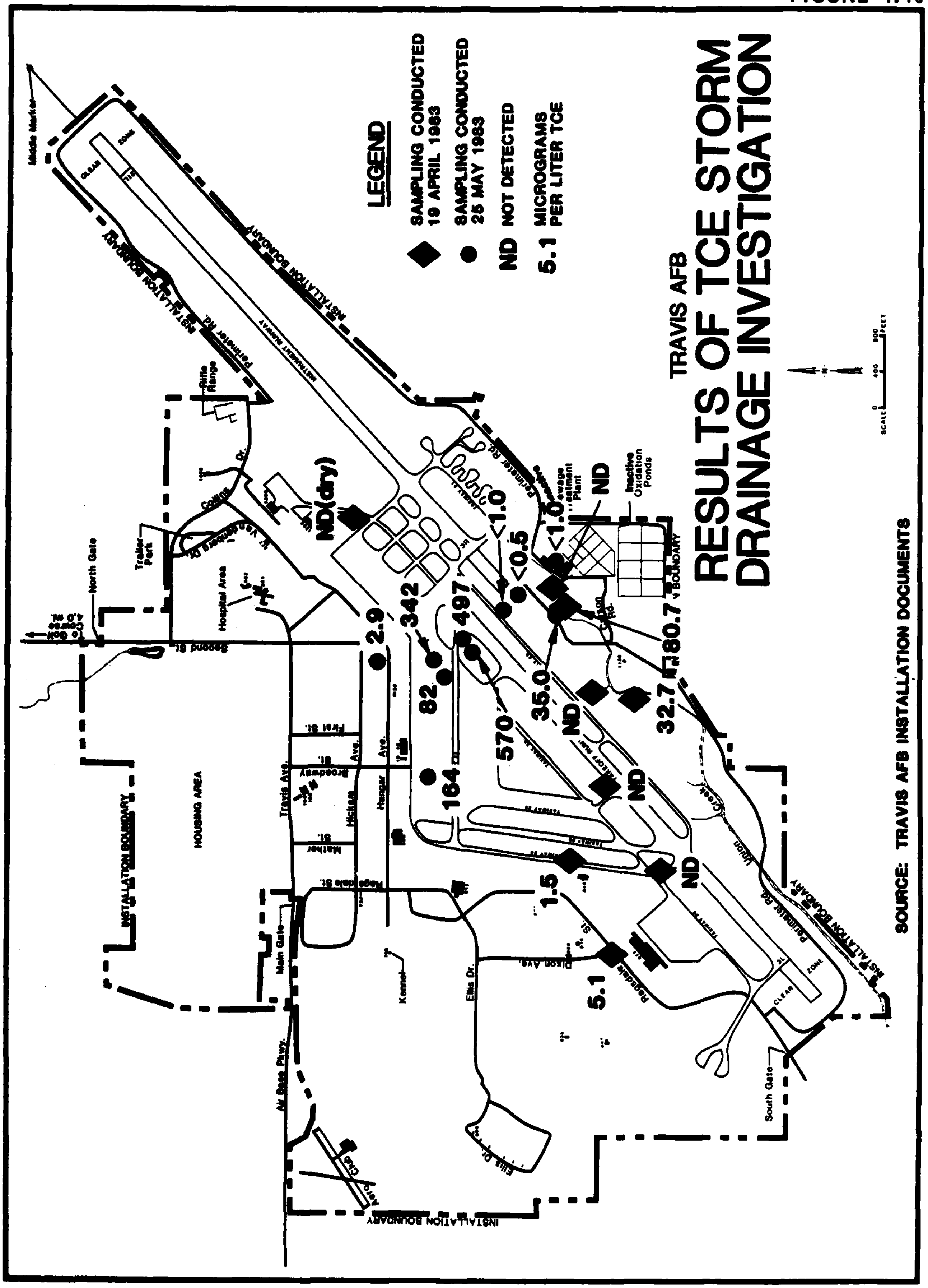
Over the history of the base, miscellaneous chemical wastes generated at many of the base shops have been discharged into the storm sewer and surface drainage system. To investigate the potential sources of TCE detected in Union Creek, samples were collected in April 1983 at various stormwater drains on the base (Figure 4.10). The highest concentration, 80.7 ug/l, was measured in the north fork of the open ditch south of Perimeter Road in the southeastern area of the base. A level of 32.7 ug/l of TCE was measured in the open drain just north of Building 1125. TCE was also detected in the drainage ditch off Ragsdale Street between the 800 building area and Building 977 and in the manhole

FIGURE 4.9



SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

FIGURE 4.10


TRAVIS AFB
RESULTS OF TCE STORM DRAINAGE INVESTIGATION
LEGEND
SAMPLING CONDUCTED 19 APRIL 1983
SAMPLING CONDUCTED 25 MAY 1983
ND NOT DETECTED
5.1 MICROGRAMS PER LITER TCE
SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS
ND(dry)
<1.0
<0.5
<1.0
ND
2.9
342
497
82
570
35.0
ND
80.7
32.7
164
ND
ND
1.5
5.1
INSTALLATION BOUNDARY
HOUSING AREA
Hospital Area
Trailer Park
North Gate
Main Gate
South Gate
Second St.
First St.
Travis Ave.
Hickam Ave.
Hangar Ave.
Broadway St.
Mather St.
Ragsdale St.
Dixon Ave.
Ellis Dr.
Kennel
Air Base Pkwy.
Perimeter Rd.
Collins Dr.
Rifle Range
Middle Marker
Union Creek
Sewage Treatment Plant
Inactive Oxidation Ponds
INSTRUMENT RUNWAY
CLEAR ZONE
Aero Club

near Building 845 at levels of 5.1 ug/l and 1.5 ug/l, respectively.

Additional sampling for TCE in the storm sewers was conducted the following month (May 1983). High concentrations of TCE were detected in two sewer line boxes south of the eastern end of Taxiway 23. High concentrations of TCE were also detected further back up each of these sewer lines. A concentration of 164 ug/l TCE was detected in a line located between Taxiway 23 and Building 18. A concentration of 342 ug/l of TCE was detected in line north of the eastern end of Taxiway 23. The data indicates that there is probably more than one source for the TCE found in Union Creek.

OFF-BASE ANNEXES

The IRP study for Travis AFB included an evaluation of several non-contiguous annexes associated with the Base. A brief discussion of each of the annexes is presented below along with a description of the areas of concern identified on the sites.

Outer Marker and TVOR Site

Associated with Travis AFB are two non-contiguous navigational markers, the Outer Marker and the TVOR. The Outer Marker is situated approximately 5 miles northeast of the north end of the runway and the TVOR station is situated approximately 1 mile further out (see Figure 2.2) on a 316-acre leased parcel of land. Both navigational stations are equipped with radar and communication equipment along with a small power generator. No contamination was reported to have occurred in either area.

Golf Course Annex

The Golf Course Annex, also referred to as Water Annex No. 2, is a 206 acre parcel of land located approximately 4 miles due north of the base (see Figure 3.6). The site has been developed into an 18 hole golf course. In addition to its recreational uses, the site is the location for the wells which supply a portion of the potable water supply to the main base (see Chapter 3 discussion of base wells). The base maintains a pipeline easment which links the annex to the main portion of Travis AFB and its water supply system. No spill or disposal sites are located within this annex.

Potrero Hills Storage Annex

The Potrero Hills Storage Annex is a 25-acre parcel located about 2.5 miles south of Travis Air Force Base and 7.5 miles from the central business district of Fairfield, California (See Figure 2.2). The site is a portion of the former Travis Air Force Base defense area, known as NIKE Battery 53. The major portion of the site has been graded and improved with three underground missile bays, an assembly building, a generator building, a crew ready room, a small guard house and an acid storage shed. The entire site is enclosed with a chain link fence. Each of the three underground missile bays has a hydraulic lift platform which was used to raise missles to the surface. The generator building is equipped with a 4,000 gallon underground fuel tank, and electrical distribution system, and a concrete transformer pad. It has been reported that no PCB transformers are presently located on the site.

The former NIKE Battery 53, which was operated by the Army, was transferred to the Air Force in 1964 and utilized for storage of weapons, medical materials and resources for the U.S. Air Force Hospital at Travis AFB. In 1967, the site was leased to Explosives Technology. The leasee holds renewal options until January 1989.

The primary function of Explosive Technology is the design, development and manufacture of escape systems for the Department of Defense. The company's offices and various test buildings are situated on approximately 500 acres of adjacent land owned by the company.

Explosive Technology has invested a substantial amount of money to install special equipment, repair and alter the leased property. They are currently utilizing two of the underground missle bays as manufacturing facilities for explosive cord. The third missle magazine is used for archive storage. The generator facility is no longer in service.

The wastes generated by the manufacturing processes conducted on the site amount to approximately four drums per year of perchloroethane and one drum per year of waste oil. The facility also utilizes x-ray equipment which generates less than 25 gallons per month of developer. The developer solution is sold for silver recovery. All explosive wastes are disposed of through the Sierra Army Depot.

No contaminated areas were identified at the Potrero Hills Storage Annex; however, the site is currently utilized as a temporary storage area for hazardous waste drums generated throughout the Explosives Technology compound. Arrangements are pending for the removal of these wastes. No leaking drums were observed at the time of the site visit.

<u>Almaden Air Force Station</u>

Almaden Air Force Station is a 119-acre site located approximately 13 miles south of the City of San Jose, California (Figure 2.2). The site is situated atop the 3,500 foot Mt. Umunhum and is divided primarily into three sections; the station proper, the GATR, and the water system annexes. The Air Force Station was used as a long range radar installation to provide coverage of aircraft entering U.S. airspace. During the late 1950's and early 1960's, as many as 300 personnel were stationed at the site.

The radar station is no longer in operational service and the Air Force Station has been put into a caretaker status. Only four individuals are presently residing at the facility.

During the period of use water was supplied by a mountain stream and pumped to a storage facility. Electrical power for the housing area was purchased. The power supply for operations area was provided by a diesel generator. Two PCB transformers were located at the facility; however, they have since been removed to Travis AFB for disposal. Wastewater has been disposed of through septic tanks and a sewage oxidation facility which allowed for the evaporation of the effluent. The solid wastes were disposed of by a contractor off site. No contaminated areas were identified at the Almaden Air Force Station.

<u>Mill Valley Air Force Station</u>

Mill Valley Air Force Station is a 106 acre site located in Marin County, 21 miles north of San Francisco (Figure 2.2). The station is situated atop Mount Tamalpais which is a steep, rocky terrain with a moderate cover of trees and shrubs.

The Mill Valley Air Force Station has supported the 666th Radar Squadron since 1951 when the facility was constructed. The mission of the 666th was to provide radar surveillance for the 26th Air Division Direction Center. In 1961, the station was designated as headquarters for the San Francisco North American Defense Control Center. Between 1961 and 1971 the 40th Artillery Brigade Air Defense Command Post became a tenant at the facility. The 40th exercised control over the NIKE-Hercules missile systems in the San Francisco-Travis AFB area. In July of 1973, the support base was changed to 60th Air Base Group at Travis AFB. The facility was deactivated in September 1980 and is now under a caretaker status. The water and sewer systems are still operated by the caretaker staff.

The Air Force Station comprised nine housing units, six dormitories, a dining hall, motor pool, maintenance stop, auto hobby shop, power generating plant and three radar sets. The facility was reported to have generated approximately 100 gallons of waste oil per year from the maintenance areas and two drums at waste oil per month from the generating facilities. These waste oils have been sent to Travis AFB since approximately 1973. It is not known how the waste oils were disposed of prior to 1973. Additional miscellaneous industrial wastes such as paint wastes were also hauled to Travis AFB.

The facility is equipped with a primary, secondary and tertiary sewage treatment system which is still being operated. The tertiary system was installed approximately in 1972. Water is supplied by an on-site well. Solid waste was hauled off-site by a contractor. The station was reported to have had several PCB transformers located throughout the facility. The transformers were sampled and removed by a contractor in 1981. The Air Force Declaration of Excess study conducted in 1980 by the Travis AFB Real Estate Office revealed that no known contamination existed at the site.

Point Arena Annex

On December 18, 1950, the 776th Radar Squadron was activated as a long range radar (LRR) site to conduct air defense operations for the Portland Air Defense Sector (POADS) of the 25th Air Division. The site was utilized as a manual back-up NORAD Control Center (NCC) starting in 1966. Beginning in 1966, the site was used as a manual Back-up Intercept Control (BUIC) Center under the BUIC II Program and become the San Francisco NORAD control center (SFNCC) of the 26th Air Division of the Fourth Air Force. The squadron transferred to the 27th Air Division of the Tenth Air Force in 1969. Shortly thereafter, in 1970, the site was returned to the 26th Air Division as an LRR site. The support base was transferred to the 60th Air Base Group at Travis Air Force Base in 1973.

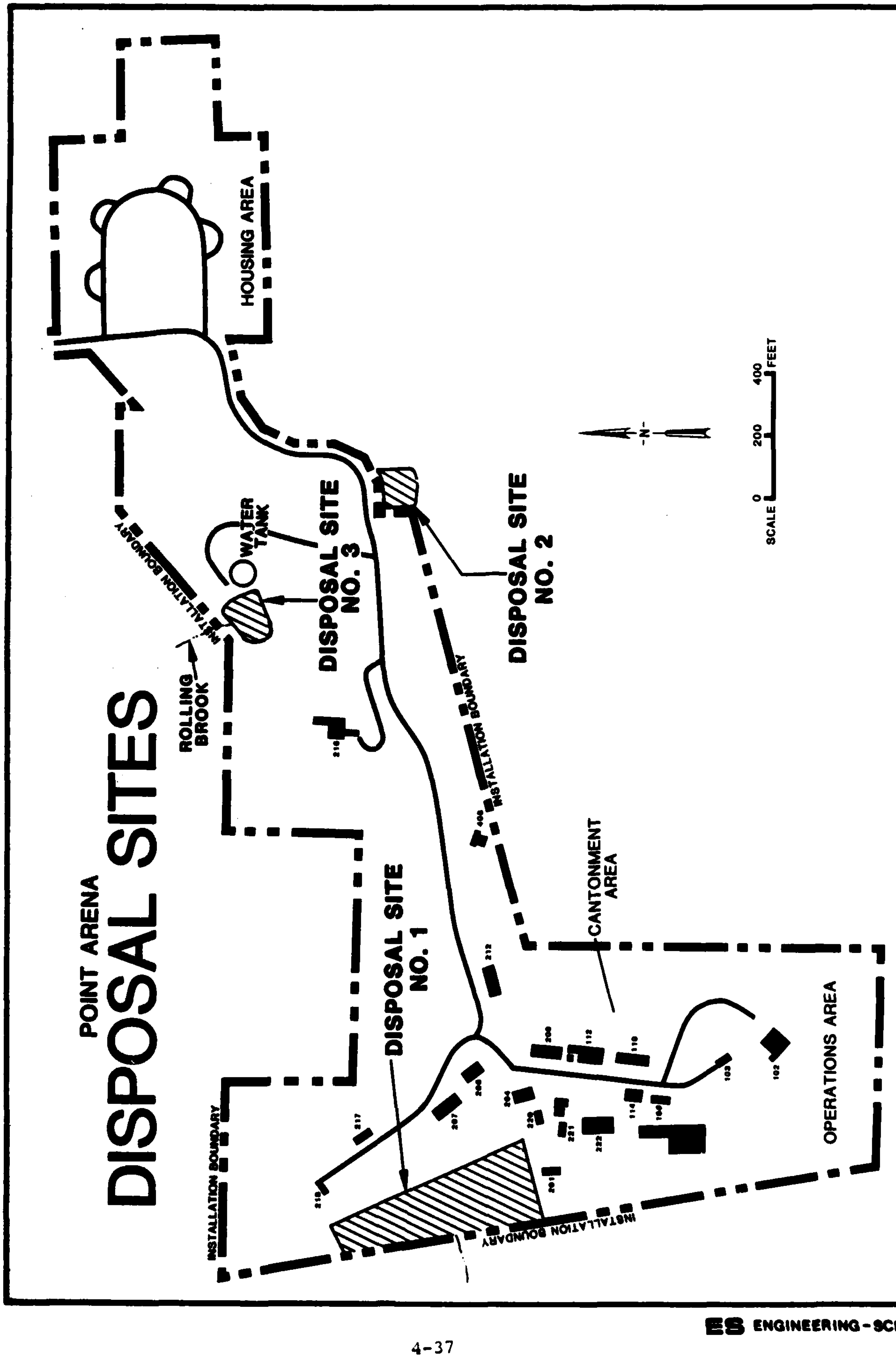
Point Arena AFS is located on the top of a 2,400 foot high mountain in Northern California, approximately 12 miles east of the City of Point Arena and 150 miles north of San Francisco (Figure 2.2). The total land area is approximately 81 acres.

Materials have been disposed of in three known locations at Point Arena. The three disposal sites are shown in Figure 4.11. Prior to the early 1960's, waste generation was less than during the ensuing years, and most of the waste material was hauled to the county dump. Since approximately 1960, an area of several acres north of Building 201 has been used for the disposal of non-putrescible refuse such as lumber, cans, sheet metal, concrete rubble, and old car bodies. Materials at this location, designated Disposal Site No. 1, have been disposed of in downslope areas and covered with earth. A small area in the middle of the site has been used for burning materials. Some waste oils, paint thinners, and solvents which were generated by vehicle maintenance and painting activities were burned at the site prior to 1978. A transformer was observed at the site; however, the oil has been tested and is not a PCB oil nor contaminated PCB oil. The site is also used as a storage facility for 55-gallon drums filled with waste oil and paint thinners. These materials are presently hauled to Travis AFB for disposal.

Disposal Site No. 2 is a small steep area located just off the facility property next to the main facility road southwest of the family housing area. A small amount of roofing material (shingles, lumber, etc.) was disposed of at this site by dumping the material downslope from the edge of the road. The material is uncovered, and some of the lumber has worked its way several hundred feet downslope. No metal, drums, or chemical wastes appear to have been disposed of at this location.

Disposal site No. 3 is an earthen dam which impounds the fire pond in the north central portion of Point Arena. Concrete rubble and hard fill is present on the face of the dam and was apparently placed there for erosion protection. No metal or other materials appear to have been disposed there. At the foot of the dam, a reddish-orange substance is present in a low, wet area. This material extends into Rolling Brook,

FIGURE 4.11



SOURCE: TRAVIS AFB INSTALLATION DOCUMENTS

which emanates from the fire pond. The origin of the deposit is unknown, but may be related to the mineral content of the water. Water samples taken at this location showed iron and manganese concentrations to be 2,740 mg/l and 2,000 mg/l respectively. While these are not unusual, concentration for naturally mineral-rich water, the level were in excess of EPA drinking water standards of 300 mg/l for iron and 50 mg/l for manganese.

