1

AD-A142 304

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For March Air Force Base, California

20030110016

CH2M HILL

Prepared for

STRATEGIC AIR COMMAND
DEPUTY CHIEF OF STAFF, ENGINEERING AND SERVICES
OFFUTT AIR FORCE BASE, NEBRASKA 68113

APRIL 1984

NOTICE

This report has been prepared for the United States Air Force by CH2M HILL SOUTHEAST, INC., for the purpose of aiding in the implementation of 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 this 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

ADA142304

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLAS	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION CH2M Hill 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION HQ Strategic Air Command
6c. ADDRESS (City, State and ZIP Code) 7201 N.W. 11th Place P.O. Box 1647 Gainesville, FL 32602	7b. ADDRESS (City, State and ZIP Code) HQ SAC/DEPV Offutt AFB NE 68113
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable) HQ SAC/DEP	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER Contract #F08637-80-G0010-5010
8c. ADDRESS (City, State and ZIP Code) Offutt AFB NE 68113	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO.: 11894F PROJECT NO.: TASK NO.: WORK UNIT NO.:
11. TITLE (Include Security Classification) Installation Restoration Program Phase I - March AFB CA	
12. PERSONAL AUTHOR(S) Mr. Norm Hatch	
13a. TYPE OF REPORT Final 13b. TIME COVERED FROM 831027 TO 830428	14. DATE OF REPORT (Yr., Mo., Day) 84 04 28 15. PAGE COUNT 119
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES		
FIELD	GROUP	SUB. GR.

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Installation Restoration Program
Hazardous Wastes
Environmental Quality

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

The identification of hazardous waste disposal sites at military installations was directed by Defense Environmental Quality Program Policy Memorandums. Phase I constitutes a records search to determine the potential, if any, for off base imgration of toxic or hazardous wastes as a result of past operations and disposal activities. The final report reveals no direct evidence of off base pollution migration. However, it has been recommended that several areas receive additional attention to determine if pollution migration exists.

84 06 21 169

JUN 2 2 1984

A

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED XX SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION UNCLAS	
22a. NAME OF RESPONSIBLE INDIVIDUAL Dr. Hugh Stirts	22b. TELEPHONE NUMBER (Include Area Code) 402-294-5854	22c. OFFICE SYMBOL HQ SAC/DEPV

DD FORM 1473, 83 APR

EDITION OF 1 JAN 73 IS OBSOLETE.

INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
March Air Force Base, California

CH2M HILL

Prepared for

STRATEGIC AIR COMMAND
DEPUTY CHIEF OF STAFF, ENGINEERING AND SERVICES
OFFUTT AIR FORCE BASE, NEBRASKA 68113

APRIL 1984

INSTALLATION RESTORATION
PROGRAM RECORDS SEARCH

FOR

MARCH AIR FORCE BASE, CALIFORNIA

Prepared for

STRATEGIC AIR COMMAND
DEPUTY CHIEF OF STAFF, ENGINEERING AND SERVICES
OFFUTT AIR FORCE BASE, NEBRASKA 68113

Prepared by

CH2M HILL
7201 N.W. 11th Place
P.O. Box 1647
Gainesville, Florida 32602

April 1984

Contract No. F08637-80-G0010-5010

A-1

NOTICE

This report has been prepared for the United States Air Force by CH2M HILL SOUTHEAST, INC., for the purpose of aiding in the implementation of 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 this 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

CONTENTS

CONTENTS--Continued

TABLES

FIGURES

FIGURES

EXECUTIVE SUMMARY

A. INTRODUCTION

1. CH2M HILL was retained on September 21, 1983 to conduct the March Air Force Base (AFB) records search under Contract No. F08637-80-G0010-5010 with funds provided by Strategic Air Command (SAC).

2. Department of Defense (DoD) policy, directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations.

3. To implement the DoD policy, a four-phase Installation Restoration Program has been directed. Phase I, the records search, is the identification of potential problems. Phase II (not part of this contract) consists of the necessary field work to confirm the extent of contamination. Phase III (not part of this contract) consists of technology base development to support the development of project plans for controlling migration or restoring the installation. Phase IV (not part of this contract) includes those efforts which are required to control identified hazardous conditions.

4. The March AFB records search included a detailed review of pertinent installation records, 18 outside agency contacts for documents relevant to the records search effort, and an onsite base visit conducted by CH2M HILL during the

week of January 9 through January 13, 1984. Activities conducted during the onsite base visit included interviews with 81 past and present base employees, ground and helicopter tours of the installation and past disposal areas, and a detailed search of installation records. Prior to the base visit, the Public Affairs Office provided a press release announcing the study and requesting persons knowledgeable of past disposal practices at the installation to contact March AFB.

B. MAJOR FINDINGS

1. Current aircraft and vehicle maintenance operations at March AFB result in the generation of hazardous wastes, including spent degreasers, waste oils and hydraulic fluids, solvents, cleaning compounds, paint strippers and thinners, and contaminated jet fuels. The total quantity of the above hazardous wastes is estimated to be approximately 60,000 gallons per year. Approximately 17,100 gallons per year of solvents and 6,000 gallons per year of cleaning compounds are generated. In addition, approximately 16,000 gallons per year of waste oils (mostly engine oils, but also includes some commingled petroleum wastes such as hydraulic fluid, PD-680, MOGAS, and JP-4) are generated. Contaminated JP-4 (approximately 4,600 gallons per year) is used in fire department training exercises or disposed of through DPDO. Approximately 16,300 gallons per year of other hazardous wastes (including hydraulic fluid, paint strippers and thinners, waste paints, acids, antifreeze, fixer and developer, etc.) are generated. These estimates of waste quantities were derived from a review of shop files and the best recollection of interviewees. The quantities of materials usage prior to the early 1980's could have been greater based on the higher level of aircraft maintenance activities during that period.

2. Standard procedures for the disposal of the majority of industrial wastes in the past have been as follows:

- Various practices including waste incinerators, storm drains, landfills, fire department training exercises, and disposal on the ground (1918-1940)
- Fire department training exercises (1940 to 1975)
- Contractor removal through DPDO (1975 to present)

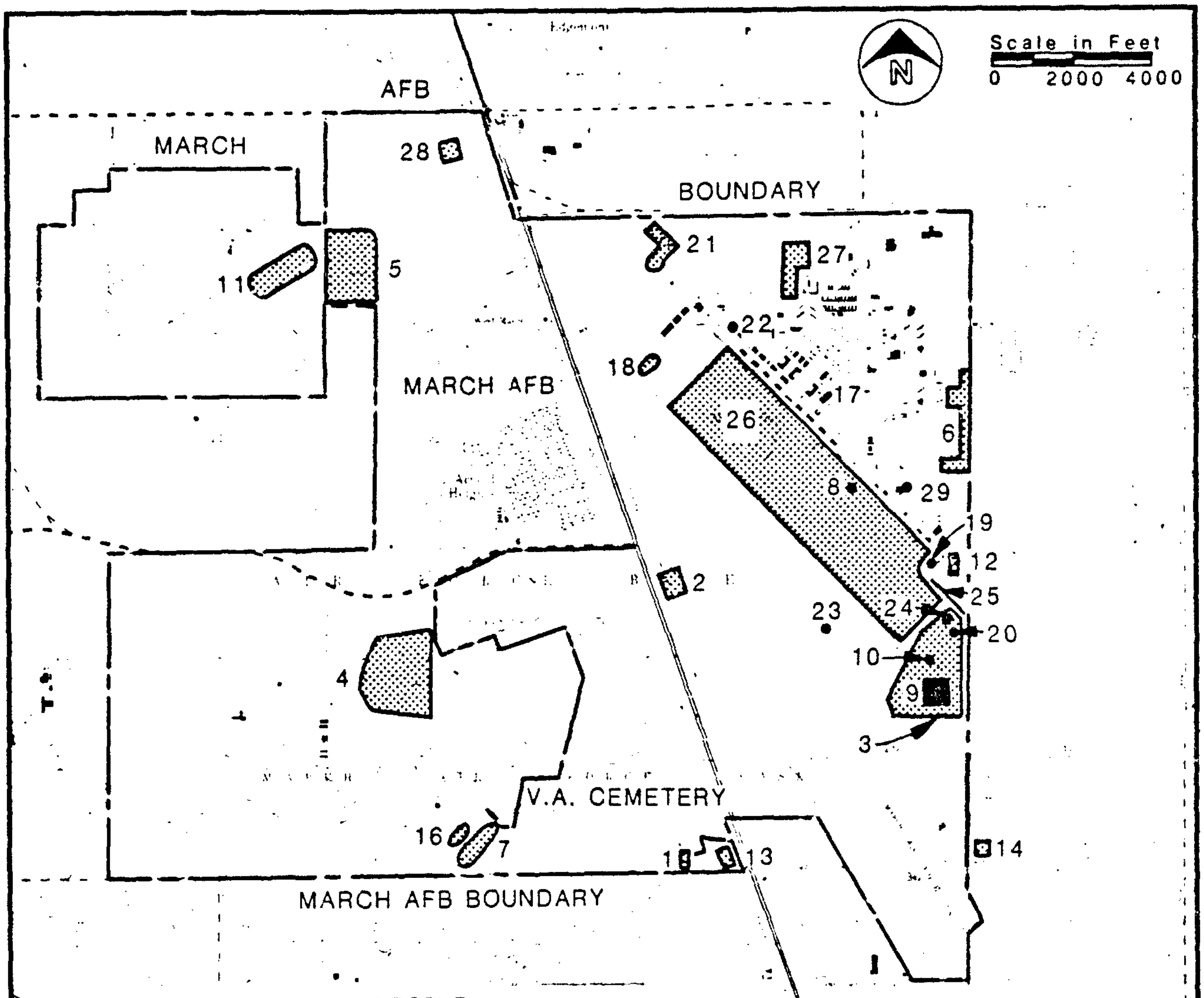
Since the early 1970's, most contaminated JP-4 fuel has been used in fire department training exercises or disposed of through DPDO.

3. Interviews with past and present base employees resulted in the identification of 30 past disposal or spill sites at March AFB and the approximate dates that these sites were active. Figure 1 shows the locations of the identified disposal and spill sites.

C. CONCLUSIONS

1. Information obtained through interviews with 81 past and present base personnel (over one-half with 20 or more years at the installation), outside agency contacts, base records, shop folders, and field observations indicates that hazardous wastes have been disposed of on March AFB property in the past.

2. The relatively deep water table at March Air Force Base (approximately 100 feet below land surface in the north-east corner at Wells No. 1, 3, and 4 and approximately 300 feet below land surface in the southeast corner at Wells No. 5 and 6) would cause a time lag in detection of contamination which originated at the ground surface. A well could become polluted long after a disposal practice ceased. Contaminants could also be stored in the unsaturated zone above the water table. In this case, the most rapid transfer of contamination into the aquifer would occur while a driving force exists, such as percolation of water into the aquifer following a



LEGEND

1. Landfill No. 1
2. Landfill No. 2
3. Landfill No. 3
4. Landfill No. 4
5. Landfill No. 5
6. Landfill No. 6
7. Landfill No. 7
8. Fire Department Training Area No. 1
9. Fire Department Training Area No. 2
10. Fire Department Training Area No. 3
11. Munitions Residue Burial Site
12. East March Sludge Drying Beds
13. West March Sludge Drying Beds
14. East March Effluent Pond
15. Coudures Effluent Pond
16. Water Treatment Plant Sludge
17. Swimming Pool Fill
18. Aircraft Isolation Area
19. Liquid Fuels Pump Station Overflow
20. Tank Truck Spill Site
21. Bulk Fuels Storage Area
22. Waste Oil Pit/Solvent Tanks
23. Engine Test Cell
24. Main Oil/Water Separator
25. Flightline Drainage Channel
26. Flightline Shop Zone
27. Civil Engineering Storage Yard
28. Construction Rubble Burial Site
29. Unconfirmed Solvent Disposal
30. Building Demolition Areas (Not shown on Figure - multiple sites)

15

FIGURE 1
Location Map of Identified Disposal and Spill Sites at March AFB

CH2M HILL

thunderstorm. An additional potential pathway for contamination to rapidly enter the aquifer may be through improperly sealed well casings. Thus, a potential for groundwater contamination exists despite the low annual net precipitation for the area (-70 inches per year).

3. Table 1 presents a priority listing of the rated disposal and spill sites and their overall scores. Site No. 18, Aircraft Isolation Area (overall score of 72), was designated as showing the most significant potential (relative to other March AFB sites) for environmental concerns due to the potential for contamination of the groundwater with fuel and possibly TCE from past practices.

4. Other sites showing the most significant potential (relative to other March AFB sites) for environmental concerns are as follows:

- Site No. 22 -- Waste Oil Pit/Solvent Tanks
- Site No. 5 -- Landfill No. 5
- Site No. 6 -- Landfill No. 6
- Site No. 3 -- Landfill No. 3
- Site No. 4 -- Landfill No. 4
- Site No. 9 -- Fire Department Training Area No. 2
- Site No. 26 -- Flightline Shop Zone
- Site No. 24 -- Main Oil/Water Separator
- Site No. 25 -- Flightline Drainage Channel

Table 1
PRIORITY LISTING OF DISPOSAL AND SPILL SITES

Ranking No.	Site No.	Site Description	Overall Score
1	18	Aircraft Isolation Area	72
2	22	Waste Oil Pit/Solvent Tanks	69
3	5	Landfill No. 5	64
4	6	Landfill No. 6	63
5	3	Landfill No. 3	62
6	4	Landfill No. 4	62
7	9	Fire Department Training Area No. 2	62
8	26	Flightline Shop Zone	62
9	24	Main Oil/Water Separator	61
10	25	Flightline Drainage Channel	61
11	21	Bulk Fuels Storage Area	58
12	27	Civil Engineering Storage Yard	58
13	20	Tank Truck Spill Site	51
14	8	Fire Department Training Area No. 1	50
15	19	Liquid Fuels Pump Station Overflow	45
16	10	Fire Department Training Area No. 3	43
17	12	East March Sludge Drying Beds	43
18	17	Swimming Pool Fill	43
19	23	Engine Test Cell	43
20	29	Unconfirmed Solvent Disposal	43
21	13	West March Sludge Drying Beds	42
22	7	Landfill No. 7	40
23	15	Coudures Effluent Pond	40
24	2	Landfill No. 2	39
25	14	East March Effluent Pond	38
26	1	Landfill No. 1	36

(Note: Sites No. 11, 16, 28, and 30 were not rated.)

- Site No. 21 -- Bulk Fuels Storage Area
- Site No. 27 -- Civil Engineering Storage Yard

5. No evidence of widespread environmental stress due to past disposal or spills of hazardous wastes was observed at March AFB, although disturbance of native vegetation from past landfilling and fire department training exercises was clearly evident.

6. No direct evidence was found to indicate that migration of hazardous contaminants exists beyond the March AFB boundary. Direct evidence of contamination and/or contaminant migration within the installation boundary was found at Wells No. 1 and No. 3 (TCE contamination of potable groundwater supply since at least 1978). The exact source(s) of TCE groundwater contamination is not known, but is suspected to have originated from past TCE usage (spills, leaking tanks, discharge to ground) in the vicinity of Site No. 18 (Aircraft Isolation Area), Site No. 22 (Waste Oil Pit/Solvent Tanks), and possibly a portion of Site No. 26 (Flightline Shop Zone) including the Building 422 (Motor Pool) 50,000-gallon-capacity underground waste accumulation tank. Two 1,000-gallon-capacity underground concrete solvent storage tanks were formerly located at Site No. 22. Sites No. 18, No. 22, and a portion of No. 26 are located upgradient and within the aquifier recharge area of Wells No. 1 and 3.

7. The remaining rated sites (Sites No. 1, 2, 7, 8, 10, 12, 13, 14, 15, 17, 19, 20, 23, and 29), as well as the sites that were not rated (Sites No. 11, 16, 28, and 30), are not considered to present significant concern for adverse effects on health or the environment.

8. The March AFB records search did not indicate any significant environmental concerns for the off-base facilities

consisting of:

- Water System Annex No. 2 (PDPE)
- VOR Annex (PDNS)
- Communications Facility Annex (PDNE)
- Communications Annex No. 2 (QKFN)
- ILS Middle Marker Annex (PDBS)
- Light Annex No. 2 (PDBH)
- Hawes Radio Relay Annex (KHGM)

D. RECOMMENDATIONS

1. A Phase II monitoring program is recommended to confirm or rule out the presence and/or migration of hazardous contaminants. Site-specific monitoring recommendations include the installation of upgradient and downgradient monitoring wells for sampling groundwater at the following sites:

- A zone consisting of Landfill No. 3 (Site No. 3), Fire Department Training Area No. 2 (Site No. 9), Fire Department Training Area No. 3 (Site No. 10), Tank Truck Spill Site (Site No. 20), Main Oil/Water Separator (Site No. 24), and the Flightline Drainage Channel (Site No. 25)

- A zone consisting of the Aircraft Isolation Area (Site No. 18), Bulk Fuels Storage Area (Site No. 21), the Waste Oil Pit/Solvent Tanks (Site No. 22), a portion of the Flightline Shop Zone (Site No. 26), and the Civil Engineering Storage Yard (Site No. 27)

- Landfill No. 4 (Site No. 4)

- Landfill No. 5 (Site No. 5)

- Landfill No. 6 (Site No. 6)

In addition, soil sampling is recommended off-base at the unlined portion of the Perris Valley Storm Drain just downstream of the lined Flightline Drainage Channel (Site No. 25). Details of the proposed Phase II monitoring program are provided in Section VI of this report. The recommended Phase II monitoring sites are shown in Figure 2.

2. The specific details of the monitoring program, including the exact locations of monitoring and sampling points, should be finalized as part of the Phase II program. If contaminants are detected at significant levels, a more extensive field survey program should be implemented to determine the extent of contaminant migration.

3. Other IRP environmental recommendations include:

- Disposing of the water treatment plant lime sludge accumulated at Site No. 16 in a permitted Class I or Class II-1 landfill.

- Emphasizing good housekeeping practices and the necessity to eliminate spillage of solvents and fuels on the ground in the Aircraft Isolation Area (Site No. 18), the Bulk Fuels Storage Area (Site No. 21), the Flightline Shop Zone (Site No. 26), and the Civil Engineering Storage Yard (Site No. 27).

- Pressure testing of the 50,000-gallon-capacity underground waste accumulation tank at Building 422 (Motor Pool) on a periodic basis to confirm that leakage of hazardous wastes from this tank is not occurring.

- Restricting access to Landfill No. 4 (Site No. 4) from Plummer Road and Landfill No. 5 (Site No. 5) from Cactus Avenue to discourage unauthorized waste dumping.

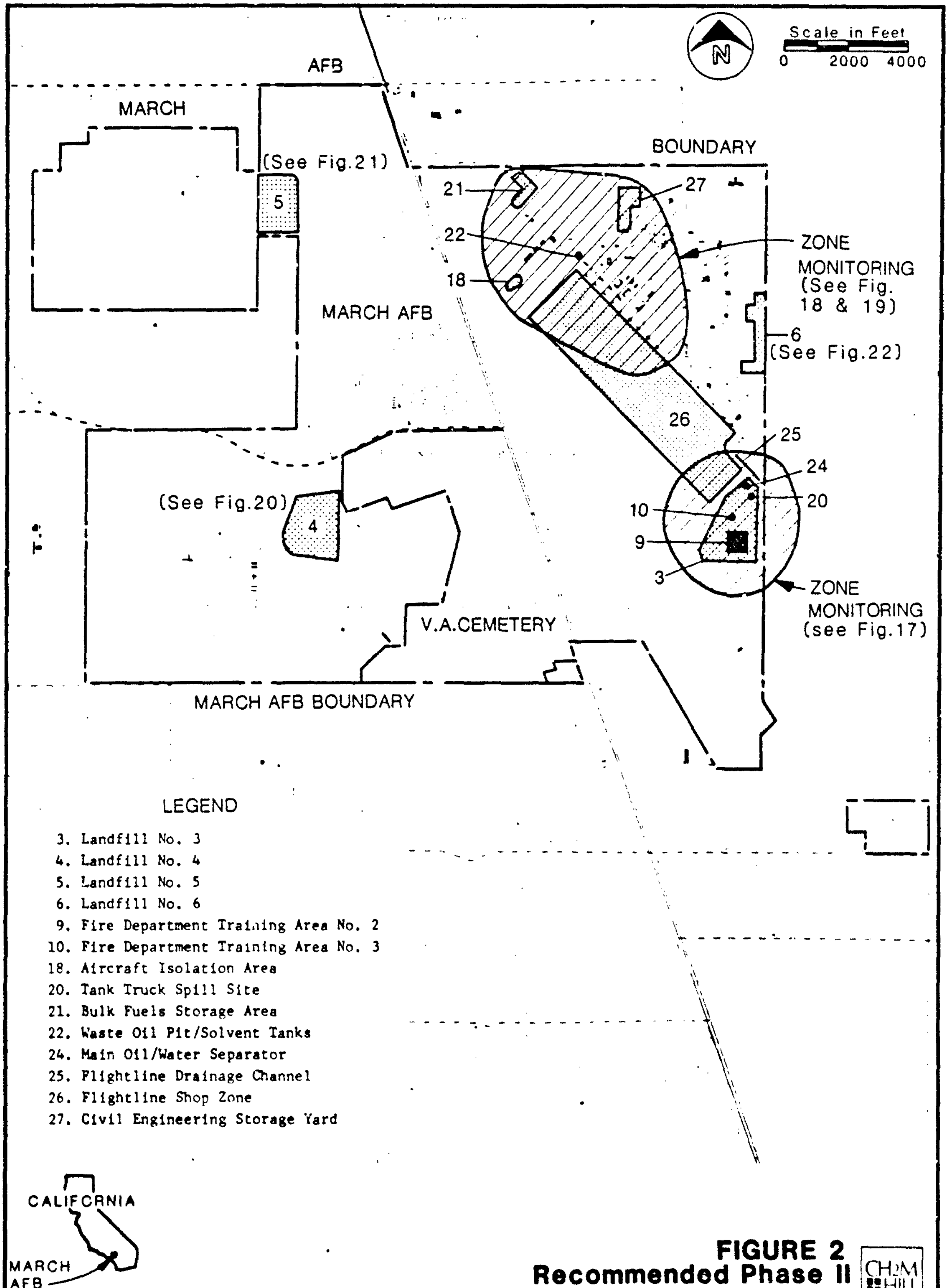


FIGURE 2
Recommended Phase II Monitoring Sites at March AFB

- o Continuing periodic sampling of the base water supply wells for volatile organic compounds (VOCs).

An unconfirmed report was received during the base personnel interviews that drummed wastes (including paints, solvents, and other flightline shop wastes) may have been included in the former base swimming pool fill (Site No. 17). Although this site only received a HARM rating of 43, consideration should be given to verifying the existence and location of these drums (via magnetrometer survey or ground penetrating radar) and to removing them from the site if they are found to exist. Although the concrete swimming pool walls are assumed to offer some limited containment of these suspected wastes, there is a potential for the steel drums to corrode allowing the waste materials to potentially seep out.

I. INTRODUCTION

A. BACKGROUND

The United States Air Force (USAF), 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 Department of Defense (DoD) developed the Installation Restoration Program (IRP) to ensure compliance with hazardous waste regulations. The current DoD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Headquarters Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material contamination, and to control hazards to health and welfare that may have resulted from these past operations. The IRP will be the basis for assessment and response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as implemented by Executive Order 12316 and provisions of Subpart F of 40 CFR 300 (National Contingency Plan). CERCLA is the primary Federal legislation governing remedial actions at uncontrolled hazardous waste sites.

To conduct the IRP Hazardous Materials Disposal Sites Records Search for March AFB, California, CH2M HILL was retained on September 21, 1983 under Contract No. F08637-

80-G0010-5010 with funds provided by Strategic Air Command (SAC). A location map of March AFB is shown in Figure 3.

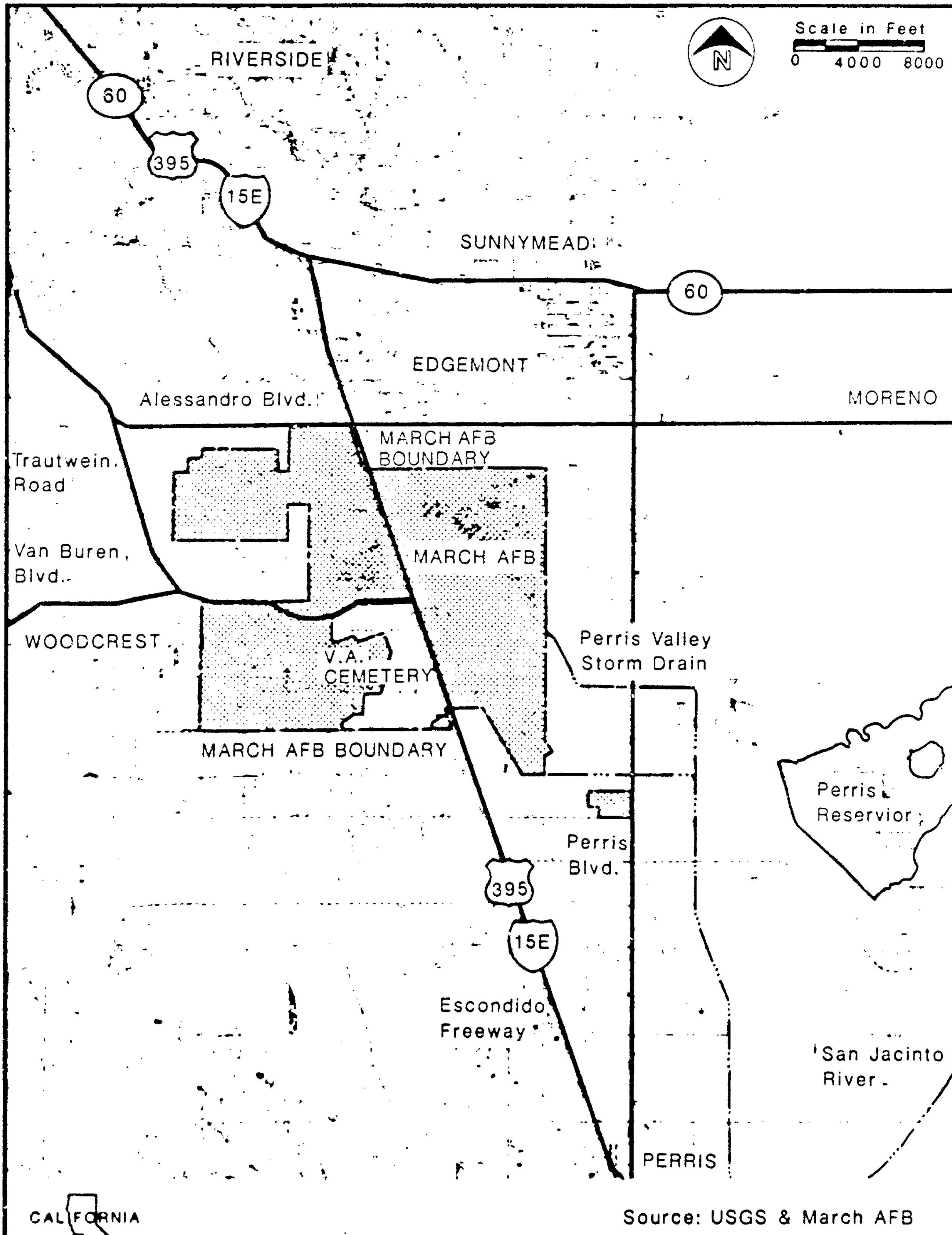
The records search comprises Phase I of the DoD IRP and presents a review of installation records for the purpose of identifying possible hazardous waste-contaminated sites and assessing the potential for contaminant migration. Phase II (not part of this contract) consists of follow-on field work as determined from Phase I. Phase II consists of the necessary field work to confirm the extent of the contamination. Phase III (not part of this contract) consists of technology base development to support the development of project plans for controlling migration or restoring the installation. Phase IV (not part of this contract) includes those efforts which are required to control identified hazardous environmental conditions.

B. AUTHORITY

The identification of hazardous waste disposal sites at Air Force installations was directed by Defense Environmental Quality Program Policy Memorandum 81-5 (DEQPPM 81-5) dated 11 December 1981, and implemented by Headquarters Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations.

C. PURPOSE OF THE RECORDS SEARCH

The purpose of the Phase I records search is to identify and evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities. The existence of and potential for migration of hazardous material contaminants were evaluated at March AFB by reviewing the existing information and conducting an analysis of installation records. Pertinent information included the



Source: USGS & March AFB

FIGURE 3
Location Map of March AFB

CH2M HILL

history of operations, the geological and hydrogeological conditions which may have contributed to the migration of contaminants, and the ecological features which indicated environmentally sensitive habitats or evidence of environmental stress. The evaluation is to determine which identified sites, if any, exhibit a significant potential for environmental impact and warrant further investigation. No sampling or field work is conducted during Phase I.

D. SCOPE

The records search program included a pre-performance meeting, an onsite installation visit, a review and analysis of the information obtained, and preparation of this report.

The pre-performance meeting was held at March AFB, California, on October 27, 1983. Attendees at this meeting included representatives of the Air Force Engineering and Services Center (AFESC), the Strategic Air Command Headquarters (SAC), March AFB, and CH2M HILL. The purpose of the pre-performance meeting was to provide detailed project instructions, to provide clarification and technical guidance by AFESC, and to define the responsibilities of all parties participating in the March AFB records search.

The onsite installation visit was conducted by CH2M HILL from January 9 through January 13, 1984. Activities performed during the onsite visit included a detailed search of installation records, ground and helicopter tours, and interviews with installation personnel. At the conclusion of the onsite visit, the Deputy Base Commander, the Deputy Base Civil Engineer, the Base Bioenvironmental Engineer, the Base Environmental Coordinator, and public affairs and legal staff representatives were briefed on the preliminary findings. The following individuals comprised the CH2M HILL records search team:

1. Mr. James Bloomquist, Project Manager (B.S., Civil Engineering, 1973)

2. Mr. Michael Kemp, Environmental/Hazardous Waste Engineer (M.S., Civil and Environmental Engineering, 1978)

3. Mr. Michael Concannon, Chemistry/Ecology (B.A., Marine Biology/Chemistry, 1972)

4. Mr. Fritz Carlson, Hydrogeologist (M.S., Hydrology, 1974; B.A., Geology, 1966)

5. Ms. Jane Gendron, Ecologist (B.A., Biology, 1976)

6. Mr. Norman Hatch, Project Administrator and QA/QC Review (M.S., Chemistry, 1972; M.S., Environmental Engineering, 1973).

Resumes of these team members are included in Appendix A.

Government organizations were contacted for information and relevant documents. Appendix B lists the organizations contacted.

Individuals from the Air Force who assisted in the March AFB records search included:

1. Mr. Bernard Lindenberg, AFESC, Program Manager, Phase I

2. Lt. James R. Krier, SAC, Command Representative

3. Lt. Allan Berenbrok, March AFB, Environmental Coordinator

4. Capt. Mohammad A. Hossain, March AFB, Bioenvironmental Engineer

5. Mr. Richard F. Glancy, March AFB, Deputy Civil Engineer

E. METHODOLOGY

The methodology used in the March AFB records search is shown in Figure 4. First, a review of past and present industrial operations was conducted at the installation. Information was obtained from available records such as shop files and real property files, as well as interviews with past and present base employees from the various operating areas of the installation. The information obtained from interviewees on past activities was based on their best recollection. A list of interviewees from March AFB, with areas of knowledge and years at the installation, is given in Appendix C.

The next step in the activity review process was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from all the industrial operations on the base. This part of the activity review included the identification of past landfill and burial sites; as well as other possible sources of contamination such as major PCB or solvent spills, or fuel-saturated areas resulting from significant fuel spills or leaks.

General ground and aerial tours of identified sites were then made by the records search team to gather site-specific information including evidence of environmental stress and the presence of nearby drainage ditches or

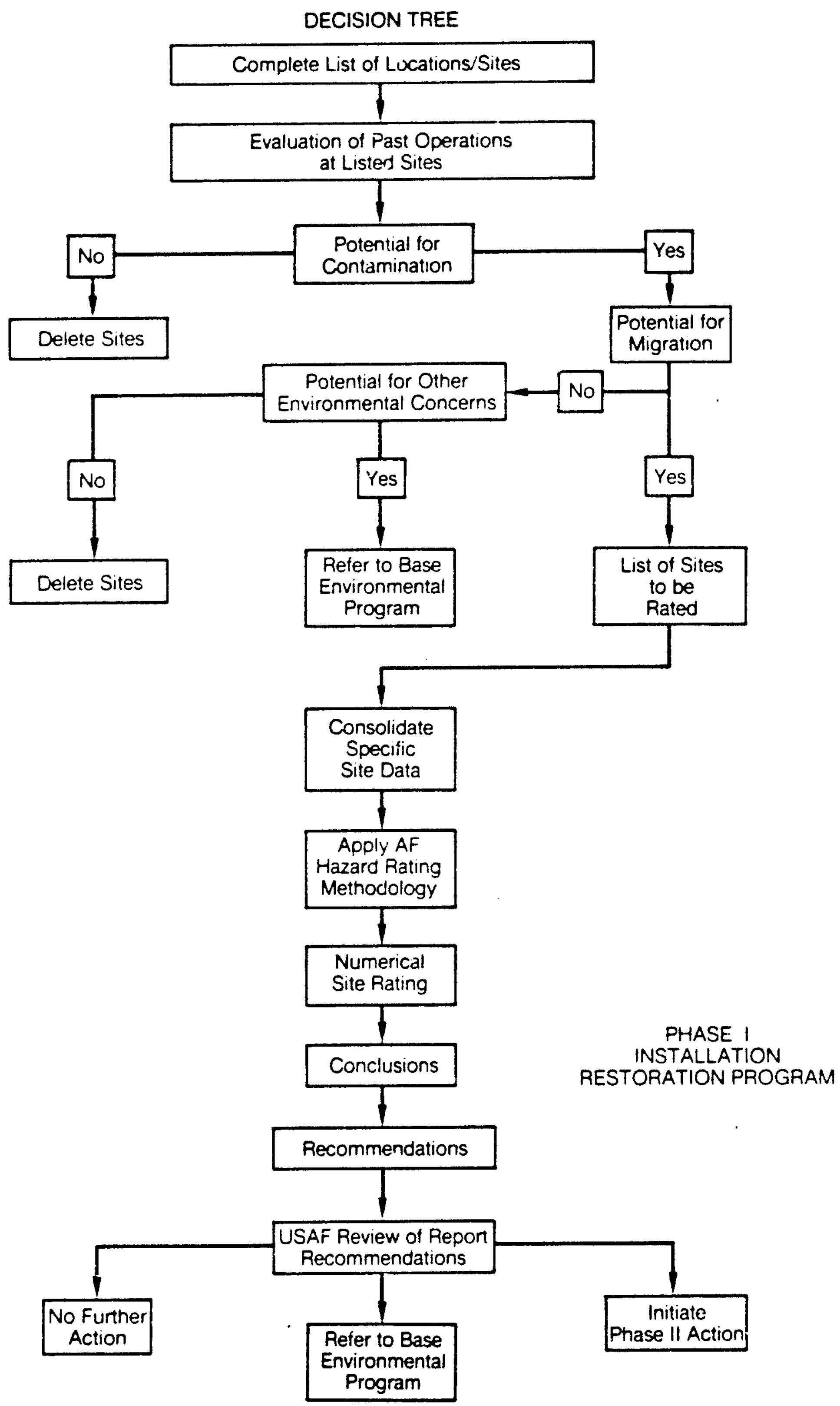


FIGURE 4

Records Search Methodology

surface-water bodies. These water bodies were visually inspected for any evidence of contamination or leachate migration.

A decision was then made, based on all of the above information, as to whether a potential existed for hazardous material contamination from any of the identified sites. If not, the site was deleted from further consideration.

For those sites at which a potential for contamination was identified, the potential for migration of this contamination was evaluated by considering site-specific soil and groundwater conditions. If no potential for contaminant migration existed, but other environmental concerns were identified, the site was referred to the base environmental monitoring program. If no further environmental concerns were identified, the site was deleted from consideration. If the potential for contaminant migration was identified, then site-specific information was evaluated and the site was rated and prioritized using the site rating methodology described in Appendix G, "Hazard Assessment Rating Methodology."

The site rating indicates the relative potential for adverse environmental impact at each site. For those sites showing a significant potential, recommendations were made to conduct a more detailed investigation of the potential contaminant migration problem under Phase II of the Installation Restoration Program. For those sites showing a low potential, no Phase II work was recommended.

II. INSTALLATION DESCRIPTION

A. LOCATION

March AFB covers over 7,000 acres on both sides of Interstate Highway 15E (also known as Interstate 215, the Escondido Freeway, and U.S. Highway 395), just east of the city of Riverside, Riverside County, California (reference previous Figure 3). Other nearby communities (within 10 miles) include Woodcrest, Edgemont, Sunnymead, Moreno, and Perris. The nearest major commercial jet airport is located in Ontario, about 30 miles to the northwest. In addition, Los Angeles International Airport is located 80 miles to the west and the John Wayne-Orange County Airport is located 50 miles southwest of the base. Access to the March AFB main gate is provided via the Cactus Avenue exit of Interstate 15E. The current base boundaries are shown in Figure 5.

Off-base facilities associated with March AFB include the following:

- Water System Annex No. 2 (PDPE)
- VOR Annex (PDNS)
- Communications Facility Annex (PDNE)
- Communications Annex No. 2 (QKFN)
- ILS Middle Marker Annex (PDBS)
- Light Annex No. 2 (PDBH)
- Hawes Radio Relay Annex (KHGM)

Descriptions of these facilities are presented in Section VII, Off-Base Facilities.

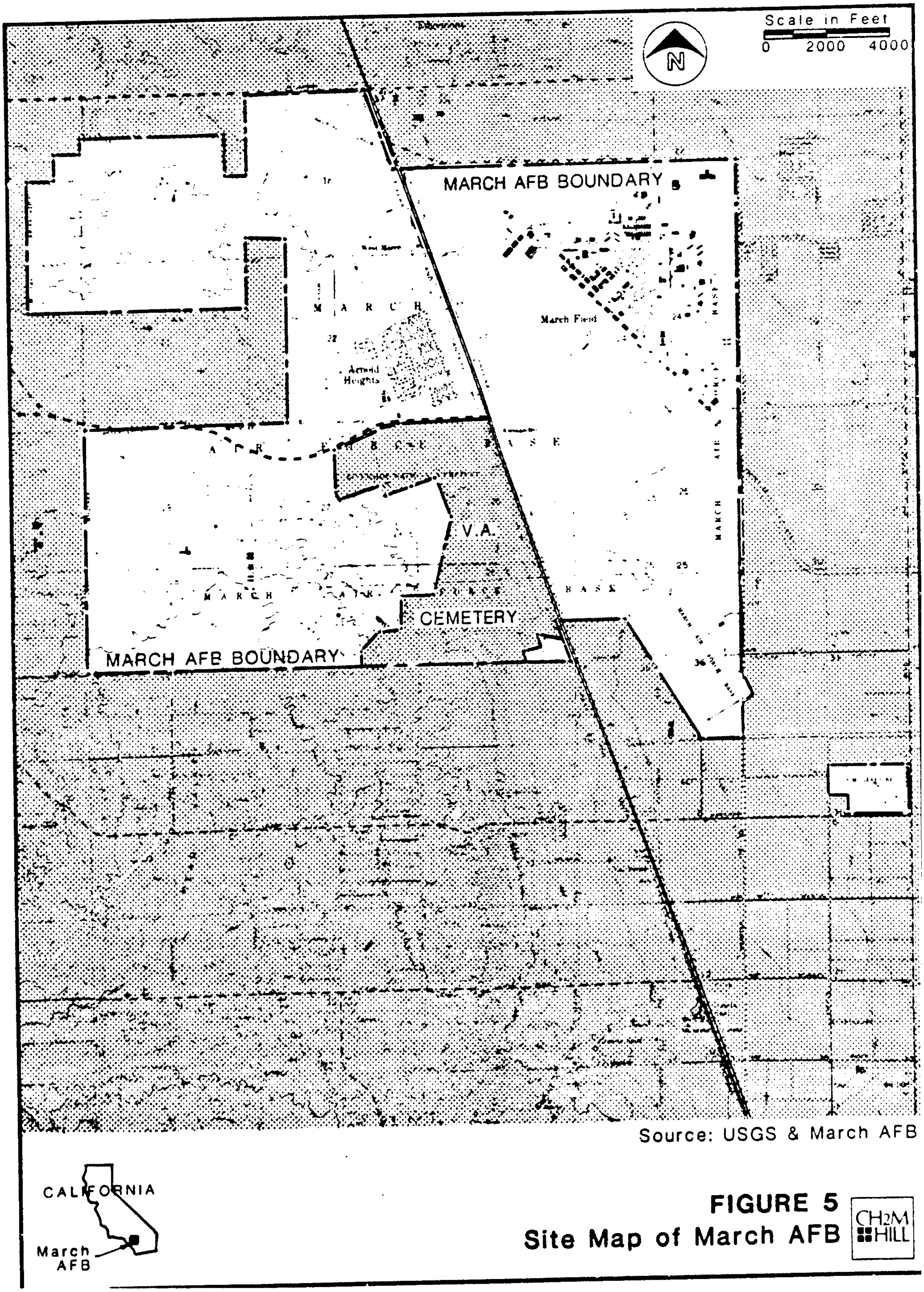


FIGURE 5
Site Map of March AFB

CH2M HILL

B. ORGANIZATION AND MISSION

March AFB is a Strategic Air Command facility hosted by the 22nd Air Refueling Wing. The more than 6,000 military and civilian personnel stationed at March AFB are part of a distinguished heritage begun over 65 years ago when the Riverside Chamber of Commerce won Congressional approval to establish a "Winged Calvary Post" on the outskirts of the city. The initial 640-acre site, originally called Alessandro Aviation Field, was officially opened on March 1, 1918 and became the first Air Force Base established in the West.

Used initially to train World War I "Jenny" pilots, the base has served as a primary flying and anti-aircraft training school, tactical bomber and pursuit training base, aircraft test center, and a key installation of the Strategic Air Command. The base was closed for approximately four years following World War I and reopened in 1927. By 1938, March AFB had become the central base for West Coast bombing and gunnery training. During World War II, the Camp Haan Army Base was constructed west of Highway 395. The army base served primarily as an anti-aircraft artillery camp and was a staging area for General Patton's tank force. According to interviewee reports, Camp Haan at its peak stretched as far as five miles along the western edge of Highway 395 south of the present alignment of Alessandro Boulevard. Following World War II, the camp area became a part of the air base and became known as West March. March AFB retained its role as an operational fighter base until the Strategic Air Command (SAC) took over control in 1949.

The 22nd Bombardment Wing became the senior host tactical unit at March AFB in early 1949. Later that same year, the Headquarters 15th Air Force was relocated to March AFB to supervise SAC's western operations. By mid-1950, the installation had again become purely a bomber base. Additional base construction occurred in the early 1950's including maintenance hangars for the 22nd Bombardment Wing's B-47's. In late 1960, the 452nd Military Airlift Wing and 303rd Air Rescue Squadron reserve units transferred to March AFB. In the mid-1960's further construction of support facilities was necessitated with the doubling of size of the base units and aircraft. At that time the 22nd Bombardment Squadron (now assigned B-52's) and the 22nd Air Refueling Squadron (with its KC-135's) were complemented by the arrival of the 909th Air Refueling Squadron and the 486th Bombardment Squadron at March AFB.

In the late 1960's March AFB saw construction of a wing maintenance control facility, engine inspection and repair shop, a large maintenance dock, as well as new officer quarters and another dormitory. The 486th and 909th tactical squadrons were lost to March in the early 1970's. In the mid-1970's the 452nd Air Refueling Wing (AFRES) converted to C-119's, then C-124's, then C-130's, and again back to KC-135's. The 303rd Aerospace Rescue and Recovery Squadron (AFRES) had joined the March AFB groups in the late 1960's. The 33rd Communications Group took over buildings in 1977 previously occupied by the Cartographic Technical Squadron. The 33rd Communications Group had been at March AFB since the late 1940's occupying various areas on base.

After a 42-year history of service as a Bombardment Wing, the 22nd was redesignated the 22nd Air Refueling Wing on October 1, 1982. The wing was notified that the aging B-52D's would be retired and that it would be only the second unit in the Air Force to receive the new KC-10A Extender giant tankers. KC-135 tankers are also currently assigned to March AFB.

The primary mission of the 22nd Air Refueling Wing is to maintain an effective air-to-air refueling operations capability. The major tenant organizations at March AFB and their missions, as well as a more detailed history of March AFB, are included in Appendix D, Installation History.

III. ENVIRONMENTAL SETTING

A. METEOROLOGY

Weather conditions in the vicinity of March AFB may be characterized by a winter period from November through April during which most rainfall occurs and a dry summer season from May through October. Transitional periods may extend a month or longer. The average yearly rainfall is approximately 9.2 inches. Thunderstorms are infrequent; usually occurring in mid-summer months. The mean annual evapotranspiration rate in the vicinity of March AFB is estimated to be over 80 inches per year. Therefore, the annual net precipitation (mean annual precipitation minus mean annual evapotranspiration) for the March AFB area is approximately -70 inches per year.

The temperature at March AFB has varied from 16°F to 114°F, with a mean of 62°F. Generally July is the hottest month, with a mean daily maximum temperature of 93°F and a minimum temperature of 61°F. January is the coolest month with mean daily highs and lows of 62°F and 38°F. The base annually has approximately 19 days with temperatures below freezing and less than one inch snowfall.

The prevailing wind is from the northwest, and the mean wind speed for that direction is 4 knots. The prevailing winds are modified by several local and regional weather conditions. The most severe condition (Santa Ana winds) occurs when strong (greater than 30 knots), dry, northerly or easterly winds flow across the Southern California deserts and move through the Santa Ana and other river canyons toward the coastal regions. The Santa Ana winds generally occur in the October through March period and last up to several days.

Another important local meteorological condition occurs when low-level marine temperature inversion reduces local visibility. The inversion caps the marine air and prevents the escape of water vapor, particulates, and impurities. Air masses exiting the Los Angeles basin are moved through the Riverside area and cause a deterioration in air quality due to ocean salt particulates, industrial emissions, and motor vehicle exhaust gases. Dust and local oil refinery and agricultural air pollutant emission sources also contribute to degrading air quality.

Fog from the ocean moving inland or ground fog emanating locally may form during the winter period. Maritime fog (derived from a temperature inversion at less than 1600 feet mean sea level--msl) or stratus (from an inversion above 1600 feet msl) often occurs at March AFB during May and October. Table 2 summarizes the available meteorological data for March AFB.

B. PHYSICAL GEOGRAPHY

March Air Force Base is located in the northern end of Perris Valley, a semiarid, north-south trending alluvial valley which is bounded by low-lying granitic bedrock on the west and a series of tributary valleys and granitic mountains on the east. Directly east of the base lies Moreno Valley, an east-west trending tributary valley that connects to the northernmost part of Perris Valley. This system of narrow valleys and crystalline rocks of granitic composition is part of the Perris Block, a mass of relatively high land located 30 to 90 miles southeast of Los Angeles, which is bounded by the Jacinto Fault on the east and the Elsinore Fault on the west.

Ground surface elevations within the March AFB boundaries vary from 1465 feet msl in the southeast corner to

Table 2

METEOROLOGICAL DATA SUMMARY FOR MARCH AFB (1948-1978)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Temperature (°F)													
Mean Daily Maximum	62	65	66	71	76	84	93	92	88	80	71	64	76
Mean Daily Minimum	38	40	42	45	50	55	61	61	58	50	44	39	49
Mean Monthly	50	53	54	58	63	70	77	77	73	65	57	52	62
Extreme Maximum	85	87	93	97	103	110	110	109	114	103	92	90	114
Extreme Minimum	16	22	24	27	33	39	49	49	42	28	26	17	16
Precipitation (Inches)													
Mean Monthly	2.1	1.7	1.3	0.9	0.2	0.0	0.1	0.2	0.3	0.2	1.0	1.2	9.2
Monthly Maximum	6.3	8.9	5.2	4.6	2.1	0.3	1.5	2.4	3.0	1.8	5.6	4.4	8.9
Monthly Minimum	0.0	0.0	0.0	a	a	a	0.0	0.0	0.0	0.0	0.0	a	a
Maximum 24 Hours	3.0	2.1	1.6	1.6	1.1	0.3	1.0	1.7	2.1	0.6	2.1	1.9	3.0
Mean Monthly Snowfall	b	b	b	b	0	0	0	0	0	0	b	b	b
Maximum Monthly Snowfall	5	b	1	b	0	0	0	0	0	0	b	1	5
Wind (Knots)													
Prevailing Direction	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Mean Speed	3	4	4	4	4	4	4	4	4	3	3	3	4

Source: AWS Climatic Brief, March AFB

[a] Less than 0.1 inch.

[b] Less than 1 inch.

1760 feet msl in the northwest corner (refer to Figure 7). The eastern two-thirds of the base, which contains the airfield and support buildings, is located on relatively flat terrain with a slope of approximately 20 feet per mile to the southeast. The western third of the base is composed of hilly terrain with small arroyos.

The Box Spring Mountains, located approximately 4 miles north of the base, rise 1500 feet above the valley floor and reach a height of 3000 feet above mean sea level. The Mount Russell Range rises to an elevation of 2200 feet msl at a location 2-1/2 miles east of the southeast corner of the base.

1. Soils

Soils at March AFB are generally sandy loams derived from granitic alluvium or weathered in place directly on the granitic basement rock. These soils are well drained to excessively drained and possess moderately low to moderately high runoff potential.

Soils in the western third of the base are developed directly on the granitic basement rock and are therefore shallow (one to 3 feet deep) and coarse to medium grained. The granitic bedrock in this area is a granodiorite or tonalite. The Cieneba, Fallbrook, and Vista Series compose this soil association. The slope of these uplands varies from 2 to 50 percent.

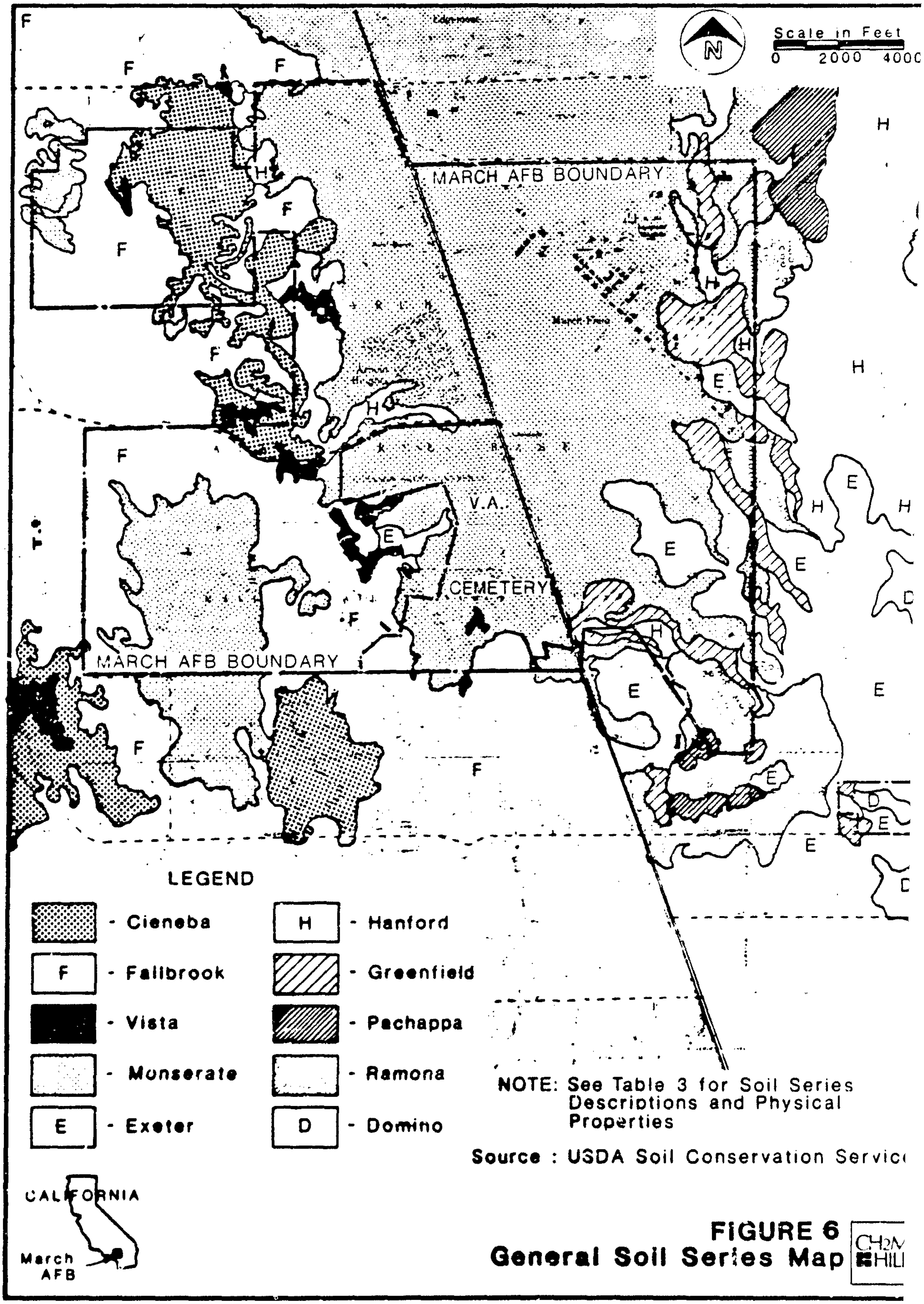
The soils in the valley on the eastern two-thirds of the base are fine to medium grained and are developed on old terraces, alluvial fans, basins, and shallow slopes. Two of the soil series, the Monserate Series and the Exeter Series, contain an indurated, relatively impermeable silica hardpan at a depth of 28 to 50 inches, thus promoting a moderately high runoff potential. The deeper soils in the valley center are found along the eastern edge of the base and are generally more permeable. This soil association consists of the Hanford, Greenfield, Pachappa, and Ramona Series.

An exposure of the Domino Series exists on the small military reservation site located directly southeast of the base (location of base water supply Wells No. 5 and 6). This soil series is underlain by an impermeable calcareous horizon at a depth of 27 to 36 inches. Figure 6 displays a map of the soil series present within the boundaries of March Air Force Base, and Table 3 summarizes the soil descriptions and physical properties.

2. Geology

The Perris Block is an eroded mass of Cretaceous and older crystalline rock cut by interconnected valleys which are deeply alluviated. The elevation of the Perris Block has oscillated since the Pliocene, thereby producing a number of erosional surfaces. The western part of March Air Force Base is situated on a relatively flat eroded bedrock surface known as the Perris Surface which is approximately 300 feet higher than the northern part of Perris Valley.

Perris Valley and its tributary valleys, including Moreno Valley, were eroded from the bedrock in a time of uplift 9 million years ago, and then filled with eroded sediment and detritus from the highlands in a period 3 to 6 million years ago. The uppermost level of sediment in Perris Valley and Moreno Valley was deposited during the last 500,000 years and consists of 20 to 100 feet of alluvial fan, terrace, and flood-plain deposits. The surface geology and the elevation of bedrock underlying the Perris Basin is shown in Figure 7.



NOTE: See Table 3 for Soil Series Descriptions and Physical Properties

Source : USDA Soil Conservation Service

FIGURE 6
General Soil Series Map

Table 3
SOIL SERIES PRESENT AT MARCH AFB

Map Symbol	Series	Location	Drainage	Runoff Potential	Depth to Bedrock or Hardpan (ft)	Depth From Surface (Typical Profile) (in.)	USDA Texture	Unified Soil Classification System	Permeability (in./hr)
SHALLOW SOILS DEVELOPED ON GRANITIC BEDROCK UPLANDS									
C	Cieneba	Uplands, 5-50 percent slope	Excessively drained	Moderately high	1-2	0-22	Gravelly coarse sandy loam	SM, GM	6.3-20.0
						22	Weathered granodiorite		
F	Fallbrook	Uplands, 2-50 percent slope	Well drained	Moderately low	1-3	0-14	Sandy loam	SM	2.0-6.3
				Moderately high		14-24	Sandy clay loam	SC	0.63-2.0
						24	Weathered tonalite		
V	Vista	Uplands, 2-35 percent slope	Well drained	Moderately low	1.5-3	0-24	Coarse sandy loam, gravelly in places	SM	2.0-6.3
						24	Weathered granodiorite		
MODERATELY SHALLOW SOILS UNDERLAIN BY INDURATED SILICA HARDPAN									
M	Monserate	Old terraces and alluvial fans, 0.25 percent slope	Well drained	Moderately high	1-3	0-10	Sandy loam	SM	2.0-6.3
						10-28	Sandy clay loam	SC, CL	0.2-0.63
						28-45	Indurated iron-silica hardpan		<0.06
E	Exeter	Basins, alluvial fans 0-8 percent slope	Well drained	Moderately high	1.5-4.5	0-16	Sandy loam, very fine sandy loam	SM, ML	2.0-6.3
						16-37	Loam	ML, CL	0.63-2.0
						37-50	Indurated silica hardpan		<0.06
						50-60	Coarse sandy loam	SM	2.0-6.3
DEEPER SOILS IN VALLEY CENTER									
H	Hanford	Alluvial fans, 0-15 percent slope	Well drained-excessively drained	Moderately low	>5	0-40	Coarse sandy loam	SM	2.0-6.3
						40-60	Loamy sand and gravelly coarse sand	SP, SM	6.3-20.0
G	Greenfield	Alluvial fans and terraces, 0-25 percent slope	Well drained	Moderately low	5	0-43	Sandy loam	SM	2.0-6.3
						43-60	Loam	ML, CL	0.63-2.0
P	Pachappa	Granitic alluvium, 0-8 percent slope	Well drained	Moderately low	>5	0-20	Fine sandy loam	SM	2.0-6.3
						20-63	Loam	ML	0.63-2.0
R	Ramona	Alluvial fans and terraces, 0-25 percent slope	Well drained	Moderately low	>5	0-23	Sandy loam	SM	2.0-6.3
						23-68	Sandy clay loam	SC, ML, CL	0.2-0.63
						68-74	Fine sandy loam	SC	2.0-6.3
D	Domino	Basins, alluvial fans	Moderately well drained	Moderately high	1.5-3.5	0-27	Silt loam	ML, CL	0.63-2.0
						27-36	Loam, weakly to strongly cemented with lime	ML, CL	<0.06
						36-63	Loam	ML, CL	0.63-2.0

Source: USDA Soil Conservation Survey, Soil Survey, Western Riverside Area, California, November 1971.

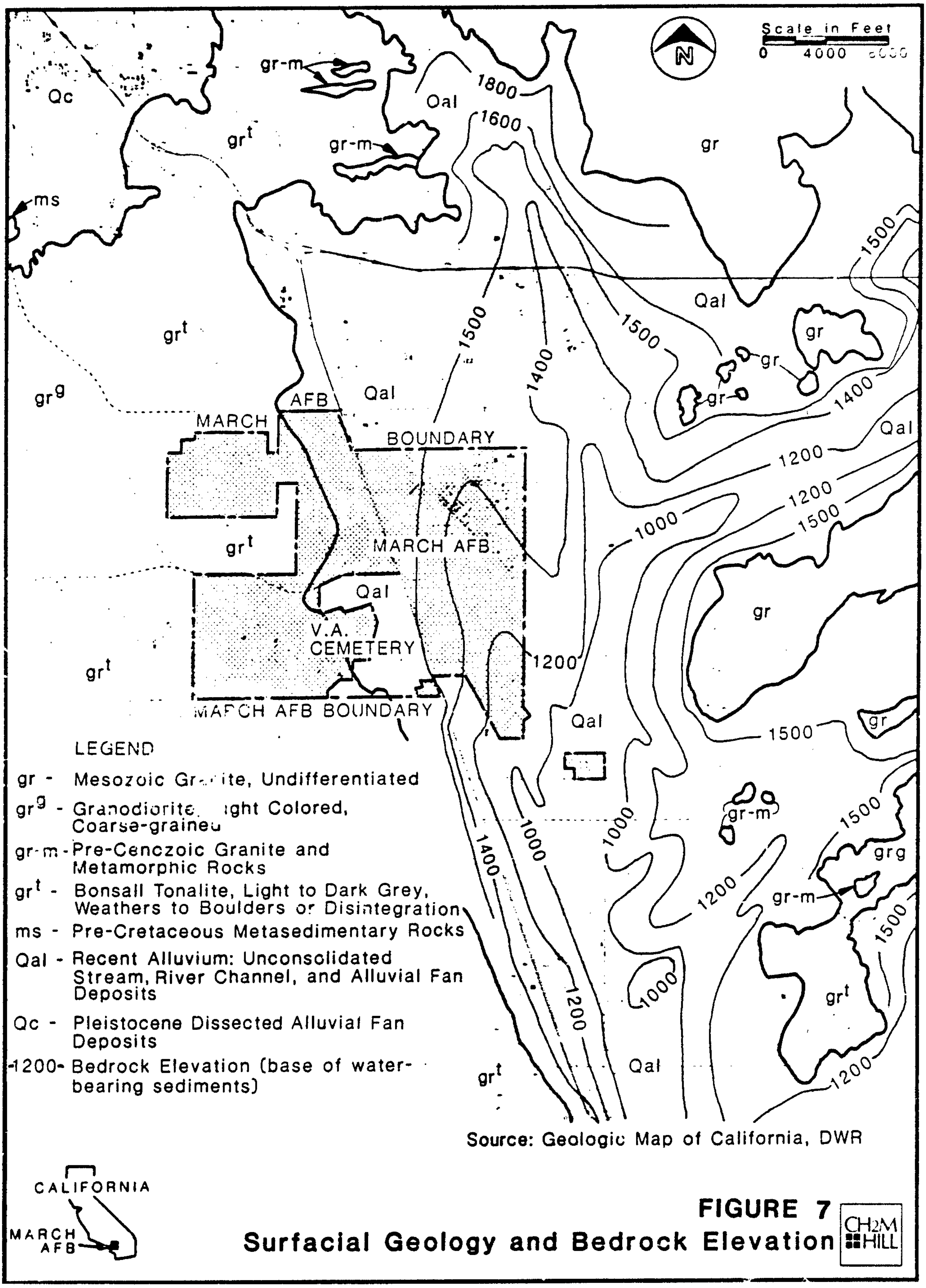


FIGURE 7
Surfacial Geology and Bedrock Elevation

The granitic bedrock to the west and north of March AFB and underlying the valley fill sediment on which the majority of the base lies is most accurately described as a tonalite or granodiorite. The Bonsall Tonalite composes most of the hills bounding Perris Valley on the west and north and the Mt. Russell Range to the east. This geologic unit contains quartz, white to gray plagioclase, hornblende, and biotite. It weathers to form rolling hills and huge rounded boulders where exposed at the land surface. Unweathered bedrock is not water bearing unless highly fractured in localized zones. Groundwater may occur in weathered bedrock zones near the surface or in fractures of the rock.

Perris Valley and Moreno Valley are filled with alluvium to an average elevation of 1500 feet. The alluvium consists of alternating layers of clay, silt, sand, and gravels. Water wells are concentrated in the valley centers where the alluvium is deeper and coarse grained. Gravel and sand beds are concentrated along the valley axis.

The thickness of the alluvium varies from a foot or less in the western part of the base up to 700 feet near Markham Street and Perris Boulevard, southeasterly of the base. There is approximately 250 feet of alluvium at the location of the base water wells in the northeast corner of the base (NW 1/4, Section 24, T3S, R4E) and 600 feet of alluvium in the southeast corner of the base.

The majority of the valley fill is composed of upper Pliocene alluvium, which is covered by recent alluvium of unknown thickness. The alluvium varies from impermeable fine-grained clay-rich strata to very permeable zones of sand and gravel, which represent buried stream channels. These permeable zones occur as lenses and stringers that are not laterally or vertically continuous over extensive areas.

Sand and gravel zones intercepted by water wells frequently cannot be correlated between wells as close as a few hundred feet.

C. HYDROLOGY

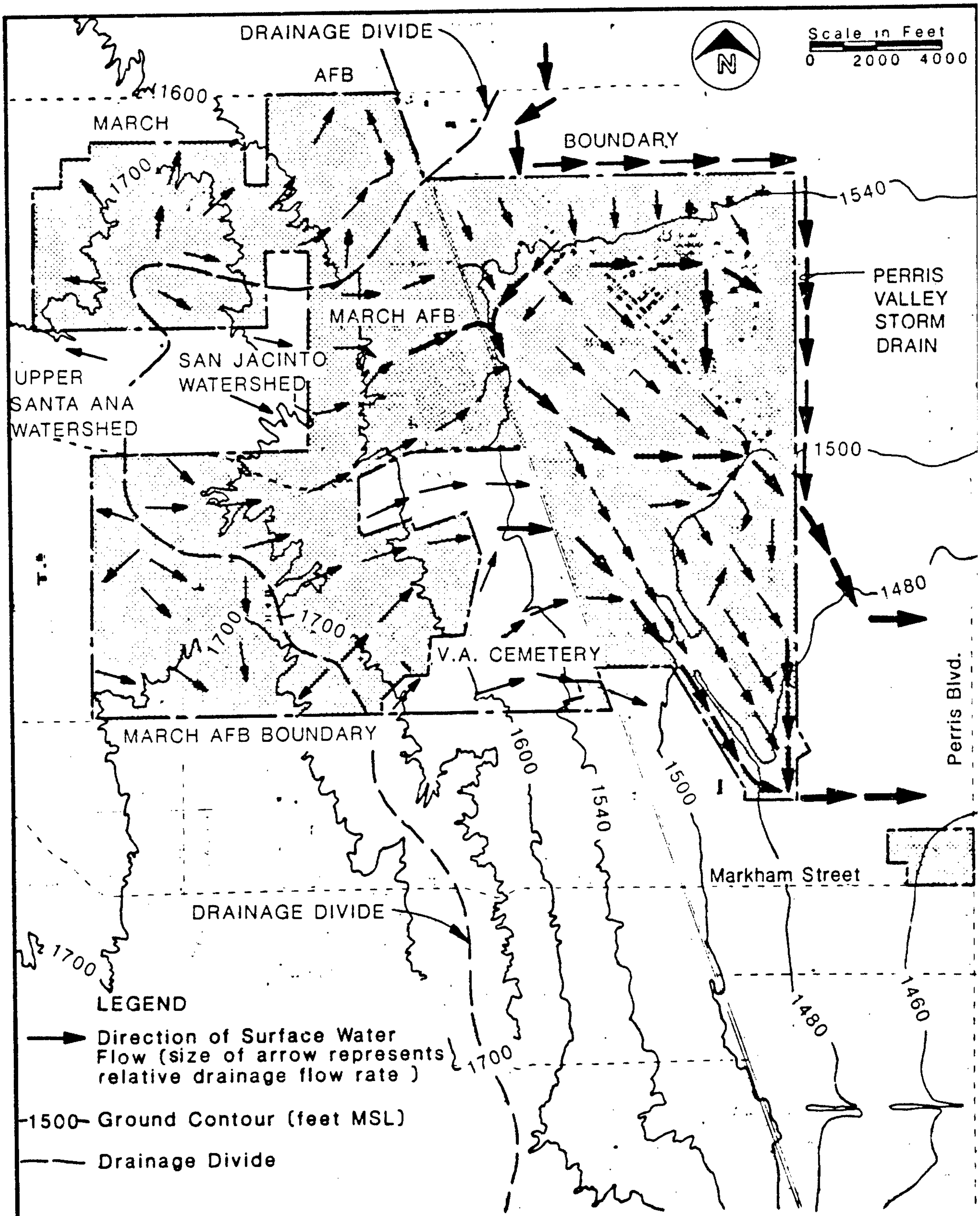
1. Surface Water

March Air Force Base is predominantly located in the northwest corner of the San Jacinto Watershed, one of three watersheds of the Santa Ana River Basin. The eastern three-quarters of the base drains southeast into the San Jacinto Watershed, whereas the extreme northwest and southwest corners of the base ultimately drain westward into the Upper Santa Ana Watershed. The drainage divide is located on the granite bedrock on the west side of the base known as the Perris Surface. Figure 8 indicates the topography and the direction of surface water flow in the vicinity of March AFB.

Surface drainage from the eastern three-quarters of the base flows to the east and south where it discharges into the Perris Valley Drain, a manmade storm drainage channel that drains Pigeon Pass Valley, Moreno Valley, and the Perris Valley. The Perris Valley Drain flows south and joins the San Jacinto River approximately 6 miles south of the base. The San Jacinto River flows west into Railroad Canyon Reservoir.

All the streams in the area are ephemeral, flowing only when precipitation occurs, and a large portion of the streamflow infiltrates to the groundwater reservoir. During heavy, prolonged rains, the ground becomes saturated, resulting in large runoff and streamflow.

Heavy runoff from March Air Force Base occurs during rainstorms due to the large portions of the base covered by paved roads, runways, and buildings. The soil in the



Source: USGS & March AFB

FIGURE 8

Surface Drainage and Topography

CH2M HILL

eastern half of the base is moderately permeable, however, and standing water does not remain a significant amount of time after it rains.

The Colorado River Aqueduct runs east-west approximately one mile south of the base. Lake Mathews, located approximately 10 miles west of the base, is the terminal reservoir of this aqueduct. State Project water is brought into the Perris Valley via the California Aqueduct, which runs north and east of March Air Force Base. Lake Perris, located between Mt. Russell and the Bernasconi Hills approximately 4 miles southeast of the base, is the terminal reservoir of this project.

2. Groundwater

The granitic bedrock that forms the perimeter of the Perris and Moreno Valleys and underlies the alluvial valley fill is not water bearing and is virtually impermeable except for fractured areas. The possibility of a limited amount of groundwater does exist in fractured areas.

Groundwater was found at a depth of 12 to 15 feet in the weathered granite bedrock underlying 2 to 6 feet of soil cover at the extreme northwest corner of the base (NW 1/4, Section 16, T3S, R4W) during Eastern Municipal Water District's recent excavation for the new Sunnymead Feeder pipeline. The total depth of weathering is not known. The weathered granite had a low permeability as shown by its very slow seepage rate into the trench.

The alluvial deposits in the Perris and Moreno Valleys contain large quantities of water and are used for water supply both on-base and in the surrounding areas. The coarse-grained deposits, which yield more water per unit volume, are concentrated near the base of mountains and along the valley axes near the site of buried stream channels. Since the depth of valley fill is greater in the center of the valley, wells situated towards the valley center are able to intersect more water-bearing sediment, and thus are capable of yielding more water. March AFB Wells No. 5 and 6 are located near the valley center.

Figure 9 shows the elevation of the groundwater table and the direction of groundwater movement. The groundwater beneath the eastern two-thirds of the base moves to the southeast toward a large pumping depression in Perris Valley caused by pumping of groundwater for irrigated agriculture. Depth to water in this portion of March Air Force Base varies between 100 feet below ground level in the northeast corner of the base to 350 feet below land surface in the extreme southeast corner of the base. The depth to water generally increases from west to east and north to south. Although the valley alluvium contains strata of fairly impermeable fine-grained clay-rich deposits (non-continuous), there is no available evidence to suggest that the water-bearing sand and gravel zones are hydraulically isolated from one another. Therefore, this aquifer is treated as one continuous unconfined aquifer in this report. Other than the limited groundwater observations from the Eastern Municipal Water District's pipeline construction previously described, no recorded data was found to substantiate groundwater table elevations and movement in the West March area (western third of the base).

Recharge into the aquifer occurs from the infiltration of rainfall; percolation of water from ephemeral streams, unlined canals, and septic systems; and the deep percolation of applied water for irrigation. Due to the density of washes at the perimeter of the basin, mountain front recharge is an important component.

Discharge from the aquifer is predominantly through high capacity agricultural wells in the Perris Valley. The

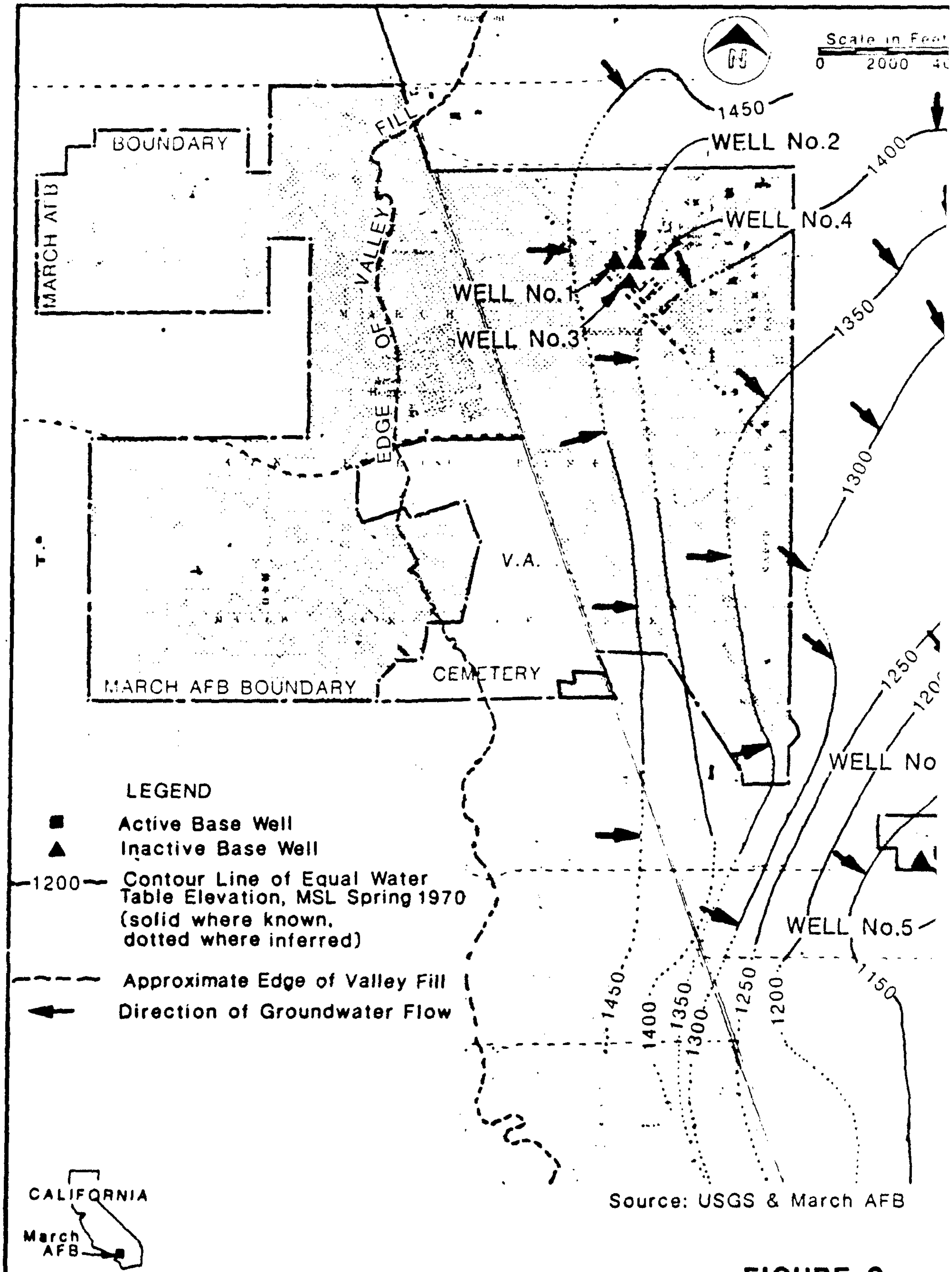


FIGURE 9

March AFB Water Well Locations and Water Table Elevations

amount of water removed from storage in the aquifer exceeds the natural recharge; therefore, groundwater levels have been dropping for the last 60 years. The water level in March AFB Well No. 1, for example, has dropped 58 feet since 1927. The water level in March AFB Well No. 6, located closer to the Perris Valley agricultural wells, has dropped approximately 185 feet since 1941.