The facility obtains its drinking water from an impoundment on Rolling Brook and from springs in the vicinity of the water treatment plant. During the low flow of the summer months, the entire flow of Rolling Brook may be used. Water treatment consists of ammonium alum dosing, pressure sand filtration, and chlorination. There are two 75,000 gallon treated water storage tanks. Except for occasional problems with turbidity, color, and odor, the chemical and bacterial quality of the water supply has been satisfactory. On June 2, 1982, inorganic chemical and pesticide analysis were performed on samples from two drinking water sources, Rolling Brook and Spring Number 1. Results show that EPA and California drinking water maximum standards were not exceeded. During the late 1970's, the water tank was sand blasted. The area surrounding the water storage tank was contaminated with paint particles. Surface soil samples collected by the State of California showed heavy metal concentrations of the following parameters:

Parameters	Concentration Detected
Zinc	6,000 ppm
Iron	9,410 ppm
Lead	2,270 ppm

The surface soils around the tanks were recently removed and disposed of in an off-base landfill.

Sanitary wastewater at the station is treated in two parallel extended aeration package wastewater treatment plants. The average daily flow rate is nearly 25,000 gallons. The chlorinated effluent (approximately 5,000 gallons per day) is discharged to the surrounding hillside and flows onto property leased from a lumber company. The point of discharge is approximately one-half mile to the headwaters of a tributary of the Garcia River.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

The review of past operation and maintenance functions and past waste management practices at Travis AFB has resulted in the identification of sites which were initially considered as areas of concern with regard to the potential for contamination, as well as the potential for the migration of contaminants. These sites were evaluated using the Decision Tree Methodology referred to in Figure 1.1. Those sites which were considered as not having a potential for contamination were deleted from further consideration. Those sites which were considered as having a potential for the occurrence of contamiantion and migration of contaminants were further evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.4 identifies the decision tree logic used for each of the areas of initial concern.

Based on the decision tree logic 3 of the 19 sites originally reviewed were not considered to warrant evaluation using the Hazard Assessment Rating Methodology. The rationale for omitting these three sites from HARM evaluation is discussed below.

The abandoned oxidation pond in the southeast most corner of the base is now being used to accept scrap wood wastes. These wastes are not considered to be hazardous and therefore no further consideration was given to this site.

Disposal site No. 2 at the Point Arena AFS was also identified as having received only hardfill material and construction debris. These materials are not considered to be hazardous; therefore, the site was not rated.

TABLE 4.4
SUMMARY OF DECISION TREE LOGIC FOR AREAS OF INITIAL ENVIRONMENTAL CONCERN AT TRAVIS AFB

Site Description	Potential For Contamination	Potential For Contaminant Migration	Potential For Other Environmental Concern	Refer to Base Environmental Programs	HARM Rating
Landfill No. 1	Yes	Yes	N/A	N/A	Yes
Landfill No. 2	Yes	Yes	N/A	N/A	Yes
Landfill No. 3	Yes	Yes	N/A	N/A	Yes
Fire Protection Training Area No. 1	Yes	Yes	N/A	N/A	Yes
Fire Protection Training Area No. 2	Yes	Yes	N/A	N/A	Yes
Fire Protection Training Area No. 3	Yes	Yes	N/A	N/A	Yes
Fire Protection Training Area No. 4	Yes	Yes	N/A	N/A	Yes
Sewage Treatment Plant Inactive Oxidation Ponds	Yes	Yes	N/A	N/A	Yes
Sewage Treatment Plant Sludge Disposal Area	Yes	Yes	N/A	N/A	Yes
Sewage Treatment Plant Wood Disposal Area	No	No	N/A	N/A	No
Solvent Spillage	Yes	Yes	N/A	N/A	Yes
Oil Spillage	Yes	Yes	N/A	N/A	Yes
JP-4 Spill - 1978	Yes	Yes	N/A	N/A	Yes
Radioactive Waste Burial Site No. 1 (RB-1)	Yes	Yes	N/A	N/A	Yes
Radioactive Waste Burial Site No. 2 (RB-2)	Yes	Yes	N/A	N/A	Yes
Disposal Site No. 1 - Point Arena	Yes	Yes	N/A	N/A	Yes
Disposal Site No. 2 - Point Arena	No	No	N/A	N/A	No
Disposal Site No. 3 - Point Arena	Yes	Yes	N/A	N/A	Yes
Water Tank Sand Blast Area - Point Arena	Yes	No	N/A	N/A	No

N/A - Not Applicable.

The contamination created from sand blasting the water tanks at the Point Arena AFS was removed from the surface of the soils in the area immediately surrounding the tanks. The contaminated soils were disposed of in an off-base landfill. The site is therefore no longer considered to have a potential for contaminant migration.

The remaining 16 sites identified on Table 4.4 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. The details of the rating procedures are presented in Appendix G. Results of the assessment for the sites are summarized in Table 4.5. The HARM system is designed to indicate the relative need for follow-on action. The information presented in Table 4.5 is intended for assigning priorties for further evaluation of the Travis AFB disposal areas (Chapter 5, Conclusions and Chapter 6, Recommendations). The rating forms for the individual waste disposal sites at Travis AFB are presented in Appendix H. Photographs of some of the key disposal sites are included in Appendix F.

TABLE 4.5
SUMMARY OF HARM SCORES FOR POTENTIAL CONTAMINATION SOURCES

Rank	Site Name	Receptor Subscore	Waste Characterization Subscore	Pathways Subscore	Waste Management Factor	Overall Total Score
1	Fire Protection Training Area No.4	61	90	43	1.0	65
2	Fire Protection Training Area No. 3	55	90	43	1.0	63
3	Disposal Site No. 1 (Point Arena)	49	45	81	1.0	58
4	Landfill No. 2	55	38	65	1.0	53
4	Solvent Spillage	51	72	35	1.0	53
6	Landfill No. 3	49	60	43	1.0	51
7	Fire Protection Training Area No. 1	54	72	28	0.95	49
8	Fire Protection Training Area No. 2	52	72	28	0.95	48
9	Disposal Site No. 3 (Point Arena)	49	10	81	1.0	47
10	JP-4 Spill - 1978	49	48	43	0.95	44
11	Oil Spillage	51	45	35	1.0	43
12	Sewage Treatment Plant (STP) Sludge Disposal Areas	64	12	43	1.0	40
13	Sewage Treatment Plant (STP) Abandoned Oxidation Ponds	64	8	43	1.0	38
14	Radioactive Waste Burial Site No. 2 (RB-2)	49	15	43	1.0	36
15	Landfill No. 1	57	4	43	1.0	35
16	Radioactive Waste Burial Site No. 1 (RB-1)	49	40	43	0.10	4

CHAPTER 5

CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is the potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on the assessment of the information collected from the project team's field inspection, review of records and files, review of the environmental setting, and interviews with base personnel, past employees and state and local government employees. Table 5.1 contains a list of the potential contamination sources identified at Travis AFB and a summary of HARM scores for those sites.

FIRE PROTECTION TRAINING AREA NO. 4

Fire Protection Area No. 4 has a high potential for environmental contamination. Training exercises have been conducted in this area since 1962. Prior to the early 1970's waste fuel, oils and solvents were used as fuel during the exercises. The waste materials were delivered to the site in 55-gallon drums. Since the early 1970's only JP-4 has been used at the site. Surface runoff from the site is not contained and has flowed over the adjacent areas into ditches leading to Union Creek. The creek is situated within 300 feet of the site. The site is underlain by clayey soils. Ground water probably occurs at a maximum depth of 20 feet. The site received a HARM score of 65.

FIRE PROTECTION TRAINING AREA NO. 3

Fire Protection Training Area No. 3 has a high potential for environmental contamination. The site was used for fire training exercises between 1953 and 1962. A considerable amount of waste fuel, oil, and solvents were burned at the site. It was reported that as much as 20 to 30 55-gallon drums per week of waste materials may have been burned at

TABLE 5.1
PRIORITY RANKING OF POTENTIAL CONTAMINATION SOURCES
TRAVIS AFB

Rank	Site Name	Date of Operation or Occurrence	Overall Total Score
1	Fire Protection Training Area No. 4	1962 - Present	65
2	Fire Protection Training Area No. 3	1953 - 1962	63
3	Disposal Site No. 1 (Point Arena)	1951 - Present	58
4	JP-4 Spill - 1978	1978	54
5	Landfill No. 2	Late 1950's - 1974	53
6	Solvent Spillage	Prior to June 1981 - Length of Time Unknown	53
7	Landfill No. 3	1972 - 1977	51
8	Fire Protection Training Area No. 1	1943 - 1950	49
9	Fire Protection Training Area No. 2	1950 - 1952	48
10	Disposal Site No. 3 (Point Arena)	Unknown	47
11	Oil Spillage	1983 - Length of time unknown	43
12	Sewage Treatment Plant (STP) Sludge Disposal Areas	Early 1950's - Late 1970's	40
13	Sewage Treatment Plant (STP) Inactive Oxidation Ponds	Early 1950's - Late 1970's	38
14	Radioactive Waste Burial Site No. 2 (RB-2)	Late 1940's - 1962	36
15	Landfill No. 1	1942 - Mid 1950's	35
16	Radioactive Waste Burial Site No. 1 (RB-1)	Late 1940's - 1962	4

the site. The waste was delivered to the site in bowsers and drums. Runoff generated from the exercises was released to the adjacent surface areas. The site is underlain by clayey soils. Ground-water depth probably occurs at a maximum depth of 20 feet. The site received a HARM score of 63.

DISPOSAL SITE NO. 1 (POINT ARENA AFS)

Disposal Site No. 1 located at the Point Arena AFS has a moderate potential for environmental contamination. It has been used for the disposal of non-putrescible refuse such as lumber, cans, sheet metal, concrete rubble and old car bodies. A small area in the center of the disposal site was used for burning materials. Some waste oils, paint thinners and solvents were burned at the site prior to 1978. The site was used for a period as a storage area for drums of waste oils and paint thinners. A non-PCB transformer was also observed at the site. The disposal site is underlain by loamy soils. Ground water which may occur in the area would be limited to the soil mantle at shallow depths. The site received a HARM score of 58.

LANDFILL NO. 2

Landfill No. 2 has a moderate potential for environmental contamination. The landfill, located northwest of the main runway, received general refuse generated at the base between 1950 and 1974. Sludge from the cleaning of fuel tanks and other minor amounts of industrial wastes may have also been disposed of within the landfill. The operation involved trenching and filling with cover applied at least twice per week. On occasions fires were reported to have occurred in the landfill. The trench locations are still evident due to even settling which has occurred at the site. The clayey cover material in conjunction with the uneven contours in the area have made the site conducive to ponding during wet periods. The site is underlain with clayey soils. Ground-water depth probably occurs at a maximum depth of 20 feet. The site received a HARM score of 53.

SOLVENT SPILLAGE

The solvent spillage site has a moderate potential for environmental contamination. The site was used for routine stripping of large aircraft parts. The spillage was detected in the summer of 1981; however, the length of time which the spillage had occurred is uncertain. It was reported that approximately 55 gallons per day of MEK, toluene or tetraethylene glycol dimethyl ether was leaking from a collection tray. Some of the chemicals are suspected to have soaked into the ground in the area. The site is underlain with clayey soils. Ground water is probably at a maximum depth of 20 feet. The site received a HARM score of 53.

LANDFILL NO. 3

Landfill No. 3 has a moderate potential for environmental contamination. The site is located in the western portion of the base adjacent to the munitions storage bunkers. It was used between 1972 and 1977 to dispose of empty pesticide containers and alkaline rinsate used to rinse the containers. The materials were buried in narrow trenches approximately 6 feet deep. The trenches were covered with about 3 feet of soil. No evidence of the site is apparent from the surface. Soil under laying the area is of a clayey nature. Ground water in this area is probably at a maximum depth of 20 feet. The site received a HARM score of 51.

FIRE PROTECTION TRAINING AREA NO. 1

Fire Protection Training Area No. 1 has a low potential for environmental contamination. Training exercises were likely conducted at this site from the time the base was first activated around 1943 until 1950. The site is in an area now occupied by barracks. As was common during the period, fuels, oils and solvents were burned at the site. FPTA No. 1 is underlain with clayey soils. Ground water probably occurs at a maximum depth of 20 feet. The site received a score of 49.

FIRE PROTECTION TRAINING AREA NO. 2

Fire Protection Training Area No. 2 has a low potential for environmental contamination. Training exercises were conducted at the site for less than two years between 1950 and 1952. The site is located in the same general area as FPTA No. 3. This training area was also reported to have received drums of wastes for burning during training exercises. The waste comprised fuels, oils and solvents. Runoff from the site was allowed to drain over the adjacent areas. The site is underlain by clayey soils. It is now covered by a concrete pad and therefore it is suspected that the contaminated surface soils were removed. Ground-water depth probably occurs at a maximum depth of 20 feet. The site received a HARM score of 48.

DISPOSAL SITE NO. 3 (POINT ARENA AFS)

Disposal Site No. 3 located at the Point Arena AFS has a low potential for environmental contamination. The site is actually an earthen dam which impounds the fire pond in the north central portion of the Air Force Station. Concrete rubble and hardfill is present on the base of the dam. At the foot of the dam, a reddish-orange substance is present in a low, wet area. The material extends into Rolling Brook, which emanates from the fire pond. The origin of the deposit is unknown, but may be related to the mineral content of the water which was found to have high concentrations of iron and manganese. Soils in the area are of a loamy nature. The site received a HARM score of 47.

JP-4 SPILL - 1978

The JP-4 spill which occurred in May 1978 has a low potential for any long term environmental contamination. The spill involved approximately 15,000 gallons of fuel which escaped from a storage tank in the southwest corner of the base. The spilled fuel entered an adjacent drainage ditch which flowed into Union Creek. Some of the spilled fuel was known to have discharged from the base boundaries; however, clean-up efforts were implemented to trap and vacuum up the fuels in the creek. The spill was reported to have killed the aquatic wildlife in a two mile area along Union Creek. The primary type of soils found in the area are made up of clayey materials. Ground water in the area is probably at a maximum depth of 20 feet. The site received a HARM score of 44.

OIL SPILLAGE

The site behind Building 16 which was used to discard waste oil on the surface of the soil has a low potential for environmental contamination. It is not known what quantities of oil were spilled in the small area; however, the area is presently stained with an oily residue. It is suspected that some of the oil spillage which occurred in the area may have been very recent. The site is located in the mist of an industrialized area of the base and is surrounded by buildings and asphalt roads. Ground water in the area is probably at a depth of 20 feet. The site received a HARM score of 43.

SEWAGE TREATMENT PLANT - SLUDGE DISPOSAL AREA

The areas which were used for the disposal of digested sludge from the Travis AFB sewage treatment plant have a low potential for environmental contamination. The plant treated primarily domestic sewage generated at the base; however, some industrial wastes were known to have entered the system. It is unlikely that the sludge would have contained any large concentrations of toxic chemicals. The sites are underlain with clayey soils. Ground water depth is probably a maximum of 20 feet below the surface. The site received a HARM score of 40.

SEWAGE TREATMENT PLANT - INACTIVE OXIDATION PONDS

The oxidation ponds used during the period the base treated its own domestic sewage have a low potential for environmental contamination. The Travis AFB STP treated primarily domestic sewage; however, some industrial wastes may have entered the system at various times. The oxidation ponds were a part of the overall treatment system. The permeability of the clay base of the ponds is not known; but they were reported to have retained water without any noticable losses. One pond is presently being used as a disposal site for scrap wood. Ground water in the area is probably at a maximum depth of 20 feet. The site received a HARM score of 38.

RADIOACTIVE WASTE BURIAL SITE NO. 2 (RB-2)

Radioactive Waste Burial Site No. 2 has a low potential for environmental contamination. The site was used for burying low level contaminated materials such as clothing and gloves. It is located south of Building 906 and is presently fenced and posted with warning signs. Surface radiation tests conducted in 1980 indicated radiation levels were comparable to the background levels found on the base. A portion of the site was excavated during 1980 and swipe samples of the uncovered materials indicated negligible low level alpha, beta and gamma radiation. The site is underlain by clayey soils. Ground water in the area is probably of a maximum depth of 20 feet. The site received a HARM score of 36.

LANDFILL NO. 1

Landfill No. 1 has a low potential for environmental contamination. The site was used as a landfill from around 1942 when the base was first activated until the mid 1950's. The landfill was situated in an excavated area. The operation involved trench and fill practices with daily burning to reduce the volume. The burning practice, would likely have reduced the long term hazards posed by the disposal of any industrial wastes. The site is underlain by clayey soils. Ground water is probably at a maximum depth of 20 feet. Landfill No. 1 received a HARM score of 35.

RADIOACTIVE WASTE BURIAL SITE NO. 1 (RB-1)

Radioactive Waste Burial Site No. 1 has a low potential for environmental contamination. The site comprises a 5,000 gallon underground steel tank which received washwater used to clean protective clothing and other equipment used in the handling and serving of nuclear weapons as well as general washdown from the building in which close activities occurred (Building 903). The site received this washwater from the late 1940's until the early 1960's.

Periodic monitoring of the liquid disposal area since 1962 indicates that surface alpha, beta and gamma radiation does not exceed background levels. Surface soil samples collected from the area in 1980 also showed radioactivitiy levels comparable to background levels. Samples of the liquid inside the tank indicated alpha radioactivity within the limits for drinking water. The only significant radioactivity detected was from a swipe sample collected from a drain plug found on the pipeline leading from Building 903 to the underground tank. The plus is covered with an additional cap to prevent radiation exposure to persons working in the building. The site received a HARM score of 4. The low score is due primarily to containment measures used at the site.

TCE CONTAMINATION IN STORM SEWERS AND UNION CREEK

TCE has been detected in Union Creek and several of the storm sewer lines on the base. The highest concentrations of TCE have been detected in the storm sewers serving the shops along the flightline. The data indicate that there are probably more than one source for the TCE found in Union Creek; however, no actual sources could be identified from the available data. No TCE is currently used on the base and the record search did not provide any indication or locations where TCE had been discharged to the storm sewers.

CHAPTER 6

RECOMMENDATIONS

Sixteen sites were identified at Travis AFB and Point Arena AFS as having the potential for environmental contamination and have been evaluated using the HARM system. This evaluation assessed their relative potential for environmental contamination and identified those sites where further study and monitoring may be necessary. Of primary concern are those sites with a high potential for environmental contamination that should be investigated in Phase II. Sites of secondary concern are those with moderate potential for environmental contamination. Further investigation at these sites may also be recommended. No further monitoring is recommended for those sites with low potential for environmental contamination, unless other data collected indicate a potential problem could exist at one of these sites. All sites have been reviewed with regard to future land use restrictions which may be applicable due to the nature of each site.

PHASE II MONITORING RECOMMENDATIONS

The following recommendations are made to further assess the potential for environmental contamination from waste disposal areas at Travis AFB and Point Arena AFS. The recommended actions are generally one-time sampling programs to determine if contamination does exist at the site. If contamination is identified, the sampling program may need to be expanded to further define the extent of contamination. The recommended monitoring program for Phase II is summarized in Table 6.1.