3. Base Water Wells

March Air Force Base has five production potable water supply wells. Wells No. 1, 3, and 4 are located in the northeast corner of the base near the intersection of Meyer Drive and Graeber Road, adjacent to the main complex of industrial shops and the flightline. These three wells were drilled in the period 1927 to 1934 and average 250 feet in depth. Wells No. 3 and 4 were abandoned in July 1978 as they were not needed to meet water supply demands. Well No. 1 is still operative, but has not been regularly used since September 1983. As of February 1984, Well No. 1 has been removed from service to avoid excessive TCE levels in the base water supply (see Section IV.A.11.b).

In the southeast corner of the base on a separate parcel of land are two high-capacity wells drilled in 1941, Wells No. 5 and 6. These wells were drilled to depths of 691 and 614 feet in a zone with a greater aquifer thickness and permeability than the previous three wells. In October 1959, Well No. 5 was sealed from 479 feet to 476 feet and was perforated from 474 feet to 325 feet. Wells No. 5 and 6 yield over 700 gpm and 900 gpm, respectively. Well No. 5 was recently taken out of service. The Eastern Municipal Water District will begin providing the entire base water supply (primarily imported State Project water) in July 1984 (see Section IV.A.9).

Table 4 summarizes the available well data for the five base wells. The well locations and the most recent published water table elevations are shown in Figure 9. An unconfirmed interviewee verbal report was received relative to a possible well located just east of Route 395 at the junction of Van Buren Boulevard and Route 395. No further information was available on this well. In addition, base water department personnel reported that Well No. 2 (located in the middle of Building 100 just north of Well No. 3 and east of Well No. 1) was abandoned in 1937. No other records were found on Well No. 2.

Drillers' logs for Wells No. 4 and 6 show the existence of alternating 5- to 15-foot-thick intervals of clay, coarse sand, and gravel. Both wells bottomed out in solid granite. These logs are included in this report as Tables 5 and 6. No other logs or details of water well construction were available from the base water department. Water levels at March Air Force Base have dropped 58 feet in Well No. 1 since 1927 and 185 feet in Well No. 6 since 1941. Historic water levels of the base wells are shown in Figures 10, 11, and 12.

Pumping test data were compiled for all base wells in order to estimate the permeability of the aquifer at the location of the wells. The specific capacity of Wells No. 1, 3, and 4 varies between 1.6 and 12.3 gpm per foot of drawdown and averages approximately 4.6 gpm per foot of drawdown. The permeability at this location varies between 2.1 ft/day and 16.0 ft/day and averages 5.6 ft/day. Wells No. 5 and 6 have an average specific capacity of 32 gpm per foot of drawdown. The permeability at this location varies between 21.4 ft/day and 60.2 ft/day and averages 31.1 ft/day. Table 7 summarizes the calculations used to estimate the permeabilities

Table 4

SUMMARY OF MARCH AFB WATER WELL DATA

Well Number	1	3[a]	4[a]	5	6
Construction Date	1927	1931	1934	1941	1941
Approximate Well Yield (gpm)	350	200	175	>700	>900
Well Depth (ft)	257	255	240	474[b]	614
Casing Diameter (in.)	14	14	14	14	14
Depth to Water in Feet, (Date of Measurement)	125 (11/83)	95 (6/78)	92 (6/78)	312 (4/81)	320 (10/83)
Pump Setting Depth (ft)	236	190	200	420	--
Pump Diameter (in.)	10	--	6	8	--
Pump Type	Turbine	Submersible	Turbine	Turbine	Turbine
Location (Building No.)	410	439	108	3001	3002

[a] Wells No. 3 and 4 have been inoperative since July 1978.

[b] Well No. 5 was originally drilled to a depth of 691 feet. In October 1959, Well No. 5 was sealed from 479 feet to 476 feet and was perforated from 474 feet to 325 feet.

Source: March AFB Files

Table 5
LOG OF WATER WELL NO. 4
(February 14, 1934)

Depth (ft)	Formation
0-55	No data available
55-60	Coarse sand
60-68	Hard clay and decomposed granite
68-78	Coarse sand
78-92	Hard clay and decomposed granite
92-108	Sandy clay
108-120	Coarse sand - water-bearing
120-125	Hard clay and decomposed granite
125-128	Coarse sand - water-bearing
128-144	Hard clay and decomposed granite
144-152	Decomposed granite
152-160	Packed silt
160-170	Decomposed granite
170-174	Coarse sand - water-bearing
174-184	Decomposed granite
184-196	Coarse sand - water-bearing
196-216	Decomposed granite
216-218	Red clay
218-232	Slightly decomposed granite
232-240	Granite

Source: March AFB Files.

Table 6

LOG OF WATER WELL NO. 6

(October 1, 1941)

Depth (ft)	Formation
0-25	Hard clay
25-75	Gray clay
75-127	Red clay
127-132	Gravel
132-150	Red clay
150-170	Gravel
170-200	Fine gravel and clay
200-215	Gravel
215-230	Gray clay
230-238	Tight sand
238-280	Clay
280-290	Gravel
290-349	Clay
349-370	Gravel
370-382	Red Clay
382-387	Gravel
387-415	Hard red clay
415-420	Gravel
420-450	Hard red clay
450-460	Gravel
460-485	Hard clay
485-495	White gravel
495-498	Clay
498-509	Gravel
509-530	Red Clay
530-539	Gravel
539-563	Hard red clay
563-571	Gravel (white)
571-586	Red clay
586-591	Gravel
591-595	Clay
595-600	Gravel
600-612	Clay
612-614	Hard decomposed granite

Source: March AFB Files

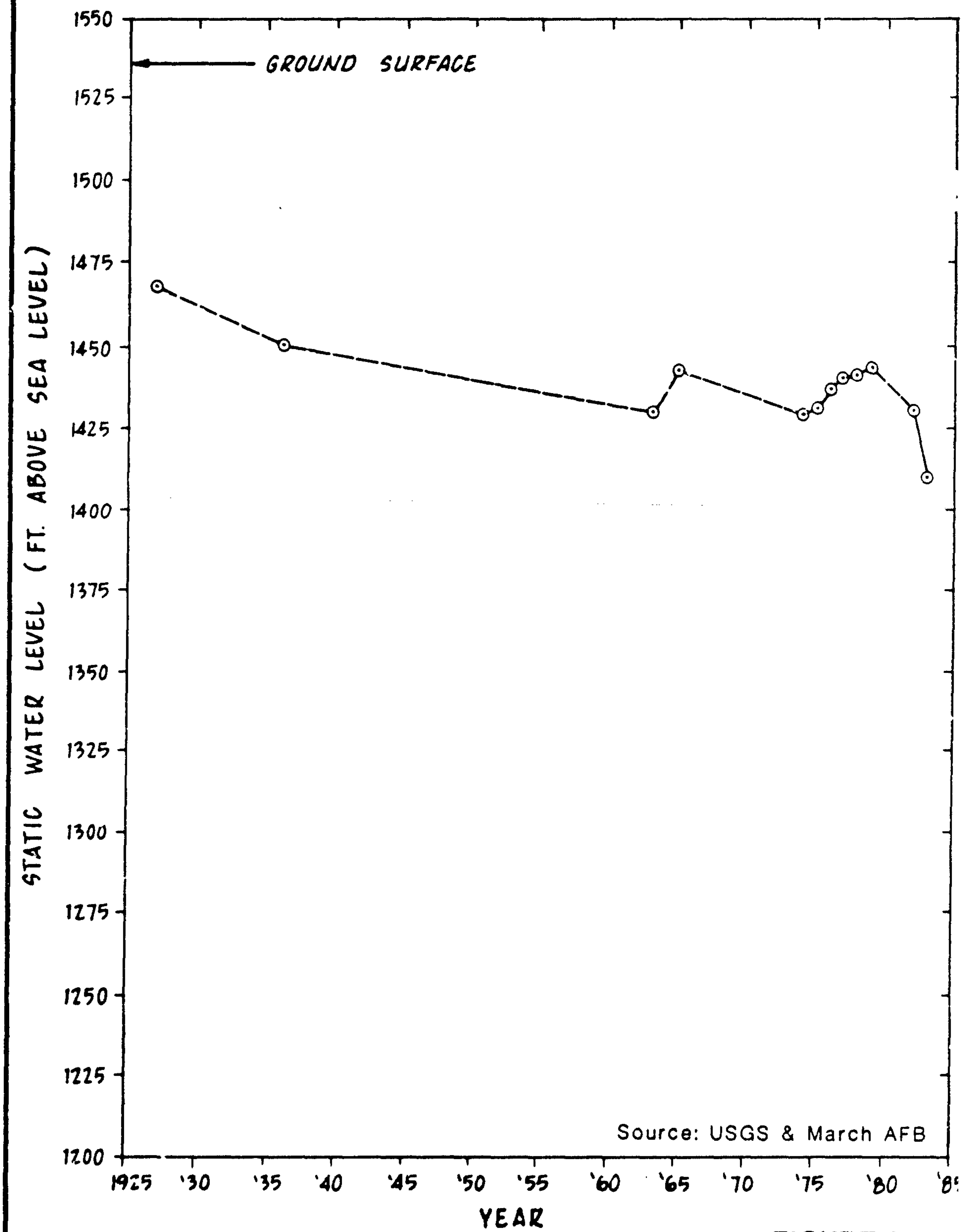


FIGURE 10

Historic Water Levels of March AFB Well No. 1

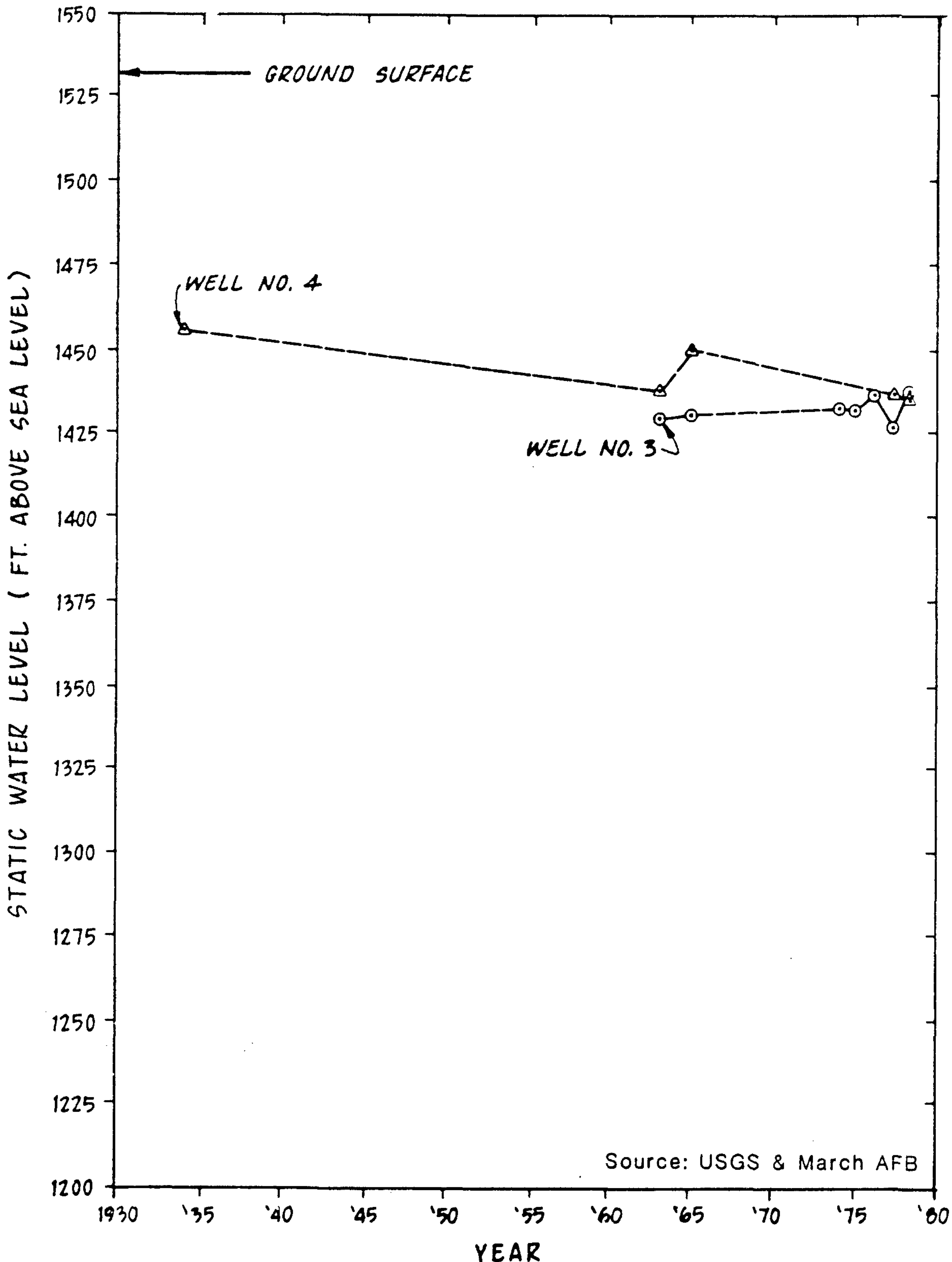


FIGURE 11

Historic Water Levels of March AFB Wells No. 3 and 4

CH2M HILL

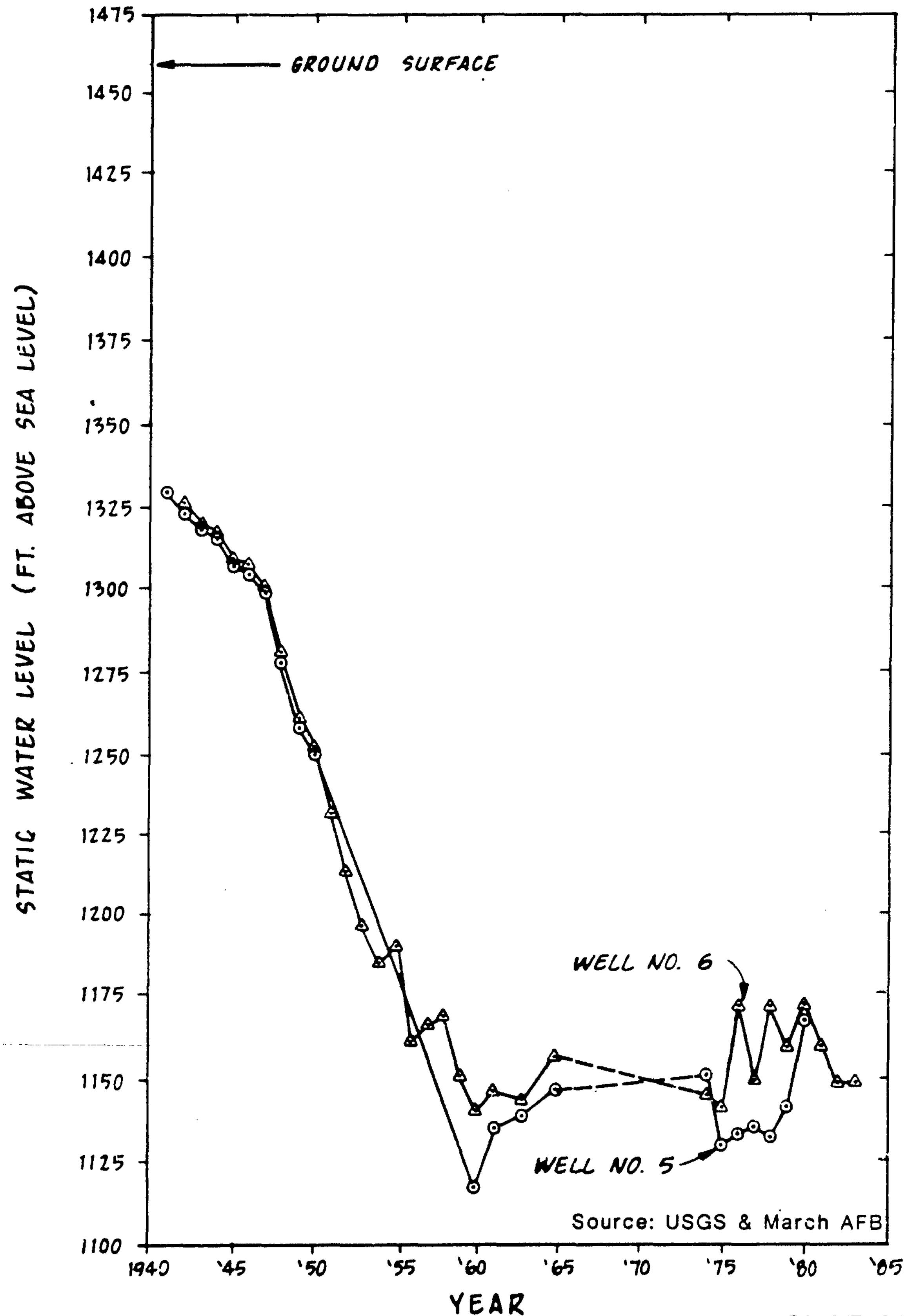


FIGURE 12

Historic Water Levels of March AFB Wells No.5 and 6

CH2M HILL

Table 7
HYDRAULIC PARAMETERS AND PERMEABILITY ESTIMATES
FOR MARCH AFB WATER WELLS

(1) Well Number	(2) Well Depth (ft)	(3) Date of Measurement	(4) Well Yield (gpm)	(5) Static Water Level (Ft Below Ground Level)	(6) Pumping Water Level (Ft Below Ground Level)	(7) Drawdown (ft)	(8) Specific Capacity (gpm/ft)	(9) Estimated Transmissivity (gpd/ft)	(10) Estimated Permeability (ft/day)
1	257	1927	390	67	127	60	6.50	4,500	3.2
		Sept 1963	350	105	146	41	8.54	13,000	11.4
		Jan 1965	350	92	185	93	3.76	5,600	4.5
		June 1975	372	103.8	134.0	30.2	12.3	18,000	16.0
		Nov 1976	500	96	196	100	5.00	7,500	6.1
		June 1977	500	95.0	190.9	95.9	5.21	7,800	6.4
		Oct 1978	300	92.0	132	40.2	7.46	11,000	9.0
						Average	6.97	9,600	8.1
3	255	Sept 1963	200	103	150	47	4.25	6,400	5.6
		Jan 1965	200	102	141	39	5.13	7,700	6.7
		Jan 1977	200	85	174	89	2.25	3,400	2.7
		June 1977	200	95	187	92	2.17	3,300	2.8
		May 1978	208	95	217	122	1.70	2,600	2.1
						Average	3.10	4,700	4.0
4	240	1934	230	76	165	89	2.58	3,900	3.2
		Sept 1963	175	94	124	30	5.83	8,700	8.0
		Jan 1965	175	82	111	29	6.03	9,100	7.6
		May 1977	200	96	220	124	1.61	2,400	2.3
		May 1978	230	92	200	108	2.13	3,200	2.9
						Average	3.64	5,500	4.8
5	474	Oct 1959	1,150	325	380	55	20.9	31,000	28.1
		Sept 1963	900	323	343	20	45	67,000	60.2
		Jan 1965	900	314	337	23	39	59,000	49.5
		Sept 1976	932	331.2	371.5	40.3	23	35,000	32.1
		July 1978	932	327	360	33	28	42,000	38.8
		Oct 1978	784	320	350	30	26	39,000	33.4
						Average	30	46,000	40.2
6	614	Sept 1963	900	318	346	28	32	48,000	21.4
		Jan 1965	900	306	332	26	35	52,000	22.7
		July 1977	942	311.4	338.1	26.7	35.3	53,000	23.4
		Oct 1978	923	299.8	327.6	27.8	33.2	50,000	21.4
		June 1980	942	288.3	316.0	27.7	34.0	51,000	21.4
						Average	34	51,000	22.1

Source: Basic data from March AFB Files
(1) See Figure 9 for water well locations.
(7) Calculated as Column (6) - Column (5).
(8) Calculated as Column (4) ÷ Column (7).
(9) Calculated as Column (8) x 1,500.
(10) Calculated as Column (9) ÷ [Column (2) - Column (5)] ÷ 7.48 gal/ft^3.

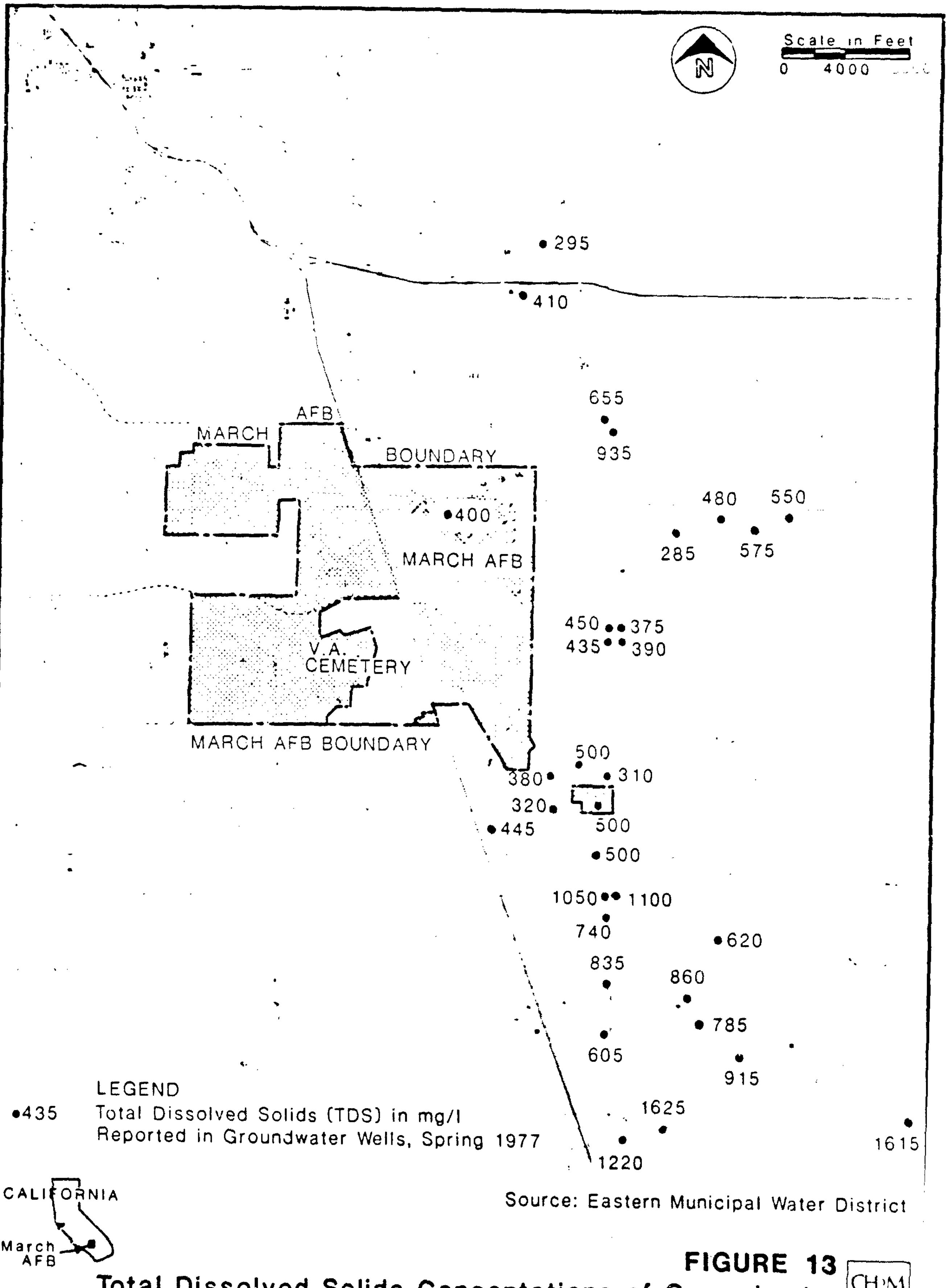
The average groundwater velocity in the vicinity of Wells No. 1, 3, and 4 was estimated to be 130 ft/yr to 265 ft/yr to the southeast. The estimated groundwater velocity in the vicinity of Wells No. 5 and 6 was estimated to be 170 ft/yr to 310 ft/yr to the southeast. These average groundwater velocity calculations are summarized below:

Location	(I) Hydraulic Gradient[a]	(K) Permeability[b] (ft/day)	(n) Effective Porosity[c]	(v) Groundwater Velocity[d] (ft/yr)
Wells No. 1, 3, and 4	0.0089	4.0-8.1	0.10	130-265
Wells No. 5 and 6	0.0021	22.1-40.2	0.10	170-310

[a]Estimated from 1970 water level map, California DWR.
[b]Calculated in Table 7.
[c]Estimated from aquifer lithology.
[d]Calculated as: $\bar{v} = \frac{KI}{n} \times 365$

4. Groundwater Quality

Groundwater quality in the North Perris Valley and Moreno Valley is generally good. Total dissolved solids (TDS) range from about 250 mg/l to 1,000 mg/l. The total dissolved solids are between 400 and 500 mg/l to the east of March Air Force Base. A zone of TDS between 500 mg/l and 1,000 mg/l exists approximately one mile to the northeast of March AFB. TDS exceed 1,000 mg/l in two wells located approximately one mile south of Base Wells No. 5 and 6. Figure 13 shows TDS concentrations in the Perris Basin taken in 1977 by the Eastern Municipal Water District.



Source: Eastern Municipal Water District

FIGURE 13
Total Dissolved Solids Concentations of Groundwater

CH2M HILL

TDS has been increasing in the groundwater over the last 40 years due to the extensive irrigated agriculture. Evapotranspiration increases the concentration of salt in the applied irrigation water, and recycling of the water concentrates the dissolved minerals in the aquifer. The only source of dilution is percolation of precipitation and runoff. The extensive use of relatively high TDS Colorado River water in the basin has compounded this problem.

The groundwater in the area is predominantly of the calcium-sodium chloride type. Hardness varies from hard to very hard (120 to 200 mg/l as calcium carbonate). Nitrate has exceeded the EPA primary standard of 10 mg/l as nitrogen in a number of wells in the basin due to irrigation return flows.

5. Potential for Groundwater Contamination

The relatively deep water table at March Air Force Base (approximately 100 feet below land surface in the northeast corner at Wells No. 1, 3, and 4 and approximately 300 feet below land surface in the southeast corner at Wells No. 5 and 6) would cause a time lag in detection of contamination which originated at the ground surface. A well could become polluted long after a disposal practice ceased. Contaminants could also be stored in the unsaturated zone above the water table. In this case, the most rapid transfer of contamination into the aquifer would occur while a driving force exists, such as percolation of water into the aquifer following a thunderstorm. An additional potential pathway for contamination to rapidly enter the aquifer may be through improperly sealed well casings.

D. ECOLOGY

1. Vegetation

Approximately 3,222 acres (45 percent) of the 7,123 acres at March AFB are considered unimproved, indicating the presence of semi-natural to natural ecological conditions. There are only 915 acres of improved or grassed areas; 1,683 acres maintained for control of erosion, dust, or visual clear zones; and 1,303 acres used for buildings, runways, and otherwise covered.

Native vegetation is derived from the coastal sage scrub and valley grassland plant communities. The hilly lands of West March are covered by typical, low-growing, sage scrub species such as California sage brush, white sage, California buckwheat, brittle brush, and perennial or annual forbs. Only a few scattered junipers and willows are present. The valley grassland community once dominated the valley floors where the present runways, main base, and highway are located. The native bunch grasses have largely been replaced by introduced European grasses and weedy species. Numerous plantings of ornamental trees have extensively altered the treeless areas of the base. Mature specimens of pines, palms, eucalyptus, cottonwood, and pepper trees are common about the main base housing and buildings.

Approximately 1,725 acres of land are leased for agricultural or grazing purposes. There are no riparian, aquatic, or otherwise unique natural areas on the base. However, grassland areas in the area between U.S. Highway 395 and Runway 14-32 appear to have elements of the native bunch grass plant community. This community is relatively rare in Southern California as development of the fertile valley lands have altered the habitat or introduced competitive exotic species. Native grasses such as Stipa pulchra, S. cervia, or Poa sp., if present, should be protected from mowing, grazing, and herbicide application if feasible.

2. Wildlife

The unimproved lands and remaining lands support a variety of wildlife. Some of the common mammals include blacktailed jack-rabbit, Audubon cottontail, antelope ground squirrel, coyote, red fox, and various species of native and introduced rodents. A large population of ground squirrels supports numerous burrowing owls in the West March hills. Other common raptors include red-tailed and ferruginous hawks, white-tailed kite, barn owl, and American kestrel. Numerous song birds, quail, dove, and other birds such as crows, starlings, and pigeons are common surrounding the main base housing area and buildings. The latter three bird species reach nuisance populations. Over 90 species of birds are resident on base and in the surrounding area. Feral dogs are also common in the West March area.

There are no major perennial or ephemeral streams occurring on March AFB. Minor aquatic habitat occurs at the small pond used for golf course irrigation water, the open holding reservoir at the water treatment plant, and in several drainage areas.

3. Threatened or Endangered Species

Two listings of endangered, threatened, and rare species are applicable to biota in the Riverside area. These listings have been generated by the U.S. Fish and Wildlife Service and the California Department of Fish and Game, respectively.

The only Federally-listed bird species likely to occur in the March AFB area would be juvenile or non-breeding American bald eagles, an endangered species. While the nearest known eagle nesting areas are in Northern California, migrating individuals could pass through the vicinity.

State-listed wildlife species known to occur in the vicinity, and possibly in West March areas, include the Stephens kangaroo rat (Dipodomys Step Fensi). March AFB has designated identified habitat areas for the protection of wildlife species in a Fish and Wildlife Management Plan prepared as a result of the Category I installation designation.

Golden eagles, a fully protected species, are year-roun residents in the vicinity, nesting in the Russel Mountains and around Lake Matthews within 10 miles of the base.

In addition to the above species with official status, several other species likely to occur on the base are candidates for special status designations. These animals include the Orange-throated whiptail (Cnemidophotus hyperthrus), the San Diego horned lizard (Phrynosoma corunatum blainvillei) and the Blacktailed Gnatcatcher (Pulioptila melanura). Habitat destruction due to overall residential/commercial development in the Perris Valley area is the primary threat to these species. The existence of March AFB currently tends to preserve these natural areas and protect them from development pressures.

IV. FINDINGS

A. ACTIVITY REVIEW

1. Industrial Waste Disposal Practices

Some level of industrial operations have been in existence at March AFB since 1918 when the area was first used as a military airfield. Several old masonry buildings and area maintenance hangars on base date back to 1929. These facilities have entertained many different functions and have supported varied missions as described in Section II, Installation Description and Appendix D, Installation History.

The major industrial operations currently at March AFB include maintenance of jet engines, fuel cells, air refueling tankers, aerospace ground equipment (AGE), and pneudraulics systems; maintenance of general and special purpose vehicles; aircraft corrosion control; non-destructive inspection (NDI) activities; and communications maintenance. These industrial operations have generated varying quantities and types of waste oils, waste and recoverable fuels, spent solvents, and cleaners over the past years.

The total quantity of spent solvents, cleaners, waste oils, contaminated JP-4, and other hazardous wastes currently generated at March AFB is estimated to be approximately 60,000 gallons per year. Of this total, it is estimated that 17,100 gallons per year are solvents and 6,000 gallons per year are cleaning compounds. In addition, approximately 16,000 gallons per year of waste oils (mostly engine oils, but also including some commingled petroleum wastes such as hydraulic fluid, PD-680, MOGAS, and JP-4) are generated. Approximately 4,600 gallons per year of contaminated JP-4 are used in fire department training exercises or disposed of through outside contractors coordinated by the local Defense Property Disposal Office (DPDO) located at Norton AFB. Approximately 16,300 gallons per year of other hazardous wastes (including hydraulic fluid, paint strippers and thinners, waste paints, acids, antifreezes, fixer and developer, etc.) are generated. These estimates of waste quantities were derived from a review of shop files and the best recollection of interviewees. The quantities of materials usage prior to the early 1980's could have been greater (up to twice the current volume) based on the higher level of aircraft maintenance activities during that period.

Based on information obtained from shop files and on the best recollection of interviewees, practices for past and present industrial waste disposal are summarized below:

- o <u>1918-1940</u>: Because this period is in the relatively distant past, little information is available on disposal practices. Waste incinerators, storm drains, landfills, fire department training areas, and disposal on the ground at the generating facility are the most likely ways wastes were disposed of during this period.

- o <u>1940-1975</u>: The three major waste disposal methods used during this time period were fire department training exercises, landfills, and discharge to base sanitary sewers. Some wash rack drainage into the southerly storm drainage system reportedly also occurred, especially from airplane wash and paint shops. The majority of wastes were commingled and burned at the fire department training areas during practice sessions. Some wastes were disposed on the ground at the generating facility.

o 1975-Present: In the early to mid-1970's, accumulation of waste oils, solvents, and other hazardous wastes in holding tanks and 55-gallon drums at various accumulation points around the base was begun. Since the late 1970's, DPDO contractors have been employed to remove these wastes from the base. Some disposal of cleaning compounds and other waste fluids still goes through the base sewage treatment plant. Several industrial shops use small quantities of solvents and cleaning compounds which are wiped off with rags. These rags are ultimately removed from the base in waste dumpsters by a contract refuse hauler. In addition, a portion of the contaminated JP-4 is burned at the fire department training area during practice exercises.

Where oil/water separators are used at industrial shops, the underflow (water) drains to the sanitary sewer, with skimmed wastes accumulating in a waste accumulation tank for ultimate disposal by DPDO contractors. The one exception to this is the main oil/water separator receiving the majority of the flightline stormwater runoff. Skimmed wastes at this location are disposed of by a local contractor, with the underflow being discharged off-base through the Perris Valley Storm Drain. Base personnel have indicated that most of the oil/water separator installations at March AFB consist of a 3,400-gallon-capacity separator and a 400-gallon-capacity underground concrete waste accumulation tank (a combined capacity of approximately 3,800 gallons).

Various DPDO accumulation points have been established at March AFB. Currently, the majority of waste oils, spent solvent and cleaners are collected throughout the base in bowsers and accum lated in a 50,000 gallon underground slop tank at Building 422 (Motor Pool). Contaminated JP-4 is also accumulated in a 500 gallo underground tank at Building 1230. The Auto Hobby Shop

(Building 941) has its own 500 gallon underground tank for accumulating waste oils. Drums of waste motor oil/transmission fluid are accumulated at Building 429.

Approximately 60 drums of waste paint, solvents, paint stripper, dyes, penetrants, and oils have been accumulated on base. A one time pickup of these wastes is scheduled for the end of March 1984. A contract with a local contractor has just recently been negotiated. In addition, DPDO has recently awarded a new contract for recurring pickups at the various March AFB hazard waste accumulation points to ensure that wastes are not accumulated on-base for more than 90 days. According to base records, DPDO contractors picked up hazardous wastes quantities totalling approximately 41,500 gallons in 1983, 41,100 gallons in 1982, and 22,400 gallons in 1981.

Details on the major types of industrial wastes and specific shop waste disposal practices are provided in the following section.

2. Industrial Operations

A master list of industrial operations at March AFB is included in Appendix E. Industrial operations at March AFB have been primarily involved with the routine maintenance and servicing of assigned bomber, fuel tanker, jet fighter, and rescue aircraft. Heavy bomber aircraft in the 1960's and 1970's required more maintenance than more recent types of aircraft. Industrial operations at March were the heaviest in the 1960 to 1975 era when the base supported one of the largest B-52 bomber squadrons in the country.

Most of the liquid wastes generated by the industrial operations can be categorized as waste oils, waste and recoverable fuels, spent solvents, and cleaners. Waste oils generally refer to lubricating fluids, such as crankcase oils and synthetic turbine oils. Recoverable fuels refers to fuels drained from aircraft tanks and vehicles, such as JP-4 and MOGAS. Waste or contaminated fuels can also be JP-4, MOGAS, or sludge from fuel storage facilities. Spent solvents and cleaners refer to liquids used for degreasing and general cleaning of aircraft, aircraft systems, electronic components, vehicles, etc. Included in this category are PD-680 and various chlorinated organic compounds such as carbon tetrachloride, trichloroethylene (TCE), and 1,1,1-trichloroethane.

Specific types of solvents in use by the Air Force have changed over the years. Carbon tetrachloride was in common use from 1956 until 1960. Its use was replaced by TCE until about 1973. Since then, only small quantities of TCE have been used: most TCE usage has been replaced primarily by PD-680 (Type II) and, to a lesser extent, by 1,1,1-trichloroethane. In addition, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), toluene, and xylene are commonly used in paint strippers or thinners at base paint and corrosion control shops. The use of photochemical solvents such as TCE, MIBK, toluene, and xylene at March AFB has been restricted since 1982. Other chemicals used on-base include carbon remover (contains cresylic acid) and penetrant (contains isopropanol).

A review of base records and interviews with base personnel resulted in the identification of the industrial operations in which the majority of industrial chemicals are handled and hazardous wastes are generated. Table 8 summarizes the major industrial operations, including the current estimated quantities of wastes generated and the primary waste management practices (i.e., treatment, storage, and disposal) used over the years. The information reported on the waste quantities

Table 8
MAJOR INDUSTRIAL OPERATIONS SUMMARY

Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Current Waste (gal/yr)	Waste Management Practices (1935-1940, 1950, 1960, 1970, 1980, 1990)
22nd Field Maintenance Squadron (FMS)				
AGE Maintenance	1221	Oils	1,000	LF/FDT → 422
		Hydraulic Fluid	500	
		Cleaning Compounds	250	LF → SS → 422
		Solvent	600	LF → 422 → SS → 422
		Antifreeze	100	LF → 422 → SS
Battery Shop	1201	Sulfuric Acid	300	SS (Not neutralized) → (Neutralized)
Corrosion Control	452	Paint Thinners	660	SS → 422 → DA
		MEK	200	
		Toluene	70	
		Hot Tank Paint Remover	350	422
		Paint Removers	800	SD → 422
		Carbon Removers	480	SD → 422 → OWS
		Waste Paint	600	
NDI Lab	1238	Penetrant	110	SS → 422
		Emulsifier	110	
		Magnaflow	60	
		Trichloroethane	100	
		Fixer	20	SS (No Ag Recovery) → SS (Ag Recovery) → 422
		Developer	20	
Fuel Systems	1244	JP-4	1,000	FDT → SWT
		MEK	50	LF → SWT
		MIBK	10	
Jet Engine Maintenance	1203	Hydraulic Fluid	50	LF/FDT → OWS
		Oils	50	
		Carbon Remover	50	SD → OWS
		Solvent	80	
Machine Shop	453	Oils	300	LF/FDT → 422
Pneudraulics	1203	Solvents	600	LF/FDT → 422
		Hydraulic Fluid	1,300	
		MEK	60	

LEGEND

SS = Sanitary sewer system
SD = Storm drainage system
LF = Landfill
DPDO = Defense Property

LEGEND

422 = Waste accumulation tank at Motor Pool -- Building No. 422 (ultimate disposal by DPDO contractor)
FDT = Fire department training area (wastes burned during fire training exercises)
SWT = Individual shop waste accumulation tank (ultimate disposal by DPDO contractor)
OWS = Oil/water separator (ultimate disposal by DPDO contractor), underflow to sanitary sewer

Table 8 -- Continued

Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Current Waste (gal/yr)	Waste Management Practices (1915-1940, 1950, 1960, 1970, 1980, 1990)
Repair and Reclamation	1246	Solvent Degreaser Hydraulic Fluid	500 400 60	LF/FDT → 1960 SWT → 1980 422 →
Small Gas Engine	1203	Oils Solvent	100 80	LF/FDT → 1970 422 →
Jet Engine Test Cell	1700	Cleaning Compounds Oils JP-4	50 660 120	LF/FDT → 1978 OWS →
22nd Organizational Maintenance Squadron (OMS)				
Non-powered AGE	457	Solvent	250	LF/SS → 1970 422 →
Tanker Maintenance	1214	Oils Hydraulic Fluids	400 300	LF/FDT → 1978 422 →
		Solvents Cleaning Compounds	5,000 500	LF/SS/SD → 1978 SWT →
Tanker Phase	2303	Hydraulic Fluid Oils	200 200	LF/FDT → 1972 422 →
Wash Rack	1242	Solvents Cleaning Compounds	6,000 4,000	SD/SS → 1972 SWT →
22nd Supply Squadron				

LEGEND

SS - Sanitary sewer system
SD - Storm drainage system
LF - Landfill
DPDO - Defense Property Disposal Office

LEGEND

422 - Waste accumulation tank at Motor Pool -- Building No. 422 (ultimate disposal by DPDO contractor)
FDT - Fire department training area (wastes burned during fire training exercises)
SWT - Individual shop waste accumulation tank (ultimate disposal by DPDO contractor)
OWS - Oil/water separator (ultimate disposal by DPDO contractor), underflow to sanitary sewer
DA - Drum accumulation (ultimate disposal by DPDO contractor)

Table 8 -- Continued

Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Current Waste (gal/yr)	Waste Management Practices (1915-1940, 1950, 1960, 1970, 1980, 1990)
Fuels Distribution/Storage	2202	JP-4	2,500	FDT; 422
<u>22nd Transportation Squadron (TRANS)</u>				
General/Special Purpose Vehicle Maintenance	429	Sulfuric Acid	120	SS; DA
		MEK	25	SD
		Solvents	120	LF/SS; DA
		Oils (also waste transmission fluids, antifreeze, fuels)	1,300	LF/FDT; 422; DA
Fire Truck Maintenance	1224	Antifreeze Oils Solvents	120 700 120	FDT; DA
Refueling Maintenance	1250	JP-4	300	FDT; SWT
		Solvents Oils Antifreeze	120 360 180	FDT; DA
<u>22nd Combat Support Group (CSG)</u>				
Auto Hobby	941	Solvents	650	SS; OWS
		Oils	3,000	LF/FDT; SWT
Printing Plant	434	Blanket Wash	60	LF; Dumpster
		Developer Solvents	250 25	SS
Photo Lab	2630	Fixer and Developer	3,000	SS (No Ag Recovery); SS (Ag Recovery)
<u>22nd Civil Engineering Squadron (CES)</u>				

LEGEND

- **SS = Sanitary sewer system**
- **SD = Storm drainage system**
- **LF = Landfill**
- **DPDO = Defense Property Disposal Office**

LEGEND

- 422 = Waste accumulation tank at Motor Pool -- Building No. 422 (ultimate disposal by DPDO contractor)
- FDT = Fire department training area (wastes burned during fire training exercises)
- SWT = Individual shop waste accumulation tank (ultimate disposal by DPDO contractor)
- OWS = Oil/water separator (ultimate disposal by DPDO contractor), underflow to sanitary sewer
- DA = Drum accumulation (ultimate disposal by DPDO contractor)

Table 8 -- Continued

Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Current Waste (gal/yr)	Waste Management Practices (1915-1940, 1950, 1960, 1970, 1980, 1990)
Liquid Fuels Maintenance	385	Oils/Waste Fuel (*Wastes from cleaning fuel tanks)	6,000*	FDT → Contract Removal
Power Plant	2606	Solvent	200	LF → 422
		Aqua-Serv Products	650 lb/yr	SS
		Refrigerant	300 lb/yr	
Power Production	2508	Engine Oil	1,200	FDT → 422
Protective Coating	2507	Paint Thinners	1,000	LF/FDT → 422
Refrigeration	2517	Oils	400	LF/FDT → 422
		Solvents	100	LF → Site No. 27
USAF Regional Hospital				
Dental Clinic	768	Mercury	25 lb/yr	LF or Incinerated → Bottle Storage
		Fixer and Developer	300	SS
33rd Communications Group				
Data Display Central	2605	Fixer	500	SS
		Developer	500	
163rd ANG Consolidated Aircraft Maintenance Squadron (CAMS)				
Flightline and Inspection Docks	2305	Solvents	700	SWT
Jet Engine Shop/Propulsion	458	Solvents	350	OWS
		Oils	400	422
Fuel Systems/Pneudraulics	2309	Hydraulic Fluids	100	422

LEGEND

SS = Sanitary sewer system
SD = Storm drainage system
LF = Landfill
DPDO = Defense Property Disposal Office

LEGEND

422 = Waste accumulation tank at Motor Pool -- Building No. 422 (ultimate disposal by DPDO contractor)
FDT = Fire department training area (wastes burned during fire training exercises)
SWT = Individual shop waste accumulation tank (ultimate disposal by DPDO contractor)
OWS = Oil/water separator (ultimate disposal by DPDO contractor), underflow to sanitary sewer
DA = Drum accumulation (ultimate disposal by DPDO contractor)

Table 8 -- Continued

Shop Name	Present Location (Bldg. No.)	Waste Material	Estimated Current Waste (gal/yr)	Waste Management Practices (1915-1940, 1950, 1960, 1970, 1980, 1990)
Environmental/Electrical/Avionics Maintenance/Munitions Maintenance/Wheel and Tire	2315/ 2272	Solvents	500	422 (from early 1980s)
303rd Aerospace Rescue and Recovery Squadron (ARRS)				
Engine and Propulsion, AGE Maintenance	2303	Hydraulic Fluid Solvents	800 300	FDT/SS (to 1970) → 422 (1970 on)
Flightline, Fuel Systems, Pneudraulics	2307	Aircraft Cleaning Compound Solvents MEK	1,000 250 100	LF/FDT/SS → SWT → OWS
		Oils JP-4 Hydraulic Fluid	400 700 200	FDT → SWT → 422
452nd Consolidated Aircraft Maintenance Squadron (CAMS)				
AGE Maintenance	440	Cleaning Compounds	200	LF/SS → OWS
		Oils Hydraulic Fluid Solvents	600 120 200	FDT → 422
Propulsion/Jet Engine (see 163rd CAMS)	458			
Corrosion Control (see 22nd FMS)	452			
NDI Lab (see 22nd FMS)	1238			
Environmental Systems/Fuel Cell Repair/Pneudraulics/Repair and Reclamation	2303	Hydraulic Fluid Solvents	1,000 300	LF/FDT (to 1970) → 422 (1970 on)

LEGEND

SS = Sanitary sewer system
SD = Storm drainage system
LF = Landfill
DPDO = Defense Property Disposal Office

LEGEND

422 = Waste accumulation tank at Motor Pool -- Building No. 422 (ultimate disposal by DPDO contractor)
FDT = Fire department training area (wastes burned during fire training exercises)
SWT = Individual shop waste accumulation tank (ultimate disposal by DPDO contractor)
OWS = Oil/water separator (ultimate disposal by DPDO contractor), underflow to sanitary sewer
DA = Drum accumulation (ultimate disposal by DPDO contractor)

and past waste management practices is based on data extracted from shop files and interviews with shop personnel. Data furnished by shop personnel are based on their best recollection

a. Jet Engine/Propulsion Shops

Activities of these shops include draining, maintenance, repair, tear down, and modification of jet and other avionic engines. The 452nd CAMS (Building 458), 22nd FMS (Building 1203), 303rd ARRS (Building 2303), and 163rd CAMS (Building 458) are involved in these types of operations. Wastes generated include solvents (PD-680), hydraulic fluids, oil, jet fuel, and carbon removers.

Under current practices most POL and solvent wastes are removed by a DPDO contractor. Building 458 waste fuels, oil, and hydraulic fluids are taken to the 50,000-gallon-capacity underground waste tank at the Motor Pool (hereafter referred to as Building 422). Solvents are discharged to an onsite oil/water separator (3,400 gallon capacity) and 400 gallon underground concrete waste accumulation tank which is maintained by 22nd CES. Underflow from the oil/water separator discharges to the sanitary sewer system. Building 1203 also has a local oil/water separator (3,400 gallons) and 400 gallon underground concrete waste accumulation tank for waste fuels, oils, and solvents. The 303rd ARRS, currently located in Building 2303, uses an oil/water separator (3,400 gallons) and 400 gallon underground accumulation tank at Building 2307 for aircraft wash wastes. Waste fuels and oils are transported to Building 422 by mobile tank. The 303rd ARRS Propulsion Shop has formerly been located in Buildings 355 and 2306. Prior to 1978, solvent wastes from the 303rd ARRS went to the wash rack at the south end of the base (Building 1242). The 163rd CAMS, a relatively new squadron at March, uses the same shop building (Building 458) as the 452nd CAMS and employs the same waste disposal methods.

Estimated waste quantities being generated at these shops are: 600 gallons per year of solvents, 450 gallons per year hydraulic fluids, and 450 gallons per year waste oils.

b. Jet Engine Test Cell

Wastes generated at the 22nd FMS test cell (Building 1700) include 50 gallons per year cleaning compounds, 660 gallons per year oils, and 120 gallons per year recovered JP-4. Current disposal practices include use of an onsite oil/water separator (3,400 gallons) and 400 gallon underground accumulation tank for all wastes with ultimate disposal of skimmed wastes by a DPDO contractor. Historically, wastes have been disposed of at landfills and at fire department training exercises.

c. Flightline

The 303 ARRS (Building 2307) and the 452nd CAMS (Building 2303) maintain flightline or organizational maintenance shops, while the 22nd FMS has a separate OMS squadron with several separate shops. Aircraft washing generates the majority of waste from this type of industrial shop. The 22nd OMS wash rack wastes drain to a 500 gallon underground accumulation tank at Building 1242 and are hauled off base once or twice a month. Wastes generated during the last three years according to DPDO manifests have ranged from 14,000 gallons in 1981 to 35,500 gallons in 1982. These wastes are estimated to be 5 percent solvents (PD-680), 7 percent JP-4, 3 percent oils, 10 percent soap or cleaning compounds, with the remaining 75 percent water. Prior to using this accumulation tank, aircraft wash wastes likely entered either the sanitary sewers or the storm drainage system at the south end of the runway.

The flightline operations of the 303rd ARRS (Building 2307) currently generate approximately 250 gallons of solvent wastes per year and approximately 400 gallons of waste oils. Prior to 1978, the 303rd ARRS used the wash rack at the south end of the flightline (Building 1242). Waste solvents (PS-661 and PD-680) are collected in an oil/water separator maintained by the 22nd CES. These wastes reportedly once entered the sanitary sewer system through the runway wash rack. Historically, approximately 3,000 gallons per year of TCE were reportedly used in aircraft cleaning and disposed of at the fire department training areas.

d. Aircraft Fuel Systems Shops

The fuel systems shops' activities include draining, repairing, and maintaining aircraft fuel systems and fuel tanks. The 22nd FMS (Building 1244), 163rd CAMS (Building 2309), 303rd ARRS (Building 2307), and 452nd CAMS (Building 2303) all maintain fuel system shops. Primary waste of all these shops is approximately 1,700 gallons of JP-4 per year. The 22nd FMS stores its wastes in two underground shop waste fuel tanks totalling approximately 900 gallons capacity, while the other units use the waste tank at Building 422. Prior to DPDO disposal of these wastes, most waste JP-4 was burned during fire department training exercises.

e. Pneudraulics

Pneudraulic shops are maintained by the 22nd FMS (Building 1203), the 163rd CAMS (Building 2309), the 303rd ARRS (Building 2307), and the 452nd CAMS (Building 2303). Activities include the maintenance and repair of aircraft pneumatic and hydraulic systems. Primary wastes generated at all these shops include solvents (PD-680--1,050 gallons per year) and hydraulic fluid (2,460 gallons per year). The 22nd FMS and 452nd CAMS use the waste tank at Building 422 for waste accumulation. The 163rd CAMS accumulates waste in drums for transport to the Building 422 waste tank. The 303rd ARRS discharges its wastes to an onsite oil/water separator (3,400 gallons) and 400 gallon underground waste accumulation tank. Historical disposal of wastes were at landfills and some fire department training exercises.

f. Corrosion Control

The corrosion control shop, located at Building 452, is utilized by both the 22nd FMS and 452nd CAMS. This shop's activities include cleaning, stripping, sanding, wiping, priming, and repainting portions of aircraft and AGE equipment. Wastes generated by these activities include paint thinners, toluene, MEK, paint removers, carbon removers, and waste paint. Over 3,000 gallons of these wastes are generated each year. The waste accumulation tank at Building 422 has received much of these wastes since the early 1970's. Since 1981 toluene, MEK, and thinners have been accumulated in drums prior to DPDO disposal. Historically, corrosion control wastes were disposed of in the storm drain or sanitary sewer systems.

g. Non-Destructive Inspection (NDI)

Non-destructive testing methods include x-ray, magnaflux, and ultrasound which are used to determine structural integrity and material defects of aircraft structures, component parts, and related ground equipment. All squadrons on base use the NDI testing and laboratory facilities at Building 1238. Current wastes generated by these processes include penetrant (110 gal/year), emulsifiers (110 gal/year), magnaflow (60 gal/year), 1,1,1-trichloroethane (100 gal/year), and fixer and developer (total 40 gal/year). Until 2 years ago all wastes entered the sanitary sewer system after silver recovery from photographic wastes. Wastes are now transported to Building 422 for DPDO disposal.

h. Tanker Maintenance

The 22nd OMS Tanker Maintenance (Building 1214) and Tanker Phase (Building 2303) generate relatively large quantities of solvents (PD-680--5,000 gal/year), cleaning compounds (500 gal/year), hydraulic fluids (500 gal/year), and waste oils (unknown quantity-estimated at 600 gal/year). Most solvents and cleaning compounds enter the Building 1242 washrack accumulation tank, while waste oils and hydraulic fluids are taken to Building 422 by bowser. MEK and toluene are used in small quantities with waste rags disposed into refuse dumpsters onsite. Historically, oils were believed to be disposed of in fire department training areas or landfills, and solvents were believed to be disposed of at landfills with small quantities going into the sanitary sewer and storm drain system.

i. Aerospace Ground Equipment (AGE) Maintenance

The AGE Repair/Inspection Shops repair and maintain aerospace ground equipment. The 22nd FMS (Building 1221), 22nd OMS (nonpowered AGE--Building 457), 303rd ARRS (Building 2303), and the 452nd CAMS (Building 440) all maintain AGE shops. Wastes generated include solvents (PD-680--approximately 1,180 gal/year), cleaning compounds (450 gal/year), hydraulic fluids (1,020 gal/year), oils (1,600 gal/year), and very small quantities of MEK, MIBK, and 1,1,1,-trichloroethan Currently, most wastes are disposed of through the Building 422 waste tank, with synthetic oils placed in separate drums for recycling. The common historic March AFB disposal methods of landfilling or fire department training exercises are believed to apply to these shops' waste.

j. Battery Shop/Electrical Systems

The primary wastes generated by this type of industrial operation is battery acid (sulfuric acid). Early wastes were placed unneutralized directly into the sanitary sewer system. However, for the last 5 to 8 years, acid wastes have been neutralized with sodium hydroxide prior to disposal to the sanitary sewer system. March AFB shops generating acidic battery wastes include the 22nd FMS Battery Shop (Building 1201) and the 22nd TRANS Vehicle Maintenance (Building 429). Approximately 300 gallons of neutralized acids per year are now disposed of in the sanitary sewer system, with an additional 120 gallons/year accumulated in drums for DPDO contractor disposal.

k. Liquid Fuels

The 22nd CES Liquid Fuels Maintenance Shop (Building 385) manages the flow of JP-4 in the on-base Panero tank system. While no wastes are directly handled by this shop, tanks are periodically cleaned out and waste sludges disposed of by outside contractors. Shop files indicate that wastes also include about 6,000 gallons per year of oil (OE-30). The 22nd Supply Squadron (Building 2202) is responsible for the receiving, storage, and pumping of JP-4. This shop handles approximately 48 million gallons of JP-4 per year. Up to a few years ago, while B-52 bombers were still at March AFB, the amount was closer to 55 to 58 million gallons per year. Approximately 2,500 gallons of waste JP-4 is generated at Building 2202 and is currently accumulated at Building 422. Some wastes (approximately 300 gallons per year) are taken to the fire department training area on an as-needed basis and are used in fire training exercises. Prior to the early 1970's, all waste JP-4 was burned in the fire training areas.

l. Repair And Recycle

The 22nd FMS (Building 1246) and 452nd CAMS (Building 2303) maintain repair and recycle shops which are responsible for removing and replacing flight controls, landing gear components, and wheel and tire assemblies, as well as reclaiming servicable parts from wracked aircraft. Waste generated at these shops include solvents (PD-680--600 gal/year), B&B degreasers (400 gal/year), and hydraulic fluids (200 gal/year). These wastes are currently disposed of at Building 422. Historically, these types of wastes were believed to be disposed of in on-base landfills, or at fire department training areas.

m. Auto Hobby Shop

The 22nd CSG Auto Hobby Shop (Building 941 since the early 1970's) generates waste solvents (PD 680--650 gal/year) and oils (3,000 gal/year). Solvents were once drained to the sanitary sewer system, but are now drained through an onsite oil/water separator (500 gallons capacity) with ultimate disposal by DPDO. Waste oils were once taken to either landfill or the fire department training area, but are now disposed of in an onsite 500 gallon underground waste accumulation tank periodically pumped out by DPDO.

Both the Auto Hobby Shop and Motor Pool have been located at various locations over the years. During World War II, the motor pool and a locomotive maintenance shop were located on U.S. Army Camp Haan property southwest of the intersection of Cactus Avenue and Highway 395 (reference Figure 5). In addition, the Auto Hobby Shop was reportedly located in the same general area of West March in the early 1970's. During the 1950's, the Motor Pool was located west of the 22nd CES Building 2506. Both the Motor Pool and Auto Hobby Shop were reportedly located east of Building 602 in the later 1950's.

n. General/Special Purpose Vehicle Maintenance

The 22nd TRANS Vehicle Maintenance Shop (Building 429) generates waste solvents (PD-680--120 gal/year) and

1,300 gallons per year of oils (including hydraulic fluids, antifreeze, and fuels). Wastes are currently accumulated in drums for DPDO contractor disposal. Small quantities of MEK are currently disposed of through the storm drain system.

o. Refueling Maintenance

The 22nd TRANS Refueling Maintenance Shop (Building 1250) generates solvent (120 gal/year), oil (360 gal/year), antifreeze (180 gal/year), and JP-4 (300 gal/year) wastes. Waste JP-4 is accumulated in an onsite underground waste accumulation tank (500 gallons capacity) and may be used in fire department training exercises. The remaining wastes are accumulated in drums for DPDO pickup. Historically, fire department training exercise areas received most of this shop's waste.

p. Fire Truck Maintenance

This 22nd TRANS shop (Building 1224) generates oils (700 gal/year), solvents (PD-680--120 gal/yr), and antifreeze (120 gal/year). All wastes were once disposed of in the fire department training areas, but now are accumulated in drums for DPDO pickup.

3. Fuels

JP-4 is piped from off-base to two aboveground bulk storage tanks (Buildings 2203 and 2204) located near the West Gate at the north end of the base. The tanks have a combined capacity of 4.6 million gallons. A third aboveground tank (Building 2205) in the bulk storage area, having a capacity of 1.3 million gallons, was used for AVGAS storage until the use of AVGAS was discontinued in 1975. This tank is now inactive and empty, having been completely drained, cleaned and capped. Fuel is piped to two liquid fuel pump stations equipped with 41 underground JP-4 storage tanks (50,000 gallons each except for one 25,000 gallon tank). The pumping stations supply flightline hydrant refueling systems with multiple refueling outlets.

Until the late 1950s, an aqua-system located across the street from Building 422 and just north of the present museum (Building 420) was used to supply AVGAS. When the system was inactivated, 3 underground steel tanks (approximately 15,000 gallons capacity each) were filled with dry ice and crushed. In addition, 4 concrete aboveground oil storage tanks (approximately 11,000 gallons capacity each) were demolished. Six remaining 50,000 gallon underground steel tanks at Building 422 are now used for MOGAS, diesel, and waste POL accumulation. It was reported that the aqua-system complex also included four underground concrete tanks of approximately 1,000 gallons capacity each. These tanks, which were reportedly in use from 1958 until they were destroyed in place around 1972, contained used oil (1 tank) and solvent (2 tanks). The fourth tank remained empty. This same site was believed to contain a waste oil holding or disposal pit prior to 1941 (see Site No. 22 description, Section IV.B).

Two 25,000 gallon underground tanks are located at Building 1215 (AGE), one for JP-4 and the other for MOGAS. MOGAS storage tanks (10,000 gallon capacity each) are also located at the BX Service Station near the Main Gate (Building 550). The tank levels are checked daily at the BX Station and no leakage has been noted, although the tanks are estimated to be approximately 30 years old. Approximately 1,000 gallons per year of waste oils from an aboveground tank, as well as old batteries, are removed by an outside contractor. A BX Service Station was formerly located at Building 2406 north of the intersection of Graeber Street and Meyer Drive. The station's fuel tanks are believed to be still in the ground. No information was found on whether the tanks were drained and filled in. A listing of existing POL storage tanks, including fuel oil tanks, is included in Appendix F. The majority of the base uses natural gas for heating. However, the 15th Air Force complex in West March relies on fuel oil for heating and, therefore, has local fuel oil tanks at several buildings.

Several significant fuel spills were reported by interviewees and in base records, with most of these occurring on paved areas. These include a 700 gallon AVGAS spill near Building 2306 in 1963, 400 and 800 gallon JP-4 spills in the same area in 1969, a 1000 gallon JP-4 spill near aircraft parking spot S-1 in 1980, and 2000 gallon JP-4 spills in the hydrant area in 1974 and 1981. Additionally, a 1975 fire department memo estimated that an average of 12 spills of 100 gallons or less occurred on the flightline each month.

Only three of the significant spills reported involved major unpaved areas. These were a 1000 gallon JP-4 spill near Building 1245 in 1973, a 5000 gallon fuel truck spill on the south end of the flightline in 1973, and a 10,000 gallon JP-4 spill near the bulk fuel storage area in 1976 (of which approximately 4,000 gallons were recovered). These spills have been identified as Sites No. 19, 20, and 21, respectively. All other spills were washed into the storm drain system from paved areas, although some minor runoff to unpaved areas likely occurred.

Tank inspections have not revealed any major leakage problems. Routine maintenance has resulted in estimated fuel losses of 10 gallons per week from each of the two hydrant systems and 5 gallons per week from each of the two active bulk storage tanks. Prior to installation of a product recovery system 4 years ago, an estimated 10 to 15 gallons per week was lost from each of the bulk storage tanks during routine maintenance. One interviewee reported that fuel floats to the ground surface in the bulk storage area during heavy rainstorms. Because of this possible saturation, the bulk fuel storage area is included in Site No. 21 (the 10,000 gallon spill).

4. Fire Department Training Exercises

Fire department training activities were reported to have been conducted at the end of Runway 12-30 since at least as early as 1961. Site No. 9, which may have consisted of several burn pits in slightly different locations, was used through 1978. Site No. 10, the current fire department training area, has been in use since 1978. Specific, verifiable information on fire department training activities prior to 1961 could not be found. A 1952 aerial photograph shows what appears to be a fire department training burn pit west of Building 1223 in the present-day apron (Site No. 8). According to the base history, the runway was extended in 1954. Assuming that the apron was paved during this expansion, it is likely that fire department training was moved to the end of the runway in 1954.

Current fire department training exercises are conducted about once per month with about 500 gallons of recovered JP-4 used per activity. Since 1972, only recovered JP-4 has been used for fire department training exercises. Prior to 1972, essentially all of the mixed POL wastes originating on the base were burned. These wastes included waste oils, solvents, and fuels. Based on current disposal records, it is possible that 50,000 to 100,000 gallons per year of waste POL may have been disposed of in the fire department training areas (primarily Site No. 9 - Fire Department Training Area No. 2) from the 1950's through the mid-1970's when bomber wings were assigned to the base. The waste POL may have been stored in the burn areas for several days prior to a training exercise; otherwise, the training exercises would have to have been conducted almost daily to burn the large quantity of waste POL generated.

5. Polychlorinated Biphenyls (PCBS)

The major potential sources of PCBs at March AFB are the approximately 800 in-service transformers and the 76 transformers currently in storage. Of the 76 transformers currently in storage, 36 have been determined to be non-contaminated (less than 7 ppm PCBs) and test results are forthcoming on the remaining 40. In mid-January, 30 PCB-contaminated transformers were transported to DPDO at Norton AFB for disposal. The number of in-service transformers containing PCBs could not be verified.

Transformers have been salvaged at DPDO since the mid-1960's. Prior to then, non-servicable transformers may have been disposed of in the on-base landfills. Specific reports were made of transformers being disposed of in Landfill No. 5. Approximately 10 transformers were removed from service per year through the late 1970's. Since initiation of a conversion program to dispose of PCB-contaminated transformers, the number of transformers removed from service has gradually increased to a current level of approximately 40 per year.

An estimated 200 to 300 gallons of transformer oil has been spread around miscellaneous areas on the base since the early 1960's. This quantity represents the oil that was not disposed of with the nonserviceable transformers. No information was found on whether or not these oils contained PCBs. In early 1984, soils from four areas contaminated with transformer oils were sampled. Soils from two of these areas (near Buildings 1305 and 317) were determined to be PCB-contaminated. The contaminated soils were excavated and removed from March AFB by an outside contractor. Test results from the remaining two areas (in the 22nd Civil Engineering Squadron supply yard--Site No. 27) did not indicate the soils to be PCB-contaminated.

6. Pesticides

Pesticides and herbicides have been used since activation of the base. The 22nd CES Entomology Shop (Building 2502) controls the use of all chemicals used to control bees, wasps, flies, ants, roaches, plant pests, rodents, birds, and weeds. Additional pesticide and herbicide application is performed by an outside contractor, principally for weed control about the base. The golf course in West March uses small quantities of pesticides and herbicides about the golf course.

The major pesticides in use at March AFB and estimates of 1983 usage are shown below.

Pesticide	Quantity
Baygon	11 gal/yr
Diazinon	60 gal/yr
Dursban	5 gal/yr
Pyrethium	9 gal/yr
Malathion	4 gal/yr
Sevin (dust)	50 lbs/yr
Avitrol (bait)	7 lbs/yr
Starlicide (bait)	10 lbs/yr
Zinc Phosphide (bait)	480 lbs/yr
Warfarin (bait)	25 lbs/yr
Paraquat	40 gal/yr

According to base personnel, zinc phosphide will no longer be used on base beginning in 1984. No information was obtained during the records search to indicate that the pesticide DDT has been in common use at March AFB in the past.

Proper pesticide application procedures are reportedly followed at March AFB, generally using a hand-held sprayer.

Empty pesticide containers are triple rinsed and disposed of in a dumpster for off-base disposal. Rinse waters are used in the spray tank. All pesticide preparation and rinsing of application equipment is conducted in a mixing room located in the 22nd Civil Engineering Squadron supply compound. The triple rinse for containers has been used for the past 6 years. Nuisance animals such as gophers, ground squirrels, starlings, and crows have been baited for the past few years. No pesticide-related spills have been reported at March AFB.

7. Wastewater Treatment

The original wastewater treatment plant at March AFB was located in Facilities 1266 through 1269 at the south end of the flightline parking apron. This plant, referred to as East March Wastewater Treatment Plant (WWTP), was constructed in 1938 and provided secondary treatment (trickling filter) for both sanitary (domestic) and industrial wastewaters which are conveyed in a common collection system. The East March WWTP was expanded in 1942 to handle the increased flow from the buildup of personnel and operations at March AFB during WW II. Treated effluent from the East March WWTP was discharged off-base to a holding pond approximately one mile south of the plant and east of the present alert facility hangar. The effluent was used for agricultural irrigation.

Waste sludge from the plant was anaerobically digested for stabilization, dewatered on unlined drying beds, and then either buried in base landfills or used as a soil conditioner on agricultural lands in the Chino area. Waste oils, solvents, and other hazardous materials from industrial shops were regularly collected in the sanitary system and occasionally caused plant upsets. In the early 1970's, the two East March digesters (approximately 108,000 gallons capacity and 137,000 gallons capacity) were cleaned and the waste material dumped in trenches near the plant (potentially in the same general area as Landfill No. 3). The East March WWTP was abandoned in 1977 when the West March WWTP was upgraded. A pump station and force main were installed to convey the wastewater to West March.

The West March WWTP, also a trickling filter secondary plant, was built in 1941-42 to meet the needs of the Camp Haan Army Base. This plant was closed in 1945-46, but reopened in 1955 when the Air Force constructed the Arnold Heights housing facilitites in West March. It was also reported that the Weapons Storage Area (WSA) on Cactus Avenue in West March had its own wastewater treatment plant (Imhoff Tank type) during WW II. This plant was removed and relocated to the City of Fallbrook after WW II according to interviewees. An unconfirmed report indicated that a fourth plant (Imhoff Tank type) during the WW II period may have served the prison which was once located south of Van Buren Boulevard in the vicinity of the present 15th Air Force Headquarters.

The effluent from the West March WWTP has been discharged to a holding pond approximately 2½ miles southeast of the plant since the plant began operating. The farmlands of the John Coudures Company are irrigated with the effluent. The West Plant also utilized anaerobic digesters and unlined sludge drying beds until the 1977 plant upgrade when underdrains were put into new sludge beds. Dried sludge has either gone to base landfills or to the Chino area as a soil conditioner for agricultural lands.

The West March WWTP currently has a design flow capacity of approximately 1.44 mgd and receives a dry weather wastewater flow of approximately 0.55 mgd. Approximately 3/4 of the annual flow is sent to the Coudures Effluent Pond, with the remaining effluent (since 1979) used for landscape irrigation at the base golf course and the Veterans Administration Cemetary. The plant is generally in compliance with the provisions of its Santa Ana Regional Water Quality Control Board Discharge Orders No. 77-227 and No. 79-9 for wastewater reclamation with the exception of certain mineral constituents (present from the base water supply), boron, and ammonia-nitrogen. With the anticipated July 1984 transfer from the current mix of Colorado River and groundwater base water supply to higher quality Northern California water (State Project Water) supplied via the Eastern Municipal Water District, compliance with mineral quality standards should be achieved.

8. Storm Drainage

March AFB has an extensive storm drainage system consisting of concrete culverts, catch basins, and drainage ditches. Runoff from the hills of West March is carried in a series of swales and ditches through culverts passing under Highway 395. This runoff is collected in a main ditch flowing southward, parallel to Runway #14-32, and empties into the Riverside County Flood Control District's channel at the intersection of Heacock and Oleander Roads.

The main airfield and apron areas are served by a network of storm drains collecting into two 72-inch diameter storm drain conduits at the southwest corner of the parking apron. A Main Oil/Water Separator (Facility 6603) was constructed at this location in 1974. The provisions of NPDES Permit No. CA 0111007 (Regional Board Discharge Order No. 81-44) require monitoring of this discharge point for oil and grease and other constituents.

Inspection of recent sampling results shows that occasionally high discharges of oil and grease (up to 300 mg/l), as well as significant levels of organophosphate pesticides (up to 37 ppb Parathion) have occured in the past few years. File correspondence indicates that the low concrete wall across the drainage channel leading to the separator intake is not always properly maintained and an accumulation of sand, water, and oily sludge occasionally builds up. During subsequent rainstorms, it is quite possible for these deposits to be washed downstream into the unlined Perris Valley Storm Drain causing a violation of the discharge permit.

9. Base Water Supply

The current source of potable water for March AFB is a system of on-base groundwater wells supplemented by Colorado River water piped in to the March AFB water treatment plant from Lake Mathews, located approximately 10 miles west of the plant. Of the six base water supply wells, three have been abandoned (Wells No. 2, 3, and 4), two have been taken out of service (Wells No. 1 and 5), and one is active (Well No 6). Well supplies are chlorinated prior to entering the distribution system. Further discussion of local groundwater aquifer characteristics, the base water wells, and general groundwater quality is contained in Section III.C.2 through Section III.C.4.

Colorado River water from Lake Mathews is purchased from the Metropolitan Water District of Southern California on an unlimited basis. The Lake Mathews Pumping Station is an Air Force-owned pumping facility discharging into a 20-inch water main leading to the March AFB water treatment plant. Colorado River water is also purchased to supplement the available wastewater effluent used for irrigation of the base golf course and the Veterans Administration Cemetary. A 5,000,000 gallon capacity holding pond for this untreated irrigation water supply is located adjacent to the water treatment plant.

The treatment plant, located in West March at the intersection of Clark Street and the southern base boundary (Facility 6007), was constructed in 1941 and has a nominal

4.3 mgd capacity. Treatment is provided via a lime-soda ash process including flocculation, clarification, rapid sand filtration, chlorination, and fluoridation. Four concrete water storage tanks (ranging from 400,000 to 1,000,000 gallons capacity) and five steel tanks (ranging from 15,000 to 2,500,000 gallons capacity) are located throughout the distribution system in both East and West March. Average daily water demand for the past 10 years has been relatively constant at 2.0 mgd. Colorado River water has supplied 70 to 75% of the demand, with on-base wells making up the difference.

Lime and soda ash sludge from the treatment process, including a small quantity of alum, is discharged via a slurry line to one of two settling/evaporation impoundments to the north of the plant. Generally, a dragline cleans out one of the impoundments each year and piles the dried lime sludge deposits on adjacent land. Approximately 3 acres of sludge has accumulated since the plant began operating. Lime sludge is classified as a Category 2 waste in the State of California and is generally disposed of in a Class I or Class II-1 permitted landfill. Although the lime sludge is not classified as a hazardous waste, it is recommended that the accumulated sludge be disposed of in a properly permitted landfill.

March AFB has recently contracted with the Eastern Municipal Water District to obtain the entire base water supply in the future from the District. Pump station and pipeline facilities are anticipated to be completed for the transfer to the new water supply in July 1984. The March AFB water treatment plant and wells will be abandoned at that time. The District serves primarily Northern California water (State Project Water) through a distribution system including extensive rural and developing areas to the south and east of the base. Although some of the residences in these areas still use private groundwater wells for their drinking water, the District does provide an alternative supply for many of the residences.

The Eastern Municipal Water District supply offers two primary advantages to March AFB. First, the TCE contaminated Well No. 1 (See Section IV.A.11) may be permanently retired from service. Secondly, the State Project Water supplied by the District has a lower mineral content than the present Colorado River/well water blend used on base. In order for the West March Wastewater Treatment Plant to achieve full compliance with the Santa Ana Regional Water Quality Control Board's Basin Plan and Discharge Orders No. 77-227 and No. 79-9 governing reclaimed water quality, it is necessary to switch to the District's higher quality water source.

10. Refuse Disposal

Base refuse, consisting mainly of garbage, rubbish, and trash generated at the family housing units and from the administration and shop buildings on base, has been disposed of in the past (1940-1976) in a series of seven base landfills. Some limited quantities of waste petroleum products and other hazardous wastes have reportedly been buried in some of the landfills, but the majority of these liquid industrial wastes have been burned in fire department training exercises or disposed of by other methods (see Section IV.A.1).