1) Fire Protection Training Area No. 4 has a high potential for environmental contamination and monitoring of this site is recommended. A ground-water monitoring system should be established to characterize the ground-water quality and identify any contaminant migration. One upgradient and two downgradient monitoring wells should

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II
TRAVIS AFB

Site	Rating Score	Recommended Monitoring	Comments
1) Fire Protection Training Area No. 4	65	Install one upgradient and two downgradient ground-water monitoring wells. Wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Sample these wells and analyze for parameters in Table 6.2, List A. Sample surface water from ditch adjacent to the fire training area during a rainfall event and analyze for the parameters in Table 6.2, List A.	Continue monitoring if sampling indicates contamination. Additional wells may be necessary to assess extent of contamination.
2) Fire Protection Training Area No. 3	63	Install one upgradient and two downgradient ground-water monitoring wells. Wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Sample these wells and analyze for parameters in Table 6.2, List A.	Continue monitoring if sampling indicates contamination. Additional wells may be necessary to assess extent of contamination.
3) Disposal Site No. 1 (Point Arena AFS)	58	Install one upgradient and three downgradient ground-water monitoring wells. Wells should be constructed of Schedule 40 PVC, screened into the top of the water table between 5 and 20 feet deep. Sample these wells and analyze for parameters in Table 6.2, List B.	Continue monitoring if sampling indicates contamination. Additional wells may be necessary to assess extent of contamination.
4) Landfill No. 2	53	Install two upgradient and three downgradient ground-water monitoring wells. Wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Sample these wells and analyze for parameters in Table 6.2, List B.	Continue monitoring if sampling indicates contamination. Additional wells may be necessary to assess extent of contamination.

TABLE 6.1 (Continued)
RECOMMENDED MONITORING PROGRAM FOR PHASE II
TRAVIS AFB

Site	Rating Score	Recommended Monitoring	Comments
5) Solvent Spillage	53	Install one upgradient and two downgradient ground-water monitoring wells in the area of the spill site. Wells should be constructed of stainless steel, screened into the top of the water table (about 25 feet deep). Sample these wells and analyze for TOC, MEK, TCE, toluene and tetraethylene glycol dimethyl ether.	Establish additional sampling stations if contamination is found to determine the extent of contamination.
6) Landfill No. 3	51	Install one upgradient and two downgradient ground-water monitoring wells. Wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Sample these wells and analyze for chlorinated hydrocarbon and organophosphate pesticide scan.	Establish additional sampling stations if contamination is found to determine the extent of contamination.
7) Disposal Site No. 3 (Point Arena AFS)	47	Collect sediment samples from orange deposit at base of earthen dam. Analyze for parameters in Table 6.2, List C.	Continue monitoring if sampling indicates contamination.
8) Additional Monitoring		Conduct additional investigations on the storm sewer system to identify the source(s) of TCE contamination.	Each storm sewer line having signficant concentrations of TCE should be sampled upstream and downstream of the high concentrations of TCE until the source(s) can be identified.

be installed adjacent to the fire protection training area. The wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Samples collected from these wells should be analyzed for the parameters in Table 6.2, List A. Additionally, a surface water sample should be collected from the ditch adjacent to the fire training area. The sample should be collected immediately following a rainfall event and analyzed for the parameters in Table 6.2, List A.

2) Fire Protection Training Area No. 3 has a high potential for environmental contamination and monitoring of this site is recommended. A ground-water monitoring system should be established to characterize the ground-water quality and identify any contaminant migration. One upgradient and two downgradient monitoring wells should be installed adjacent to the fire protection training area. The wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Samples collected from these wells should be analyzed for the parameters in Table 6.2, List A.

3) Disposal Site No. 1 located at the Point Arena AFS has a moderate potential for environmental contamination. A ground-water monitoring system should be established to characterize the ground-water quality and identify any contaminant migration in the vicinity of the landfill. One upgradient and three downgradient monitoring wells should be installed in the area adjacent to the landfill. The wells should be constructed of Schedule 40 PVC, screened into the top of the water table (between 5 and 20 feet deep). Samples collected from these wells should be analyzed for the parameters in Table 6.2, List B.

4) Landfill No. 2 has a moderate potential for environmental contamination. A ground-water monitoring system should be established to characterize the ground-water quality and identify any contaminant migration. One upgradient and four downgradient monitoring wells should be installed in the area adjacent to the landfill. The wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Samples collected

TABLE 6.2
RECOMMENDED LIST OF ANALYTICAL PARAMETERS
TRAVIS AFB

List A

Carbon Tetrachloride	Methylene Chloride
Trichloroethane	Total Organic Halogens (TOH)
Trichloroethylene	Total Organic Carbon (TOC)
Phenols	Total Dissolved Solids (TDS)
Oils and Grease	pH
Methyl Ethyl Ketone (MEK)	Lead

List B

GC/MS Scan	Manganese
Total organic carbon	Oil and Grease
Phenol	Nickel
pH	Cyanide
Copper	Sulfate
Iron	Total dissolved solids
Zinc	

Interim Primary Drinking Water Standards (selected list)

Arsenic	Lead	Endrin	2,4,5-TP
Barium	Mercury	Lindane	
Cadmium	Nitrate	Methoxychlor	
Chromium	Selenium	Toxaphene	
Fluoride	Silver	2,4-D	

List C

Oil and Grease	Barium
TOC	Cadmium
pH	Chromium
Copper	Lead
Zinc	Mercury
Manganese	Selenium
Nickel	Silver
Arsenic	

from these wells should be analyzed for the parameters in Table 6.2, List B.

5) The area situated adjacent to Building 550 where solvent had been spilled has a moderate potential for environmental contamination. A ground-water monitoring system should be established to characterize the ground-water quality and identify any contaminant migration. One upgradient and two downgradient monitoring wells should be installed in the area of the spill site. The wells should be constructed of stainless steel, screened into the top of the water table (about 25 feet deep). Samples collected from these wells should be analyzed for TOC, MEK, TCE, toluene, tetramethylene glycol dimethyl ether.

6) Landfill No. 3 has a moderate potential for environmental contamination. A ground-water monitoring system should be established to characterize the ground-water quality and identify any contaminant migration. One upgradient and two downgradient monitoring wells should be installed in the area adjacent to the landfill. The wells should be constructed of Schedule 40 PVC, screened into the top of the water table (about 25 feet deep). Samples collected from these wells should be analyzed for a chlorinated hydrocarbon and organophosphate pesticide scan.

7) Disposal Site No. 3 located at the Point Arena AFS has a low potential for environmental contamination. An orange deposit was observed at the foot of an earthen fire pond dam. Samples of the orange deposit should be collected to characterize its constituents. The sample should be analyzed for the parameters in Table 6.2, List C.

8) Additional investigations should be conducted to identify the source(s) of TCE contamination in the storm sewer system within the base. Previous investigations have indicated that the TCE is originating from shop areas along the flightline. The investigations should be designed to further pinpoint the source of contamination.

RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

It is desirable to have land use restrictions for the following reasons: (1) to provide the continued protection of human health, welfare, and the environment; (2) to insure that the migration of potential contaminants is not promoted through improper land uses; (3) to facilitate the compatible development of future USAF facilities; and (4) to allow for identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions at each of the identified disposal and spill sites at Travis AFB and Point Arena AFS are presented in Table 6.3. A description of the land use restriction guidelines is presented in Table 6.4. Land use restrictions at sites recommended for Phase II monitoring should be reevaluated upon the completion of the Phase II monitoring program and changes made where appropriate.

TABLE 6.3

RECOMMENDED GUIDELINES FOR FUTURE LAND USE RESTRICTIONS AT POTENTIAL CONTAMINATION SITES

Site Name	Construction on the site	Excavation	Well construction on or near the site	Agricultural use	Silvicultural use	Water infiltration (Run-on, ponding, irrigation)	Recreational use	Burning or ignition source	Disposal operations	Vehicular traffic	Material storage	Housing on or near the site
FPTA No. 4	NR	R	R	R	R	NR	R	NR	R	NR	N/A	R
FPTA No. 3	NR	R	R	R	R	NR	R	NR	R	NR	N/A	R
Disposal Site No. 1 (Point Arena)	R	R	R	R	R	NR	R	NR	R	NR	N/A	R
FPTA No. 2	NR	R	R	R	NR	NR	R	NR	R	NR	N/A	R
FPTA No. 1	NR	R	R	R	NR	NR	R	NR	R	NR	N/A	R
Landfill No. 2	R	R	R	R	R	R	R	NR	R	NR	NR	R
Solvent Spillage	NR	NR	R	R	N/A	NR	R	NR	R	NR	NR	R
Landfill No. 3	R	R	R	R	R	NR	R	NR	R	NR	NR	R
Disposal Site No. 3 (Point Arena)	R	R	R	R	R	NR	R	NR	NR	R	NR	R
JP-4 Spill 1978	NR	N/A	NR	N/A	N/A	NR	N/A	NR	NR	N/A	N/A	N/A
Oil Spillage	NR	NR	NR	R	N/A	NR	R	NR	R	NR	NR	R
STP Sludge Disposal Arena	NR	NR	R	R	NR	NR	R	NR	NR	NR	NR	R
STP Abandoned Oxidation Ponds	NR	NR	NR	R	NR	NR	R	NR	NR	NR	NR	R
RB-2	R	R	R	R	R	R	R	R	R	R	NR	R
Landfill No. 1	R	R	R	R	R	R	R	NR	NR	NR	NR	R
RB-1	R	R	R	R	R	R	R	R	R	R	R	R

R = Restriction
N/A = Not Applicable
PU = Present Use
NR = No Restriction

See Table 6.4 for definition of Land Use Restrictions

TABLE 6.4
DESCRIPTION OF GUIDELINES FOR LAND-USE RESTRICTIONS

Guideline	Description
Construction on the site	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover or subsurface materials.
Well construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will vary from site to site, based on prevailing soil conditions and ground-water flow.
Agricultural use	Restrict the use of the site for any and all agricultural purposes to prevent food chain contamination.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials).
Water infiltration	Restrict water run-on, ponding and/or irrigation of the site. Water infiltration could produce contaminated leachate.
Recreational use	Restrict the use of the site for recreational purposes.
Burning or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Vehicular traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.

APPENDIX A

BIOGRAPHICAL DATA

D. G. Johnson, P.E.

Y. Nordhav

E. J. Schroeder, P.E.

M. I. Spiegel

Biographical Data

DAVID G. JOHNSON

Environmental Engineer

PII Redacted

[redacted]

Education

B.S. in Civil Engineering with Highest Honors, University of Texas, Austin, Texas, 1977

M.S. in Engineering (Environmental Health), University of Texas, Austin, Texas, 1979

Professional Affiliations

Registered Professional Engineer (Texas No. 52932)
Water Pollution Control Federation

Honorary Affiliations

Tau Beta Pi
Chi Epsilon
Phi Kappa Phi
Phi Eta Sigma

Experience Record

1976-77	University of Texas, Austin, Texas, Dept. of Civil Engineering - Research Assistant II. Performed data reduction and analysis and application of computer models to predict dynamic wheel loadings on pavements and bridges.
1977-78	University of Texas, Austin, Texas, Dept. of Engineering (Environmental Health) - Research Assistant II. Performed literature review and analysis of data pertaining to the sources and influx of nitrogen species into confined aquifers, and the fate of ammonia used for in-situ uranium solution mining.
1978-80	Espey, Huston & Associates, Inc. - Staff Engineer I. Preparation of Federal Flood Insurance Studies for thirteen coastal communities and four counties in Texas. Responsible for the data collection, hydrologic and hydraulic analyses and report writing, as well as coordination of staff engineers and technicians involved in the project. Extensive use was made of the computer program HEC-2. Prepared outfall drainage studies for the communities of Refugio and Missouri City, Texas, outlining existing drainage problems and alternative improvements. Designed drainage ditch improvements for a major Houston, Texas subdivision.

David G. Johnson (Continued)

1980-Present Engineering-Science, Inc. Project Engineer on 201 Step 1 studies for the communities of Edinburg and Sugar Land, Texas. Activities included preparation of an Environmental Information Document for Edinburg and Facility Plan for Sugar Land.

Project Engineer for Phase 1 Installation Restoration Program projects for the Department of Defense. Evaluated radioactive and hazardous materials handling and waste disposal activities at several Air Force bases to identify practices potentially resulting in groundwater contamination and contaminant migration beyond property boundaries. Past disposal sites were ranked to establish a priority basis for futher investigations.

Project Engineer involved with the preparation of an EIS for a new central Florida phosphate mine. Project activities included an analysis of radionuclide redistribution as a result of mining and an evaluation of potential radiological impacts.

Project Manager on an evaluation of fly ash disposal alternatives for a large power plant. Objectives of the project included assessment of collection, transportation, and disposal methods, as well as the potential for fly ash reuse.

Project Engineer in charge of coordinating bench-scale biological treatability studies on a coal gasification wastewater project. Systems using various amounts of powdered activated carbon were evaluated. Adsorption isotherms and temperature-rate dependency tests were also performed.

Project Engineer in charge of the preparation of conceptual wastewater treatment system design for a major oil refinery expansion. Activities included estimation of waste loads, and evaluation and conceptual design of collection and treatment facilities. Project Manager in charge of discharge permit preparation and application.

Project Engineer involved with the development of a wastewater management program for a major chemical company. Treatment technologies evaluated included granular carbon adsorption, powdered activated carbon adsorption in an activated sludge system, incineration, solvent extraction, steam stripping, chemical treatment, deep-well injection, and wet air oxidation.

Project Engineer in charge of coordination of bench-scale testing for a secondary oil removal and slop oil

David G. Johnson (Continued)

handling system for an organic chemical plant wastewater. Dissolved air flotation tests were run to identify optimum operating procedures. Batch slop oil screening tests were performed to identify effective oil/solid/water emulsion-breaking agents.

Project Engineer responsible for the preparation of hazardous waste management plans for a small refinery. A Contingency Plan, Preparedness and Prevention Plan, Closure and Post-Closure Plan, Waste Analysis Plan, Inspection Schedule, and Personnel Training Program were prepared to meet RCRA requirements.

Project Manager responsible for the preparation of closure and post-closure plans for a Gulf Coast chemical facility. Closure and post-closure activities and cost estimates were included to meet RCRA requirements.

Publications

Brasewell, J., M. Breland, M. Chang, D. Hill, D. Johnson, R. Schechter, L. Turk, and M. Humenick. 1978. "Literature Review and Preliminary Analysis of Inorganic Ammonia Pertinent to South Texas In-Situ Leaching." Center for Research in Water Resources Report No. CRWR-155, EHE 78-01.

Garwacka, K., D. Johnson, M. Walsh, M. Breland, R. Schechter, and M. Humenick. 1979. "Investigation of the Fate of Ammonia from In-Situ Uranium Solution Mining." Technical Report EHE 79-01.

Johnson, D., and M. Humenick. 1979. "Nitrification and In-Situ Uranium Solution Mining," SPE No. 8321. Presented at the 1979 SPE Annual Technical Conference and Exhibition, Sept. 23-26, 1979 in Las Vegas, Nevada. Also presented at the Texas Section ASCE Fall 1979 meeting on October 4-6, 1979, at College Station, Texas.

Johnson, D. 1979. "Nitrification and In-Situ Uranium Solution Mining." Masters Thesis, University of Texas, Austin, Texas. August 1979.

Biographical Data

YANE NORDHAV

Hydrogeologist

PII Redacted

[redacted]

Education

B.A. in Political Science, 1974, University of Copenhagen

B.A. in Geology, 1976, University of California, Berkeley

M.Sc. candidate in Geology, 1983, California State University, Hayward

Professional Affiliations

Association of Environmental Professionals
Association of Women Geoscientists
Association of Engineering Geologists

Experience Record

1977-1980 Environmental Impact Planning Corporation, San Francisco, California. Geologist/Project Manager. Conducted geologic and hydrologic studies to evaluate adverse impacts of residential, commercial, and industrial developments. Responsible for evaluating effects on groundwater quality and quantity of converting 750 acres of prime agricultural land to residential use in Fresno County. Developed a water balance for the basin for existing and future conditions and estimated water quality impacts of installing septic tank systems in areas with a high water table and well-developed hardpan.

Supervised study of quantity and quality of available sand and gravel resources in Sacramento County, including an estimate of the cost-effectiveness of extraction versus importation. Conducted hydrogeologic investigation focusing on groundwater occurrence and movement, fault activity, and nature of soil material to determine suitable disposal sites for sludge generated in the San Francisco Bay area. Served as project manager for numerous environmental studies focusing on hazards from slope instability, settlement, subsidence, erosion, and flooding in California, Wyoming, and Nevada.

1981-Date Engineering-Science. Hydrogeologist/Project Manager. Responsible for hydrologic and geologic investigations supporting hazardous waste investigations and water resource development and groundwater management programs in a variety of geologic and hydrologic regimes. Activities include development of drilling programs, supervision of well installation, geophysical logging, and groundwater sampling for trace metals and organic analysis. Developed and supervised drilling programs to investigate potential groundwater contamination at Edwards AFB and McClellan AFB as part of the US Air Force's Installation Restoration Program - Phase II. Directed installation and sampling of groundwater monitoring wells and completion of soil borings downgradient from suspected contamination sources to determine the extent of area contamination resulting from past waste management practices of semiconductor firms. Involved in a study of past material handling practices at Drew Manufacturing Company to determine surface and subsurface distribution of trace metals and the extent of soil contamination.

Served as project manager on field investigations and preparation of environmental impact reports concerning increased discharge of wastewater treatment plant effluent to the Santa Ynez River in Santa Barbara County, development of an area subject to severe flooding in Richmond, California, and proposed gold mining operations in Napa County. Also involved in major research and field demonstration project investigating the feasibility of irrigating food crops with treated wastewater. Duties include preparing reports on studies of aerosol generation and pathogen dispersion as well as interpreting water quality and physical/chemical soils data.

#10.8

Biographical Data

ERNEST J. SCHROEDER

Environmental Engineer
Manager, Solid and Hazardous Waste

[PII Redacted]

[redacted]

Education

B.S. in Civil Engineering, 1966, University of Arkansas, Fayetteville, Arkansas
M.S. in Sanitary Engineering, 1967, University of Arkansas, Fayetteville, Arkansas

Professional Affiliations

Registered Professional Engineer (Arkansas No. 3259, Georgia No. 10618, Texas No. 33556 and Florida No. 0029175)
Water Pollution Control Federation
American Academy of Environmental Engineers

Honorary Affiliations

Chi Epsilon

Experience Record

1967-1976 Union Carbide Technical Center, Engineering Department, South Charleston, West Virginia (1967-1968). Project Engineer. Responsible for environmental protection engineering projects for various organic chemicals and plastics plants. Conducted industrial waste surveys, landfill design, and planning for plant environmental protection programs; evaluated air pollution discharges from new sources; reviewed a wastewater treatment plant design; and participated on a project team to design a new chemical unit.

Union Carbide Corporation, Environmental Protection Department, Texas City, Texas (1969-1975). Project Engineer and Engineering Supervisor. Responsible for various aspects of plant pollution abatement programs, including preparation of state and federal permits for wastewater treatment activities.

#10.8
ERNEST J. SCHROEDER (Continued)

Operations Representative on $8 million regional wastewater treatment project and member of design team which made the initial site selection and process evaluation and recommendation. Participated in contract negotiations, process and detailed engineering design, construction of the facilities, preparation of start-up manuals, operator training, and the start-up activities. Designated as Project Engineer after start-up on expansion to original waste treatment unit.

Engineering Supervisor responsible for operation of wastewater treatment facilities including collection system, sampling and monitoring programs, spill control and clean-up, primary waste treatment, wastewater transfer system, biological waste treatment, and waste treatment pilot plants. Developed odor control program which successfully reduced odor emissions and represented Union Carbide at a public hearing on community odor problems.

Led special projects such as an excess loss control program to reduce water pollution losses; sewer segregation program involving coordination and reporting of 38 projects for the separation of contaminated and non-contaminated water; and sludge disposal program to develop long-term sludge disposal alternatives and recover land in present sludge landfill area. Developed improved methods of sampling and continuous monitoring of wastewater.

Union Carbide Corporation, Environmental Protection Project Engineer, Toronto, Ontario, Canada (1975-1976). Responsible for the overall environmental permitting, engineering design, construction and start-up of waste treatment systems associated with a new refinery.

1976-Date Engineering-Science, Inc., Project Manager (1976-1978). Responsible for several industrial wastewater projects including the following: wastewater investigation to characterize sources of waste streams in a chemical plant and to develop methods to reduce the wastes, sludge settling studies to evaluate settling characteristics of activated sludge at a chemical plant, development of a process document for the design and operation of a wastewater treatment facility at a petrochemical complex, wastewater treatment evaluation which included characterization of wastewater, unit process evaluation, inhibition studies, design review, operations review, preparation of operations manual, operator training and providing operating assistance for waste treatment facilities, various biological treatability studies and bench-scale and pilot-scale evaluation of advanced waste treatment technologies such as granular carbon adsorption, multimedia filtration, powdered activated carbon treatment, ion exchange and ozonation.

#10.8

ERNEST J. SCHROEDER (Continued)

Project Manager for hazardous waste disposal projects involving waste characterization, development of criteria for disposal of hazardous waste, site investigation, preparation of permits, detailed design, construction of facilities and spill clean-up activities.

Deputy Project Manager for industry-wide pilot plant study of advanced waste treatment in the textile industry. Technologies evaluated included coagulation/clarification, multi-media filtration, granular carbon adsorption, powdered activated carbon treatment, ozonation and dissolved air flotation.

Engineering-Science, Inc., Manager of the Industrial Waste Group in the Atlanta, Georgia office (1978-1980). Responsible for the supervision of industrial waste project managers and project engineers and the management of industrial waste studies conducted in the office. Also directly involved in project management consulting with clients on environmental studies and environment assessment projects, e.g., project manager for several spill control and wastewater treatability projects and for a third-party EIS for a new phosphate mine in Florida.

Engineering-Science, Inc., Manager of Solid and Hazardous Waste Group in the Atlanta, Georgia office (1980-date). Responsible for the supervision of solid and hazardous waste project managers and project engineers and the management of solid and hazardous waste projects in the office. Project activities have included permit and regulatory assistance, environmental audits, waste management program development, delisting partitions, ground-water monitoring, landfill evaluations, landfill closure design, hazardous waste management, waste inventory, waste recovery/recycle evaluation, waste disposal alternative evaluation, transportation evaluation, and spill control and countermeasure planning.

Project Manager for eight Phase I Installation Restoration Program projects for the U.S. Air Force. The objective of this program is to audit past hazardous waste disposal practices that could result in migration of contaminants and recommend priority sites requiring further investigation. Also conducted environmental audits (air, water and solid waste) at several industrial facilities. Project manager for a contamination assessment and site cleanup being conducted for an industrial client as part of a consent degree agreement.

#10.8
ERNEST J. SCHROEDER (Continued)

Publications and Presentations

Schroeder, E. J., "Filamentous Activated Sludge Treatment of Nitrogen Deficient Waste," research paper submitted in partial fulfillment of the requirements for MSCE degree, 1967.

Schroeder, E. J. and Loven, A. W., "Activated Carbon Adsorption for Textile Wastewater Pollution Control," Symposium Proceedings: Textile Industry Technology, December 1978, Williamsburg, VA.

Schroeder, E. J., "Summary Report of the BATEA Guidelines (1974) Study for the Textile Industry," North Carolina Section of AWWA/ WPCA, Pinehurst, North Carolina, November 1979.

Mayfield, R. E., Sargent, T. N. and Schroeder, E. J., "Evaluation of BATEA Guidelines (1974) Textiles," U.S. EPA Report, Grant No. R-804329, February 1980.

Storey, W. A. and Schroeder, E. J., "Pilot Plant Evaluation of the 1974 BATEA Guidelines for the Textile Industry," Proceedings of the 35th Industrial Waste Conference, Purdue University, May 1980.

Pope, R. L., and Schroeder, E. J., 'Treatment of Textile Wastewaters Using Activated Sludge With Powdered Activated Carbon," U.S. EPA Report, Grant No. R-804329, December 1980.

Schroeder, E. J., "Industrial Solid Waste Management Program to Comply with RCRA," Engineering Short Course Instructor, Auburn University, October 1980.

Schroeder, E. J., "Technical and Economic Impact of RCRA on Industrial Solid Waste Management, Florida Section, American Chemical Society, May 1981.

Schroeder, E. J. and Sargent, T. N., "Hazardous Waste Site Rating Systems," Textile Wastewater Treatment and Air Pollution Control Conference, January 1983.

ES ENGINEERING-SCIENCE

Biographical Data

MARK I. SPIEGEL

Environmental Scientist

PII Redacted

[redacted]

Education

B.S. in Environmental Health Science (Magna cum laude), 1976, University of Georgia, Athens, Georgia

Limnology and Environmental Biology, University of Florida, Gainesville, Florida

MBA Candidate, Marketing, Georgia State University

Professional Affiliations

American Water Resources Association

Technical Association of the Pulp and Paper Industry

Experience Record

1974-1976 U.S. Environmental Protection Agency, Surveillance and Analysis Division. Cooperative Student. On assignment to Air Surveillance Branch, participated in ambient air study in Natchez, Mississippi, and operated unleaded fuel sampling program for Southeast National Air Surveillance Network. For Engineering Branch, participated in NPDES compliance monitoring of industrial facilities throughout the southeast; operation and maintenance studies of municipal waste treatment facilities; and post-impoundment study of West Point Reservoir, West Point, Georgia. Participated in industrial bioassay studies for the Ecological Branch.

1977-Date Engineering-Science. Environmental Scientist. Responsible for the conduct of water and wastewater sampling programs and analyses, quality control, laboratory process evaluations, and evaluation of other environmental assessment data. Conducted leachate extraction studies of sludges produced at a large organic chemicals plant to define nature of sludges according to the Resource Recovery and Conservation Act guidelines. Involved in laboratory quality assurance program for the analysis of water samples used in a stream modeling project. Conducted a water quality modeling study for Amerada Hess Corporation to determine the assimilative capacity of a stream receiving effluent from a southern Mississippi refinery.

Mark I. Spiegel (Continued)

Participated in bench-scale industrial treatability studies conducted for the American Textile Manufacturers Institute and Eli Lilly Pharmaceuticals in Mayaguez, Puerto Rico, and in carbon adsorption studies for an American Cyanamid chemical plant and Union Carbide Agricultural Products Division.

Involved in various aspects of several industrial environmental impact assessments including preliminary planning for a comprehensive study for St. Regis Paper Company on a major pulp and paper mill expansion project. Assisted in preparation of third-party EIS for EPA and Mobil Chemical Company concerning a proposed 16,000-acre phosphate mining and beneficiation facility. Developed an EIA prior to construction of a pulp and paper complex by the Weyerhaeuser Company in Columbus, Mississippi, which included preparation of a separate document for the Interstate Commerce Commission concerning the construction of a railroad spur to serve the complex. Also involved in formulating the water quality, water resource and socio-economic aspects of an environmental impact assessment for International Paper Company. Participated in large scale site evaluation to determine the suitability and environmental permitting requirements of a site for an east coast brewery for the Adolph Coors Company. Participated in a study to evaluate various options for developing a large parcel of land in the coastal section of North Carolina. The study involved evaluating both the market potential and environmental constraints of various options for development such as timber harvesting, peat mining, corporate farming and aquaculture (catfish farming).

Project Manager. Conducted comprehensive process evaluation of an 80 mgd wastewater treatment system for Weyerhaeuser Company. Responsible for a study to determine the leaching characteristics of sludges for a paint manufacturing facility for RCRA compliance. Also managed study for development of a solid waste management plan for a ceramic pottery manufacturer in northern Alabama which included evaluating surface and ground-water contamination potential from the existing disposal site and assisting manufacturer in developing a disposal program acceptable to state agencies.

Participated as project team member for Phase I Installation Restoration Program projects for the Department of Defense. Studies were conducted at

Mark I. Spiegel (Continued)

five Air Force bases to identify past hazardous waste disposal practices that could result in migration of contaminants and recommend priority sites requiring further investigation.

APPENDIX B

LIST OF INTERVIEWEES

APPENDIX B
LIST OF INTERVIEWEES

TRAVIS AFB INTERVIEWEES

	Most Recent Position	Period of Service
1.	Chief Base Bioenvironmental Engineer, DGMC	1981-Present
2.	Base Bioenvironmental Engineer, DGMC	1978-Present
3.	Shop Supervisor, Corrosion Control, 307 CAMS	1981-Present
4.	Shop Supervisor, AGE Section, 307 CAMS	1978-Present
5.	Shop Supervisor, Engine Conditioning, 307 CAMS	1979-Present
6.	Employee, Engine Conditioning, 307 CAMS	1973-Present
7.	Shop Supervisor, Fuel Systems, 307 CAMS	1981-Present
8.	Shop Supervisor, Wheel and Tire, 60 FMS	1981-Present
9.	Shop Supervisor, GTU Section, 60 FMS	1962-Present
10.	Shop Supervisor, Base Dental Supply, DGMC	1976-Present
11.	Mechanic AGE Shop, 60 FMS	1961-Present
12.	NCOIC, Corrosion Control, 60 FMS	1974-Present
13.	Foreman, Cleaning and Degreasing, 60 FMS	1952-Present
14.	Shop Supervisor, C-141 Iso Dock, 60 FMS	1981-Present
15.	Employee, TF-39 Section, 60 FMS	1973-Present
16.	Shop Supervisor, Inspection Iso Dock, 602 OMS	1980-Present
17.	Shop Supervisor, Refrigeration/Air Conditioning, 60 CES	1982-Present
18.	Shop Supervisor, Pneudraulic Systems, 60 FMS	1978-Present
19.	Shop Supervisor, C-5 Iso Dock, 60 FMS	1982-Present
20.	Employee, Comfort Pallet, 60 FMS	1982-Present
21.	Shop Supervisor, Component Repair, 60 FMS	1956-Present
22.	Shop Supervisor, Cleaning and Degreasing, 60 FMS	1952-Present
23.	Employee, Interior Electric/Motor Shops, 60 CES	1980-Present
24.	Employee, Refueling Vehicle Maintenance, 60 TRNS	1982-Present

APPENDIX B (Continued)

LIST OF INTERVIEWEES

	Most Recent Position	Period of Service
25.	Shop Supervisor, Heavy Equipment Maintenance, 60 TRNS	1982-Present
26.	Shop Supervisor, General Equipment Maintenance, 60 TRNS	1981-Present
27.	Base Historian, 60 MAW	1978-Present
28.	Shop Foreman, Entomology Shop, 60 CES	1961-Present
29.	Supervisor, DPDO	1967-Present
30.	Property Marketing Specialist, DPDO	1964-Present
31.	Fire Fighter, 60 CES	1968-Present
32.	NCOIC, EOD, 60 MAW	1982-Present
33.	EOD Specialist, 60 MAW	1980-Present
34.	Supervisor, Metal Bonding/Fiberglass Shop, 60 FMS	1959-Present
35.	NCOIC, NDI Lab, 60 FMS	1978-Present
36.	Asst. Supervisor, Electric Power Production, 60 CES	1953-Present
37.	Power Production Foreman, AFESC/CEMIRT	1976-Present
38.	Project Manager, Photo Lab, AVS	1979-Present
39.	Funds Manager, 60 FMS	1946-Present
40.	NCOIC, Fuels Lab, 60 SS	1981-Present
41.	Senior Maintenance Officer, Structural Repair Shop, 60 FMS	1951-Present
42.	NCOIC, Medical Lab, DGMC	1979-Present
43.	Supervisor, Medical Photo Lab, DGMC	1979-Present
44.	Supervisor, Radiology Lab, DGMC	1979-Present
45.	Supervisor, Dental Lab, DGMC	1980-Present
46.	NCOIC, Refueling Vehicle Maint.. 60 TRANS	1982-Present
47.	NCOIC, Non-Powered AGE, 60 FMS	1982-Present
48.	Supervisor, Auto Hobby Shop, 60 SS	1972-Present
49.	NCOIC, TF-39 Test Cell, 60 FMS	1975-Present
50.	NCOIC, Radar Maintenance, 60 AMS	1982-Present

APPENDIX B (Continued)

LIST OF INTERVIEWEES

	Most Recent Position	Period of Service
51.	Supervisor, C-5 Inspection Branch, 60 OMS	1970-Present
52.	Foreman, Plumbing Shop, 60 CES	1959-Present
53.	Supervisor, Allied Trades Shop, 60 FMS	1956-Present
54.	Machinist, 60 FMS	1959-Present
55.	Supervisor, Vehicle Insp., 60 TRANS	1963-Present
56.	Supervisor, Battery Shop, 60 FMS	1960-Present
57.	Environmental Coordinator, 60 CES	1981-Present
58.	Supervisor, Water & Waste, 60 CES	1961-Present
59.	Equipment Operator, 60 CES	1968-Present
60.	Supervisor, Int./Ext. Electrics, 60 CES	1972-Present
61.	Engine Mechanic, Retired	1953-late 1970's
62.	NCOIC, Machine Shop, 60 FMS	1980-1982
63.	Employee, Entomology Shop, 60 CES	1966-Present
64.	Operator, Water Plant, 60 CES	1963-Present
65.	Supervisor Structural Repair Shop, 60 CES	1961-Present
66.	Foreman, Paint Shop, 60 CES	1961-Present
67.	Supervisor, POL, 60 SS	1961-Present
68.	NCOIC, POL, 60 SS	1979-Present
69.	Supervisor, Roads and Grounds, 60 CES	1970-Present
70.	NCOIC, TF-39 Section, 60 FMS	1982-Present
71.	Deputy Base Civil Engineer, Retired, 60 CES	1966-1983
72.	Deputy Base Civil Engineer, Retired, 60 CES	1945-1978
73.	Foreman, Corrosion Control, 60 FMS	1962-1983
74.	Equipment Operator, 60 CES	1952-Present
75.	Operator, Water and Wastes, 60 CES	1965-Present
76.	Equipment Operator, Retired, 60 CES	1950-1972
77.	Fire Fighter, Retired, 60 CES	1945-1961 and 1966-1972
78.	Agronomist, Retired, 60 CES	1946-1979
79.	Fire Fighter, 60 CES	1966-Present
80.	Fire Fighter, 60 CES	1958-Present

APPENDIX B (Continued)

LIST OF INTERVIEWEES

	Most Recent Position	Period of Service
81.	Fire Fighter, 60 CES	1967-Present
82.	Equipment Operator, 60 CES	1963-Present
83.	Mechanical Supervisor, 60 CES	1957-Present
84.	Chief, Environmental Planning, 60 CES	1980-Present
85.	Deputy Base CE, Retired, 60 CES	1952-1973
86.	Supervisor, Fuels Maintenance, 60 CES	1961-Present
87.	Foreman, Fuels Maintenance, 60 CES	1952-Present
88.	Supervisor, Real Properties, 60 CES	1977-Present
89.	Caretaker, Mill Valley AFS	1975-Present
90.	Caretaker, Almaden AFS	1956-Present
91.	Maintenance Foreman, Point Arena AFS	1967-Present
92.	Employee, Civil Engineering, Point Arena AFS	1983-Present
93.	NCOIC, Weather Squadron	1982-Present

OUTSIDE CONTACTS

Manager, Manufacturing Engineering, Explosives Technology, 1977-Present

Personnel Manager, Explosives Technology, 1981-Present

California Natural Diversity Data Base: Suzanne Wall, Environmental Specialist, Sacramento, CA Tel. (916) 324-3812

California Department of Fish and Game: Fred Botti, Fish and Game Manager, Yountville, CA Tel. (907)944-4460

California Department of Health Services: Kris Knoblack, Environmental Engineer, Berkeley CA Tel. (415)540-2043

California Regional Water Quality Control Board, San Francisco Bay Region: Dennis Mishek, Environmental Engineer, Oakland, CA Tel. (415)464-1255

California Department of Water Resources: Edward J. Labrie, Chief, Water Evaluation Section; Ted Matsumoto, Data Anlayst, Sacramento, CA

APPENDIX B (Continued)

LIST OF INTERVIEWEES

City of Vallejo, Water Department: Erwin Folland, Water Superintendent, Vallejo, CA

Solano Irrigation District: Bud Barton, Water Master, Elmira, CA Tel. (707)448-6847

U.S. Geological Survey: Gil Bertaldi, Chief Water Resources Div., California District, Sacramento, CA Tel.

U.S. Environmental Protection Agency: Bob Mandel, Chief Field Inspection Manager, San Francisco, CA Tel. (415)974-8362.

APPENDIX C

ORGANIZATIONS AND MISSIONS

APPENDIX C

ORGANIZATIONS AND MISSIONS

PRIMARY ORGANIZATION AND MISSION

The primary mission of the 60th Military Airlift Wing (MAW) is to provide global strategic airlift support for the Air Force. The primary airlift task of Travis is to provide rapid, responsive airlift of United States fighting forces to any point on earth in support of the nation's objectives. The secondary task is to fulfill the global air logistics needs of the Department of Defense in sustaining worldwide activities. The Wing is also responsible for operating Travis AFB and supporting its various tenant units.

TENANT ORGANIZATIONS AND MISSIONS

Travis AFB is the host to several tenant organizations and provides services, facilities and other support to these organizations. The following list identifies the major tenant organizations located at Travis AFB and briefly describes their missions.

David Grant Medical Center (DGMC)

The David Grant Medical Center was built in 1948. Since then it has grown to be one of the largest medical facilities in the Military Airlift Command and one of six (6) Air Force Medical Centers. David Grant operates as a referral hospital which supports 21 Air Force medical facilities in the eight (8) western states. DGMC also serves as one of four major Air Force teaching centers. The medical center offers a full range of health, dental, aeromedical, and consultant services.

349th Military Airlift Wing (Reserve)

The 349th Military Airlift Wing, like its active duty counterpart, the 60th MAW, is the largest airlift organization in the Air Force Reserve. The 349th MAW operates two, C-141 and two C-5 flying squadrons and shares the first line defense mission of its active duty counterpart. As an associate unit, they do not own any aircraft but fly those assigned to their command.