The general method of past landfill operation on base was to maximize the use of the natural depressions and ravines in the West March area. Base records indicate that in the mid-1970's prior to closure of the base landfills that approximately 5,000 cubic yards of refuse per month was hauled to the landfills. It was estimated that after compaction and earth covering that the daily volume was reduced to 1,500 cubic yards. Further discussion of the base landfills is included in Section IV.B. From 1976 to the present time, base refuse has been disposed of by contract collection with off-base disposal. However, there remains some evidence of unauthorized dumping at Landfills No. 4 and No. 5.

11. Available Water Quality Data

a. Inorganic Mineral Content

Table 9 lists available water quality data for samples of five of the March AFB water wells and water treatment plant influent and effluent collected in 1976. Wells No. 1, 3, 5, and 6 have similar chemical composition. These waters are less than 500 mg/l TDS and predominantly calcium chloride or sodium chloride in chemical character. Well No. 1 has a relatively high nitrate/nitrite concentration of 8.2 mg/l as nitrogen (N). State and federal standards dictate a maximum allowable concentration of 10 mg/l nitrite (NO_2) and nitrate (NO_3) as N. Well No. 4 has a TDS content 80 percent higher than the other four wells and elevated concentrations of calcium, magnesium, bicarbonate, sulfate, and chloride. The magnesium concentration is three to five times higher than that found in wells to the north and east of the base. Nitrate is also high in this well.

Analyses of water from Wells No. 1 and 6 in August of 1983 (Table 10) demonstrate that Well No. 1 water has more than doubled its mineral content since 1976, whereas Well No. 6 water has become slightly less saline. The current TDS in Wells No. 1 and 6 are 965 and 338 mg/l, respectively. The increase in TDS in Well No. 1 water over the 7-year period may be due to nearby percolation of mineralized water or in part to the lowering of the water table.

b. Organic Contamination

Contamination of the groundwater with trichloroethylene (TCE) occurs at Wells No. 1 and 3. Wells No. 5 and 6 are apparently free of any organic contamination, as was Well No. 4 in August 1979 when it was last sampled. Wells No. 3 and 4 have been abandoned since July 1978. Available

Table 9
ANALYSIS OF MARCH AFB WATER SUPPLY[a]
SAMPLED SEPTEMBER 9, 1976
(Analyzed by USGS)

Parameter	Water Treatment Plant Influent	Water Treatment Plant Effluent	Well No. 1	Well No. 3	Well No. 4	Well No. 5	Well No. 6
Calcium	77	36	49	56	130	58	64
Magnesium	31	26	17	11	44	5.5	9.1
Sodium	110	130	51	92	87	100	86
Potassium	5.2	5.2	2.6	3.2	3.9	3.4	3.6
Bicarbonate	124	54	86	96	201	88	100
Carbonate	0	0	0	0	0	0	0
Sulfate	300	300	21	36	89	28	29
Chloride	90	90	130	180	300	200	190
Fluoride	0.4	0.9	0.4	0.8	0.3	1.1	0.6
$NO_2 + NO_3$ (as N)	0.45	0.62	8.20	3.90	7.20	3.00	3.40
Silica	8.5	8.4	60	29	59	20	25
Iron	0.07	0.02	0.04	0.03	0.25	0.02	0.23
Manganese	0.00	0.00	0.01	0.00	0.00	0.01	0.00
Color	3	2	2	2	2	2	2
Dissolved Solids	685	625	410	473	844	473	472
Residue	708	626	400	477	910	474	487
Total Hardness (as $CaCO_3$)	320	200	190	190	510	170	200
Alkalinity	102	44	71	79	165	72	82

[a]All concentrations in mg/l

Table 10
ANALYSIS OF MARCH AFB WATER SUPPLY[a]
SAMPLED AUGUST 1983
(Analyzed by USAF OEHL)

Analysis	Well No. 1	Well No. 6	Hospital[b]	Water Treatment (Lake Math
Ammonia as N	<0.10 mg/l	<0.20 mg/l	<0.20 mg/l	<0.20 n
Nitrate as N	<0.02 mg/l	<0.02 mg/l	<0.02 mg/l	<0.02 n
Nitrate as N (Cd Reduction Method)	0.16 mg/l	1.6 mg/l	1.4 mg/l	0.3 mg
Oil and Grease	<1.0 mg/l	<0.3 mg/l	<0.3 mg/l	0.3 mg
Cyanide, Total	<0.01 mg/l	<0.01 mg/l	<0.01 mg/l	<0.01 n
Phenols	<10	<10	<10	<10
Arsenic	<10	<10	<10	<10
Barium	295	<200	<200	<200
Boron	<500	1,300	900	NR
Cadmium	<10	<10	<10	<10
Calcium	98.6 mg/l	27.6 mg/l	0.7 mg/l	36.5 n
Chromium, Total	<50	<50	<50	<50
Chromium VI	<50	<50	<50	<50
Copper	<20	<20	<20	<20
Hardness	394 mg/l	83 mg/l	6 mg/l	NR
Iron	227	<100	<100	<100
Lead	<20	<20	<20	<20
Magnesium	35.8 mg/l	3.5 mg/l	1.0 mg/l	23.8 r
Manganese	<50	<50	<50	<50
Mercury	<1	<1	<1	<1
Nickel	<50	<50	<50	<50
Potassium	2.9 mg/l	1.7 mg/l	3.2 mg/l	4.3 m
Selenium	<10	<10	<10	<10
Silver	<10	<10	<10	<10
Sodium	53.4 mg/l	68.4 mg/l	125.0 mg/l	102.8
Zinc	<50	<50	<50	<50
Alkalinity, Total	113 mg/l	79 mg/l	67 mg/l	23 mg
Alkalinity, Bicarb.	119 mg/l	79 mg/l	67 mg/l	NR
Chloride	220 mg/l	80 mg/l	120 mg/l	110 m
Color	<5 units	<5 units	<5 units	NR
Fluoride	0.3 mg/l	1.5 mg/l	1.2 mg/l	<0.10
Odor	None	None	None	None
Residue, Filterable (TDS)	965 mg/l	338 mg/l	414 mg/l	730 m
Specific Conductance	1,160 umhos	590 umhos	720 umhos	860 um
Sulfate	61 mg/l	22 mg/l	97 mg/l	450 m
Surfactants-MBAS	<0.1 mg/l	<0.1 mg/l	<0.1 mg/l	<0.1 m
Turbidity	<1 unit	<1 unit	<1 unit	24 uni

[a] Concentrations in ppb unless otherwise specified.

[b] Sample collected at hospital from the March AFB distribution syste

NR = not reported

analyses of organics for five of the base wells, the water treatment plant, and the March AFB distribution system sampled at the hospital are shown in Tables 11 through 13.

The concentration of TCE in Well No. 1 was first measured at 21.4 ppb in February 1978. Two samples taken on September 13, 1983, were analyzed at 33.6 and 66 ppb by two separate laboratories. The most recent sample analysis conducted by USAF OEHL (January 11, 1984) revealed a TCE concentration of 111 ppb in Well No.1. The concentration has apparently been slowly rising over the past 5 years. Well No. 3 had 57.6 ppb TCE in February 1978, almost three times higher than the level in Well No. 1 at that time. Therefore, Well No. 3 may contain higher TCE levels than Well No. 1 at this time.

More detailed organic analyses of water from Well No. 1 demonstrate that carbon tetrachloride, chloroform, tetrachloroethylene, bromodichloromethane, and perchloroethylen also exist in the well water, but at lesser concentrations than the TCE.

Well No. 1 has been monitored over the past 6 years since this well has contributed a significant portion of the total March AFB water supply flow. The dilution of the organic contamination with water from Wells No. 5 and 6 and Colorado River water from the base water treatment plant maintains a level of TCE below the action level of 5 ppb set by the State of California Department of Health Services. However, a 5-to 6-fold dilution of Well No. 1 water is about the maximum level of dilution obtainable from the present water supply system (without reducing the output of Well No. 1 significantly). Well No. 1 is still operative, but has not been regularly used since September 1983. As of February 1984, Well No. 1 has been removed from service to avoid excessi TCE levels in the base water supply system (see Section III.C.3

Table 11
ANALYSIS OF ORGANICS IN MARCH AIR FORCE BASE
WATER WELL NO. 1

Analysis[a]	02/21/78[c]	08/07/79[c]	09/09/82[c]	03/09/83[c]	06/22/83[b]	07/06/83[c]	09/13/83[c]	09/13/83[b]	01/11/84[c]
Trihalomethanes:									
Bromoform	---	---	ND<0.2	ND<0.2	---	ND<0.2	---	---	---
Bromodichloromethane	---	---	ND<0.1	ND<0.1	---	5.6	---	---	---
Chloroform	---	---	10.6	8.8	13	15.7	2.1	4.3	---
Dibromochloromethane	---	---	ND<0.1	ND<0.1	---	ND<0.1	---	---	---
Total Trihalomethanes	---	---	<11.0	<9.2	---	<21.6	---	---	---
Volatile Halocarbons:									
Carbon tetrachloride	---	---	9.0	---	3.1	---	4.3	4.3	---
Methylene chloride	---	---	ND<0.2	---	---	---	---	---	---
Tetrachloroethylene	---	---	1.5	---	---	---	1.1	---	---
Trichloroethylene	21.4	28.8	31.6	---	37	---	33.6	66	111
Perchloroethylene	---	---	---	---	1.6	---	---	1.7	---
Dibromochloropropane	---	---	---	---	ND<0.1	---	---	---	---
Other Organics:									
PCBs	---	---	---	---	---	---	ND<0.25	---	---
Pesticides	---	---	---	---	---	---	ND	---	---

[a] All concentrations in ppb

[b] Analyzed by Southern California Public Health Lab (California Department of Health Services)

[c] Analyzed by USAF OEHL

ND = Not detected

--- = Not analyzed for

Source: March AFB files.

Table 12
ANALYSIS OF ORGANICS IN MARCH AIR FORCE BASE
WATER WELLS NO. 3, 4, 5, AND 6

Analysis[a]	Well No. 6						
	02/21/78[c]	08/07/79[c]	09/09/82[c]	11/24/82[c]	07/06/83[c]	06/22/83[b]	09/13/83[c]
Trihalomethanes:							
Bromoform	---	---	ND<0.2	ND<0.2	ND<0.2	---	---
Bromodichloromethane	---	---	ND<0.1	ND<0.1	ND<0.1	---	---
Chloroform	---	---	ND<0.1	ND<0.1	1.3	---	---
Dibromochloromethane	---	---	ND<0.1	ND<0.1	ND<0.1	---	---
Total Trihalomethanes	---	---	<0.5	<0.5	<1.7	---	---
Volatile Halocarbons:							
Carbon tetrachloride	---	---	ND<0.1	---	ND<0.1	ND<0.1	---
Methylene chloride	---	---	0.4	---	---	---	---
Tetrachloroethylene	---	---	ND<0.1	---	ND<0.1	---	---
Trichloroethylene	ND<1.5	ND<1.5	ND<0.1	---	ND<0.1	ND<0.1	---
Perchloroethylene	---	---	---	---	---	ND<0.1	---
Dibromochloropropane	---	---	---	---	---	ND<0.1	---
Other Organics:							
PCBs	---	---	---	---	---	---	ND<0.25
Pesticides	---	---	---	---	---	---	ND

Analysis[a]	Well No. 3		Well No. 4		Well No. 5	
	02/21/78[c]	08/07/79[c]	02/21/78[c]	08/07/79[c]	02/21/78[c]	08/07/79[c]
Trichloroethylene	57.6	Inoperable	ND<1.5	Inoperable	ND<1.5	ND<1.5

[a] All concentrations in ppb

[b] Analyzed by Southern California Public Health Lab (California Department of Health Services)

[c] Analyzed by USAF OEHL

ND = Not detected

--- = Not analyzed for

Source: March AFB files.

Table 13
ANALYSIS OF ORGANICS IN MARCH AIR FORCE BASE
WATER TREATMENT PLANT AND HOSPITAL WATER SUPPLY

Analysis[a,b]	Water Treatment Plant				Hospital[c]				
	09/09/82	11/24/82	07/06/83	09/13/83	09/09/82	11/24/82	03/09/83	07/06/83	09/13/83
Trihalomethanes:									
Bromoform	ND<0.2	ND<0.2	ND<0.2	ND<0.1	10.3	27.2	13.7	38.4	---
Bromodichloromethane	0.5	0.5	ND<0.1	ND<0.1	21.9	2.6	22.6	11.2	---
Chloroform	6.9	2.4	3.5	8.2	31.1	2.7	18.1	16.7	21.5
Dibromochloromethane	ND<0.1	ND<0.2	ND<0.1	ND<0.1	16.2	7.4	23.6	13.5	---
Total Trihalomethanes	<7.7	<3.3	<3.9	<3.7	79.5	39.9	78.0	79.8	---
Volatile Halocarbons:									
Carbon tetrachloride	0.3	---	---	ND<0.1	ND<0.1	---	---	---	ND<0.1
Methylene chloride	ND<0.2	---	---	---	0.5	---	---	---	---
Tetrachloroethylene	ND<0.1	ND<0.1	---	NI<0.1	0.4	---	---	---	ND<0.1
Trichloroethylene	ND<0.1	ND<0.1	---	ND<0.1	ND<0.1	---	---	---	ND<0.1
Other Organics									
PCBs	---	---	---	---	---	---	---	---	NC<0.25
Pesticides	---	---	---	---	---	---	---	---	ND

[a] All concentrations in ppb

[b] Analyzed by USAF OEHL

[c] Sample collected at hospital from March AFB water distribution system

ND = Not Detected

Source: March AFB files.

--- = Not analyzed for

Relatively high levels of trihalomethanes occur in samples from the base water distribution system collected at the hospital. Trihalomethanes are a group of chemicals produced during the chlorination of water by the reaction of the chlorine with any dissolved or suspended organic matter in the water. These chemicals include bromoform, bromodichloromethane, chloroform, and dibromochloromethane. The total of these chemicals is referred to as the total trihalomethanes (TTHMs). The State of California action level for TTHMs is 100 ppb. This level has not been exceeded in samples collected at the hospital since the onset of routine testing in September 1982. The cause of the high TTHMs is not positively known at this time. It may be caused by a free chlorine residual in the distribution system reacting with some organic matter present in the water. If this is the cause of the problem, switching to a combined chlorine residual in the distribution system may prevent TTHMs from forming.

The concentration of pesticides and polychlorinated biphenyls (PCBs) was found to be below the detection limit in samples collected from Wells No. 1 and 6 and from the distribution system at the hospital in September 1983.

According to information received during the outside agency contacts, it was learned that the California Department of Health Services, Sanitary Engineering Branch, will soon be notifying owners of water supplies, including March AFB, that a groundwater monitoring and sampling program must be implemented where there is known or suspected chemical contamination of the supply. This program has been authorized by legislation passed under AB 1603 and is expected to begin in April 1984. The recommendations contained in this report could form the basis for establishing the required monitoring program.

12. Other Activities

Review of available base records and information obtained during the base personnel interviews produced no evidence of the past or present storage, disposal, or handling of biological or chemical warfare agents at March AFB.

Small-scale munitions disposal was conducted up until approximately 1977. Outdated small arms ammunition, egress items, smoke grenades, starter cartridges, and other pyrotechnics were deactivated in Facility 5060 (Demolition Burn Area--Site No. 11) and buried in an area adjacent to Landfill No. 5 (Site No. 5) in the northwestern portion of the base. Interviewees indicated that the demolition burn site was used throughout the 1960's and possibly in the 1950's, although real property records show that Facility 5060 was constructed in 1967. An estimated 10 to 15 pounds of munitions residue and 150 to 200 pounds of shell casings were disposed of each month.

A small-arms firing range (Facility 6006) is located northeast of the water filtration plant at the southern end of the base (West March area). The range was established in 1942. Brass casings are periodically reclaimed, and the lead shot are retained in an earthen embankment. No information was available on whether or not the embankment is periodically excavated and replaced. Another small arms range was located in Box Springs, north of the base, as early as 1952. No specific details were available on this range.

Aircraft crashes in the vicinity of the base have occured in the past, including a T-37 crash in 1962 at the south end of the base between the water filtration plant and the West March Wastewater Treatment Plant, and a B-47 crash in 1955 at the north end of the base. Debris from these crashes was removed and presumably disposed of in the base landfills.

B. DISPOSAL SITES IDENTIFICATION AND EVALUATION

Interviews were conducted with base personnel (Appendix C) to identify disposal and spill sites at March AFB. A preliminary screening was performed on all the identified sites based on the information obtained from the interviews and available records from the base and outside agencies. Using the decision tree process described in Section I.E., a determination was made whether a potential exists for hazardous material contamination at any of the identified sites. For those sites with the potential for hazardous material contamination, a determination was then made as to whether significant potential exists for contaminant migration from these sites. These sites were then rated using the U.S. Air Force Hazard Assessment Rating Methodology (HARM), which was developed jointly by the Air Force, CH2M HILL, and Engineering-Science for specific application to the Air Force IRP.

The HARM system considers four aspects of the hazard posed by a specific site: (1) the receptors of the contamination, (2) the waste and its characteristics, (3) potential pathways for waste contaminant migration, and (4) any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating. A more detailed description of the HARM system is included in Appendix G.

A total of 30 disposal and spill sites were identified at March AFB. Of these, 26 were rated using the HARM rating system. A complete listing of all of the sites, including potential hazards, is given in Table 14. Copies of the completed rating forms are included in Appendix H, and a summary of the hazard ratings for the sites is given in Table 15.

A description of each site, including a brief discussion of the rating results, is presented below. Approximate locations

Table 14
DISPOSAL AND SPILL SITES SUMMARY

Site No.	Site Description	Hazard Potential		
		Contamination	Migration	Rating
1	Landfill No. 1	Yes	Yes	Yes
2	Landfill No. 2	Yes	Yes	Yes
3	Landfill No. 3	Yes	Yes	Yes
4	Landfill No. 4	Yes	Yes	Yes
5	Landfill No. 5	Yes	Yes	Yes
6	Landfill No. 6	Yes	Yes	Yes
7	Landfill No. 7	Yes	Yes	Yes
8	Fire Department Training Area No. 1	Yes	Yes	Yes
9	Fire Department Training Area No. 2	Yes	Yes	Yes
10	Fire Department Training Area No. 3	Yes	Yes	Yes
11	Munitions Residue Burial Site	No	No	No
12	East March Sludge Drying Beds	Yes	Yes	Yes
13	West March Sludge Drying Beds	Yes	Yes	Yes
14	East March Effluent Pond	Yes	Yes	Yes
15	Coudures Effluent Pond	Yes	Yes	Yes
16	Water Treatment Plant Sludge	Yes	No	No
17	Swimming Pool Fill	Yes	Yes	Yes
18	Aircraft Isolation Area	Yes	Yes	Yes
19	Liquid Fuels Pump Station Overflow	Yes	Yes	Yes
20	Tank Truck Spill Site	Yes	Yes	Yes
21	Bulk Fuels Storage Area	Yes	Yes	Yes
22	Waste Oil Pit/Solvent Tanks	Yes	Yes	Yes
23	Engine Test Cell	Yes	Yes	Yes
24	Main Oil/Water Separator	Yes	Yes	Yes
25	Flightline Drainage Channel	Yes	Yes	Yes
26	Flightline Shop Zone	Yes	Yes	Yes
27	Civil Engineering Storage Area	Yes	Yes	Yes
28	Construction Rubble Burial Site	No	No	No
29	Unconfirmed Solvent Disposal	Yes	Yes	Yes
30	Building Demolition Areas	No	No	No

Table 15

SUMMARY OF DISPOSAL AND SPILL SITE RATINGS

Site No.	Site Description	Subscore (% of Maximum Possible Score in Each Category) Receptors	Waste Characteristics	Pathways	Factor for Waste Management Practices	Overall Score	Page Reference of Site Rating Form
1	Landfill No. 1	48	30	30	1.0	36	H-1
2	Landfill No. 2	49	30	37	1.0	39	H-3
3	Landfill No. 3	48	100	37	1.0	62	H-5
4	Landfill No. 4	41	100	44	1.0	62	H-7
5	Landfill No. 5	49	100	44	1.0	64	H-9
6	Landfill No. 6	60	100	30	1.0	63	H-11
7	Landfill No. 7	54	30	37	1.0	40	H-13
8	Fire Department Training Area No. 1	51	70	28	1.0	50	H-15
9	Fire Department Training Area No. 2	48	100	37	1.0	62	H-17
10	Fire Department Training Area No. 3	44	48	37	1.0	43	H-19
11	Munitions Residue Burial Site	Not Rated					
12	East March Sludge Drying Beds	52	40	37	1.0	43	H-21
13	West March Sludge Drying Beds	48	40	37	1.0	42	H-23
14	East March Effluent Pond	54	30	30	1.0	38	H-25
15	Coudures Effluent Pond	54	30	37	1.0	40	H-27
16	Water Treatment Plant Sludge	Not Rated					
17	Swimming Pool Fill	57	50	28	0.95	43	H-29
18	Aircraft Isolation Area	57	80	80	1.0	72	H-31
19	Liquid Fuels Pump Station Overflow	49	48	37	1.0	45	H-33
20	Tank Truck Spill Site	53	64	37	1.0	51	H-35
21	Bulk Fuels Storage Area	58	80	37	1.0	58	H-37
22	Waste Oil Pit/Solvent Tanks	57	70	80	1.0	69	H-39
23	Engine Test Cell	41	50	37	1.0	43	H-41
24	Main Oil/Water Separator	47	100	37	1.0	61	H-43
25	Flightline Drainage Channel	47	100	37	1.0	61	H-45
26	Flightline Shop Zone	57	100	30	1.0	62	H-47
27	Civil Engineering Storage Yard	58	80	37	1.0	58	H-49
28	Construction Rubble Burial Site	Not Rated					
29	Unconfirmed Solvent Disposal	51	40	37	1.0	43	H-51
30	Building Demolition Areas	Not Rated					

of the sites are shown in Figure 14. Approximate operating dates for the fire department training sites and for the identified landfills are shown in Figure 15.

1. Landfills

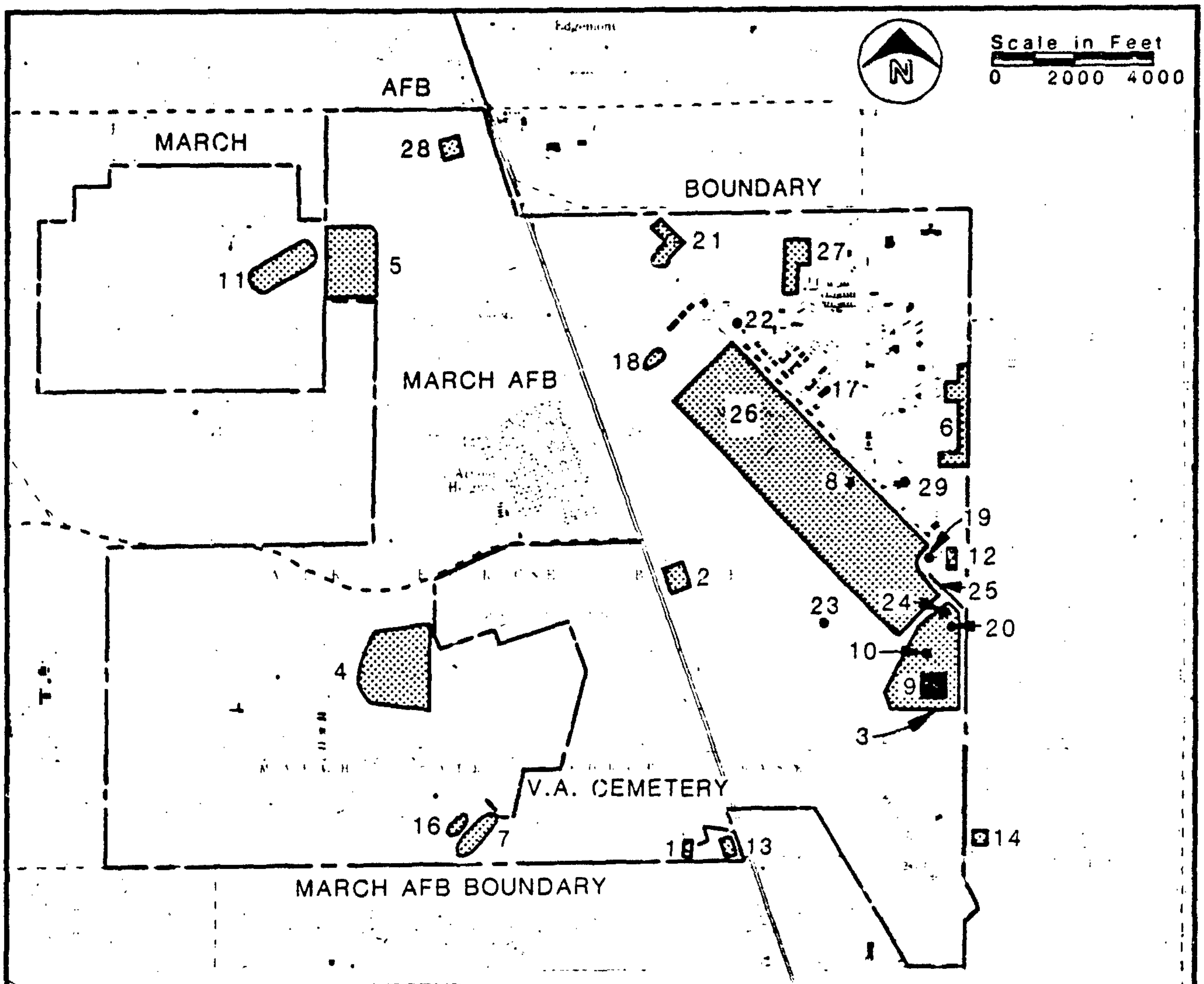
Base solid waste has been disposed of in seven base landfills from 1940 until 1976. All landfills have received domestic and industrial solid wastes generated on base. In addition, unknown quantities of flightline-generated liquid wastes (oils, solvents, paints, etc.) that were not burned in fire department training exercises or disposed of otherwise were received at the landfills. The seven base landfills are discussed below:

a. Site No. 1 - Landfill No. 1

Landfill No. 1, the oldest identified March AFB landfill, was operated from about 1941 to 1965. The site is located to the west of the West March Wastewater Treatment Plant and extends along the access road and perimeter fence lines. The site is adjacent to the incinerator reportedly used by the Camp Haan Army Base during the 1940's, and is estimated to be approximately 1.5 acres in size.

The landfill alledgely received incinerated wastes from the large U.S. Army incinerator, which is reportedly buried under the earthen mound just west of the wastewater treatment plant. Types of materials received at Landfill No. 1 are believed to include domestic solid wastes, shop wastes, ash, and debris.

Landfill No. 1 (Site No. 1) received an overall HARM rating score of 36, primarily due to: (1) the proximity of the site to the base boundary (adjacent) and the nearest well, (b) the presence of a population greater than 1,000



LEGEND

1. Landfill No. 1
2. Landfill No. 2
3. Landfill No. 3
4. Landfill No. 4
5. Landfill No. 5
6. Landfill No. 6
7. Landfill No. 7
8. Fire Department Training Area No. 1
9. Fire Department Training Area No. 2
10. Fire Department Training Area No. 3
11. Munitions Residue Burial Site
12. East March Sludge Drying Beds
13. West March Sludge Drying Beds
14. East March Effluent Pond
15. Coudures Effluent Pond
16. Water Treatment Plant Sludge
17. Swimming Pool Fill
18. Aircraft Isolation Area
19. Liquid Fuels Pump Station Overflow
20. Tank Truck Spill Site
21. Bulk Fuels Storage Area
22. Waste Oil Pit/Solvent Tanks
23. Engine Test Cell
24. Main Oil/Water Separator
25. Flightline Drainage Channel
26. Flightline Shop Zone
27. Civil Engineering Storage Yard
28. Construction Rubble Burial Site
29. Unconfirmed Solvent Disposal
30. Building Demolition Areas (Not shown on Figure - multiple sites)

FIGURE 14

Location Map of Identified Disposal and Spill Sites at March AFB

CH2M HILL

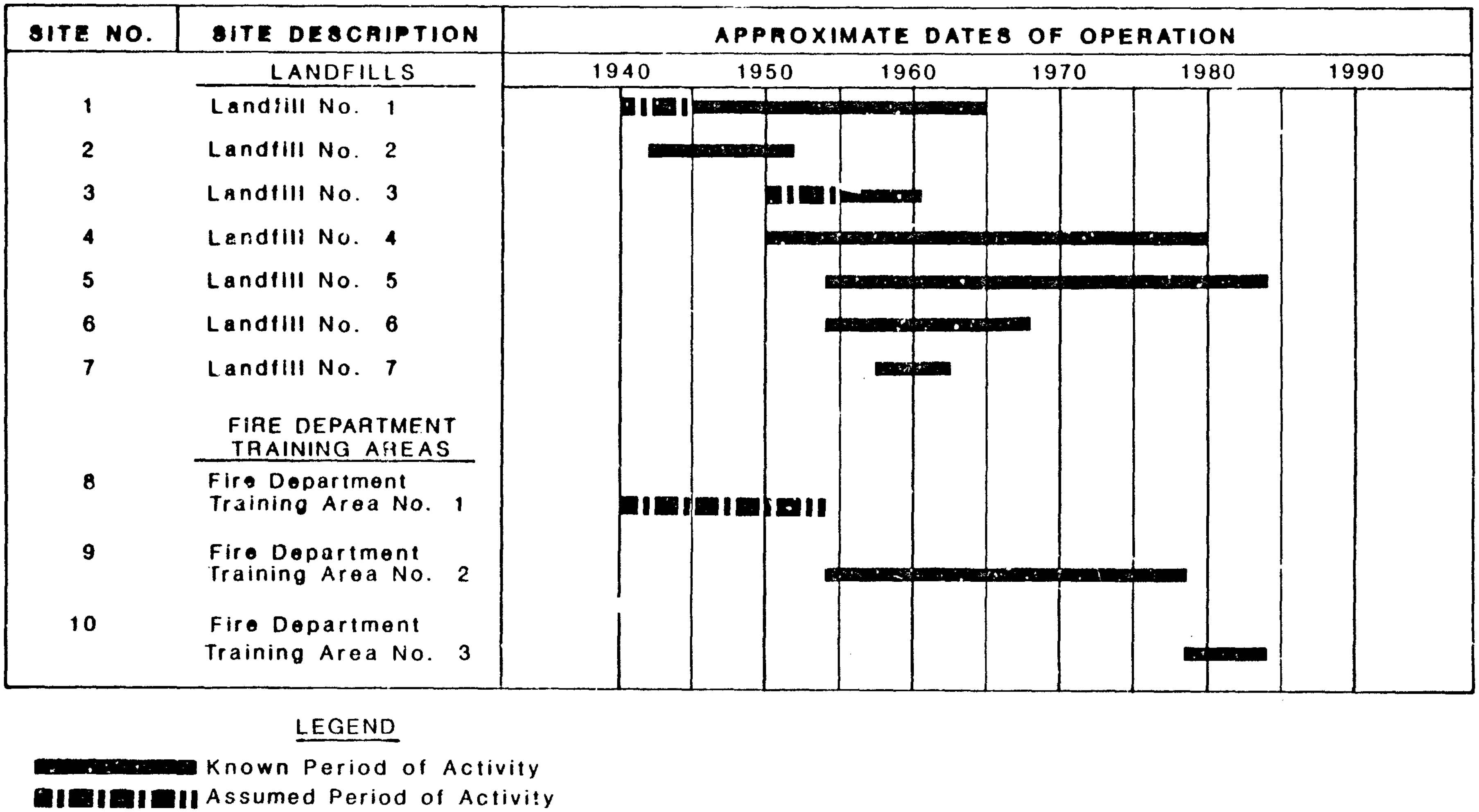


FIGURE 15

Historical Summary of Activities at Landfills and Fire Department Training Areas

CH2M HILL

people served by groundwater supply within 3 miles of the site, (3) permeable soils with clay contents between 0% to 15%, and (4) the suspected disposal of small quantities of moderately hazardous wastes.

b. <u>Site No. 2 - Landfill No. 2</u>

Landfill No. 2 is located between U.S. Highway 395 and Runway #14-32, south of Van Buren Boulevard. The site reportedly served U.S. Army Camp Haan and March AFB from 1942 to 1951. The landfill is approximately 7 acres in size. The site received domestic and military wastes from both Camp Haan and March AFB. Very little information is available concerning this site. One interviewee recalled disposing of aircraft parts and building debris at this location. Others recalled the dumping of small quantities of liquid and solid shop wastes at this landfill by both the Army and Air Force.

Landfill No. 2 (Site No. 2) received an overall HARM rating score of 39, primarily due to: (1) the proximity of the site to the base boundary (approximately 900 feet) and the nearest well, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the presence of residential areas within 1 mile, (4) the proximity of the site to the base drainage ditch system (adjacent), (5) permeable soils with clay contents between 0% and 15%, and (6) the suspected disposal of small quantities of moderately hazardous wastes.

c. <u>Site No. 3 - Landfill No. 3</u>

Landfill No. 3 is not well-defined in time or location. It was apparently operational from the early 1950's to approximately 1960. The site is approximately 62 acres in size, although only sections of the entire area were used for disposal. Exact burial locations are not known. Within the landfill area, fire department training sites were also established. The general location of Landfill No. 3 is the south end of the flightline ramp. Several interviewees reported disposal locations as being to the north and west of the current fire department training area (see Figure 14), while other sources, particularly early aerial photographs, show excavations and debris to the south of the present fire department training area. Materials disposed of at this site included domestic and industrial solid waste. The site also had the potential of receiving waste liquids such as oils, solvents, paints, thinners, and residues due to its proximity to the fire department training areas and flightline shops.

Landfill No. 3 (Site No. 3) received an overall HARM rating score of 62, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (adjacent) and, (5) permeable soils with clay contents between 0% to 15%.

d. <u>Site No. 4 - Landfill No. 4</u>

Landfill No. 4 was a major landfill operated from the early 1950's to as late as 1980. Some dumping of fill, tree clippings, construction debris, and domestic solid waste still occurs at the site. The site is approximately 66 acres in size and is located between Plummer Road and the golf course access road, south of Van Buren Boulevard. The dimensions of the site are poorly known, but several interviewees indicated that two large ravines have been generally filled with solid waste over the years. It was operated as a place and cover landfill with considerable import of material.

Materials received at the landfill included domestic solid waste, demolition rubble, and virtually all types of industrial wastes generated by the base, both liquids and solids. Reports of several junked car bodies, transformer cases, drummed wastes, and liquids released on site were noted by several interviewees. Over the long life of Landfill No. 4, it is likely that a considerable volume of waste oils, solvents, paint, and pesticide residues could have been disposed of at the site.

Landfill No. 4 (Site No. 4) received an overall HARM rating score of 62, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the presence of residential areas within 1 mile, (4) the proximity of the site to the base drainage ditch system (adjacent), (5) permeable soils with clay contents between 0% to 15%, and (6) its proximity to groundwater (11 to 50 feet).

e. Site No. 5 - Landfill No. 5

Landfill No. 5 was opened as early as 1954 and officially closed in 1974, although adjacent areas still have active disposal operations. The site is approximately 53 acres in size and is located to the south of Cactus Avenue in the West March area. Mode of operation was cut and fill or importing fill to cover material dumped in gullys and ravines. A borrow pit is located to the north of the site.

Materials received at the site included domestic solid waste, dumpster trash from the base, some demolition debris, and refuse from off-base areas as the site may not have had controlled access. Several interviewees reported that waste oils, solvents, thinners, sludge in drums, and other liquid wastes were disposed of at this site. In addition, there is a report of transformer oils being drained at the site with the case being sent to metal recycling. As these activities occurred in the 50's and 60's, any transformer fluids disposed of here were likely to contain polychlorinated biphenyls (PCBs).

Landfill No. 5 (Site No. 5) received an overall HARM rating score of 64, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the presence of residential areas within 1 mile, (5) the proximity of the site to the base drainage ditch system (adjacent), (6) permeable soils with clay contents between 0% to 15%, and (7) its proximity to groundwater (11 to 50 feet).

f. <u>Site No. 6 - Landfill No. 6</u>

Landfill No. 6 was opened around 1955 and closed about 1968. It is approximately 22 acres in size and is located along the eastern base perimeter fence adjacent to the riding club area, south of the East Gate (Myer Drive). It was reported to be an irregularly shaped site, bounded by several existing roadways in the area of 7th, 8th, N, Y, and Midway Streets. The Perris Valley Storm Drain is located just east of this landfill site. Mode of operation was cut and fill. Several sources indicate excavations at the site were quite deep. Generally a depth of 12 to 25 feet was recalled, although several vividly remember depths as great as 40 feet below grade.

Materials disposed of at this landfill included domestic solid wastes, dumpster refuse from the base, and building rubble. Quantities of waste oils, solvents, paint, thinners, and sludges would also likely have been disposed of at this site. The close proximity of this site to the flightline shops may have encouraged the disposal of hazardous materials at this site. A few interviewees recalled that liquid wastes were disposed of at this site.

Landfill No. 6 (Site No. 6) received an overall HARM rating score of 63, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 800 feet), (3) the proximity of the site to the base boundary (adjacent), (4) the presence of a population greater than 1,000 people served by a groundwater supply within 3 miles of the site, (5) an estimated population greater than 100 people within 1,000 feet of the site, (6) the proximity of the site to the base drainage ditch system (adjacent), and (7) permeable soils with clay contents between 0% and 15%.

g. Site No. 7 - Landfill No. 7

Landfill No. 7 was a minor landfill operated from approximately 1958 to 1962 and again from 1963 to 1965. This site, approximately 7 acres in size, is located in West March just to the east of the base water filtration plant (Building 6007) and north of the southerly base boundary. Material being disposed of was reportedly dumped over a slope and covered with fill pushed over from the top of the hill.