AF conducts MAC operations over half the world. The geographical area extends westward from the Mississippi River, across the Pacific Ocean to the eastern border of India, from Pole to Pole.

Throughout this area, the 22nd Air Force performs airlift operations, provides a vast network of support facilities and maintains a flexible airlift capability in support of the global mobility and logistics needs of the United States fighting forces.

Detachment 2, 17 Weather Squadron

The Base Weather Station supports other military units assigned to Travis, with special emphasis on the flying requirements of the 60th Military Airlift Wing and the 916th Air Refueling Squadron. Weather forecasters and observers provide information on winds and weather affecting flight routes throughout the Pacific and to Alaska and the contiguous United States.

They prepare weather folders and present briefings to hundreds of aircrews departing Travis each month and provide observations of Travis weather conditions for use locally and in the Air Weather Service global network of weather stations, all on a 24-hour day basis.

Headquarters 17th Weather Squadron

The 17th Weather Squadron is the headquarters for 11 detachments located west of the Mississippi River which supports 22 Air Force units.

Co-located with the 22nd Air Force Operations Center, the Weather Support Unit provides briefings, forecasts, and meteorological watch for all missions and exercises under 22nd Air Force control. This unit is part of the squadron headquarters and coordinates the efforts of the Air Force Global Weather Central and the Base Weather Stations supporting 22nd Air Force Wings.

Air Force Audit Agency (AFAA)

The mission of the Air Force Audit Agency is to provide all levels of Air Force management with an independent, objective, and constructive evaluation of the effectiveness and efficiency with which managerial responsibilities (including financial, operational, and supporting activities) are carried out.

Defense Property Disposal Office (DPDO)

The mission of the DPDO is to provide for control and warehousing of excess and surplus government property for preparation for reutilization, donation, sale or other dispositions.

Air Force Office of Special Investigations (OSI), District 19

The mission of this organization is to provide criminal, counterintelligence, internal security and special investigative services to Air Force activities; to perform distinguished visitor protection services and operations; to collect, analyze and disseminate information of investigative and counterintelligence significance; and to collect and report information which is pertinent to base security.

Additional Tenants

AFOSI Detachment 1900

American Red Cross

Armed Forces Courier Service

Civil Air Patrol, Sq. 22

Defense Investigative Services

DOD Wage Fixing Authority

Military Air Traffic Coordinator Unit (MATCU)

Military Personnel Transportation Assistance Office

Navy Construction Office (ROICC)

Navy Quick Trans CPE Cargo

OL-K AFESC/CEMIRT

OLOH AF Commissary/FCS

Operating Loc L Hq MAC

U.S. Customs

U.S. Department of Agriculture

U.S. Postal Service

USAF Trial Judiciary 5th Circuit

Det. 4 375th Aeromedical Airlift Wing

Field Training Det. 524

Det. 2 1600th Management Engineering Sq. (MACMET)

3566th USAF Recruiting Sq.

T37 ACE Det.

USAF Scouting Liaison Office

2604 Reserve Recruiting Sq.

APPENDIX D

TRAVIS AFB SUPPLEMENTAL INFORMATION AND DATA

TABLE D.1
TRAVIS AFB
LOG OF WELL NO. 6
(Construction August 1949)

0	to	6'	-	6'	Top Soil
6	"	26'	-	20'	Sandy Clay
26	"	34'	-	8'	Sand
34	"	59'	-	25'	Hard Clay
59	"	61'	-	2'	Sand
61	"	72'	-	11'	Hard Clay
72	"	96'	-	24'	Sandy Clay
96	"	117'	-	21'	Sand and Gravel
117	"	124'	-	7'	Sandy Clay
124	"	155'	-	31'	Soft Clay
155	"	168'	-	13'	Sandy Clay
168	"	182'	-	14'	Hard Clay
182	"	185'	-	3'	Soft Clay
185	"	191'	-	6'	Sandy Clay
191	"	212'	-	21'	Soft Clay
212	"	222'	-	10'	Sand with a Little Gravel
222	"	230'	-	8'	Soft Clay
230	"	245'	-	15'	Broken Gravel
245	"	252'	-	7'	Hard Clay
252	"	274'	-	22'	Soft Clay
274	"	284'	-	10'	Gravel
284	"	297'	-	13'	Soft Clay
297	"	307'	-	10'	Gravel
307	"	319'	-	12'	Clay
319	"	341'	-	22'	Soft Clay
341	"	356'	-	15'	Clay, Broken with Gravel
356	"	364'	-	8'	Clay
364	"	408'	-	44'	Hard Clay
408	"	440'	-	32'	Soft Clay
440	"	480'	-	40'	Gravel

32" x 3/16" outer surface water control pipe
installed to a depth of 68'
Well is cased to a depth of 480' with
14" x 1/4" Buttwelded casing as follows:

0	"	160'	-	Plain		
160	"	184'	-	Perforated	-	24'
184	"	216'	-	Plain		
216	"	248'	-	Perforated	-	32'
248	"	264'	-	Plain		
264	"	312'	-	Perforated	-	48'
312	"	336'	-	Plain		
336	"	360'	-	Perforated	-	24'
360	"	408'	-	Plain		
408	"	480'	-	Perforated	-	72'
				Total Perforations	-	200'

Source: Travis AFB Records

TABLE D.2
TRAVIS AFB
LOG OF WELL NO. 7

0	to	4'	-	4'	Top Soil
4	"	39'	-	35'	Clay
39	"	49	-	10'	Sand
49	"	82	-	33'	Clay
82	"	94	-	12'	Sand
94	"	108	-	14'	Clay
108	"	117	-	9'	Sand and Gravel
117	"	138	-	21'	Hard Clay
138	"	140	-	2'	Sand
140	"	180	-	40'	Hard Clay
180	"	185	-	5'	Gravel, Fair
185	"	190	-	5'	Clay
190	"	195	-	5'	Sand
195	"	217	-	22'	Soft Clay
217	"	230	-	13'	Gravel
230	"	304	-	74'	Hard Clay
304	"	329	-	25'	Gravel and Sand
329	"	341	-	12'	Broken w/Sand and Clay Mixed
341	"	386	-	45'	Soft Clay
386	"	453	-	67'	Hard Clay
453	"	463	-	10'	Broken w/Gravel and Clay Mixed
463	"	476	-	13'	Boulders - Large
476	"	502	-	26'	Boulders, Gravel Sand
502	"	521	-	19'	Gravel
521	"	544	-	23'	Hard Clay

32" x 3/16" outer surface water control pipe installed to a depth of 63'
Well is cased to a depth of 522' with 14" ID x 1/4" Buttwelded casing as follows:

0	"	178'	-	Plain		
178	"	258'	-	Perforated	-	80'
258	"	306'	-	Plain		
306	"	354'	-	Perforated	-	48'
354	"	450'	-	Plain		
450	"	522'	-	Perforated	-	72'
				Total Perforations	-	200'

Source: Travis AFB Records

TABLE D.3
WATER ANALYSES FOR SELECTED OFF-BASE WELLS
(Refer to Figure 3.7)

Date & Time	Field Laboratory (pH)	Mineral Constituents (mg/l)								
		Ca	Mg	Na	K	$CaCO_3$	SO_4	Cl	NO_3	TDS
05N/01W-25R01 M										
08/02/71	7.3	118	32	178	--	207	--	418	--	
1630	8.2	5.89	2.63	7.74		4.14		11.79		
		36	16	48						
07/17/73	7.3	--	--	206	--	191	--	485	--	
1315	7.9			8.96		3.82		13.68		
				49						
05N/01W-25R01 M										
05/15/75	7.4	--	--	182	--	174	--	460	--	
1355	8.0			7.92		3.48		12.97		
				47						
06/04/76	7.3	117	36	192	.9	169	12	482	17.0	1130
1415	7.9	5.84	2.96	8.35	.02	3.38	.25	13.59	.27	980
		34	17	49	0	19	1	78	2	
07/08/77	7.3	123	40	196	1.0	180	14	511	17.0	1160
1445	8.0	6.14	3.29	8.53	.03	3.60	.29	14.41	.27	1034
		34	18	47	0	19	2	78	1	
07/06/78	7.3	139	39	220	1.2	182	17	569	14.0	528
1530	8.0	6.94	3.21	9.57	.03	3.64	.35	16.05	.23	326
		35	16	48	0	18	2	79	1	

TABLE D.3
(Continued)
WATER ANALYSES FOR SELECTED OFF-BASE WELLS
(Refer to Figure 3.7)

Date & Time	Field Laboratory (pH)	Mineral Constituents (mg/l) Ca	Mg	Na	K	$CaCO_3$	SO_4	Cl	NO_3	TDS
05N/01W-25R01 M (Continued)										
06/14/79	7.2	134	39	204	.9	189	13	504	18.0	495
1430	7.6	6.69	3.21	8.87	.02	3.78	.27	14.21	.29	306
		36	17	47	0	20	1	77	2	
06/17/80	7.3	128	40	196	.7	187	11	506	17.0	484
1400	7.8	6.39	3.29	8.53	.02	3.74	.23	14.27	.27	297
		35	18	47	0	20	1	77	1	
06/24/81	7.3	125	39	197	.8	146	20	501	15.0	473
1030	7.9	6.24	3.21	8.57	.02	2.92	.42	14.13	.24	986
		35	18	48	0	16	2	80	1	
05N/01W-28P01 M										
07/19/73	7.5	--	--	59	--	241	--	102	--	
1430	7.8			2.57		4.82		2.88		
		31								
05/15/75	7.7	--	--	37	--	217	--	57	--	
	7.9			1.61		4.34		1.61		
07/08/77	7.3	73	25	75	.9	239	9.4	137	8.7	526
	8.0	3.64	2.06	3.26	.02	4.78	.20	3.86	.14	501
		41	23	36	0	53	2	43	2	

TABLE D.3
(Continued)
WATER ANALYSES FOR SELECTED OFF-BASE WELLS
(Refer to Figure 3.7)

Date & Time	Field Laboratory (pH)	Mineral Constituents (mg/l)								
		Ca	Mg	Na	K	$CaCO_3$	SO_4	Cl	NO_3	TDS
05N/01W-28P01 M (Continued)										
07/06/78	7.3	67	24	65	1.5	238	12	112	4.5	469
1400	8.2	3.34	1.97	2.83	.04	4.76	.25	3.16	.07	451
		41	24	35	0	58	3	38	1	
06/14/79	7.3	64	22	54	1.5	232	9.0	87	3.8	416
1100	7.7	3.19	1.81	2.35	.04	4.64	.19	2.45	.06	381
		43	24	32	1	63	3	33	1	
06/17/80	7.3	65	21	49	4.1	221	2.0	96	1.2	445
1215	8.0	3.24	1.73	2.13	.10	4.42	.04	2.71	.02	371
		45	24	30	1	61	1	38	0	
06/24/81	7.3	70	23	65	1.3	245	2.0	112	7.5	466
0845	7.4	3.49	1.89	2.83	.03	4.90	.04	3.16	.12	428
		42	23	34	0	60	0	38	1	

Source: Travis AFB Records

TABLE D.4
FUEL STORAGE TANKS
Travis AFB, California

Facility	Location/ Identification	Material	Type of Tank	Capacity Per Tank
Aviation and Vehicle Fuel				
1743	Area A	AVGAS	Underground	2 @ 50,000 gals
1746	Area A	AVGAS	Underground	50,000 gals
1746	Area A	AVGAS	Underground	50,000 gals
1766	Area A	Diesel	Underground	2 @ 25,000 gals
1767	Area A	Contaminated JP-4	Underground	2 @ 25,000 gals
1767	Area B	Used Oil	Underground	25,000 gals
1771	Area A	MOGAS	Underground	3 @ 25,000 gals
1771	Area A	MOGAS	Underground	2 @ 30,000 gals
1772	Area B	JP-4	Aboveground	10,000 bbls
1790	Area B	JP-4	Underground	25,000 gals
1794	Area B	JP-4	Underground	6 @ 50,000 gals
1783	Area B	JP-4	Underground	25,000 gals
1792	Area C	JP-4	Underground	7 @ 50,000 gals
1791	Area D	JP-4	Underground	7 @ 50,000 gals
1919	Area D	JP-4	Aboveground	5,000 gals
1919	Area D	JP-4	Aboveground	5,000 gals
1793	Area E	JP-4	Underground	8 @ 50,000 gals
1750	Area F	Empty	Underground	2 @ 25,000 gals
1751	Area F	JP-4	Underground	20,000 gals
1768	Area F	JP-4	Underground	20,000 gals
1769	Area F	Diesel	Underground	10,000 gals
1769	Area F	Diesel	Aboveground	7,500 bbls
1773	Area F	JP-4	Aboveground	55,000 bbls
1774	Area F	JP-4	Aboveground	20,000 bbls
1775	Area F	JP-4	Aboveground	35,000 bbls
1778	Area F	JP-4	Aboveground	55,000 bbls
1795	Area G	JP-4	Aboveground	5,000 bbls
1796	Area G	JP-4	Aboveground	5,000 bbls
1780	Area H	JP-4	Aboveground	2,500 bbls
Organizational Tanks				
41	MAC AGE	MOGAS	Underground	2,000 gals
41	MAC AGE	JP-4	Underground	10,000 gals
781	Motor Pool	MOGAS	Underground	2 @ 15,000 gals
139	Supply Storage Tank	Solvent	Underground	12,000 gals
170	BX Service Sta	Gasoline	Underground	6 @ 8,000 gals
171	BX Service Sta	Gasoline	Underground	3 @ 10,000 gals
771	Aero Club	AVGAS	Underground	12,000 gals
771	Aero Club	AVGAS	Underground	4,000 gals
810	SAC AGE	MOGAS	Underground	2,000 gals

TABLE D.4
(Continued)
FUEL STORAGE TANKS
Travis AFB, California

Facility	Location/ Identification	Material	Type of Tank	Capacity Per Tank
810	SAC AGE	JP-4	Underground	2,000 gals
872	BCE	MOGAS	Underground	2,500 gals
872	BCE	Diesel	Underground	2,500 gals
1001	Test Cell	JP-4	Underground	2 @ 10,000 gals
1798	Sub Motor Pool	MOGAS	Underground	5,000 gals
1798	Sub Motor Pool	Diesel	Underground	5,000 gals
1919	Test Cell	JP-4	Aboveground	2 @ 2,500 gals
2020	Golf Course	MOGAS	Underground	1,000 gals
Sugar 9	Parking Spot 9	MOGAS	Aboveground	750 gals
1753	Fireman Tng Area	JP-4	Aboveground	25,000 gals
<u>Heating Plant Fuel Tanks</u>				
32	Htg Plant Fuel	#2 Oil	Aboveground	6,000 gals
32	Abandoned	*	Underground	10,000 gals
106	Abandoned	#5 Oil	Underground	2,500 gals
112	Abandoned	#5 Oil	Underground	2,5000 gals
150	Abandoned	#5 Oil	Underground	1,220 gals
163	Abandoned	#2 Oil	Underground	2,200 gals
212	Htg Plant Fuel	#2 Oil	Underground	2,100 gals
382	Htg Plant Fuel	#2 Oil	Underground	2 @ 11,500 gals
437	Htg Plant Fuel	#2 Oil	Underground	700 gals
550	Htg Plant Fuel	#2 Oil	Underground	12,000 gals
557	Htg Plant Fuel	#2 Oil	Underground	2,060 gals
755	Htg Plant Fuel	#2 Oil	Aboveground	700 gals
804	Htg Plant Fuel	#2 Oil	Underground	2,000 gals
810	Htg Plant Fuel	#2 Oil	Underground	10,000 gals
818	Htg Plant Fuel	#2 Oil	Underground	15,000 gals
835	Htg Plant Fuel	#2 Oil	Underground	1,500 gals
837	Htg Plant Fuel	#2 Oil	Underground	1,500 gals
838	Htg Plant Fuel	#2 Oil	Underground	1,500 gals
892	Standby Fuel	Liq Propane	Aboveground	2 @ 25,000 gals
903	Htg Plant Fuel	#2 Oil	Underground	1,000 gals
908	Htg Plant Fuel	#2 Oil	Underground	500 gals
942	Htg Plant Fuel	#2 Oil	Underground	1,750 gals
1027	Htg Plant Fuel	#2 Oil	Underground	1,000 gals
1152	Sewage Plant	#2 Oil	Aboveground	1,000 gals
1175	Htg Plant Fuel	#2 Oil	Underground	1,000 gals
1205	Htg Plant Fuel	#2 Oil	Underground	750 gals
1312	Htg Plant Fuel	#2 Oil	Underground	10,000 gals
1315	Htg Plant Fuel	#2 Oil	Underground	10,000 gals
1322	Htg Plant Fuel	#2 Oil	Underground	10,000 gals
1325	Htg Plant Fuel	#2 Oil	Underground	5,000 gals
1348	Htg Plant Fuel	#2 Oil	Underground	10,000 gals

TABLE D.4
(Continued)
FUEL STORAGE TANKS
Travis AFB, California

Facility	Location/ Identification	Material	Type of Tank	Capacity Per Tank
Industrial Waste Tanks				
18	Used Solvents	Flammable Solvents	Underground	25,000 gals
377	Used Oils	Contaminated Oil & Solvent	Underground	5,000 gals
935	Used Oils	Syn Oils	Underground	6,000 gals
943	Used OIls	Hydraulic Oil	Underground	1,000 gals
1027	Used Oils	PD-680	Underground	2,000 gals
1202	Contaminated Fuel	Contaminated Fuel	Underground	1,500 gals
1743	Contaminated Fuel	Contaminated Fuel	Underground	2 @ 25,000 gals
1767	Used Oil	Used Oil	Aboveground	25,000 gals
1754	Used Oil	Hydraulic Fluid	Aboveground	25,000 gals

Tanks at Pump Stations

Facility	Type of Fuel	Type of Tanks	Size of Tank
24	Diesel Fuel	Underground	200 gals
801	Gasoline	Underground	500 gals
8499	Gasoline	Underground	100 gals
Power Production Fuel Tanks			
4, 8	Diesel Fuel	Underground	1,200 gals
4, 8	Diesel Fuel	Aboveground	400 gals
8	Diesel Fuel	Aboveground	200 gals
10	Diesel Fuel	Underground	600 gals
20	Diesel Fuel	Underground	500 gals
54	Diesel Fuel	Underground	750 gals
163	Diesel Fuel	Aboveground	250 gals
241	Diesel Fuel	Aboveground	350 gals
243	Diesel Fuel	Underground	1,000 gals
380	Diesel Fuel	Underground	600 gals
381	Diesel Fuel	Underground	750 gals
560	Diesel Fuel	Aboveground	275 gals
710	Diesel Fuel	Aboveground	600 gals
916	Diesel Fuel	Underground	2 @ 10,000 gals

TABLE D.4
(Continued)
FUEL STORAGE TANKS
Travis AFB, California

Tanks at Pump Stations (Continued)