Materials received at Landfill No. 7 were domestic solid waste during the latter period, while building foundation and demolition debris from the Camp Haan Army Base was placed here during the earlier years. As with other landfills on base, some waste oils, solvents, paints, paint strippers, thinners, pesticide containers, and other empty cans were also probably disposed of at this site, although the estimated waste quantities were smaller here.

Landfill No. 7 (Site No. 7) received an overall HARM rating score of 40, primarily due to: (1) the proximity of the site to a well (approximately 2,000 feet), (2) the proximity of the site to the base boundary (approximately 500 feet), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (approximately 200 feet), (5) permeable soils with clay contents between 0% and 15%, and (6) the suspected disposal of small quantities of moderately hazardous wastes.

2. Fire Department Training Areas

Two verifiable, and a third possible, fire department training areas were identified. These fire department training sites cover a period from the late 1940's to the present.

a. Site No. 8 - Fire Department Training Area No. 1

Aerial photographs from the late 1940's and 1952 show what appears to be a fire department training burn pit west of Building 1223 in the present-day flightline parking apron. Positive verification of this area could not be made. The area was likely used until 1954 when the runway was lengthened. Photographs taken prior to the 1940's did not show this area or any other identifiable fire department training areas.

Based on the number and types of aircraft reported to be on base prior to the early 1950's, the quantity of waste POL disposed of was probably much less than the current 50,000 to 60,000 gallons per year, and most of the materials would have been consumed in the fires.

Fire Department Training Area No. 1 (Site No. 8) received an overall HARM rating score of 50, primarily due to: (1) the suspected disposal of a large quantity of hazardous wates, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) an estimated population greater than 100 people within 1,000 feet of the site and the proximity of the nearest well, and (4) permeable soils with clay contents between 0% and 15%.

b. Site No. 9 - Fire Department Training Area No. 2

Site No. 9, located at the end of Runway #12-30, may have consisted of several burn pits in slightly different locations. The site was reported to have been used from 1961 through 1978, but may have been used as early as 1954 when the runway was lengthened and Fire Department Training Area No. 1 was assumed to be abandoned. Up until 1972, essentially all of the waste POL generated on base was burned at this site. Based on current disposal records, as much as 50,000 to 100,000 gallons per year of waste oils, solvents, and fuel may have been burned. After 1972, only recovered JP-4 was reportedly burned in the training area.

Because of the large quantity of liquids disposed of, the wastes may have been stored in the burn pit(s) several days prior to a burning exercise. The burn pit(s) were enclosed by a berm, but were not lined. Most of the wastes were destroyed in the fires, but some percolation undoubtedly occurred.

Fire Department Training Area No. 2 (Site No.9) received an overall HARM rating score of 62, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (approximately 500 feet) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (approximately 200 feet), and (5) permeable soils with clay contents between 0% and 15%.

c. <u>Site No. 10 - Fire Department Training Area No. 3</u>

Site No. 10, the current fire department training area, is located at the end of Runway #12-30, north of Fire Department Training Area No. 2. Approximately 6,000 gallons per year of recovered JP-4 has been burned at this site since its construction in 1978. The site is a conical-shaped depression constructed by placing a layer of gravel over a clay liner. Fire-fighting foams and any unburned fuel remaining after a training exercise are washed into an unlined sump located adjacent to the burning area.

Fire Department Training Area No. 3 (Site No. 10) received an overall HARM rating score of 43, primarily due to: (1) the confirmed disposal of a small quantity of hazardous wastes, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the proximity of the site to the base drainage ditch system (approximately 200 feet) and the nearest well, and (4) permeable soils with clay contents between 0% and 15%.

3. <u>Other Sites</u>

a. <u>Site No. 11 - Munitions Residue Burial Site</u>

The munitions residue burial site is located adjacent to the Weapons Storage Area in West March, south of Cactus Avenue. The currently identifiable area is approximately 15 acres in size. The limits of this pre-1960 site are imprecisely known as adjacent lands have been used as part of Landfill No. 5 (Site No. 5). The pit area is unlined and specific detonation sites are not well-defined. The munitions disposed of could be hazardous if not completely inactivated or destroyed. Residues may also be contaminating the surface soils. However, it has been assumed that the residues are relatively inert and, therefore, the site did not receive a HARM rating.

Approximately 300 gallons of acetone were reportedly disposed of either at this site or Landfill No. 5 in 1981. The solvent was brought to the site by the Riverside County Sheriff's Department for disposal. Other requests for off-base material disposal have been received by the base. Due to the closeness of Sites No. 5 and 11, any recommended monitoring for the rated Site No. 5 should be designed to also detect any contaminant migration from the unrated Site No. 11.

b. <u>Site No. 12 - East March Sludge Drying Beds</u>

The area in the vicinity of Building 1267 at the south end of the flightline parking apron was the site of the former East March Wastewater Treatment Plant. The site contains the former sludge drying beds from this facility, as well as several underground storage tanks. The sludge drying beds could contain slightly elevated concentrations of heavy metals and organic substances arising from past industrial wastes discharged to the sanitary sewer system. The drying beds were unlined and, therefore, provide a contaminant migration route to underlying soils and groundwater. Dewatered sludges were either buried in base landfills, or hauled to the Chino area for agricultural landspreading.

East March Sludge Drying Beds (Site No. 12) received an overall HARM rating score of 43, primarily due to: (1) the proximity of the site to the base boundary (approximately 300 feet) and the nearest well, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the proximity of the site to the base drainage ditch system (approximately 300 feet), (4) permeable soils with clay contents between 0% and 15%, and (5) the suspected disposal of a moderate quantity of moderately hazardous wastes.

c. Site No. 13 - West March Sludge Drying Beds

Site No. 13 is located adjacent to the present wastewater treatment plant in West March. This site consists of sludge drying beds used for trickling filter sludges resulting from the treatement of base residential and industrial shop discharges to the sanitary sewer system. There are both active and inactive beds at the site. A large majority of the sludge resulted from domestic wastewater discharges, but the presence of potentially hazardous industrial wastes and possible migration of these contaminants from the unlined sludge beds create the need for numerical rating of this site.

West March Sludge Dring Beds (Site No. 13) received an overall HARM rating score of 42, primarily due to: (1) the suspected disposal of a moderate quantity of moderately hazardous wastes, (2) the proximity of the site to the base boundary (approximately 300 feet) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (approximately 300 feet) and, (5) permeable soils with clay contents between 0% and 15%.

d. Site No. 14 - East March Effluent Pond

Site No. 14 is located just east of the alert facility hangar outside the eastern boundary of the base. This site consists of treated wastewater effluent holding ponds in slightly different locations that have been used from 1938 to 1977 for storage of treated effluent from sanitary and industrial wastes prior to application to surrounding agricultural lands. Waste oils, solvents, and other hazardous materials from the industrial shops were regularly collected in the sanitary system. Secondary treatment of wastewater was provided at the East March Wastewater Treatment Plant, but the characteristics of the treated wastewater are still potentially hazardous. The possibility of contamination and migration exists.

East March Effluent Pond (Site No. 14) received an overall HARM rating score of 38, primarily due to: (1) the suspected disposal of a small quantity of moderately hazardous wastes, (2) the proximity of the site to a well (approximately 2,800 feet), (3) proximity of the site to the base boundary (off-base), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, and (5) permeable soils with clay contents between 0% and 15%.

e. Site No. 15-Coudures Effluent Pond

Site No. 15 is located off base approximately 2½ miles southeast of the West March Wastewater Treatment Plant, just east of U.S. Highway 395. This site consists of a treated wastewater holding pond (possibly in slightly different locations) that has been used from 1941 to 1946 and again from 1955 to the present time for storage of treated effluent from sanitary and industrial wastes prior to application to surrounding agricultural lands farmed by the John Coudures Company. As in the case of the East March Effluent Pond, the possibility exists for the treated wastewater to have potentially hazardous characteristics even after secondary treatment at the West March Wastewater Treatment Plant.

Coudures Effluent Pond (Site No. 15) received an overall HARM rating score of 40, primarily due to: (1) the proximity of the site to a well (approximately 2,700 feet), (2) the proximity of the site to the base boundary (off-base), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to a drainage ditch system (approximately 100 feet), (5) permeable soils with clay contents bewteen 0% and 15%, and (6) the suspected disposal of a small quantity of moderately hazardous wastes.

f. Site No. 16 - Water Treatment Plant Sludge

The base operates a water treatment facility located in Buildings 6007 and 6008 in West March, south of the golf course. The lime sludge from the plant is disposed of via a slurry line to an impoundment to the north of the plant. The evaporative pond is periodically excavated with the sludge deposits sidecast or hauled to adjacent land. The dried sludge lime deposits occupy approximately 3 acres. Lime sludge is classified as a Category 2 waste in the State of California and is generally disposed of in a Class I or Class II-1 permitted landfill. Due to the lack of known hazardous waste disposal or contamination at this site, it was not given a HARM rating. However, it is recommended that the accumulated lime sludge be disposed of in a properly permitted landfill.

g. Site No. 17 - Swimming Pool Fill

A former base swimming pool (Site No. 17), located on U Street between DeKay and K Streets, was filled around 1979 or 1980. This pool fill may have included drummed wastes, paints, solvents, and other flightline shop wastes according to an interviewee's report. Quantities of drummed wastes and other liquids are unknown. Debris from building demolition was also used in the fill for the pool.

Swimming Pool Fill (Site No. 17) received an overall HARM rating score of 43, primarily due to: (1) the suspected presence of a moderate quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 2,000 feet), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) an estimated population greater than 100 people within 1,000 feet of the site, (5) permeable soils with clay contents bewteen 0% and 15%, and (6) the limited containment of the wastes due to the concrete swimming pool walls.

h. Site No. 18 - Aircraft Isolation Area

The aircraft isolation area, Site No. 18, is located on the north side of Taxiway No. 5. The area is used to drain fuels from damaged or otherwise potentially unsafe aircraft prior to moving the plane to the flightline area. Waste fuels are drained to bowsers for transfer to the waste tanks at Building 422 or to the fire department training area. It was reported by some interviewees that bowsers were also moved off the isolation area and drained into the grasslands north and west of the aircraft isolation area. Several shops may have also drained solvents from bowsers in the area; particularly during the period from 1961 to 1965. Among specific incidences of solvent dumping, it was reported that spent TCE was disposed of on the ground near the west side of Building 2307 adjacent to the Aircraft Isolation Area. This site is upgradient and in the recharge area for the contaminated base water wells (Wells No. 1 and 3).

Aircraft Isolation Area (Site No. 18) received an overall HARM rating of 72, primarily due to: (1) the confirmed disposal of a moderate quantity of hazardous wastes, (2) indirect reported evidence of contaminant migration from the site (potential TCE contamination source of Wells No. 1 and 3), (3) the proximity of the site to a well (approximately 2,000 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, and (5) an estimated population greater than 100 people within 1,000 feet of the site.

i. <u>Site No. 19 - Liquid Fuels Pump Station Overflow</u>

Approximately 1,000 gallons of JP-4 overflowed the liquid fuels pump station at Building 1245 in 1973. The spill was contained in the unpaved area south of Building 1245 and allowed to percolate into the ground.

Liquid Fuels Pump Station Overflow (Site No. 19) received an overall HARM rating of 45, primarily due to: (1) the confirmed disposal of a small quantity of hazardous wastes, (2) the presence of population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the proximity of the site to the base drainage ditch system (approximately 100 feet), base boundary (1200 feet), and nearest well, and (4) permeable soils with clay contents between 0% to 15%.

j. <u>Site No. 20 - Tank Truck Spill Site</u>

Approximately 5,000 gallons of JP-4 were discharged from a fuel truck along the perimeter road near Fire Training Area No. 3 in the southeast corner of the base in 1973. The discharge resulted from a mechanical malfunction. No details were found on whether or not the spill was confined or if any of the fuel was recovered.

Tank Truck Spill (Site No. 20) received an overall HARM rating score of 51, primarily due to: (1) the confirmed disposal of a moderate quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (approximately 100 feet), and (5) permeable soils with clay contents between 0% and 15%.

k. Site No. 21 - Bulk Fuels Storage Area

In 1976, a transfer valve malfunction resulted in a discharge of 10,000 gallons of JP-4 from bulk storage tank T-2. Approximately 4,000 gallons of fuel were recovered, with the remaining 6,000 gallons either evaporating or percolating into the ground southwest of the bulk fuels storage area. Routine maintenance has also resulted in the loss of 5 gallons per week of fuel from each of the two active tanks for at least the past 4 years. A loss of 10 to 15 gallons per week from each tank was reported prior to installation of the product recovery system. Interviewees indicated that this lost fuel was usually disposed of on the ground adjacent to the tanks and that during rainstorms, fuel floats to the surface in the bulk fuels storage area.

Bulk Fuels Storage Area (Site No. 21) received an overall HARM rating score of 58, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 2,500 feet), (3) the proximity of the site to the base boundary (approximately 800 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (5) the proximity of the site to the base drainage ditch system (approximately 400 feet), and (6) permeable soils with clay contents bewteen 0% and 15%.

l. Site No. 22 - Waste Oil Pit/Solvent Tanks

Aerial photographs taken prior to 1941 show what appears to be a waste oil holding or disposal pit located just northwest of the present base museum (Building 420). No specific information could be found on the apparent waste oil pit. The area was approximately 200 feet long and 100 feet wide.

As described in Section IV.A.3. (Fuels), the former AVGAS aqua-system and related tankage of the 22nd CES Liquid Fuels Maintanance shop was also located at Site No. 22. Two 1,000 gallon capacity underground concrete tanks containing solvent (possibly containing TCE) were reportedly in use from 1958 until they were destroyed in place around 1972. This site is immediately upgradient and adjacent to contaminated Water Well No. 1.

Waste Oil Pit/Solvent Tanks (Site No. 22) received an overall HARM rating score of 69, primarily due to: (1) the suspected disposal of a large quantity of hazardous wastes, (2) indirect reported evidence of contaminant migration from the site (potential TCE contamination source of Wells No. 1 and No. 3), (3) the proximity of the site to a well (approximately 500 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, and (5) an estimated population greater than 100 people within 1,000 feet of the site.

m. Site No. 23 - Engine Test Cell

The jet engine test cell located south of Taxiway No. 2 has been used from 1951 to the present. No verifiable reports of fuel spills were made. However, test cells at other bases have generally had frequent spills during testing and incidents may have occurred at this site. An oil/water separator was installed at the test cell site in 1976. Prior to this time, oils, fuels, or solvents would have gone on the ground or to a nearby flightline drainage ditch. The waste fuels discharged at this site are hazardous, but the suspected quantities are relatively insignificant and contamination may not be a problem.

Engine Test Cell (Site No. 23) received an overall HARM rating score of 43, primarily due to: (1) the suspected presence of a moderate quantity of hazardous waste, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the proximity of the site to the base drainage ditch system (approximately 400 feet), and (4) permeable soils with clay contents between 0% and 15%.

n. Site No. 24 - Main Oil/Water Separator

The main oil/water separator (Facility No. 6603), is located at the south end of the flightline apron and serves the primary storm drainage system conveying runoff water from the flightline and parking apron zone. The facility became operational in 1974. It is unknown if the facility is lined with an impermeable material. Base personnel when questioned regarding the possible existence of a liner indicated that it is not apparent that one exists. Base personnel were of the opinion that if there was a liner at all, it was of clay construction only. Waste fuels, solvents, and dissolved metals residues trapped in the system are deposited on the sloping sides and in bottom sediments of the separator.

Main Oil/Water Separator (Site No. 24) received an overall HARM rating score of 61, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (approximately 300 feet), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (adjacent), and (5) permeable soils with clay contents between 0% and 15%.

o. Site No. 25 - Flightline Drainage Channel

This site is located south of the flightline apron and industrial shop area. The site is a portion of the storm drainage system for the base. The storm channel is concrete lined (since the late 1960's) past the point where the drain enters the main oil/water separator up to the point where the channel discharges into the unlined Perris Valley Storm Drain channel at the base's eastern boundary. Prior to the late 1960's the flightline drainage channel was unlined.

The main oil/water separator (Facility No. 6603--Site No. 24), is located at the south end of the flight-line apron. The facility was constructed in 1974 and serves the main storm drainage system leaving the flightline apron and industrial shop zone. The storm drains have reportedly received various waste oils, hydraulic fluids, diesel fuel, JP-4, waste paints, spent solvents (including TCE), paint strippers, paint thinners, and battery acids. Spillage of materials and overfilling of bowsers and 55-gallon drums also has historically resulted in waste fluids being deposited on the parking apron or ground. Contaminated waters leaving the base prior to 1974 would enter the flightline drainage channel (Site No. 25). Since its installation, the main oil/water separator has effectively removed oils during dry weather flow periods. During storm events, however, the hydraulic capacity of the system is reportedly often exceeded, which may result in waste fluids being moved off-base into the Perris Valley Storm Drain.

Flightline Drainage Channel (Site No. 25) received an overall HARM rating score of 61, primarily due to: (1) the confirmed presence of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (adjacent), and (5) permeable soils with clay contents between 0% and 15%.

p. Site No. 26 - Flightline Shop Zone

The industrial shop and parking apron area along the flightline has been the major source of generation of hazardous wastes during the lifetime of the base. Most of this waste material is disposed of away from the flightline area; however, some liquid wastes were reportedly disposed of on the ground, on concrete parking aprons, or in storm or sanitary sewers. There have been fuel spills in the area as well. Facilities in this area contain general purpose aircraft shops, maintenance hangars, POL storage tanks, waste liquids underground storage tanks, and numerous oil/water separators. Among specific incidences of solvent dumping, it was reported that spent TCE was disposed of on the west side of Building No. 2307 (nearby the Aircraft Isolation Area -- Site No.18). The 50,000 gallon hazardous waste accumulation tank at the Motor Pool (Building No. 422) is included as a portion of Site No. 26.

Flightline Shop Zone (Site No. 26) received an overall HARM rating score of 62, primarily due to: (1) the confirmed presence of a large quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 500 feet), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) an estimated population greater than 100 people within 1,000 feet of the site, and (5) permeable soils with clay contents between 0% and 15%.

q. Site No. 27 - Civil Engineering Storage Yard

The Civil Engineering storage yard, located north of Building 2506, has had various hazardous materials stored on the site. Multiple spills of possibly contaminated oils, disposal of refrigeration shop waste fluids and solvents, and discharges of other wastes have reportedly occurred at the site. Numerous drums, tanks, and transformers are currently stored on the site. Two recent spills of transformer oils, possibly containing PCBs, have also occurred in this area. The 22nd Civil Engineering Squadron is taking appropriate action to reduce the contamination potential from materials handling practices at this location.

Civil Engineering Storage Yard (Site No. 27) received an overall HARM rating score of 58, primarily due to: (1) the confirmed presence of a moderate quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 1,000 feet), (3) the proximity of the site to the base boundary (approximately 800 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (5) the proximity of the site to the base drainage ditch system (approximately 300 feet), and (6) permeable soils with clay contents bewteen 0% and 15%.

r. Site No. 28 - Construction Rubble Burial Site

A construction rubble burial site in the West March area located north of Cactus Avenue near Landfill No. 5 was reportedly used only for inert construction debris. There was no known or suspected disposal of domestic or industrial wastes at this site, and consequently, Site No. 28 did not justify a HARM rating.

s. Site No. 29 - Unconfirmed Solvent Disposal

There was an unsubstantiated report by an interviewee of solvent disposal (principally TCE) at a site located on the east side of Building 1211. The practice of discharging solvent on the ground reportedly periodically occurred from approximately the mid-50's to the mid-70's. Small quantities of solvents disposed of could contribute to groundwater problems in the area and, therefore, this site warrants numerical rating.

Unconfirmed Solvent Disposal (Site No. 29) received an overall HARM rating score of 43, primarily due to: (1) the suspected disposal of a small quantity of hazardous wastes, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) an estimated population greater than 100 people within 1,000 feet of the site, (4) the proximity of the site to the base drainage ditch system (approximately 100 feet), and (5) permeable soils with clay contents between 0% and 15%.

t. Site No. 30 - Building Demolition Areas

At numerous locations within the main base area, old buildings have been razed and the foundation materials left in place or buried. As the materials buried at these sites consists of inert materials and no known or suspected disposal of domestic or industrial wastes was reported, Site No. 30 did not justify a HARM rating.

C. Environmental Stress

No widespread environmental stress caused by handling of hazardous substances at March AFB was found during the on-base investigation. However, landfill and grading areas on base were clearly evident. In several areas vegetation was sparse or completely removed. Chapparral and coastal scrub ecosystems are sensitive to disturbance and plant cover is not easily established. Disturbed areas may not fully recover with native species for many years. Grading and seeding of tracts tends to mask the effects of native cover removal.

No significant environmental stress was revealed during this investigation caused by landfill disposal of hazardous wastes through surface erosion, surface runoff, or groundwater pathways. Significant portions of West March have concrete and asphalt paved areas remaining from U.S. Army Camp Haan activities. These lands will not revert to natural conditions in the foreseeable future. Environmental degradation associated with the use of herbicides and other pesticides was not evident.

V. CONCLUSIONS

A. Information obtained through interviews with 81 past and present base personnel (over one-half with 20 or more years at the installation), outside agency contacts, base records, shop folders, and field observations indicates that hazardous wastes have been disposed of on March AFB property in the past.

B. The relatively deep water table at March Air Force Base (approximately 100 feet below land surface in the northeast corner at Wells No. 1, 3, and 4 and approximately 300 feet below land surface in the southeast corner at Wells No. 5 and 6) would cause a time lag in detection of contamination which originated at the ground surface. A well could become polluted long after a disposal practice ceased. Contaminants could also be stored in the unsaturated zone above the water table. In this case, the most rapid transfer of contamination into the aquifer would occur while a driving force exists, such as percolation of water into the aquifer following a thunderstorm. An additional potential pathway for contamination to rapidly enter the aquifer may be through improperly sealed well casings. Thus, a potential for groundwater contamination exists despite the low annual net precipitation for the area (-70 inches per year).

C. No evidence of widespread environmental stress due to past disposal or spills of hazardous wastes was observed at March AFB, although disturbance of native vegetation from past landfilling and fire department training exercises was clearly evident.

D. No direct evidence was found to indicate that migration of hazardous contaminants exists beyond the March AFB boundary. Direct evidence of contamination and/or contaminant migration within the installation boundary was found at Wells No. 1

and No. 3 (TCE contamination of potable groundwater supply since at least 1978). The exact source(s) of TCE groundwater contamination is not known, but is suspected to have originated from past TCE usage (spills, leaking tanks, discharge to ground) in the vicinity of Site No. 18 (Aircraft Isolation Area), Site No. 22 (Waste Oil Pit/Solvent Tanks), and possibly a portion of Site No. 26 (Flightline Shop Zone) including the Building 422 (Motor Pool) 50,000-gallon-capacity underground waste accumulation tank. Two 1,000-gallon-capacity underground concrete solvent storage tanks were formerly located at Site No. 22. Sites No. 18, No. 22, and a portion of No. 26 are located upgradient and within the aquifer recharge area of Wells No. 1 and 3.

E. Table 16 presents a priority listing of the rated disposal and spill sites and their overall scores. The following sites were designated as areas showing the most significant potential (relative to other March AFB sites) for environmental concerns.

1. Site No. 18 - Aircraft Isolation Area

It was reported by some interviewees that bowsers containing waste fuels and solvents were drained onto grasslands north and west of the aircraft isolation area, particularly during the period from 1961 to 1965. Among specific incidences of solvent dumping, it was reported that spent TCE was disposed of on the ground near the west side of Building 2307 adjacent to the aircraft isolation area. This site is upgradient and in the recharge area for the contaminated base water wells (Wells No. 1 and 3). Aircraft Isolation Area (Site No. 18) received an overall HARM rating of 72, primarily due to: (1) the confirmed disposal of a moderate quantity of hazardous wastes, (2) indirect reported evidence of contaminant migration from the site (potential TCE contamination source of Wells

Table 16
PRIORITY LISTING OF DISPOSAL AND SPILL SITES

Ranking No.	Site No.	Site Description	Overall Score
1	18	Aircraft Isolation Area	72
2	22	Waste Oil Pit/Solvent Tanks	69
3	5	Landfill No. 5	64
4	6	Landfill No. 6	63
5	3	Landfill No. 3	62
6	4	Landfill No. 4	62
7	9	Fire Department Training Area No. 2	62
8	26	Flightline Shop Zone	62
9	24	Main Oil/Water Separator	61
10	25	Flightline Drainage Channel	61
11	21	Bulk Fuels Storage Area	58
12	27	Civil Engineering Storage Yard	58
13	20	Tank Truck Spill Site	51
14	8	Fire Department Training Area No. 1	50
15	19	Liquid Fuels Pump Station Overflow	45
16	10	Fire Department Training Area No. 3	43
17	12	East March Sludge Drying Beds	43
18	17	Swimming Pool Fill	43
19	23	Engine Test Cell	43
20	29	Unconfirmed Solvent Disposal	43
21	13	West March Sludge Drying Beds	42
22	7	Landfill No. 7	40
23	15	Coudures Effluent Pond	40
24	2	Landfill No. 2	39
25	14	East March Effluent Pond	38
26	1	Landfill No. 1	36

(Note: Sites No. 11, 16, 28, and 30 were not rated.)

No. 1 and 3), (3) the proximity of the site to a well (approximately 2,000 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (5) an estimated population greater than 100 people with 1,000 feet of the site.

2. <u>Site No. 22 - Waste Oil Pit/Solvent Tanks</u>

Aerial photographs taken prior to 1941 show what appears to be a waste oil holding or disposal pit located just north of the present base museum. In addition, two solvent tanks (possibly containing TCE) were in use at this site from 1958 to 1972. This site is immediately upgradient and adjacent to contaminated Well No. 1. Waste Oil Pit/Solvent Tanks (Site No. 22) received an overall HARM rating score of 69, primarily due to: (1) the suspected disposal of a large quantity of hazardous wastes, (2) indirect reported evidence of contaminant migration from the site (potential TCE contamination source of Wells No. 1 and No. 3), (3) the proximity of the site to a well (approximately 500 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, and (5) an estimated population greater than 100 people within 1,000 feet of the site.

3. <u>Site No. 5 - Landfill No. 5</u>

Landfill No. 5, which operated from approximately 1954 to 1974, reportedly received wastes including waste oils, solvents, thinners, sludge in drums, and transformer oils suspected to contain PCBs. Landfill No. 5 (Site No. 5) received an overall HARM rating score of 64, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the presence of residential areas within 1 mile, (5) the proximity of the site to the base drainage ditch system (adjacent), (6) permeable soils with clay contents between 0% and 15%, and (7) its proximity to groundwater (11 to 50 feet).

4. Site No. 6 - Landfill No. 6

This site was used for waste disposal from 1955 to 1968. Materials disposed of at this landfill reportedly include waste oils, solvents, paint thinners, and sludges. Landfill No. 6 (Site No. 6) received an overall HARM rating score of 63, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 800 feet), (3) the proximity of the site to the base boundary (adjacent), (4) the presence of a population greater than 100 people within 1,000 feet of the site, (5) an estimated population greater than 100 people within 1,000 feet of the site, (6) the proximity of the site to the base drainage ditch system (adjacent), and (7) permeable soils with clay contents between 0% and 15%.

5. Site No. 3 - Landfill No. 3

This landfill was apparently operational from the early 1950's to approximately 1960. Within the landfill area, fire department training sites were also established. Materials disposed of at this site are believed to include waste oils, solvents, paints, thinners, and residues. Landfill No.3 (Site No. 3) received an overall HARM rating score of 62, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (adjacent) and, (5) permeable soils with clay contents between 0% and 15%.

6. Site No. 4 - Landfill No. 4

Landfill No. 4 was a major landfill operated from the early 1950's to as late as 1980. Virtually all types of domestic and industrial wastes generated by March AFB, including waste oils, solvents, paints, and pesticide residues, were reportedly buried at this site. Landfill No. 4 (Site No. 4) received an overall HARM rating score of 62, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (3) the presence of residential areas within 1 mile, (4) the proximity of the site to the base drainage ditch system (adjacent), (5) permeable soils with clay contents between 0% to 15%, and (6) its proximity to groundwater (11 to 50 feet).

7. Site No. 9 - Fire Department Training Area No. 2

Several burn pits in slightly different locations may have been in use as early as 1954 through 1978 at this fire department training site. Up until 1972, essentially all of the waste POL generated on base was burned at this site. Due to the large quantity of waste liquids, it is believed that wastes may have been stored in the unlined burn pit(s) several days prior to a burning exercise, allowing some percolation to occur. Fire Department Training Area No. 2 (Site No. 9) received an overall HARM rating score of 62, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (approximately 500 feet) and the nearest well, (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (approximately 200 feet), and (5) permeable soils with clay contents between 0% and 15%.

8. Site No. 26 - Flightline Shop Zone

The industrial shop and parking apron area along the flightline has been the major source of generation of hazardous wastes during the lifetime of the base. Some liquid wastes have reportedly been disposed of on the ground in this area, including spent TCE. The northerly portion of this site, which includes the 50,000 gallon hazardous waste accumulation tank at the Motor Pool (Building No. 422), is upgradient of the contaminated base wells. Flightline Shop Zone (Site No. 26) received an overall HARM rating score of 62, primarily due to: (1) the confirmed presence of a large quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 500 feet), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) an estimated population greater than 100 people within 1,000 feet of the site, and (5) permeable soils with clay contents between 0% and 15%.

9. Site No. 24 - Main Oil/Water Separator

This facility, operational since 1974, serves the primary storm drainage system conveying runoff from the flightline and parking apron zone. Waste fuels, solvents, and metal residues are deposited on the sloping sides and in bottom sediments of the separator. It is unknown if the facility is lined with an impermeable material. Main Oil/Water Separator (Site No. 24) received an overall HARM rating score of 61, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (approximately 300 feet), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (adjacent), and (5) permeable soils with clay contents between 0% and 15%.

10. Site No. 25 - Flightline Drainage Channel

This storm channel receives runoff from the flightline and parking apron zone. The channel was concrete lined in the late 1960's past the main/oil water separator to the point where the channel discharges into the unlined Perris Valley Storm Drain. Various spills and dumps of wastes fluids enter the storm drainage system. Prior to the late 1960's the flightline drainage channel was unlined. Flightline Drainage Channel (Site No. 25) received an overall HARM rating score of 61, primarily due to: (1) the confirmed presence of a large quantity of hazardous wastes, (2) the proximity of the site to the base boundary (adjacent), (3) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (4) the proximity of the site to the base drainage ditch system (adjacent), and (5) permeable soils with clay contents between 0% and 15%.

11. Site No. 21 - Bulk Fuels Storage Area

A 10,000 gallon spill of JP-4 occurred at this site in 1976. Approximately 4,000 gallons of fuel were recovered, with the remaining 6,000 gallons either evaporating or percolating into the ground. In addition, an interviewee indicated that during rainstorms, lost fuel from routine maintenance floats to the ground surface in the vicinity of the bulk storage tanks. Bulk Fuels Storage Area (Site No. 21) received an overall HARM rating score of 58, primarily due to: (1) the confirmed disposal of a large quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 2,500 feet), (3) the proximity of the site to the base boundary (approximately 800 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (5) the proximity of the site to the base drainage ditch system (approximately 400 feet), and (6) permeable soils with clay contents between 0% and 15%.

12. Site No. 27 - Civil Engineering Storage Yard

Various hazardous materials are stored on this site. Moderate quantities of possibly contaminated oils, solvents, and transformer fluids have been spilled at this site. Civil Engineering Storage Yard (Site No. 27) received an overall HARM rating score of 58, primarily due to: (1) the confirmed presence of a moderate quantity of hazardous wastes, (2) the proximity of the site to a well (approximately 1,000 feet), (3) the proximity of the site to the base boundary (approximately 800 feet), (4) the presence of a population greater than 1,000 people served by groundwater supply within 3 miles of the site, (5) the proximity of the site to the base drainage ditch system (approximately 300 feet), and (6) permeable soils with clay contents between 0% and 15%.

F. The remaining rated sites (Sites No. 1, 2, 7, 8, 10, 12, 13, 14, 15, 17, 19, 20, 23, and 29), as well as the sites that were not rated (Sites No. 11, 16, 28, and 30), are not considered to present significant concern for adverse effects on health or the environment.

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A Phase II monitoring program is recommended at March AFB to confirm or rule out the presence and/or migration of hazardous contaminants. Tables 17 and 18 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. The recommended preliminary monitoring locations (approximate only) are shown in Figures 16 through 22. Additional IRP environmental recommendations of a more general nature are presented in Section VI.B.

1. General Monitoring Methodology

The specific details of the suggested initial March AFB monitoring program outlined herein should be finalized as part of the Phase II program, including the selection of exact locations of monitoring and sampling points. If evidence of contaminant migration is found and the level of contamination indicates that remedial actions for contaminant control or cleanup are required, additional investigations will be needed to obtain sufficient information to select and design a cost-effective remedial action. Necessary activities could include, but are not limited to, soil borings to determine the vertical and lateral extent of contamination sources and to obtain site geological characteristics; additional groundwater monitoring wells to more clearly isolate potential sources and to obtain a more complete characterization of the site hydrogeology; geophysical surveys using ground penetrating radar to define the extent of disposal sites such as landfills and waste pits; and pumping tests to obtain aquifer characteristics and to develop potential recovery alternatives.

Table 17
RECOMMENDED PHASE II ANALYSES

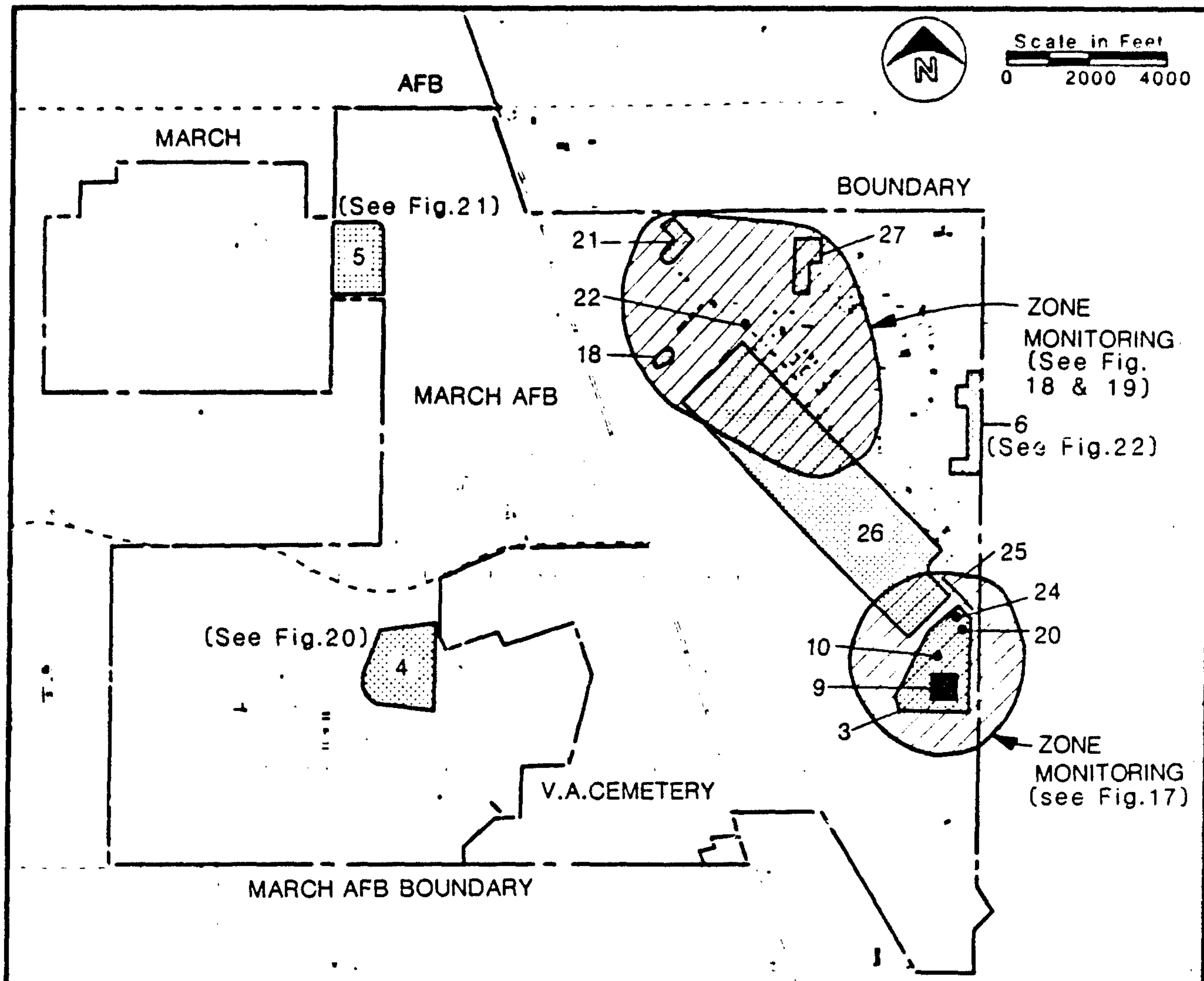
Sample Location	Groundwater Monitoring Wells[g]	Soil Sample Locations[g]	Number of Samples[g]	Analyses: VOC[a]	Heavy Metals	Phenols	Pesticides	COD[b] TOC[c]	Oil and Grease
1. Zone Monitoring of Sites No. 3, 9, 10, 20, 24 and 25	4	--	8	X	X	X	X	X	X
	--	3[d]	6	X	X	--	--	--	X
2. Zone Monitoring of Sites No. 18, 21, 22, 26 and 27	17	--	34[f]	X	X	X	X	X	X
	--	5[e]	10	X	X	--	--	--	X
3. Landfill No. 4 (Site No. 4)	3	--	6	X	X	X	X	X	X
4. Landfill No. 5 (Site No. 5)	3	--	6	X	X	X	X	X	X
5. Landfill No. 6 (Site No. 6)	4	--	8	X	X	X	X	X	X

a VOC = Volatile Organic Compounds
b COD = Chemical Oxygen Demand
c TOC = Total Organic Carbon
d Site No. 25 only
e Site Nos. 18 and 22 only
f Does not include base well monitoring on a continued basis.
g The precise number of wells or soil borings, exact locations, and number of samples collected should be determined by the Phase II contractor. These values represent preliminary suggestions only.

Table 18
RATIONALE FOR RECOMMENDED ANALYSES

Parameter	Rationale
Volatile Organic Compounds (VOC)	Known TCE contamination in the main water supply aquifer for the base; organic solvents used on base (past and present); persistent components of fuels and other POL products, e.g. benzene and toluene
Heavy Metals (lead, nickel, chromium, cadmium, and silver)	Potential sources identified (leaded fuel, battery acid and other electrolytes, paint wastes, photographic chemicals)
Phenols	Phenolic cleaners and paint strippers used in the past
Pesticides	Known or suspected use at March AFB [a]
COD, TOC, and Oil and Grease	Fuel spill indicators and indicators of non-specific contamination

[a] Pesticide analysis should be a chlorinated pesticide scan.



LEGEND

3. Landfill No. 3
4. Landfill No. 4
5. Landfill No. 5
6. Landfill No. 6
9. Fire Department Training Area No. 2
10. Fire Department Training Area No. 3
18. Aircraft Isolation Area
20. Tank Truck Spill Site
21. Bulk Fuels Storage Area
22. Waste Oil Pit/Solvent Tanks
24. Main Oil/Water Separator
25. Flightline Drainage Channel
26. Flightline Shop Zone
27. Civil Engineering Storage Yard

FIGURE 16
Recommended Phase II Monitoring Sites at March AFB

CH2M HILL

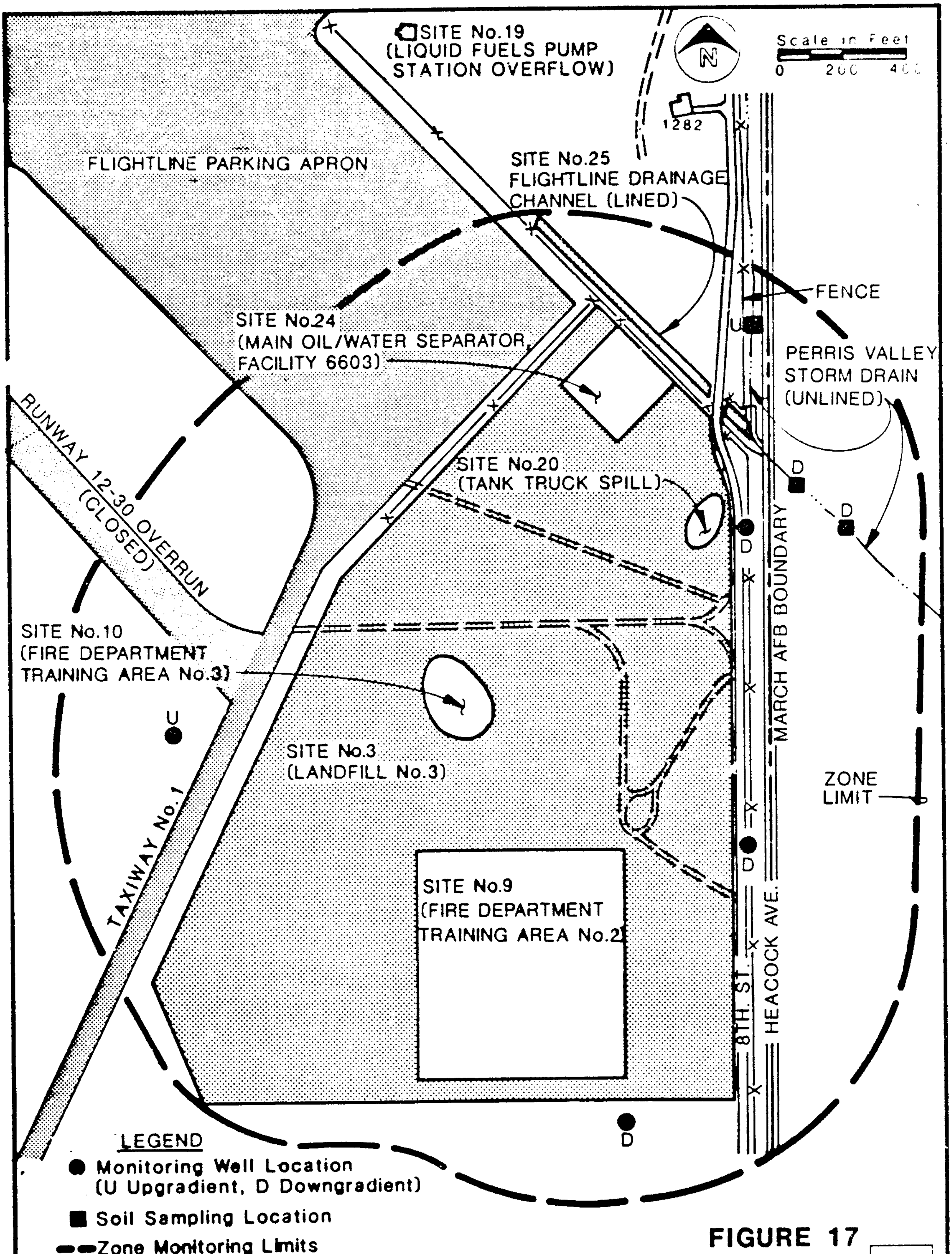


FIGURE 17
Recommended Preliminary Sampling Locations For Zone Monitoring of Sites No.3,9,10,20,24, & 25

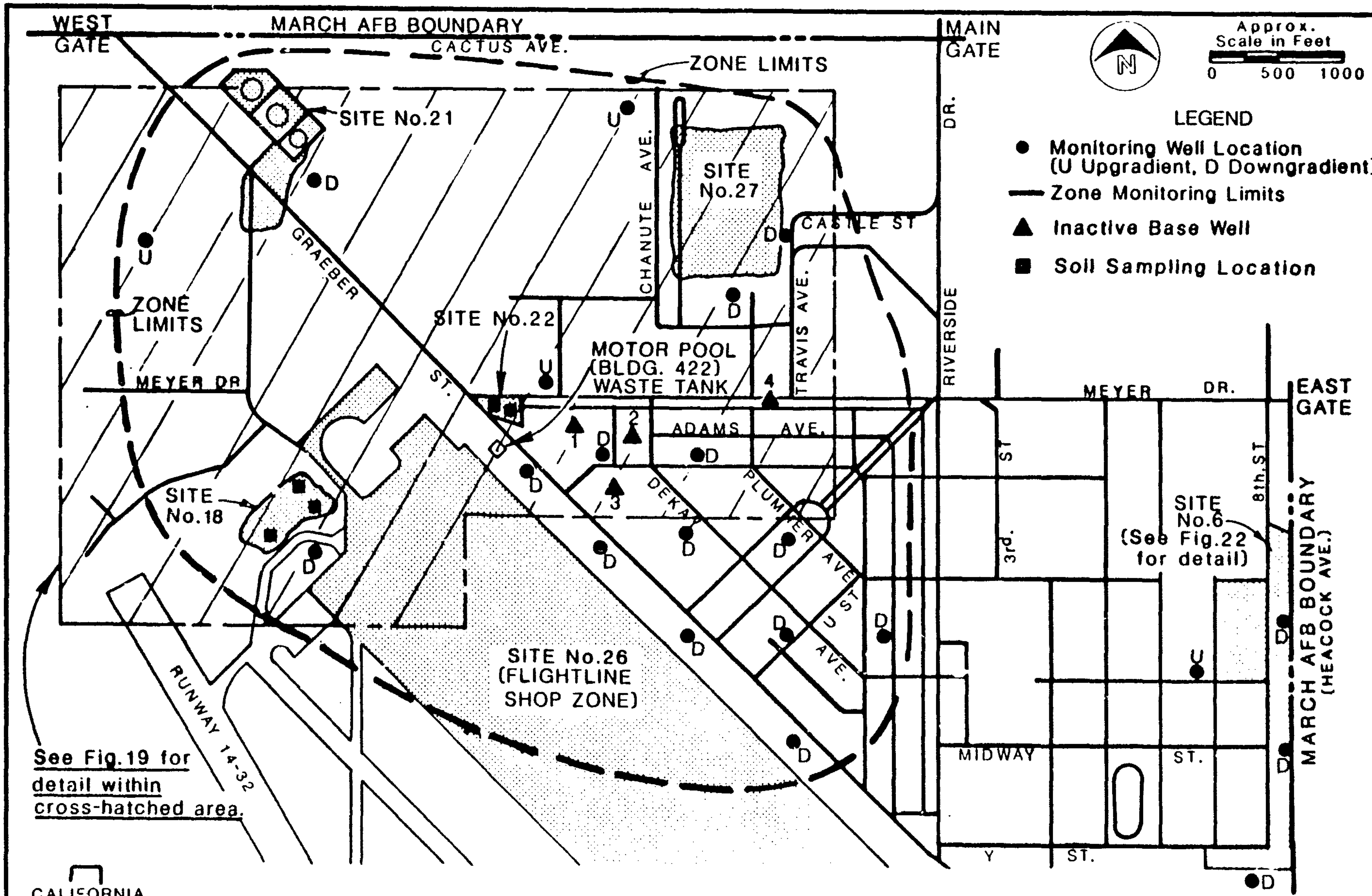


FIGURE 18
Recommended Preliminary Sampling Locations for Zone Monitoring of Sites No. 18,21,22,26 & 27

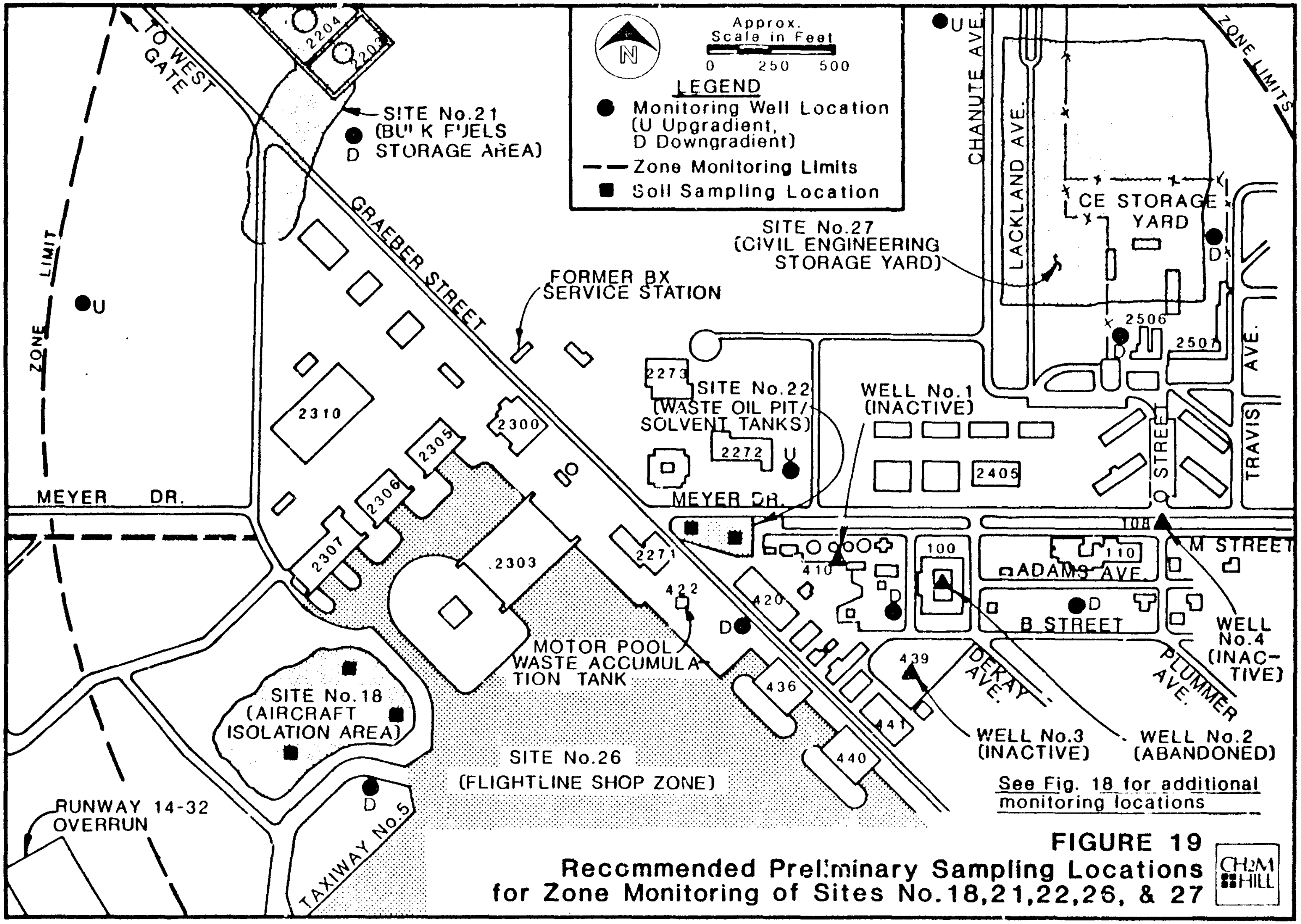


FIGURE 19
Recommended Preliminary Sampling Locations for Zone Monitoring of Sites No.18,21,22,26, & 27

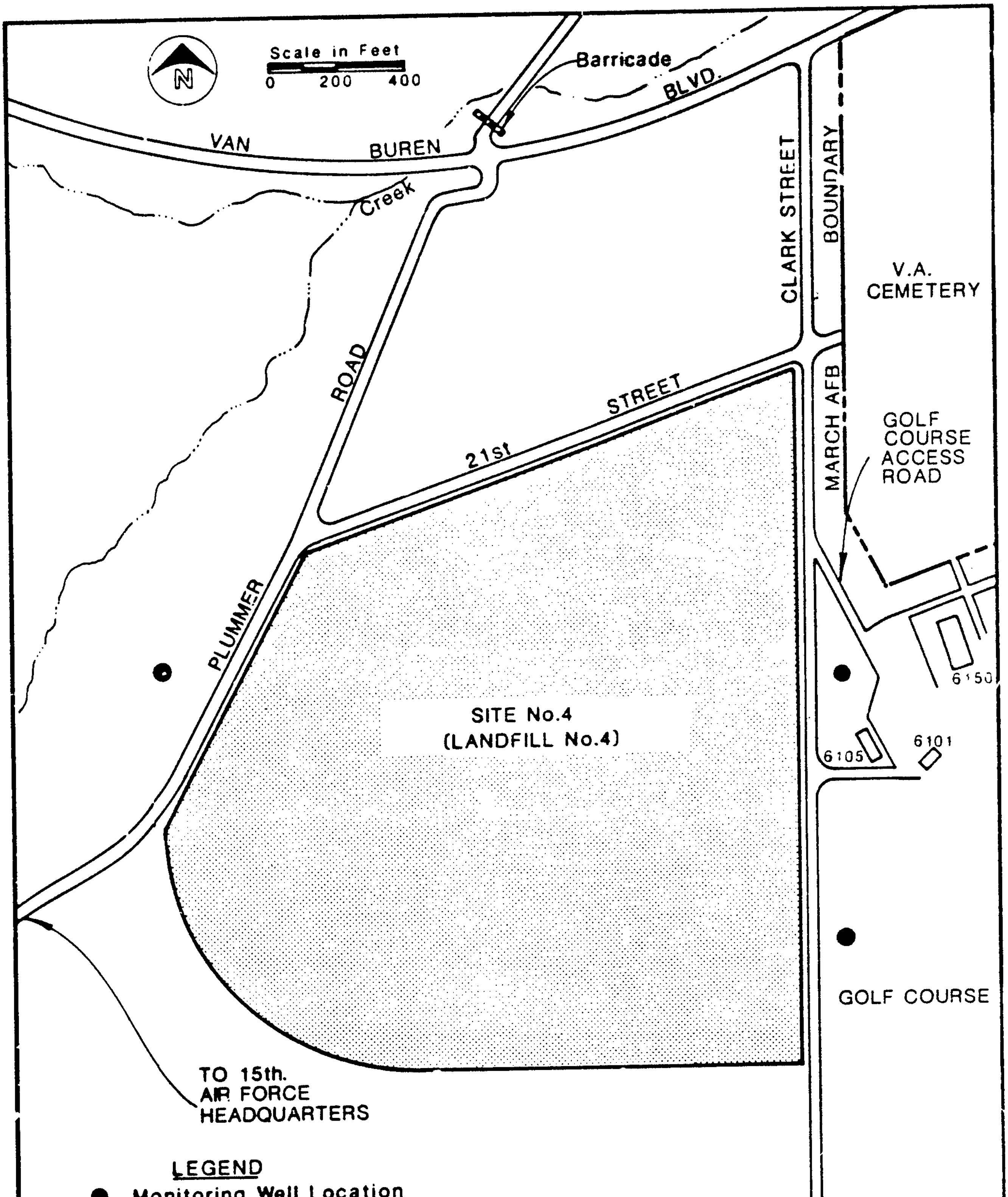


FIGURE 20
Recommended Preliminary Sampling Locations for Site No.4

CH2M HILL

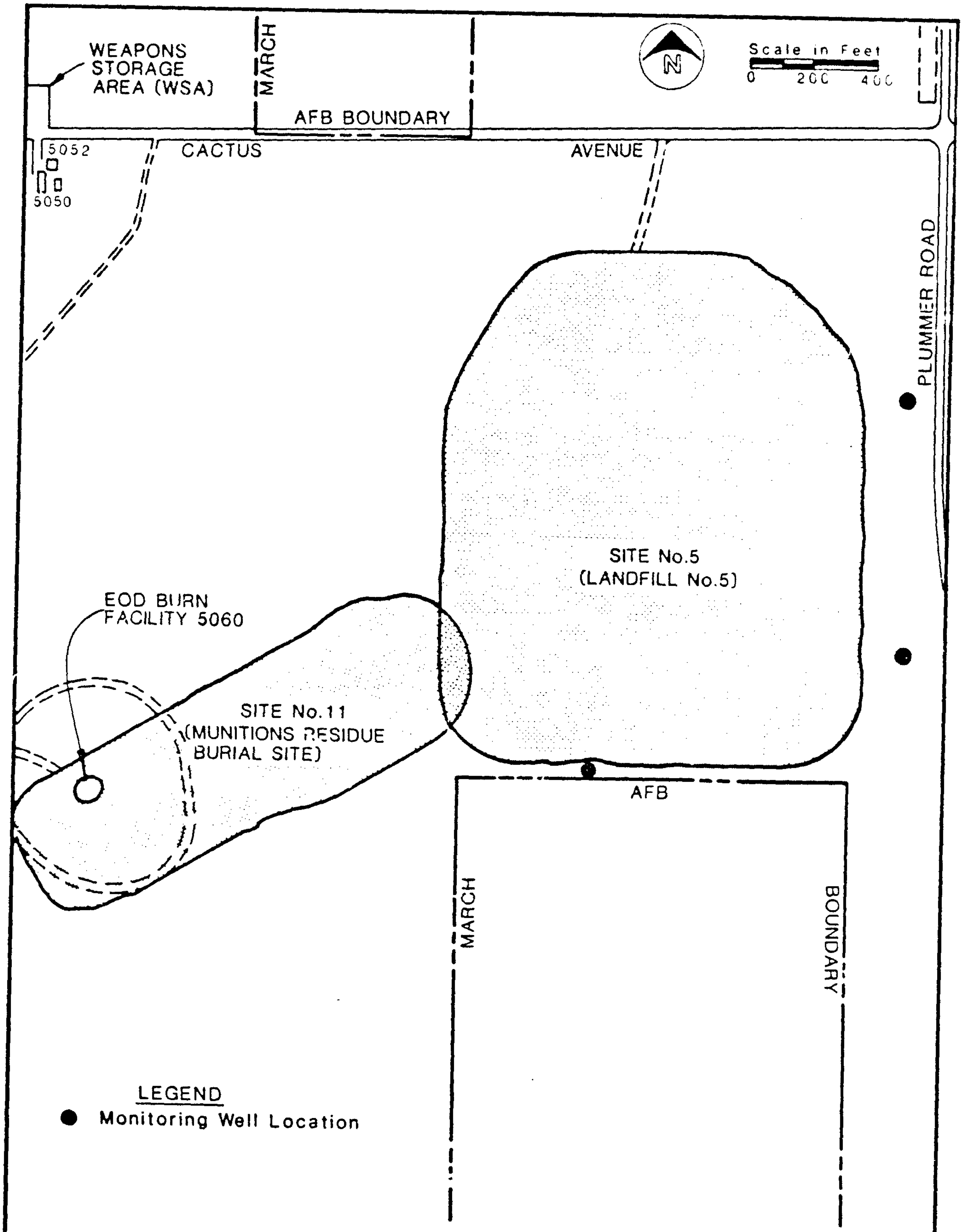


FIGURE 21
Recommended Preliminary Sampling Locations for Site No.5

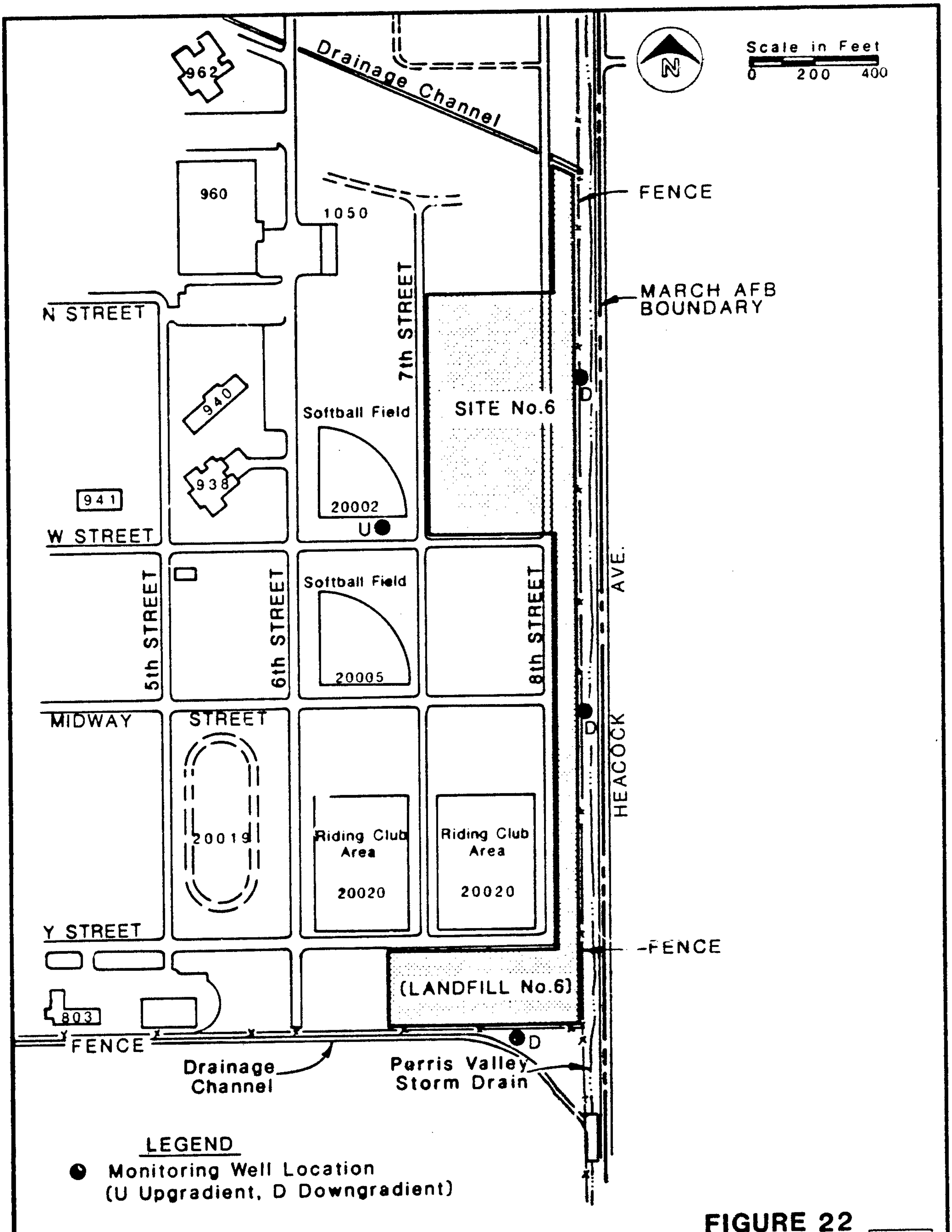


FIGURE 22
Recommended Preliminary Sampling Locations for Site No. 6

2. Site-Specific Initial Monitoring Recommendations

Figure 16 illustrates the recommended Phase II March AFB monitoring sites. Site-specific monitoring recommendations include the installation of upgradient and downgradient monitoring wells for sampling groundwater at the following sites:

- A zone consisting of Landfill No. 3 (Site No. 3), Fire Department Training Area No. 2 (Site No. 9), Fire Department Training Area No. 3 (Site No. 10), Tank Truck Spill Site (Site No. 20), Main Oil/Water Separator (Site No. 24), and the Flightline Drainage Channel (Site No. 25)-- See Figure 17.

- A zone consisting of the Aircraft Isolation Area (Site No. 18), Bulk Fuels Storage Area (Site No. 21), the Waste Oil Pit/Solvent Tanks (Site No. 22), a portion of the Flightline Shop Zone (Site No. 26), and the Civil Engineering Storage Yard (Site No. 27)-- See Figures 18 and 19.

- Landfill No. 4 (Site No. 4)-- See Figure 20.

- Landfill No. 5 (Site No. 5)-- See Figure 21.

- Landfill No. 6 (Site No. 6)-- See Figure 22.

In addition, soil sampling is recommended off-base at the unlined portion of the Perris Valley Storm Drain just upstream and downstream of the lined Flightline Drainage Channel (Site No. 25).

At the present time, Wells No. 1 and No. 3 are known to be contaminated with TCE and other organics at levels that exceed California and EPA guidelines. However, the vertical and lateral extent of this contamination is not known, nor is its source. The estimated average groundwater velocity is about 130 to 265 feet per year, generally in a southeasterly direction. If the contaminants were introduced into the aquifer 20 or 30 years ago, groundwater contamination could extend a considerable distance downgradient from the source. However, any contaminant movement would have been further affected by the pumping gradient created by the operations of the production wells in service over the period of time since the contaminants were introduced.

In order to characterize the vertical and lateral extent of contamination and to identify the potential sources, a field investigation may be warranted. This investigation might consist of two parts (in addition to the site-specific monitoring recommendations listed above):

- Soil sampling in known or suspected source areas-- this would consist of hollow-stem auger drilling and sampling to detect areas of soil, above the water table, that contain high concentrations of contaminants. Suspected source areas include reported solvent dumping areas (Site No. 18) and former solvent holding tanks (Site No. 22) near Well No. 1. Both sites are considered potential TCE contamination sources of Wells No. 1 and No. 3.

- Hydrogeologic investigations in downgradient areas--this would consist of additional monitoring wells in key areas that would allow definition of the vertical and lateral extent of contamination. The precise number of required wells is difficult to forecast. It is recommended that the hydrogeologic investigation proceed on a phased approach with results of the early phases being used to refine drilling locations, sampling techniques, and aquifer testing requirements in future phases. It is estimated that 6 to 10 monitoring wells would be required in the initial phase of the hydrogeologic investigation outlined herein.

A brief description of the initial monitoring recommendations at each site follows.

a. Zone Monitoring (Sites No. 3, 9, 10, 20, 24 and 25)

Due to the proximity of Sites No. 3, 9, 10, 20, 24, and 25 to each other, zone monitoring is recommended for the area encompassing these sites. Four monitoring wells, three downgradient and one upgradient, should be installed to determine if groundwater contamination is present and migrating from this zone. The wells should be drilled to a depth of approximately 50 feet below the top of the aquifer (total depth of approximately 175 to 225 feet). Permeable zones in the upper 50 feet of the aquifer should be screened as determined in the field by a certified geologist. Care should be exercised to avoid breeching impermeable clay layers which act as a barrier to vertical migration of contaminants. Each well should be analyzed for the parameters given in Table 17 and should be sampled on two occasions, at least 30 days apart.

Three soil borings (hollow-stem auger drilling), two downgradient and one upgradient, should be completed in the unlined Perris Valley Storm Drain near the Flightline Drainage Channel (Site No. 25) as shown in Figure 17. Each boring should be completed to a depth of approximately 50 feet. A certified geologist should be present to examine the soil profile and characteristics and to inspect for signs of fuel or VOC contamination. Soil samples should be analyzed in accordance with Table 17. The number of samples collected and analyzed should be at the discretion of the geologist (estimated two analyses per soil boring). Representative samples should be collected (but not necessarily analyzed) for each major strata. After sampling has been completed, the boreholes should be properly sealed to prevent a pathway for contaminant migration.

b. Zone Monitoring (Sites No. 18, 21, 22, 26 and 27)

Due to the proximity of Sites No. 18, 21, 22, 26, and 27 to each other, zone monitoring is recommended for the area encompassing these sites. Also included in this zone are Wells No. 1 and No. 3 which are known to be contaminated with TCE and other organics. Seventeen monitoring wells, fourteen "downgradient" and three "upgradient", should be installed to determine if groundwater contamination is present and to begin to define the vertical and lateral extent of contamination in this zone. Due to the influence of production wells (none currently in service) in this zone, it is not always clear as to which locations are "upgradient" or "downgradient" based on available data. As indicated previously, a phased approach to the Phase II hydrogeologic investigation within this zone is recommended.

Monitoring wells should be drilled to a depth of approximately 50 feet below the top of the aquifer (total depth of approximately 150 to 200 feet). Permeable zones in the upper 50 feet of the aquifer should be screened as determined in the field by a certified geologist. Each well should be analyzed for the parameters given in Table 17 and should be sampled on two occasions, at least 30 days apart.

In addition, five soil borings (hollow-stem auger drilling) should be completed at Sites No. 18 and No. 22 as shown in Figure 19. Each boring should be completed to a depth of approximately 50 feet. A certified geologist should be present to examine the soil profile and characteristics and to inspect for signs of fuel or VOC contamination. Soil samples should be analyzed in accordance with Table 17. The number of samples collected and analyzed should be at the discretion of the geologist (estimate two analyses per soil boring). Representative samples should be collected (but not necessarily analyzed) for each major strata. After sampling has been completed, the boreholes should be properly sealed to prevent a pathway for contaminant migration.

c. Landfill No. 4 (Site No. 4)

Three shallow monitoring wells should be installed to determine if groundwater contamination is present and migrating from this site. Due to the lack of hydrogeologic data in the West March area, the monitoring wells shown on Figure 20 have not been labeled as either upgradient or downgradient. Based on surface drainage patterns, the best estimate of subsurface flow direction at this site is primarily to the east. The wells should be drilled through the alluvium to bedrock (total depth of approximately 10 to 20 feet) and permeable zones screened below the water table as determined in the field by a certified geologist. Each well should be analyzed in accordance with Table 17 and should be sampled on two occasions, at least 30 days apart.

d. Landfill No. 5 (Site No. 5)

Three shallow monitoring wells should be installed to determine if groundwater contamination is present and migrating from this site. Due to the lack of hydrogeologic data in the West March area, the monitoring wells shown on Figure 21 have not been labeled as either upgradient or downgradient. Based on surface drainage patterns, the best estimate of subsurface flow direction at this site is primarily to the northeast. The wells should be drilled through the alluvium to bedrock (total depth of approximately 10 to 20 feet) and permeable zones screened below the water table as determined in the field by a certified geologist. Each well should be analyzed in accordance with Table 17 and should be sampled on two occasions, at least 30 days apart.

e. Landfill No. 6 (Site No. 6)

Four monitoring wells, three downgradient and one upgradient, should be installed to determine if groundwater contamination is present and migrating from this site. The wells should be drilled to a depth of approximately 50 feet below the top of the aquifer (total depth of approximately 175 to 225 feet). Permeable zones in the upper 50 feet of the aquifer should be screened as determined in the field by a certified geologist. Each well should be analyzed in accordance with Table 17 and should be sampled on two occasions, at least 30 days apart.

B. OTHER ENVIRONMENTAL RECOMMENDATIONS

Other IRP environmental recommendations include:

- Disposing of the water treatment plant lime sludge accumulated at Site No. 16 in a permitted Class I or Class II-1 landfill.

- Emphasizing good housekeeping practices and the necessity to eliminate spillage of solvents and fuels on the ground in the Aircraft Isolation Area (Site No. 18), the Bulk Fuels Storage Area (Site No. 21), the Flightline Shop Zone (Site No. 26), and the Civil Engineering Storage Yard (Site No. 27).

- Pressure testing of the 50,000-gallon-capacity underground waste accumulation tank at Building 422 (Motor Pool) on a periodic basis to confirm that leakage of hazardous wastes from this tank is not occurring.

- Restricting access to Landfill No. 4 (Site No. 4) from Plummer Road and Landfill No. 5 (Site No. 5) from Cactus Avenue to discourage unauthorized waste dumping.

- Continuing periodic sampling of the base water supply wells for volatile organic compounds (VOCs).

An unconfirmed report was received during the base personnel interviews that drummed wastes (including paints, solvents, and other flightline shop wastes) may have been included in the former base swimming pool fill (Site No. 17). Although this site only received a HARM rating of 43, consideration should be given to verifying the existence and location of these drums (via magnetrometer survey or ground penetrating radar) and to removing them from the site if they are found to exist. Although the concrete swimming pool walls are assumed to offer some limited containment of these suspected wastes, there is a potential for the steel drums to corrode allowing the waste materials to potentially seep out.

C. LAND USE RESTRICTIONS FOR IDENTIFIED SITES

Land use restrictions at the identified disposal and spill sites at March AFB are recommended for consideration. The rationale for imposing land use restrictions include: (1) providing the continued protection of human health, welfare, and environment; (2) ensuring that the migration of potential contaminants is not promoted through improper land uses; (3) facilitating the compatible development of future USAF facilities; and (4) allowing for identification of property which may be proposed for excess or outlease.

Before any land use activity is planned at suspected contamination sites, potential hazards and environmental impacts must be considered. As more site information becomes available (Phase II) and/or cleanup actions occur (Phase IV), land use restrictions should be re-evaluated.

VII. OFF-BASE FACILITIES

A. INTRODUCTION

Off-base facilities associated with March AFB include the following:

- Water System Annex No. 2 (PDPE)
- VOR Annex (PDNS)
- Communications Facility Annex (PDNE)
- Communications Annex No. 2 (QKFN)
- ILS Middle Marker Annex (PDBS)
- Light Annex No. 2 (PDBH)
- Hawes Radio Relay Annex (KHGM)

The following section presents brief descriptions of these facilities.

B. OFF-BASE FACILITIES

1. Water System Annex No. 2 (PDPE)

The March Water System Annex No. 2 consists of approximately 8½ miles of right-of-way easement running west of the base and a pump station site at Lake Mathews. A 20-inch untreated water supply pipeline was installed in the 1940's from Lake Mathews to the March AFB water treatment plant to provide the base with imported Colorado River water. The only known potential contamination source at the pump station site is from electrical transformers. No contaminant spills, industrial operations, or generation of hazardous wastes are known to exist at this facility.

2. VOR Annex (PDNS)

The March VOR (Very High Frequency Omni Range) Annex consists of approximately 258 acres of leased land located approximately 7 miles southeast of March AFB. This installation provides aircraft with directions to the transmitting station. All equipment at this site is owned and operated by the Federal Aviation Administration (FAA). The property has been transferred to General Services Administration (GSA) for disposal. According to the April 6, 1983 March AFB Real Property Study, it was anticipated that the FAA would acquire the site shortly. No contaminant spills, industrial operations, or generation of hazardous wastes are known to exist at this site.

3. Communications Facility Annex (PDNE)

The March Communications Facility Annex consisted of approximately 92 acres of fee-owned land located approximately 3 miles southeast of March AFB. The FAA uses one building at this site for traffic control of area airports. Equipment within the building is FAA owned and operated. A Declaration of Excess for 90 acres at this transmitter site was processed and the property sold to a private corporation in mid-December 1983. Two March AFB water wells (Wells No. 5 and 6), roads, and easements for utility and communication lines were retained by the Air Force. A standby power generator and underground fuel storage tank were located on the site. Wastewater treatment is provided by a septic tank system. No contaminant spills, industrial operations, or generation of hazardous wastes are known to exist at this facility.

4. Communications Annex No. 2 (QKFN)

The March Communications Annex No. 2 consists of approximately 187 acres of fee-owned land located approximately 15 miles west of March AFB along State Highway 60 at Mira Loma, California. The site was formerly an antenna facility for the 33rd Communications Group, but was inactivated in May 1983. A Declaration of Excess has been prepared and the site is up for sale. Approximately 8 acres of the site has been leased to GSA since the late 1960's and has been used for bauxite storage. The San Bernardino Civic Light Opera Association leases 39,600 square feet of space in Building 7051 for storage. A 600 KW stand-by generator, underground fuel storage tank, and electrical transformers are located on the site. The transformers have been checked for PCBs concentration. No contaminant spills industrial operations, or generation of hazardous wastes are known to exist at this facility.

5. <u>ILS Middle Marker Annex (PDBS) and Light Annex No. 2 (PDBH)</u>

The March Instrument Landing System (ILS) Middle Marker Annex and Light Annex No. 2 are small easement areas used for navigational aids. No contaminant spills, industrial operations, or generation of hazardous wastes are known to exist at these facilities.