Facility	Type of Fuel	Type of Tanks	Size of Tank
916	Diesel Fuel	Underground	2 @ 400 gals
1115	Diesel Fuel	Underground	350 gals
1125	Gasoline	Aboveground	220 gals
1125	Diesel Fuel	Underground	1,000 gals
1130	Diesel Fuel	Underground	500 gals
1155	Gasoline	Underground	600 gals
1182	Diesel Fuel	Aboveground	350 gals
1185	Diesel Fuel	Underground	750 gals
1290	Gasoline	Underground	600 gals
1291	Gasoline	Aboveground	600 gals
1293	Gasoline	Aboveground	120 gals
1360	Gasoline	Aboveground	120 gals
1385	Gasoline	Aboveground	250 gals
1785	Diesel Fuel	Underground	500 gals
3586	Gasoline	Aboveground	250 gals
3601	Gasoline	Aboveground	250 gals
3701	Gasoline	Aboveground	600 gals

Source: Travis AFB Records

APPENDIX E

MASTER LIST OF INDUSTRIAL SHOPS

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Military Airlift Wing (MAW)				
Aircrew Life Support	1212	Yes	No	N/A
60 Supply (SUP)				
Fuels Distribution/Operations	1202	Yes	No	N/A
Fuels Laboratory	707	Yes	Yes	Off-Site Contract Disposal
Fuels Storage Section	711	Yes	No	N/A
Explosive Ordinance Disposal	903	No	No	N/A
Supply ADPM Section	549	No	No	N/A
Supply PCAM Section	549	No	No	N/A
60 Transportation (TRANS)				
Allied Trades	144	Yes	Yes	Off-Site Contract Disposal
Diagnostic/QC Shop	138	Yes	No	N/A
Fire Truck Maintenance	540	Yes	No	N/A
General Purpose Maintenance	139	Yes	Yes	Off-Site Contract Disposal

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Transportation (TRANS) (continued)				
Heavy Equipment Maintenance	139	Yes	Yes	Off-Site Contract Disposal
MHE Shop	139	Yes	No	N/A
Refueling Vehicle Maintenance	1202	Yes	Yes	Off-Site Contract Disposal
Tire Shop	180	No	No	N/A
463L Shop	139	No	No	N/A
60 Avionics Maintenance Squadron (AMS)				
Autopilot Shop	21	No	No	N/A
Battery Shop	755	Yes	Yes	Sanitary Sewer
CSD/Generator Shop	755	Yes	No	N/A
Electrical Systems Shop	21	No	No	N/A
Instrument Systems Shop	21	Yes	No	N/A
Nav-Aids Shop	804	Yes	No	N/A
Inertial Navigation Shop	804	Yes	No	N/A
Communications Systems Shop	804	Yes	No	N/A
PMEL	942	Yes	No	N/A

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Field Maintenance Squadron (FMS)				
Comfort Pallet Section	1201	Yes	Yes	Off-Site Contract Disposal
Environmental Systems Shop	819	Yes	No	N/A
Fuel Systems Shop	551, 808	Yes	No	N/A
Pneudraulic Systems Shop	819	Yes	Yes	Off-Site Contract Disposal
Repair and Reclamation Shop	819	No	No	N/A
Wheel and Tire Shop	819	Yes	Yes	Off-Site Contract Disposal
Corrosion Control	550 (and other locations)	Yes	Yes	Off-Site Contract Disposal
Flotation Shop	904	Yes	No	N/A
Machine Shop	550	Yes	Yes	Off-Site Contract Disposal
Metal Processing	550	Yes	No	N/A
NDI Laboratory	550	Yes	Yes	Off-Site Contract Disposal
Pattern and Plug Shop	550	Yes	No	N/A
Refurbishment Shop	810	Yes	No	N/A
Structural Bonding/ Fiberglass	550	Yes	No	N/A

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Field Maintenance Squadron (FMS) (continued)				
Structural Repair Shop	550	Yes	No	N/A
Structural Repair Areas	16 (and other locations)	Yes	No	N/A
Survival Equipment	525	Yes	No	N/A
Non-Powered Age	12 (previously 1014)	No	No	N/A
AGE Repair Section	41	Yes	Yes	Off-Site Contract Disposal
Carpenter Shop	550	Yes	No	N/A
AGE Servicing Section	11	No	No	N/A
C-5 ISO Dock	809	Yes	Yes	Contract Disposal
C-141 ISO Dock	840	Yes	Yes	Contract Disposal
Cleaning and Degreasing Shop	18	Yes	Yes	Oil/Water Separator or Contract Disposal
Component Repair	16	Yes	Yes	Oil/Water Separator or Contract Disposal
GTU Section	12	Yes	Yes	Contract Disposal
TF-33 Section	839	Yes	Yes	Contract Disposal, Washrack

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Field Maintenance Squadron (FMS) (continued)				
TF-33 Test Cell	1022	Yes	Yes	Contract Disposal
TF-39	16	Yes	Yes	Contract Disposal
TF-39 Test Cell	1001	Yes	Yes	Contract Disposal
60 Organizational Maintenance Squadron (OMS)				
Support Shops	810	No	No	N/A
Inspection ISO Dock	809	Yes	Yes	Contract Disposal
602 Organizational Maintenance Squadron (OMS)				
Support Shops	844	No	No	N/A
Inspection ISO Dock	841	Yes	Yes	Contract Disposal
60 Aerial Port Squadron (APS)				
MMHS Maintenance	977	Yes	No	N/A
Data/Records Processing	977	No	No	N/A
Recooperage	977	No	No	N/A
Comfort Pallet Section	1201	No	No	N/A
Packing and Crating	549	No	No	N/A

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Air Base Group (ABG)				
Data Automation Computer Room	243	No	No	N/A
Reprographics	243	Yes	No	N/A
Combat Arms Maintenance and Training	943	Yes	No	N/A
Auto Hobby Shop	226	Yes	Yes	Contract Disposal
Ceramics/Pottery Shop	226	No	No	N/A
Photo/Stained Glass Shop	226	Yes	Yes	Sanitary Sewer
Woodworking Shop	226	No	No	N/A
60 Civil Engineering Squadron (CES)				
Fire Station 1	560	No	No	N/A
Fire Station 2	175	No	No	N/A
Fire Extinguisher Maintenance	175	Yes	No	N/A
Electric Power Production	931	Yes	Yes	Contract Disposal
Entomology	872	Yes	Yes	Water Reuse, Contract Disposal
Equipment Operations	872	Yes	No	N/A
Exterior Electric	936	Yes	No	N/A
Family Housing Maintenance	5569	Yes	No	N/A
Golf Course Maintenance	2011	Yes	No	N/A

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
60 Civil Engineering Squadron (CES) (continued)				
Grounds	872	Yes	No	N/A
Heating Systems Maintenance	32	Yes	No	N/A
Hospital Maintenance	381	Yes	No	N/A
Instrument Controls	861	No	No	N/A
Interior Electric/ Motor Shops	873, 874	Yes	Yes	Contract Disposal
Liquid Fuels Systems	908	Yes	No	N/A
Metal Working	879, 880 884	Yes	No	N/A
Pavements	872	No	No	N/A
Plumbing	806	No	No	N/A
Protective Coating	874	Yes	Yes	Contract Disposal
Refrigeration/Air Conditioning	882	Yes	Yes	Sanitary Sewer
Structural Maintenance/ Masonry	874	Yes	No	N/A
Water and Waste	882	Yes	No	Transports Sump Wastes to Bldg. 18
Armed Forces Courier Service (ARFCOS)				
Armed Forces Courier Station	934	No	No	N/A

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
Audiovisual Service Center (ASC)				
Base Photo Lab	235	Yes	Yes	Silver Recovery, Sanitary Sewer
375 Aeromedical Airlift Wing (AAW)				
Aeromedical Airlift Wing, Det 4	1	No	No	N/A
Air Force Engineering Service Center (AFESC)				
CEMIRT	1205	Yes	Yes	Contract Disposal
David Grant Medical Center (DGMC)				
Medical Systems Office	3XX	No	No	N/A
Base Dental Clinic, X-Ray and Laboratory	117	Yes	Yes	Silver Recovery, Sanitary Sewer
Hospital Dental Clinic, X-Ray and Laboratory	379	Yes	Yes	Silver Recovery, Sanitary Sewer
Medical Photography	381	Yes	Yes	Silver Recovery, Sanitary Sewer
Occupational Therapy	381	No	No	N/A

Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
David Grant Medical Center (DGMC)				
Histopathology	381	Yes	No	N/A
Cytopathology	378	Yes	No	N/A
Clinical Laboratory	381	Yes	No	N/A
Central Sterile Supply	381	No	No	N/A
Diagnostic Radiology, Nuclear Medicine	381	Yes	Yes	Silver Recovery, Sanitary Sewer
Radiation Therapy	381	Yes	Yes	Silver Recovery, Sanitary Sewer
Surgery	381	No	No	N/A
Brace and Appliance Shop	373	Yes	No	N/A
Physical Therapy	381	No	No	N/A
MERC	373	Yes	No	N/A
Veterinary Animal Clinic	543	No	No	N/A
1901 Communications Group (CG)				
Base Communications Center	241	No	No	N/A
Nav-Aids Maintenance	909	No	No	N/A
Radar Maintenance	1186	Yes	No	N/A
Contingency Communications Element	54	No	No	N/A

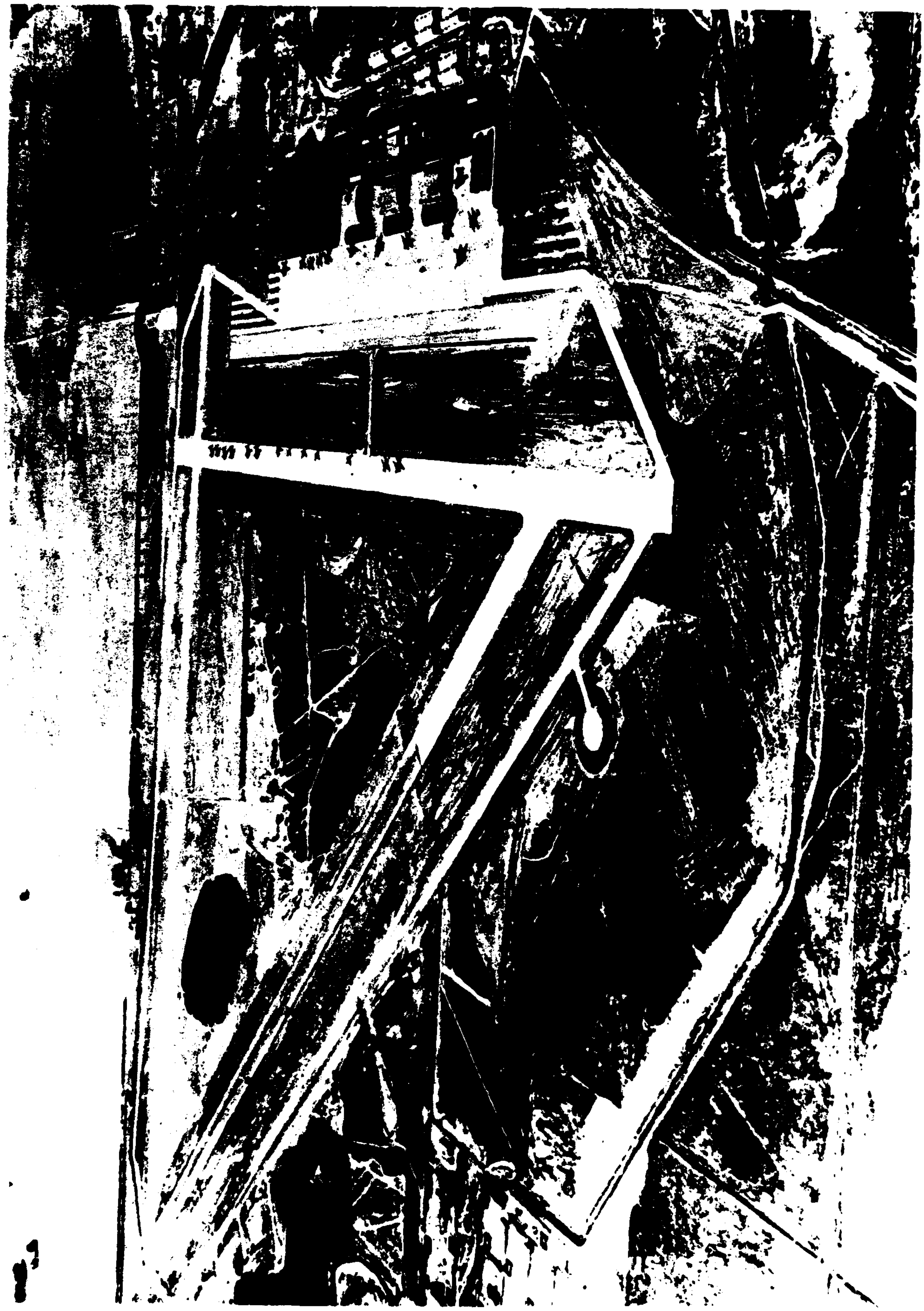
Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
307 Consolidated Aircraft Maintenance Squadron (CAMS)				
Avionics Shops	804	No	No	N/A
Aero Repair Shop	845	No	No	N/A
Electric Shop	838	No	No	N/A
Environmental Systems Shop	838	No	No	N/A
Fuel Systems Shop	838	Yes	Yes	Contract Disposal
Pneudraulic Shop	838	Yes	No	N/A
AGE Section	842	Yes	Yes	Contract Disposal
Fabrication Section	550	No	No	N/A
Corrosion Control	847	Yes	Yes	Contract Disposal
Engine Conditioning	843	Yes	Yes	Contract Disposal
Test Cell	1022	No	No	N/A
Periodic Inspection	847	No	No	N/A
Recovery Section	838	No	No	N/A
Support Section	838	No	No	N/A
Non-Powered AGE	842	No	No	N/A
Point Arena AFS				
CE Maint. Shop	201	Yes	No	N/A
Heating Facility	202	No	No	N/A

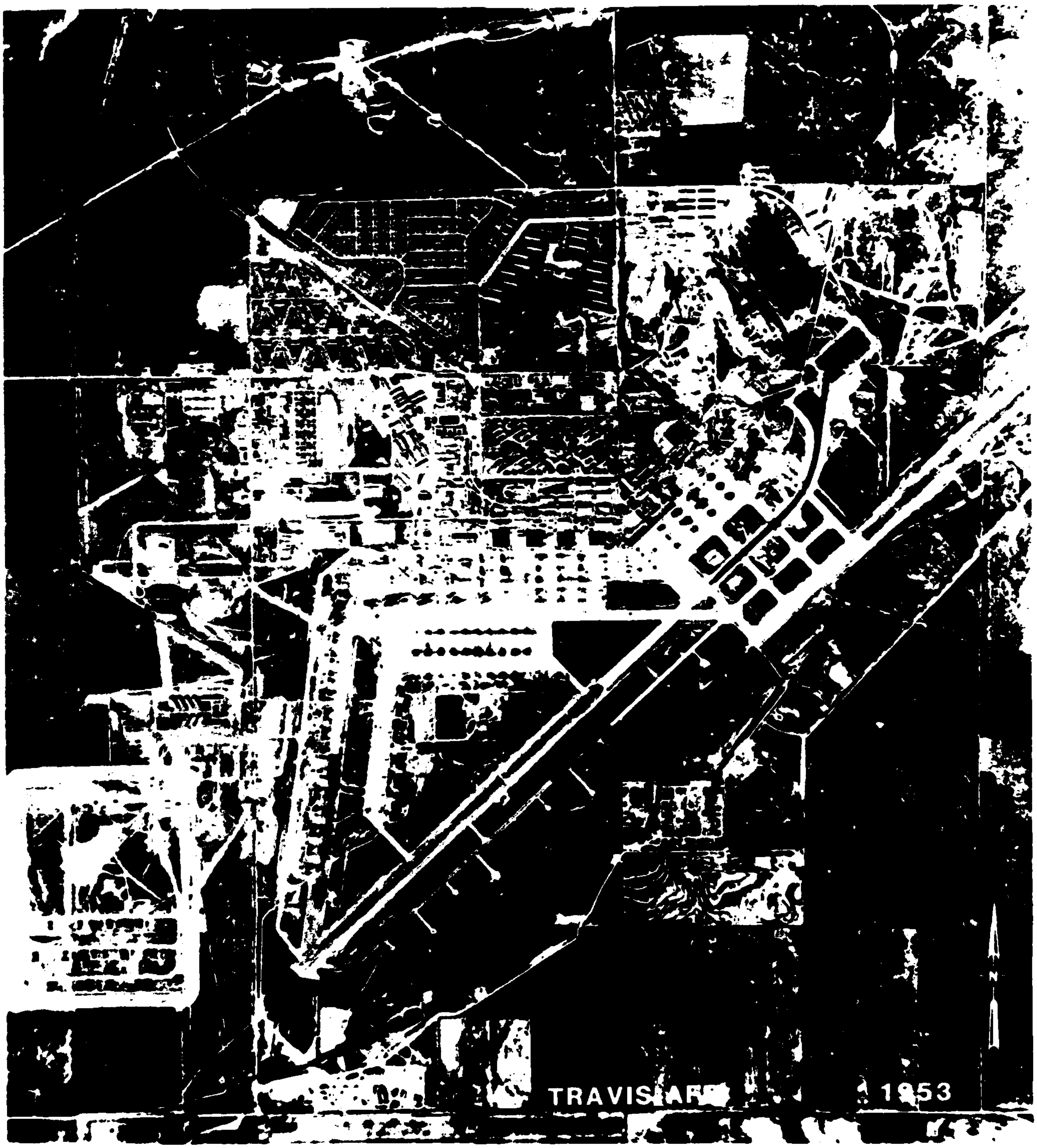
Name	Present Building Location	Handles Hazardous Materials	Generates Hazardous Wastes	Typical Treatment Storage & Disposal Methods
Point Arena AFS (continued)				
Paint Shop	203	Yes	Yes	Drummed to Travis AFB for contract Disposal
Vehicle Fuel Station	214	Yes	No	N/A
Auto Maintenance Shop	217	Yes	Yes	Drummed to Travis AFB for contract Disposal
Sewage Treatment and Disposal	408	No	No	N/A

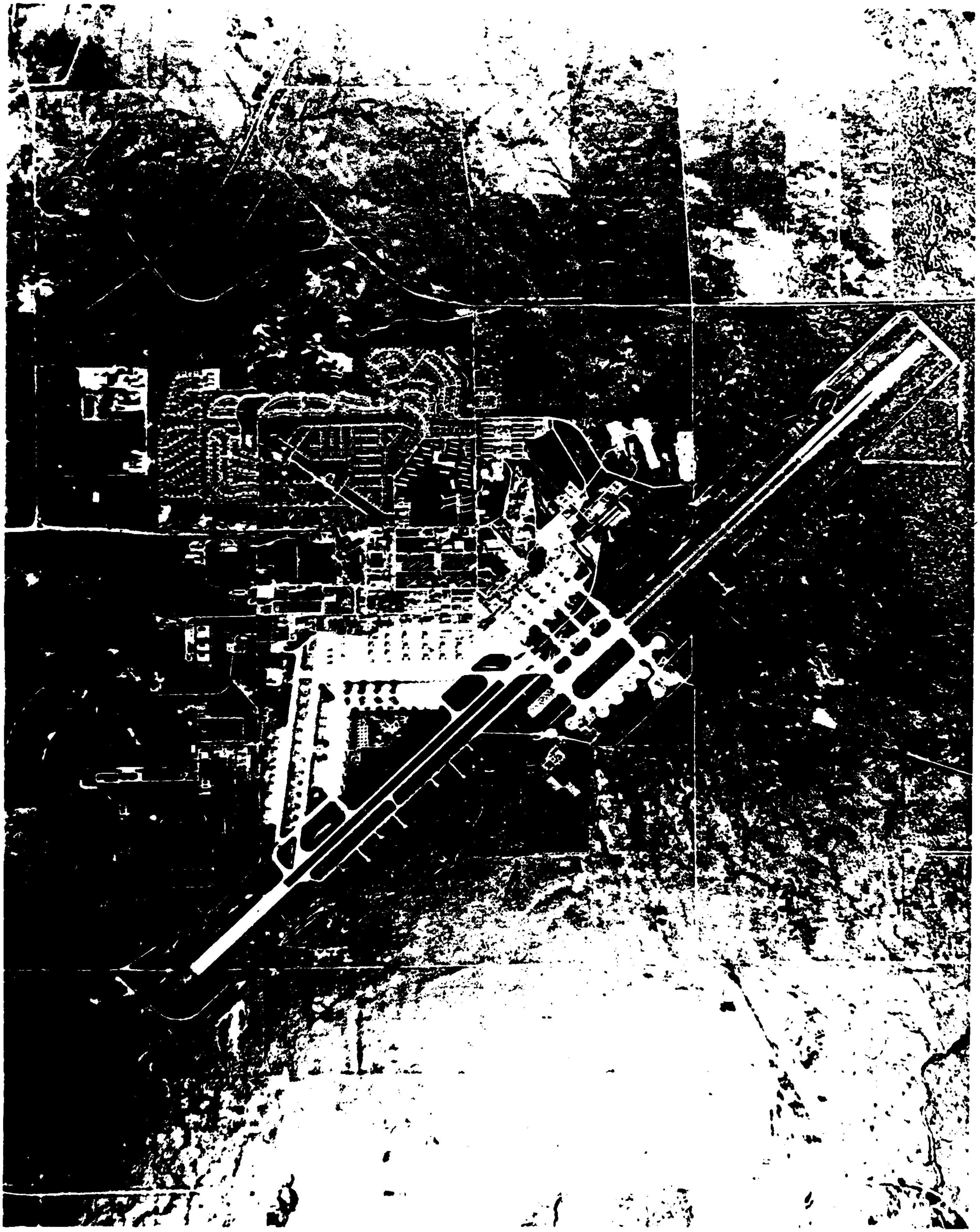
N/A - Not Applicable

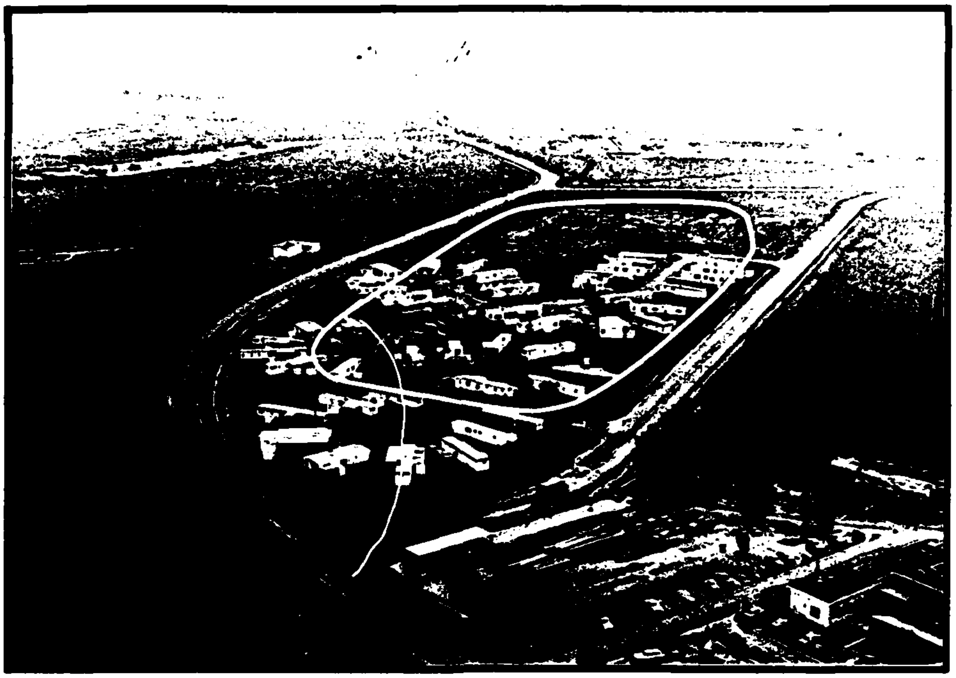
APPENDIX F

PHOTOGRAPHS

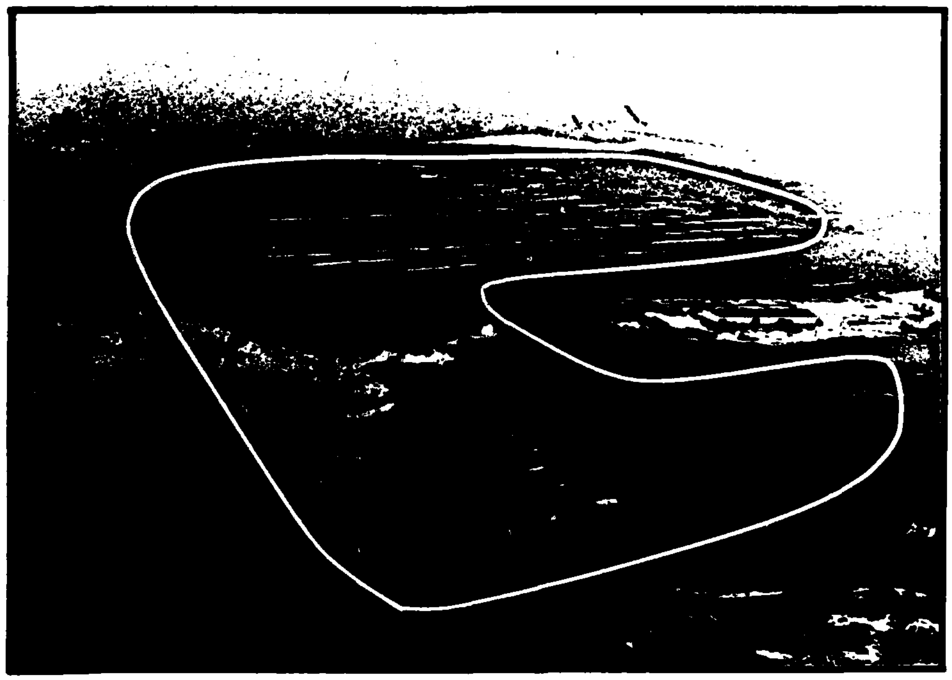



TRAVIS AF
1953



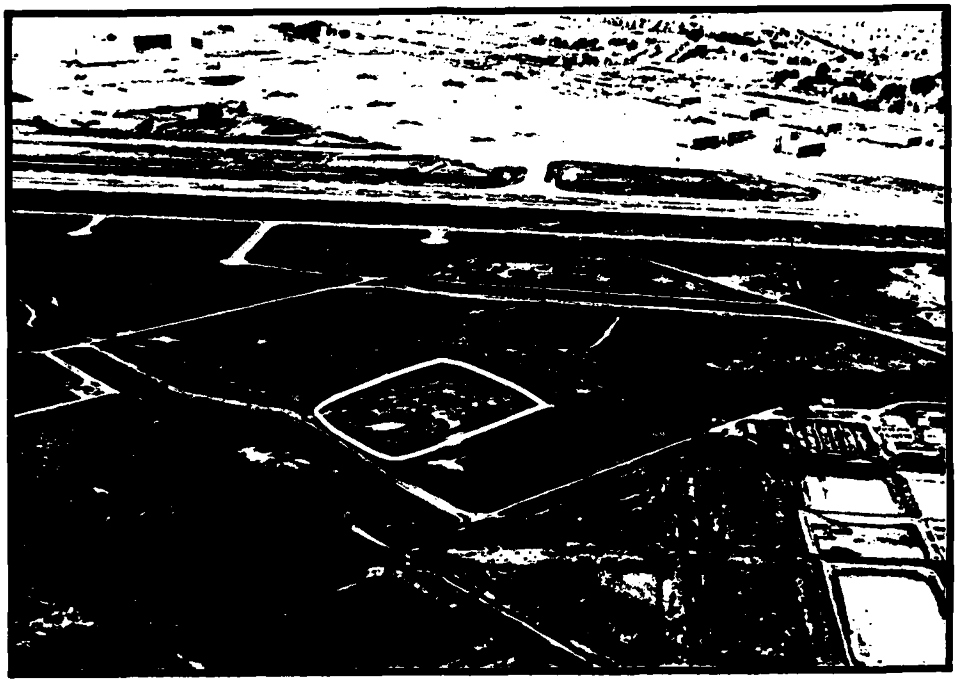


Landfill No. 1

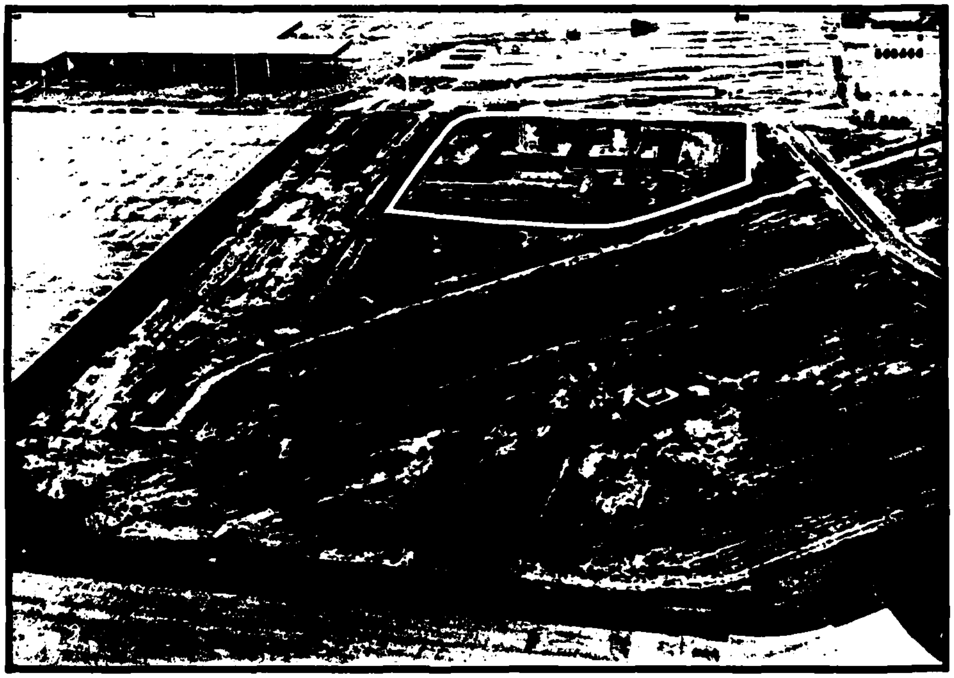


Landfill No. 2

TRAVIS AFB

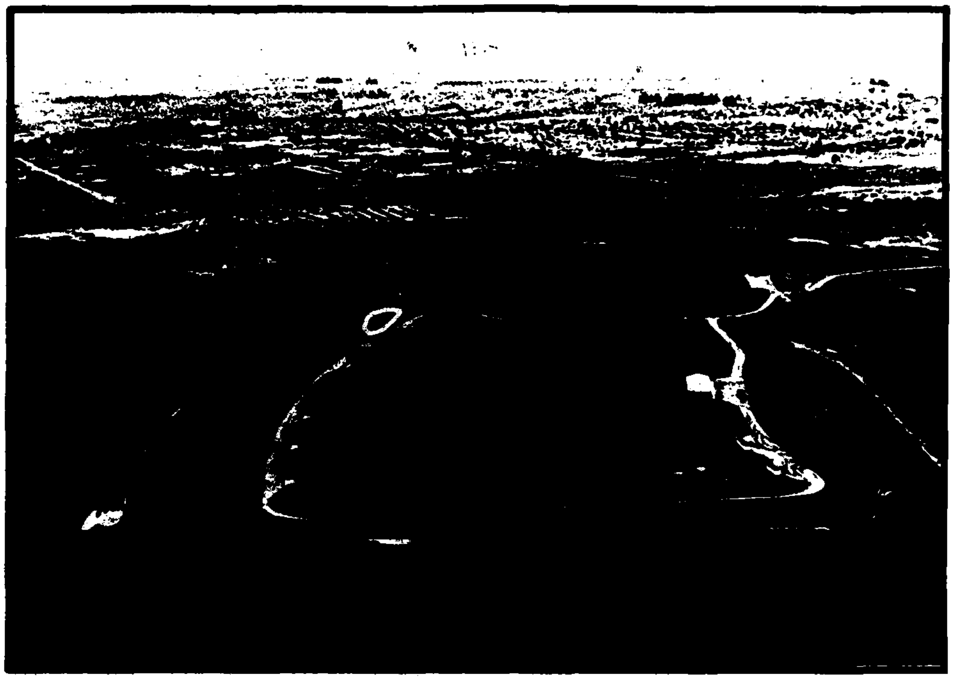


Fire Protection Training Area No. 4

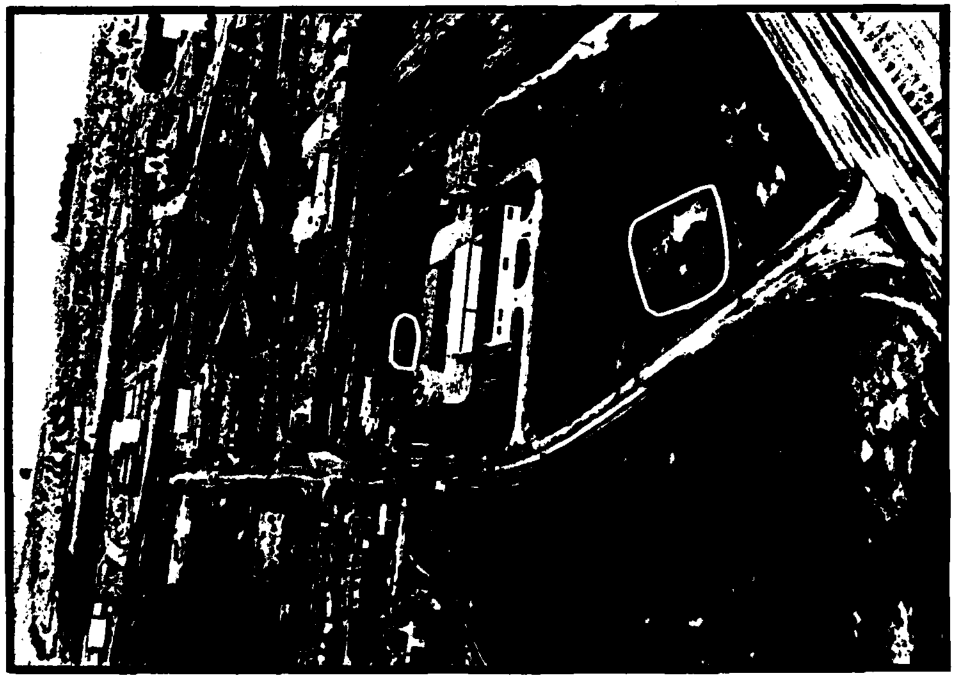


JP-4 Spill Site

TRAVIS AFB



Landfill No. 3



Radioactive Waste Burial Sites
(RB-1 and RB-2)

TRAVIS AFB

Point Arena Disposal Site No. 1
Burn Area

Point Arena Disposal Site No. 3
Orange Deposit at the bottom of earthen dam at fire pond

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from USAF Occupational Environmental Health Laboratory (OEHL), Air Force Engineering Services Center (AFESC), Engineering-Science (ES) and CH_2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering Science, and CH_2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Record Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

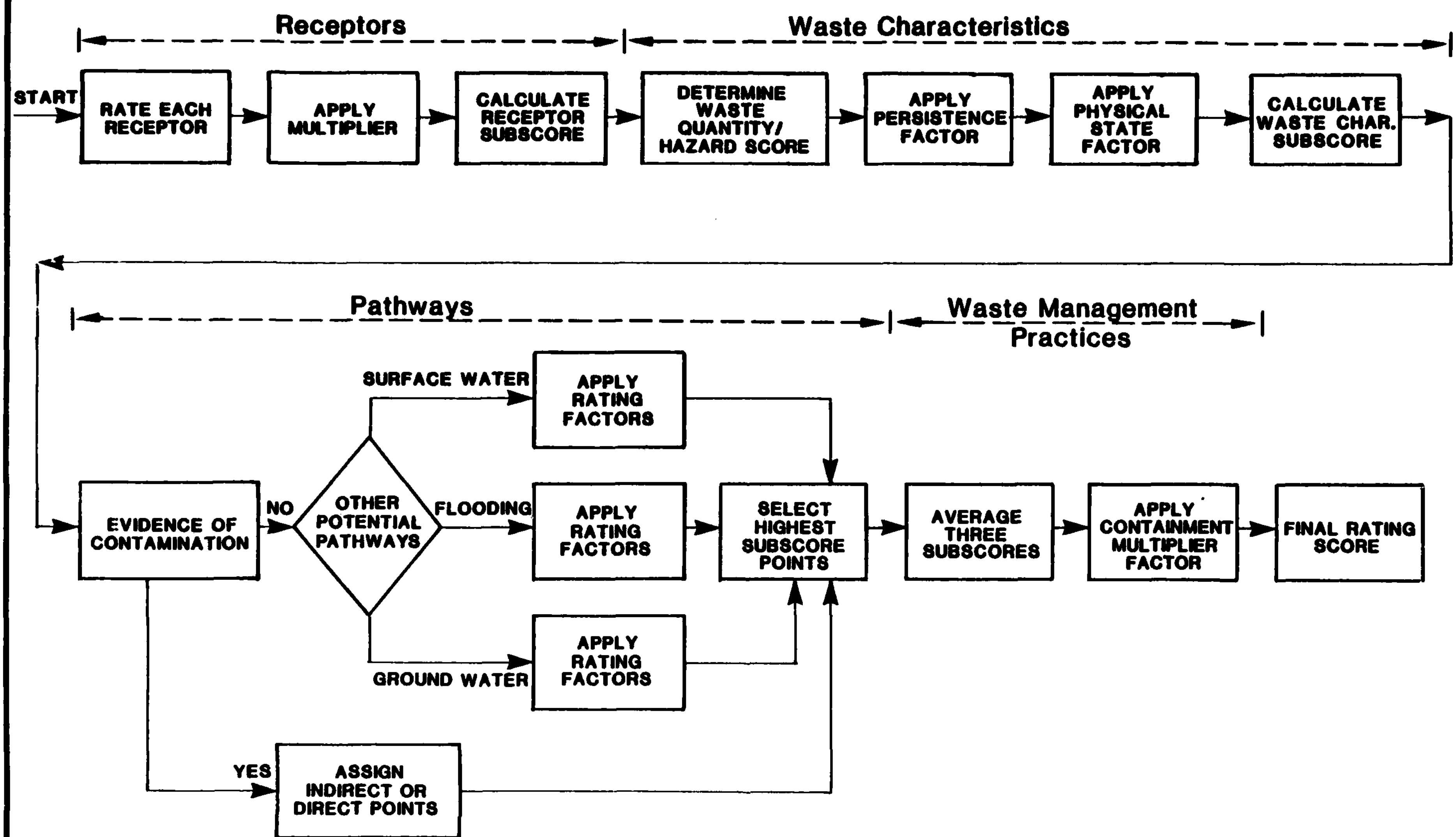


FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______

LOCATION ______

DATE OF OPERATION OR OCCURRENCE ______

OWNER/OPERATOR ______

COMMENTS/DESCRIPTION ______

SITE RATED BY ______

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
		Subtotals	______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
		Subtotals	______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

	Rating Scale Levels			
Hazard Category	0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION					
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8
B-2 POTENTIAL FOR FLOODING					
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1
B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION					
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. **WASTE MANAGEMENT PRACTICES FACTOR**

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

HAZARD ASSESSMENT RATING METHODOLOGY FORMS

TABLE OF CONTENTS
HAZARD ASSESSMENT RATING METHODOLOGY
TRAVIS AIR FORCE BASE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Fire Protection Training Area No. 4

LOCATION North of Carson Road, west of Sewage Treatment Plant, south of Inner Perimeter Rd.

DATE OF OPERATION OR OCCURRENCE 1962-present

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Burned waste oils, fuels, solvents; presently burn only JP-4

SITE RATED BY [signature] [signature]

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	109	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 61

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 0.9 = 90

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

90 x 1.0 = 90

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. *Ground-water migration*

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	61
Waste Characteristics	90
Pathways	43
Total 194 divided by 3 =	65
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

65 x 1.0 = $\boxed{65}$

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Fire Protection Training Area No. 3

LOCATION Just west of Perimeter Road, south of pistol and rifle range

DATE OF OPERATION OR OCCURRENCE 1953-1962

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Burned waste oils, fuels and solvents

SITE RATED BY Mark Spiewl E. Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 0.9 = 90

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

90 x 1.0 = 90

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	90
Pathways	43
Total 188 divided by 3 =	63 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

63 x 1.0 = 63

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Disposal Site No. 1
LOCATION Point Arena AFS
DATE OF OPERATION OR OCCURRENCE 1951-present
OWNER/OPERATOR Point Arena AFS
COMMENTS/DESCRIPTION Located behind Building 201
SITE RATED BY Mark Spiegel E. J. Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			89	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B
50 x 0.9 = 45

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore
45 x 1.0 = 45

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
		Subtotals	88	108

Subscore (100 X factor score subtotal/maximum score subtotal) 81

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	0

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	0	8	0	24
		Subtotals	74	114

Subscore (100 x factor score subtotal/maximum score subtotal) 65

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 81

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	45
Pathways	81
Total 175 divided by 3 =	58
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

58 x 1.0 = 58

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Landfill No. 2

LOCATION Just south of property line, west of pistol range, east of Collins Dr.

DATE OF OPERATION OR OCCURRENCE Late 1950's to 1974

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION General refuse, fuel tank sludge, minor amounts of other industrial

SITE RATED BY [signature] E/ [signature] wastes, occasional fires at landfi

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

50 x 0.75 = 38

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	3	8	24	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	70	108

Subscore (100 X factor score subtotal/maximum score subtotal) 65

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 65

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	38
Pathways	65
Total 158 divided by 3 =	53 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

53 x 1.0 = 53

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Solvent Spillage

LOCATION Just south of Hangar Avenue, east of Mills Street, west of Broadway St.

DATE OF OPERATION OR OCCURRENCE Prior to June 1981; length of time unknown

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Solvents from random cleaning operations

SITE RATED BY Mark Spurge E / Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	91	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 51

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 0.9 = 72

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

72 x 1.0 = 72

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	38	108

Subscore (100 X factor score subtotal/maximum score subtotal) 35

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	51
Waste Characteristics	72
Pathways	35
Total 158 divided by 3 =	53
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

53 x 1.0 = 53

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Landfill No. 3

LOCATION Just north of Ellis Drive, south of the Rodeo, east of property line

DATE OF OPERATION OR OCCURRENCE 1972-1977

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Received rinsed pesticide containers, bags and rinsate solutions

SITE RATED BY Mark Spiegel E / Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	89	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	60
Pathways	43

Total 152 divided by 3 = 51
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

51 x 1.0 = 51

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Fire Protection Training Area No. 1

LOCATION South of Travis Avenue, west of Broadway St., east of Mather Street

DATE OF OPERATION OR OCCURRENCE 1943-1950

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Burned waste oils, fuels and solvents

SITE RATED BY [signature] E. J. Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	97	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 54

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 0.9 = 72

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

72 x 1.0 = 72

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	N/A	8	N/A	-
Net precipitation	N/A	6	N/A	-
Surface erosion	N/A	3	N/A	-
Surface permeability	N/A	6	N/A	-
Rainfall intensity	N/A	3	N/A	-
		Subtotals	-	-

Subscore (100 X factor score subtotal/maximum score subtotal) N/A

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. *Ground-water* migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 38

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	54
Waste Characteristics	72
Pathways	28
Total 154 divided by 3 =	51 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

51 x .95 = 49

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Fire Protection Training Area No. 2
LOCATION North of Taxiway 7, East of Baker St., just west of Fire Prot. Training No.3
DATE OF OPERATION OR OCCURRENCE 1950-1952
OWNER/OPERATOR Travis AFB
COMMENTS/DESCRIPTION Burned waste oils, fuels and solvents
SITE RATED BY [signatures]

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	3	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	93	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 52

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 0.9 = 72

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

72 x 1.0 = 72

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	N/A	8	N/A	-
Net precipitation	N/A	6	N/A	-
Surface erosion	N/A	8	N/A	-
Surface permeability	N/A	6	N/A	-
Rainfall intensity	N/A	8	N/A	-
		Subtotals	-	-

Subscore (100 X factor score subtotal/maximum score subtotal) N/A

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	52
Waste Characteristics	72
Pathways	28
Total 152 divided by 3 =	51 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

51 x .95 = 48

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Disposal Site No. 3

LOCATION Point Arena AFS

DATE OF OPERATION OR OCCURRENCE

OWNER/OPERATOR Point Arena AFS

COMMENTS/DESCRIPTION Adjacent to Fire Pond

SITE RATED BY [signature] [signature]

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	1	6	6	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	89	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 20

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

20 x 1.0 = 20

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

20 x 0.5 = 10

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
		Subtotals	88	108

Subscore (100 X factor score subtotal/maximum score subtotal) 81

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	2	8	16	24
Subsurface flows	3	8	24	24
Direct access to ground water	0	8	0	24
		Subtotals	82	114

Subscore (100 x factor score subtotal/maximum score subtotal) 72

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 81

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	10
Pathways	81

Total 140 divided by 3 = 47 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

47 x 1.0 = 47

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE JP-4 Spill

LOCATION North of Taxiway 30, south of Ragsdale Street, west of Taxiway 29

DATE OF OPERATION OR OCCURRENCE 1978

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Approximately 15,000 gallons JP-4, some contained and cleaned up

SITE RATED BY Mark Spiegel E/ Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	89	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	48
Pathways	43
Total 140 divided by 3 =	47
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

47 x 0.95 = 44

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Oil Spillage

LOCATION South of Hangar Ave., east of Broadway St., north of Taxiway 23

DATE OF OPERATION OR OCCURRENCE Prior to 1983; length of time unknown

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Miscellaneous waste oils spilled on ground surface, soil discoloration

SITE RATED BY Mark Spiegel E. J. Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			91	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 51

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) M

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

50 x 0.9 = 45

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

45 x 1.0 = 45

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	38	108

Subscore (100 X factor score subtotal/maximum score subtotal) 35

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	51
Waste Characteristics	43
Pathways	35

Total 129 divided by 3 = 43
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

43 x 1.0 = 43

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Sewage Treatment Plant (STP) Sludge Disposal Areas

LOCATION Within boundaries of Sewage Treatment Plant & abandoned Oxidation Ponds

DATE OF OPERATION OR OCCURRENCE Early 1950's to late 1970's

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION STP digested sludge spread over two general areas

SITE RATED BY Mark Spiegel E J Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			115	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 0.4 = 16

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

16 x 0.75 = 12

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	64
Waste Characteristics	12
Pathways	43

Total 119 divided by 3 = 40 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

40 x 1.0 = 40

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Sewage Treatment Plant - Abandoned Oxidation Ponds

LOCATION West of Permeter Road, south of Inner Perimeter Road, East of Carson Rd.

DATE OF OPERATION OR OCCURRENCE Early 1950's to late 1970's

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Ponds received domestic and minor amounts of industrial wastes

SITE RATED BY [illegible] [illegible]

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	[illegible]	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6		18
I. Population served by ground-water supply within 3 miles of site	2	6	1[illegible]	18
			Subtotals 115	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 64

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 20

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

20 x 0.4 = 8

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

8 x 1.0 = 8

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	64
Waste Characteristics	8
Pathways	43

Total 115 divided by 3 = 38
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

38 x 1.0 = 38

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Radioactive Waste Burial Site No. 2 (RB-2)

LOCATION North of Ragsdale St., east of Dixon Ave., south of R.W.B. No.1

DATE OF OPERATION OR OCCURRENCE Late 1940's to 1962

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Contaminated solid materials such as clothing and gloves

SITE RATED BY [signatures]

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	59	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 30

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

30 x 1.0 = 30

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

30 x 0.5 = 15

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	15
Pathways	43
Total 107 divided by 3 =	36 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

36 x 1.0 = 36

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Landfill No. 1

LOCATION Between Vandenberg Drive and Collins Drive, south of property line

DATE OF OPERATION OR OCCURRENCE 1942 to mid 1950's

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION General refuse, minor amounts of industrial wastes; burned daily

SITE RATED BY [signature] E [signature]

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	103	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 57

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 20

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

20 x 0.4 = 8

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

8 x 0.5 = 4

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors 57
Waste Characteristics 4
Pathways 43

Total 109 divided by 3 = 35
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

35 x 1.0 = 35

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Radioactive Waste Burial Site No. 1 (RB-1)

LOCATION East of Dixon Ave., north of Ragsdale Street, south of Siren St.

DATE OF OPERATION OR OCCURRENCE Late 1940's to 1962

OWNER/OPERATOR Travis AFB

COMMENTS/DESCRIPTION Received washwater used to clean clothing and equipment used to service nuclear weapons

SITE RATED BY Mark Small, E J Schroeder

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
		Subtotals	89	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	46	108

Subscore (100 X factor score subtotal/maximum score subtotal) 43

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	1

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	32	114

Subscore (100 x factor score subtotal/maximum score subtotal) 28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49
Waste Characteristics	40
Pathways	43

Total 132 divided by 3 = 44 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

44 x 0.10 = 4

APPENDIX I

REFERENCES

APPENDIX I
REFERENCES

Blake, M. C. and Hones, D. L., 1974, Origin of Franciscan Melanges in Northern California, in Dott, R. H., Jr., Soc. Econ. Paleontologists and Minerologists Spec. Pub. 19

Bureau of Reclamation, 1979, Solano County Water Project California, A Report on the Feasibility of Water Supply Development

California Natural Diversity Data Base, Personal Interview, Ms. Suzanne Wall, June 1983

Department of Water Resources, 1978, Evaluation of Ground Water Resources: Sacramento Valley, Bulletin 118-6

Department of Water Resources, 1980, Ground Water Basins in California, Bulletin 118-80

Dickinson, W. R. and Rich, E. I., 1972, Petrologic Intervals and Petrofacies in the Great Valley Sequency, Sacramento Valley, California. Geologic Society of Am. Bull., V:83

Jenkins, O. P., 1966, Geologic Map of California, Sacramento Sheet, in Geologic Atlas of California, California Division of Mines and Geology

Jenkins, O. P., 1951, Geologic Guidebook of the San Francisco Bay Counties, California Division of Mines and Geology, Bulletin 154

Jennings, C. W., 1975, Fault Map of California, California Division of Mines and Geology

Montgomery, James M., Consulting Engineers, 1972, City of Fairfield Subregional Wastewater Management Study, prepared for the City of Fairfield

Nichols, D. R. and Wright, N. A., 1971, Preliminary Map of Historic Margins of Marshland, San Francisco Bay, California, U.S. Geologic Survey Open File Map

Page, B. N., 1965, Geology of the Coast Ranges of California, Cal. Div. Mines and Geology, Bull. 160

Sims, J. D., Fox, K. F., Bartow, J. A., and Helley, E. J., 1973, Preliminary Geologic Map of Solano County and Parts of Napa, Contra Costs, Marin, and Yolo Counties, California, U.S. Geologic Survey Miscellaneous Field Studies Map MF-848, reprinted 1980

U.S. Army Corps of Engineers, 1975, Final Environmental Statement Fairfield Vicinity Streams, California, prepared by U.S. Army Engineer District Sacramento, California

U.S.D.A. Soil Conservation Service, 1977, Soil Survey of Solano County, California

U.S. Environmental Protection Agency, National Iterim Primary Drinking Water Regulations, 40 CFR 141.

Woodward-Clyde Consultants, 1983, Travis AFB Composite Medical Facility Replacement, Phase I Geotechnical Studies

APPENDIX J

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX J
GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

ABANDONED WELL: A well which has been inactive for more than one year and has been destroyed according to the specifications outlined in the State of California, Well Standards Bulletin 74-81, December 1981.

ACFT MAINT: Aircraft Maintenance

AEC: Atomic Energy Commission

AF: Air Force

AFB: Air Force Base

AFCS: Air Force Communications Service

AFESC: Air Force Engineering and Services Center

AFFF: Aqueous Film Forming Foam, a fire extinguishing agent

AFR: Air Force Regulation

AFS: Air Force Station

Ag: Chemical symbol for silver

AGS: Aircraft Generation Squadron

Al: Chemical symbol for aluminum

ANG: Air National Guard

ARTESIAN: Ground water contained under hydrostatic pressure

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring

AQUIFER: a geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring

AQUITARD: A geologic unit which impedes ground-water flow

ASC: Audiovisual Service Center

AVGAS: Aviation Gasoline

Ba: Chemical symbol for barium

BEE: Bioenvironmental Engineering

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals

BOWSER: A portable tank to contain waste fuels, oils and chemicals

CAMS: Consolidated Aircraft Maintenance Squadron

Cd: Chemical symbol for cadmium

CEMIRT: Civil Engineering Maintenance Inspection Repair Training

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act

CES: Civil Engineering Squadron

CIRCA: About; used to indicate an approximate date

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation

CN: Chemical symbol for cyanide

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water

COE: Corps of Engineers

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water

Cr: Chemical symbol for chromium

CSG: Combat Support Group

Cu: Chemical symbol for copper

DET: Detachment

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water

DOD: Department of Defense

DOWNGRADIENT: In the direction of lower hydraulic static head; the direction in which ground water typically flows

DPDO: Defense Property Disposal Office, formerly Redistribution and Marketing

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease, vectors and scavengers

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment

ENT: Ear, Nose and Throat, an area of medical specialization

EOD: Explosive Ordnance Disposal

EP: Extraction procedure, the EPA's standard laboratory procedure for leachate generation

EPA: Environmental Protection Agency

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally

EROSION: The wearing away of land surface by wind, water or chemical processes

FAA: Federal Aviation Administration

FACILITY: Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes

Fe: Chemical symbol for iron

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient

FPTA: Fire Protection Training Area

GATR: Ground to Air Transmitter Receiver Site

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown organic compounds

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure

GROUND-WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material

HARM: Hazardous Assessment Rating Methodology

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. As defined in the California Health and Safety Code, four major hazard characteristics have been used to identify hazardous wastes: toxicity, flammability, reactivity, and corrosivity. These hazards are largely a consequence of the chemical compositions and properties of wastes. Radioactive wastes are not subject to control under state hazardous waste regulations.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations

Hg: Chemical symbol for mercury

HQ: Headquarters

HWMF: Hazardous Waste Management Facility

INACTIVE WELL: A well which is not in use but is still intact and could be put in service in the future.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground

IRP: Installation Restoration Program

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

JP-4: Jet Propulsion Fuel Number Four

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water

LINER: A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone

MAC: Military Airlift Command

MATS: Military Air Transport Service

MAW: Military Airlift Wing

MEK: Methyl Ethyl Ketone

MGD: Million gallons per day

MOGAS: Motor gasoline

Mn: Chemical symbol for manganese

MONITORING WELL: A well used to measure ground-water levels and to obtain water-quality samples

MSL: Mean Sea Level

NCO: Non-commissioned Officer

NCOIC: Non-commissioned Officer In-Charge

NDI: Non-destructive inspection

Ni: Chemical symbol for nickel

NPDES: National Pollutant Discharge Elimination System

OEHL: Occupational and Environmental Health Laboratory

OPNS: Operations

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon

OSI: Office of Special Investigations

O&G: Symbols for oil and grease

PAAFS: Point Arena Air Force Station

Pb: Chemical symbol for lead

PCB: Polychlorinated Biphenyl; liquids used as dielectrics in electrical equipment

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium

PD-680: Cleaning solvent

pH: Negative logarithm of hydrogen ion concentration

PL: Public Law

POL: Petroleum, Oils and Lubricants

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose

PPB: Parts per billion by weight

PPM: Parts per million by weight

RCRA: Resource Conservation and Recovery Act

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade

RECHARGE: The addition of water to the ground-water system by natural or artificial processes

RIPARIAN - Living or located on a riverbank

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water

SCS: U.S. Department of Agriculture Soil Conservation Service

SLUDGE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923)

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a period of years, in such a manner as not to constitute disposal of such hazardous waste

STP: Sewage Treatment Plant

TAC: Tactical Air Command

TDS: Total Dissolved Solid, a water quality parameter

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous

TSD: Treatment, storage or disposal

TAFB: Travis Air Force Base

TVOR: Tacan Visual Omni Range

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground water

USAF: United States Air Force

USAFSS: United States Air Force Security Service

USGS: United States Geological Survey

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere

Zn: Chemical symbol for zinc

APPENDIX K

INDEX OF REFERENCES TO POTENTIAL CONTAMINATION SOURCES

APPENDIX K

INDEX OF REFERENCES TO POTENTIAL CONTAMINATION SOURCES