6. <u>Hawes Radio Relay Annex (KHGM)</u>

The Hawes Radio Relay Annex site is located off Highway 58 at Hinkley in San Bernardino County, approximately 27 miles northwest of Victorville, California. This facility consists of approximately 643 acres of land owned by the U.S. Department of Interior, Bureau of Land Management (BLM) and permitted to the Air Force. Water is reportedly supplied by a 500 foot deep potable water well and wastewater treatment is provided by a septic tank system. No contaminant spills, industrial operations, or generation of hazardous wastes are known to exist at this facility.

C. CONCLUSIONS/RECOMMENDATIONS

The records search did not identify any past disposal sites or spill sites at any of the off-base facilities. Therefore, Phase II monitoring is not recommended for any of these off-base facilities.

APPENDIX CONTENTS

Appendix A

RESUMES OF TEAM MEMBERS

JAMES L. BLOOMQUIST
Sanitary Engineer

Education

B.S., Civil Engineering, University of Illinois
Graduate Courses in Civil Engineering (Environmental), University of Illinois

Experience

Since joining CH2M HILL in March 1980, Mr. Bloomquist has been assigned to the Wastewater Reclamation Group where his primary duties include preparation of studies, design, and project engineering/management. His experience includes the full range of project engineering from initial conception to final design and construction of municipal water and wastewater facilities.

As project engineer for the Irvine Ranch Water District's (Irvine, California) Regional Wastewater Management Study, Mr. Bloomquist's duties included analysis of the existing 15-mgd wastewater reclamation plant and evaluation of various options for future wastewater treatment and disposal needs. He also served as project engineer for IRWD's Irrigation/Reclamation System Master Plan where he assisted in the development, analysis, and computer optimization of alternatives for expanding the District's reclaimed water system.

Mr. Bloomquist was project manager for services during construction on the Nyeland Acres Wastewater Facilities, County of Ventura Public Works Agency, California. Mr. Bloomquist also served as project engineer during the design of the Nyeland Acres pressure sewer collection system and wastewater treatment plant. The treatment facility includes a hydrogen sulfide oxidation process which incorporates an innovative approach to the situation.

Mr. Bloomquist served as lead process engineer for preliminary design of the 55-mgd (120-mgd existing) Point Loma Wastewater Treatment Plant Advanced Primary Expansion, San Diego Metro Wastewater Program. Areas of responsibility included Pump Station No. 2, primary sedimentation, odor control, and support systems.

As a lead engineer, Mr. Bloomquist was responsible for the infiltration/inflow analysis and assistance on other portions of the Oxnard Wastewater Treatment Plant Facilities Plan, Ventura Regional County Sanitation District, California. Mr. Bloomquist had similar responsibilities on I/I analysis projects for the Cities of Gilman and Watseka, Illinois, and for a sewer system evaluation survey in the City of Gilman.

JAMES L. BLOOMQUIST

During the Sludge Management Study for the City of Santa Barbara, California, Mr. Bloomquist assisted in the development and evaluation of windrow, aerated static pile, and mechanical enclosed vessel sludge composting alternatives. He also assisted in the analysis of wastewater pretreatment facilities for the Santa Barbara Regional Water Reclamation Study.

For the Village of Cissna Park, Illinois, Mr. Bloomquist was responsible for design, services during construction, grant administration, and project management for a new sanitary sewer system and advanced secondary treatment plant.

Mr. Bloomquist also has experience in hazardous waste management projects. Under the EPA's Superfund (CERCLA) contract, he recently served as assistant project manager for the review of the State of California's remedial action feasibility study developed for the McColl Site in Fullerton, California. The McColl Site is an uncontrolled hazard waste landfill consisting of predominantly acidic sludge resulting from the refining of aviation fuel during WW II.

Prior to joining CH2M HILL, Mr. Bloomquist was employed by a consulting engineering firm in central Illinois as a project manager in the water and wastewater field. He previously worked for a governmental agency in Sydney, Australia, where he was involved in regional solid waste disposal regulation and planning, a metropolitan area leachate study, and studies for a regional industrial liquid waste treatment facility.

Professional Registration

Professional Engineer, California
Professional Engineer, Illinois

Membership in Professional Organizations

National Society of Professional Engineers
California Society of Professional Engineers
Water Pollution Control Federation
California Water Pollution Control Association
Chi Epsilon (Civil Engineering Honorary Fraternity)

MICHAEL C. KEMP
Hazardous Wastes Engineer

Education

M.S., Civil and Environmental Engineering, Utah State University
B.S., Civil Engineering, Tennessee Technological University

Experience

Mr. Kemp is a project manager and design engineer in CH2M HILL's Industrial Processes Division. He specializes in hazardous waste management and industrial wastewater treatment. He also provides technical expertise in municipal wastewater treatment.

In CH2M HILL's Solid and Hazardous Waste Management Discipline, Mr. Kemp serves as the coordinator for Southwest District hazardous waste activities. He is the Assistant Regional Project Team Leader for EPA "Superfund" remedial planning projects for field investigations and selection of cleanup actions at uncontrolled hazardous waste sites in EPA Regions IX and X. He has managed or served as a technical reviewer for remedial planning activities at more than 15 "Superfund" sites. Mr. Kemp's other solid and hazardous waste management experience includes serving as project manager or assistant project manager for hazardous waste generation, disposal, and potential contamination surveys at four U.S. Air Force bases; preparing RCRA operating and closure plans for a Gulf Oil Company refinery; performing a preliminary study on landfill leachate treatment alternatives for Portland Metro; and evaluating closure alternatives for a wastewater treatment lagoon and waste sludge pit for Gulf Oil Company.

Mr. Kemp's industrial wastewater treatment experience includes serving as an onsite inspector and providing services during construction for the expansion of a potato processor's wastewater treatment plant; studying the feasibility of land application of pulp mill wastewater for Australian Pulp Manufacturers; reviewing the sampling, analysis, and treatability alternatives used in the EPA Aluminum Forming Development Document for the Aluminum Manufacturers Association; studying the feasibility of using biological treatment for electronics manufacturing wastewater; designing miscellaneous facilities and performing hydraulic analyses for the Washington Irrigation and Development Company's coal fines dewatering plant and the ITT Rayonier Port Angeles Pulp Mill wastewater treatment plant; and preparing operations manuals for the potato processor's and the ITT Rayonier wastewater treatment plants.

MICHAEL C. KEMP

Mr. Kemp has served as production manager and lead engineer for the design of anaerobic sludge digesters at two Clackamas County, Oregon, municipal wastewater treatment plants. Before joining CH2M HILL, he worked as a research assistant at the Utah Water Research Laboratory, a surveyor with the National Park Service, and an engineering assistant with the Atomic Energy Commission.

Professional Registration

Engineer-in-Training, Tennessee
Class II Wastewater Treatment Plant Operator, Washington

Membership in Professional Organizations

American Society of Civil Engineers
Chi Epsilon
Water Pollution Control Federation
Pacific Northwest Water Pollution Control Association

Publications

With R.D. Hansen, M.F. Torpy, M.C. Kemp, and D. Mills. "Graduate Training in Water Track Environmental Engineering: Results of a Survey of Employers." Water Resources Bulletin, Vol. 16, No. 5. Pp. 862-865. 1980.

With M.C. Kemp, D.S. Filip, and D.B. George. Evaluation and Comparison of Overland Flow and Slow Rate Systems to Upgrade Secondary Wastewater Lagoon Effluent. Logan, Utah: Utah Water Research Laboratory, 1978.

MICHAEI O. CONCANNON
Environmental Scientist

Education

Graduate studies, Marine Biology, San Francisco State University
B.A., Marine Biology/Chemistry, San Francisco State University

Experience

Mr. Concannon is a project manager in CH2M HILL's Environmental Sciences Discipline. He specializes in water and sediment quality assessments for industrial and mineral resource development projects and municipal water supply systems. He also provides technical expertise in hazardous waste site assessment, materials management, and regulatory permitting assistance.

Under the EPA's Superfund (CERCLA) contract, Mr. Concannon evaluated the toxic substance monitoring program and onsite treatment feasibility studies of the remedial plans developed for the Stringfellow Acid Pits near Glen Avon, California. Mr. Concannon was project manager of a hazardous waste site assessment for ITT-Grinnell on property contaminated by a major spill of polychlorinated biphenyls (PCB's). Classification of hazardous wastes from a mine development project for Homestake Mining Co. was included in the design of the ore processing scheme. He has also been involved with assessments of lead contaminations near a former smelter site and at a battery fabrication plant and investigated explosive residues in the wash ponds of an abandoned munitions production facility.

Mr. Concannon's projects concerning water supply have included an evaluation of existing technology to continuously monitor for toxic substances in the river source for the Sonoma County Water Agency. The Alameda County Water District site selection study for the location of a new treatment plant included a potential toxic contamination risk assessment.

Comprehensive chemical and physical assessments of aquatic environment have been completed for the 105-mgd cooling and process water discharge of the Richmond Refinery for Chevron, USA. The project included the analysis of trace metals and organic substances for potential bioaccumulation in estuarine organisms. Mr. Concannon has also been involved in the predischarge oceanographic assessment for the City and County of San Francisco's Southwest Ocean

Outfall Project and was responsible for chemical and bacteriological baseline studies. The Bayside Overflow Study, also for the City and County of San Francisco, evaluated the effects of combined sewer overflows on the bacterial, trace metal and organic hydrocarbon contamination of estuarine organisms and sediments.

Ecological assessment projects have included an analysis of impacts on the aquatic environment associated with over 100 stream crossings by the proposed Alaska Highway Natural Gas Pipeline project for the Pacific Gas & Electric Company. The siting of a 49-MW coal-fired cogeneration powerplant at Cominco-American's lake-deposit mining operation in Inyo County, California, required an analysis of the vegetation types and of the rare or endangered species potentially impacted by the proposed project.

Mr. Concannon reviewed data on rare and endangered species for the Arroyo Seco Dam feasibility study for Monterey County Flood Control District. He participated in small mammal and bird population surveys for Chevron, USA in the evaluation of the effect of wastewater discharges on an estuarine marsh ecosystem.

Before joining CH2M HILL, Mr. Concannon was a program manager with an environmental analysis laboratory. He served as project manager of several trace metal and organic pollutant baseline studies for the U.S. Environmental Protection Agency. This program involved water supply systems and groundwater resources in the southwestern United States, Guam, American Samoa, the Trust Territories of the Pacific, and the Northern Marianas Islands. He conducted an onsite study of condensable and noncondensable gases at PG&E's Geysers Geothermal Power Plants. Mr. Concannon performed bioassays of estuarine and freshwater fish and invertebrate species and, as a laboratory supervisor, was responsible for many field and laboratory water quality studies.

Mr. Concannon has teaching experience in botany, marine invertebrate natural history, and algology at San Francisco State University.

<u>Membership in Professional Organizations</u>

American Society of Limnology and Oceanography
Association of Environmental Professionals
International Phycological Society
Water Pollution Control Federation
Western Society of Naturalists

MICHAEL O. CONCANNON

Publications

"Evaluation of Water Quality Test Kits for Field Use." U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 1978.

"Bioaccumulation of DDE, 1,2,4-Trichlorobenzene and 1,3-Hexachlorobenzene by Pimaphales promelas." U.S. Environmental Protection Agency. 1980.

"The Effects of Combined Sewer Overflows on Shellfish in San Francisco Bay." With Roderick W. Hoffman. In preparation.

FRITZ R. CARLSON
Department Manager
Groundwater

Education

M.S., Hydrology, University of Arizona
Graduate Courses in Geology, University of California, Berkeley
B.A., Geology, University of California, Berkeley

Experience

As Manager of the Groundwater Department in the Redding Regional Office, Mr. Carlson is responsible for projects involving all aspects of groundwater hydrology. His experience includes the development of groundwater resources; projects relating to wastewater reuse, the protection of groundwater resources, and groundwater control and drainage; and the development of basinwide water budgets.

Mr. Carlson has managed and participated in a number of projects involving development of groundwater resources ranging from large (3,000+ gpm) municipal water wells to small domestic supplies. He is very familiar with modern drilling and well construction techniques, much of which was gained during his experience with a water well drilling firm. In addition to providing design and onsite construction review of water wells, Mr. Carlson has designed large (6,000+ gpm) well fields, conducted hydrogeologic mapping for the purpose of well site selection, and supervised major aquifer testing programs.

In numerous projects involving the reuse of wastewater, Mr. Carlson has analyzed the impacts of wastewater reuse on groundwater quality and quantity. Working closely within the project terms, Mr. Carlson has helped to develop sites and operation plans for wastewater reuse with minimum environmental impacts. His project experience related to wastewater reuse includes a major municipal wastewater reuse study in the Livermore Valley, California, where he developed a groundwater quality model of the basin. He analyzed sites in Pennsylvania for a cheese processing wastewater project, which included monitoring well drilling. He also provided a review of the impacts of emergency disposal of raisin processing wastewater near Fresno, California.

Mr. Carlson has been involved in numerous projects relating to the protection of groundwater resources. These projects have included basinwide studies of the salt balance in the Livermore Valley in California; investigation of present and potential groundwater pollution from landfill leachate in Shasta County, California, and Klamath County, Oregon;

cumulative impact studies of high densities of septic systems in Trinity County, California; potential groundwater contamination from proposed tailings ponds in Arkansas; the potential movement of radioactive water from hypothetical accidents at nuclear power plants; and the potential movement of pentachlorophenol in groundwater near lumber mills in Northern California.

Mr. Carlson has developed water budgets for several basins in California and Nevada. These projects involved estimating values for all components in the hydrologic system, including groundwater recharge, groundwater discharge, streamflow, evapotranspiration by crops, and native vegetation and groundwater pumpage. These projects required synthesizing a wide range of hydrologic data. Basins Mr. Carlson has studied include the Livermore Valley and Round Mountain, California, and Lower and Upper Truckee Meadows and Washoe Valley, Nevada.

Mr. Carlson's projects related to groundwater control and drainage have included geologic investigations and design of a subsurface drain system for a residence and a condominium development in Redding, California, and numerous designs of construction dewatering facilities. In addition, Mr. Carlson has conducted investigations leading to the prediction of the seasonal high groundwater levels in Redding and Oakland, California.

Prior experience includes several years with a large multidiscipline engineering firm based in San Francisco, and vice-president of a small groundwater consulting and drilling firm located in Redding, California. He also served as a hydrogeologist while stationed in India with the U.S. Peace Corps.

Professional Registration

Registered Geologist No. 3397, California

Membership in Professional Organizations

National Water Well Association

JANE DYKZEUL GENDRON
Biologist

Education

B.A., Biology, San Francisco State University
Graduate Studies, Moss Landing Marine Laboratory, Monterey, California

Experience

Ms. Gendron is a biologist in the environmental sciences department of CH2M HILL. Her primary experience is in marine and freshwater ecosystem assessment. She has been involved in analyzing ecological impacts of many industrial and municipal developments through field, laboratory, and literature research studies. These studies have included water quality, toxicology, and aquatic as well as terrestrial ecology.

Ms. Gendron has studied several marine and estuarine ecosystems in relation to effects of sanitary discharges. She has done field work and literature surveys in the preparation of 301-h waiver applications for Ventura Regional County Sanitation District in California and for the City of Port Angeles in Washington. She has also studied the nonpoint sources of pollution in Willapa Bay, Washington State, relative to oyster production. This study involved sanitary surveys and an extensive water quality study.

Other marine and estuarine projects on which Ms. Gendron has worked include baseline data collection and analysis for the Southwest Ocean Outfall Project, San Francisco, California; benthic invertebrate identification and resource analysis for the proposed expansion of Cornet Bay Marina, Washington; alternative fishery resources analysis for the Tulalip Tribes, Washington; and impact of dredging to estuarine and marine organisms in Grays Harbor, Washington.

Water quality analysis is often a major emphasis in impact assessments of aquatic ecosystems. Ms. Gendron has been involved with data collection, laboratory analysis, water quality modeling and impact assessment for several projects. These projects include Lake Hicks restoration analysis done for King County Division of Parks and Recreation, Washington; Willapa Bay baseline survey conducted for Washington State Department of Ecology; and stormwater overflow study for the City and County of San Francisco, California.

Ms. Gendron has also conducted literature surveys and analyses of potential impacts to water quality and aquatic systems resulting from proposed discharges. These studies include development of a wetland system in arid western states using geothermal waters; potential gasohol spill in the Columbia River, Washington; and general petroleum impacts to freshwater systems for a proposed boat storage and docking facility near Lake Washington. All of these projects involved assessing potential water quality impacts and determining resulting impacts to the aquatic systems.

Ms. Gendron has experience in assessing impacts of hazardous wastes and toxic substances to aquatic systems. She has participated in several Phase I studies for the U.S. Air Force Installation Restoration Programs, which include records search and analysis of old waste disposal practices on Air Force installations. The bases she has studied include Eielson AFB, Alaska; Nellis AFB, Nevada; McChord AFB, Washington; George AFB, California; and Kingsley AFS, Oregon. Other toxic substance studies Ms. Gendron has conducted include an analysis of constituents of geothermal waters for a proposed wetland development project for the U.S. Fish and Wildlife Service, effects of constituents found in the effluent of a silicon chip processing plant, and the impacts of spills of gasoline and gasohol.

Ms. Gendron is experienced in analyzing development-related impacts on fishery resources. She has worked on several projects for public utility districts along the Columbia River in Washington that involved assessing hydroelectric impacts on salmonid populations, both upstream and downstream migrants, and evaluating mitigating measures including fingerling bypass systems. She has also done work analyzing impacts of other proposed hydroelectric developments in Idaho and Washington. These projects included field data collection, analysis, and literature surveys. As aquatic ecosystem task leader on a natural gas pipeline route selection project, Ms. Gendron assessed impacts to fisheries that would result from stream crossings on several routes from Wyoming to southern California. She has also analyzed irrigation-caused impacts to fishery resources in the Yakima Valley, Washington.

Ms. Gendron has also been involved with wildlife and botanical studies on several projects. She has analyzed vegetational communities and sensitive habitats at several Air Force bases in West Coast states from Alaska to Nevada during Phase I of the Air Force Installation Restoration Program, and she has assisted in formal wildlife and botanical surveys on the Skokomish River system in preparation of a FERC application for a major hydroelectric facility.
Ms. Gendron has also done literature searches and made agency contacts relative to identifying Federal- and state-

protected species for projects throughout the western states.

Prior to joining CH2M HILL, Ms. Gendron was involved in sampling program design and collection and analysis of water, sediment, and biological samples for the City of Avalon, California, sewage outfall monitoring program. Ms. Gendron also worked for the University of Southern California's Catalina Marine Science Center where she designed and directed field studies and prepared the final report for a reconnaissance survey of the west end of Catalina for the California State Water Quality Control Board. Previously, Ms. Gendron was with the California Department of Fish and Game where she analyzed intertidal data during the Diablo Canyon Nuclear Power Plant baseline study.

Membership in Professional Organizations

American Fisheries Society
American Institute of Biological Sciences
Pacific Estuarine Research Society

Publications (Authored as Jane E. Dykzeul)

"Reconnaissance Survey--Santa Catalina Island; Area of Special Biological Significance--Subarea 1." State of California Department of Fish and Game. Report to California State Water Quality Control Board. May 1978.

NORMAN N. HATCH, JR.
Manager, Industrial Processes

Education

M.S., Environmental Engineering, University of Florida
M.S., Analytical Chemistry, University of Florida
B.S., Chemistry, University of New Hampshire

Experience

Mr. Hatch's range of engineering experience includes hazardous waste projects, laboratory and pilot treatability studies, process design of industrial wastewater treatment facilities, and process design of municipal water and wastewater treatment facilities.

Mr. Hatch has extensive experience in the hazardous waste field, including overall responsibility for hazardous materials disposal site evaluations for over 20 U.S. Air Force installations throughout the United States. The purpose of the site assessments is to determine the potential for hazardous contaminant migration from past disposal practices and to recommend follow-up actions. Mr. Hatch is also a principal investigator in the Biscayne Aquifer-Dade County Superfund project, which includes the evaluation of the magnitude and extent of major well field contamination from numerous potential sources in the study area. Mr. Hatch also participated in a comprehensive RCRA compliance program for Gulf Oil Company's Port Arthur Refinery in Texas.

Mr. Hatch has extensive experience in industrial wastewater treatment projects. He served as project manager of a feasibility study for treatment of high nitrogen industrial wastewater from the Air Products and Chemicals, Inc., manufacturing complex in Pensacola, Florida. Treatment technologies investigated included aerated lagoons, oxidation ponds, anaerobic treatment ponds, spray irrigation, activated carbon, and air stripping. Mr. Hatch also served as project manager of a comprehensive treatability and process selection study for the American Cyanamid Fibers Division plant in Milton, Florida. Wastewater treatment processes investigated included spray irrigation, deep well injection, activated sludge, rotating biological contactors, anaerobic contact treatment, activated carbon, ion exchange, and chemical coagulation. In addition, Mr. Hatch has served as project manager for several other treatability and process selection studies for industrial clients, including Arizona Chemical Company, Kaiser Agricultural Chemicals, and Engelhard Minerals and Chemicals. He has also provided assistance in the investigation of state and NPDES discharge permits for Air Products and Chemicals, Inc., American Cyanamid, and Kaiser Agricultural Chemicals.

Mr. Hatch has extensive experience in municipal water and wastewater treatment. He served as lead engineer for an ozone disinfection pilot plant and feasibility study for the City of Philadelphia's Queen Lane Water Treatment Plant. Mr. Hatch was also the lead engineer in charge of process design of chemical feed systems for the Queen Lane Plant, process design and design of chemical feed and sludge handling facilities for the Alexander City, Alabama, Water Treatment Plant, and process design and design of chemical feed system modifications for the St. Augustine, Florida, Water Treatment Plant. Mr. Hatch also served as project manager for a water system master plan for the City of Ft. Pierce, Florida; design of water treatment facilities for a sugar mill in south Florida; a feasibility study of direct wastewater reuse for potable water for the City of St. Petersburg, Florida; and pilot plant investigations leading to a unique system for removal of hydrogen sulfide from potable water for the Orlando Utilities Commission, Orlando, Florida.

Mr. Hatch also has experience in municipal wastewater treatment alternative analyses and process design and in the preparation of numerous 201 facilities plans.

Professional Registration

Professional Engineer, Florida, Georgia

Membership in Professional Organizations

Phi Beta Kappa
Phi Kappa Phi
Society of Sigma Xi
Water Pollution Control Federation

Publications

"The Sarasota Phosphate Removal Project," co-authored with M. Sturm. Water and Sewage Works, March 1974.

"Laser Excited Atomic and Ionic Fluorescence of the Rare Earths in the Nitrous Oxide-Acetylene Flame," co-authored with H. Omenetto, L. M. Fraser, and J. D. Winefordner. Analytical Chemistry, Vol. 45, No. 1, January 1973.

Appendix B

OUTSIDE AGENCY CONTACT LIST

Appendix B
OUTSIDE AGENCY CONTACT LIST

1. U.S. Environmental Protection Agency, Region IX
   Toxics Division
   San Francisco, California
   Bill Wilson (Section Chief-RCRA Permits)
   Steve Fuller (Water Quality Enforcement)
   Paul Blaze (Toxics Enforcement)
   415/974-8391 and -8127

2. U.S. Fish and Wildlife Service
   Laguna Nigel, California
   Dick Zembel (Biologist)
   714/831-4270

3. U.S. Geological Survey
   Water Resources Division
   Laguna Niguel, California
   Dick Moyle (Hydrologist)
   714/831-4232

4. U.S. Department of Agriculture
   Soil Conservation Service
   Riverside, California
   David Will (Soil Scientist)
   714/684-1552

5. U.S. Department of Interior
   Bureau of Land Management
   Riverside, California
   Doug Romoli (Realty Specialist)
   Al Endo (Hydrologist)
   714/351-6394

6. University of California at Riverside
   Riverside, California
   Andrew Sanders (Herbarium Specialist)
   714/787-3601

7. California Regional Water Quality Control Board
   Santa Ana Region
   Riverside, California
   Jim Bennett (Supervising Engineer)
   Bob Michlin (Senior Engineer-Water Quality)
   Kurt Berchtold (Lead Engineer-Toxics Section)
   Mark Adelson (Sanitary Engineering Associate)
   Michael Salter (Area Engineer)
   John Zasadzinski (Retired Sanitary Engineer 686-7236)
   714/684-9330

8. California Department of Water Resources
Southern District Office
Los Angeles, California
Dr. Ahmad Hassan (Engineering Geologist)
213/620-4108

9. California Department of Health Services
Sanitary Engineering Branch
San Diego, California
Diana Barrish (Area Engineer)
619/237-7391

Toxic Substances Control Division
Los Angeles, California
Steve Kobe (Abandoned Sites)
John Hinton (Enforcement Division)
213/620-2380

10. California Department of Fish and Game
Long Beach, California
Clyde Edon (Regional Supervisor)
213/590-5188

Area Office
Idyllwild, California
Bonner Blong (Area Supervisor)
714/659-2970

11. San Jacinto Wildlife Refuge (Dept. of Fish and Game)
Lakeview, California
Allan Craig (Manager)
714/654-0880

12. California Native Plant Society
Sacramento, California
Rick York (Botanist)
916/322-2493

13. Riverside County Flood Control/Water Conservation Dist.
Riverside, California
Don Tracy (Assistant Engineer)
714/787-2015

14. Riverside County Health Department
Environmental Engineering
Riverside, California
Judy Iverson (Senior Sanitary Supervisor)
714/787-2852

15. Riverside County Planning Department
Riverside, California
Dave Leonard (Environmental Planner)
Jerry Jolliffe (Environmental Planner)
714/787-6181

16. Riverside County Road Department
Waste Disposal Section
Riverside, California
Tom Phillips (Facility Engineer)
714/787-1612

17. Eastern Municipal Water District
Hemet, California
Richard Morton (Associate Civil Engineer)
714/925-7676

18. South Coast Air Quality Management District
Engineering Division
El Monte, California
Robert Pease (Senior Air Quality Engineer)
Carol Coy (Hazardous Materials)
213/572-6174 and -6195

Appendix C

MARCH A.F.B. RECORDS SEARCH INTERVIEW LIST

Appendix C
MARCH AFB RECORDS SEARCH INTERVIEW LIST

Organizational Unit and Activity Represented	No. of Interviewees	Range of Years at Installation
22nd Civil Engineering Squadron	17	10-33
o Civil Engineering		
o Construction Inspection		
o Real Property		
o Environmental Engineering		
o Mechanical/Heating		
o Water Treatment		
o Wastewater Disposal		
o Grounds Maintenance		
o Entomology		
o Fire Department		
o Exterior Electric		
o Heavy Equipment Operation		
o Liquid Fuels Maintenance		
22nd Services Squadron	5	1-17
o Print Shop		
o Food Services		
o BX Service Station		
o Auto Garage		
o Photo Hobby Lab		
22nd Air Refueling Wing	4	13-32
o Utilities Administration		
o Supplies Contracting		
o Construction Contracting		
22nd Supply Squadron	7	9-31
o Material Storage and Distribution		
o Base Service Store		
o Munitions Disposal (EOD)		
o Bulk Fuels Storage and Distribution		
22nd Transportation Squadron	6	12-39
o Vehicle Maintenance		
o Minor Maintenance		
o Maintenance Supplies		
o Motor Pool		
22nd Field Maintenance Squadron	8	1-22
o Aerospace Ground Equipment		
o Fabrication and Structural Repair		
o Propulsion (Test Cell, Engine Maintenance)		
o Corrosion Control and Paint Shop		
o Systems (Fuels, Pneudraulics, etc.)		

Organizational Unit and Activity Represented	No. of Interviewees	Range of Years at Installation
22nd Avionics Maintenance Squadron o Avionics Maintenance	1	4
22nd Organizational Maintenance Squadron o Wash Rack o Non-Powered AGE	2	2-4
USAF Regional Hospital o Bioenvironmental Engineering Services o Laboratory Services o Radiology/Nuclear Medicine	5	1-15
33rd Communications Group o Photo Lab o Flight Facilities Maintenance	3	13-25
163rd ANG Consolidated Aircraft Maintenance Squadron o Aerospace Systems o Munitions Maintenance o Avionics Maintenance o Propulsion and Jet Engine o Flightline and Inspection Docks	5	1
303rd Aerospace Rescue and Recovery Squadron o Aerospace Ground Equipment o Flightline o Propulsion o Environmental Systems o Hydraulics o Aircraft Maintenance	9	18-30
452nd Air Refueling Wing (AFRES) o Avionics Maintenance o Aerospace Ground Equipment o Corrosion Control and Paint Shop o Non-Destructive Inspection o Aero Repair o Systems o Propulsion o Fabrication and Welding	9	1-18

Appendix D

INSTALLATION HISTORY

Appendix D
INSTALLATION HISTORY

A. INSTALLATION HISTORY

The history of March AFB, described in the following narrative, was obtained from a variety of sources including Tab A-1 (Environmental Narrative), the March AFB Welcoming Guide (June 1983), and the March Field Story, 60th Anniversary, 1918-1978 (prepared by Headquarters 15th Air Force, Office of the Historian).

The more than 6,000 military and civilian personnel stationed at March are part of a distinguished heritage, begun over 60 years ago when the Riverside Chamber of Commerce won Congressional approval to establish a "Winged Cavalry Post" on the outskirts of the city. Word came from Washington on February 7, 1918, that the proposed Riverside site, called the Alessandro Plains, had been accepted. The first pilot to set down his fabric-covered JN-4 "Jenny" on a makeshift runway among wheat, barley and rye was Cadet Harold Compere on March 2, 1918. His uniform and memorabilia are on display in the March AFB museum.

This site, originally called Alessandro Aviation Field, was officially opened on March 1, 1918. It was renamed March Field in honor of Lt. Peyton C. March, who had died in an aircraft accident in Texas the previous month. His father, General Peyton C. March was Army Chief of Staff during World War I.

The original 640-acre site initially served as an auxiliary field for Rockwell Field in San Diego. A four-man work crew, headed by Sgt. Charles Garlick, was the first contingent to arrive at March, and began preparing it for the engineers. Local mule teams were used to help level the land.

Used initially to train World War I "Jenny" pilots, the base has served as a primary flying and anti-aircraft training school, tactical bomber and pursuit training base, aircraft test base, and a key installation of the Strategic Air Command. Many aviation leaders were trained or served at March, including Generals Henry "Hap" Arnold, Carl "Tooey" Spaatz, Curtis LeMay, and Lt. Gen. Ira Eaker. Following WWI, the base was closed for approximately four years. The field was reactivated in 1927 and was used as a primary flying school, due in part to the request of the citizens of Riverside.

By 1931, March Field began to look like a permanent Army post. The runway had been converted from dirt to asphalt, and by 1934 a number of buildings, including hangars and housing units, were completed for the growing number of personnel assigned to March Field. March then included the Headquarters 1st. Wing, 17th Pursuit Group and the 19th Bombardment Group. In July 1931, the 9th and 31st Bomb Squadrons were reactivated and assigned to the base.

In 1938 March became the central base for West Coast bombing and gunnery training. The bombing training was accomplished at Muroc Dry Lake, now Edwards AFB, California, then a part of March. As the clouds of war formed, action was taken to build up an Air Force capable of defending the nation while its armed strength could be mobilized. Early in 1940, the National Guards from Ventura, California, and Illinois were assigned to March to train in anti-aircraft protection, thus doubling the personnel strength to almost 4,000 officers and enlisted men.

Pursuit planes of the 4th Fighter Command lined the runways of March in October 1940, and March also assisted in testing new ideas and equipment. Highly secret tests were held in 1941 when Ercouple proved that jet-assisted take offs were feasible. In 1942, liquid rockets were used to assist A-20's on take off, thus helping to pave the way for the jet age.

From the "Jennies" of WWI to the formidable KC-135 and KC-10 of today, March has been home for a variety of aircraft, including the B-17, B-24, B-47, B-52, P-38, P-47, F-60 and F-86.

Following the war, March retained its role as an operational fighter base until the Strategic Air Command took over control in 1949. The 22nd Bombardment Wing was assigned from Smokie Hill AFB, Kansas, as the senior host tactical unit. About the same time the Fifteenth Air Force was transferred from Colorado Springs, Colorado, to March.

From the point of the 22nd Bomb Wing's arrival at March, the history of the Wing and the base were intertwined. During the Korean Conflict in the 1950's, when B-29's of the Wing departed for Kadena Air Base, Okinawa, for combat duty, March AFB hosted both the 44th and 330th Bombardment Wings and the 106th Bombardment Wing which later was redesignated the 320th. In November 1952, the 22nd Bomb Wing, back at March, converted from its B-29s to the first jet bomber, the B-47.

Already having established its place in the history of military aviation, March Air Force Base began a new era with the arrival of the Stratofortresses in September 1963. The base received its first KC-135 "Stratotanker" in support of its air refueling mission the following month.

The base played a heavy role in the Southeast Asia conflict in the late 1960s and early 1970s, serving as a staging area for bombers and tanker aircraft enroute to the Pacific.

In early 1976, March AFB turned over a large area in West March to the Veterans Administration to be used as a VA National Cemetery. The site, U.S. National Cemetery Riverside, was officially opened on November 11, 1978. Also in 1976, the first reserve unit to become a part of the Strategic Air Command's tanker force - the 452nd Air Refueling Wing (Reserve), was transferred from Hamilton AFB, California, to March AFB.

The first Air Base established in the West, March has always maintained a progressive and steady growth. Normal growth and expansion surged in 1982-83 when two new units arrived to take their place at March.

In October of 1982, the 163d Tactical Air Support Group of the California Air National Guard began their move from Ontario Airport to March. Currently flying the F-4, the 163d ANG fly approximately 18 "Phantoms" out of the base.

Shortly thereafter, in early 1983, the 26th Air Division's Regional Operational Control Center (ROCC) became operational. The ROCC, under TAC/NORAD, maintains surveillance over the sovereign air space of the Southwestern United States, and serves to defend that air space during periods of national emergency. The ROCC brought approximately 270 additional people to the base.

A summary of the types of aircraft assigned to March AFB and their approximate dates of use are shown below.

o	<u>1917-1930</u>:	JN-4 ("Jenny")	DH-4B
		JN-4D	La Pere
		JN-6H	Spad
		SE-5	Pt-1, -2, -3
		DH-4	

- 1930-1950

1930-1950	B-2	B-19
	B-4	B-24
	B-10	B-29
	P-6	P-80
	P-12	F-80
	A-17	F-86
1950-1960:	B-47	
	KC-97	
1960-1980:	B-52	C-119
	B-52B	C-124
	B-52D	HC-97
	KC-135	HC-130
	EC-135	T-39
1980-Present:	KC-10A	C-130
	HC-130	KC-135
	F-4C	

B. PRIMARY MISSION

The primary mission of the 22nd Air Refueling Wing (ARW) is to develop and maintain a capability of effective air refueling operations. The primary aircraft currently assigned to the 22nd ARW in pursuit of this mission are the KC-135 and the KC-10A Extender fuel tankers. As host unit, the 22nd ARW also supports several tenant units.

C. TENANT MISSION

Several tenant organizations are present at March AFB. The primary tenant units and their missions are briefly described below.

The 22nd Combat Support Group is in charge of providing personnel support for the 22nd Air Refueling Wing.

The USAF Regional Hospital provides comprehensive medical care to military personnel and their dependents at March AFB and referral service to other Air Force bases in Southern California, Arizona, and Nevada.

Headquarters Fifteenth Air Force maintains operational control over major SAC units at bases in 10 states throughout the western half of the U.S., including Alaska.

Fifteenth Air Force Noncommissioned Officer Leadership School is an academy to provide primary education to improve the leadership and management techniques of selected Air Force junior NCO's.

The Fifteenth Air Force Band has a role in promoting good relations between the public and the United States Air Force.

The Headquarters 26th Air Division TAC/NORAD Region is the command and control center for the air defense of more than one million square miles of the southwestern U.S. The 26th Air Division is a member of the Aerospace Defense Tactical Air Command (ADTAC) and is operationally responsible to North American Aerospace Defense Command (NORAD). The function of the 26th Air Division is to maintain surveillance and to defend the sovereign airspace of the southwestern U.S. during periods of national emergency.

The 33rd Communications Group supports the Strategic Air Command and Control System, the SAC telephone net and administrative switchboards, the 15th Air Force radio networks, and the remainder of the primary base communications facilities.

It operates and maintains the VFR control tower, approach radar, and all ground navigational aid facilities at March.

The 163rd Tactical Fighter Group (ANG) is a tenant unit assigned to the Tactical Air Command (TAC) under the 12th Air Force, headquartered at Bergstrom AFB, Texas, and the California Air National Guard (ANG). The 163rd ANG arrived at March AFB in October of 1982 and flies the F-4C "Phantom". Their primary mission is to provide close air support to ground forces utilizing coventional weapons. The 163rd ANG occupies over 70 acres of the base located near the "Pride" hangar (Building 2303).

The 303rd Aerospace Rescue and Recovery Squadron (AFRES) is one of four Reserve rescue squadrons in the U.S. Air Force in charge of long-range, long-endurance search and rescue operations. The HC-130H Hercules is the squadron's assigned aircraft. The unit's primary mission is training.

The 452nd Air Refueling Wing (AFRES) trains Reservists to support SAC's global air refueling mission in case of mobilization. The 452nd ARW originally transferred from Long Beach to March AFB in 1960 as a tactical aircraft wing. The 452nd ARW transferred to Hamilton AFB in 1972, and then returned to March AFB as a refueling wing in 1976.

The Field Training Detachment 507 is in charge of providing all KC-10/KC-135 aircraft systems maintenance training and educational services to personnel of March.

Detachment 7, 9th Weather Squadron provides all weather and forecast services to March AFB.

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Shop Name	Present Location (Bldg No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Waste Management Methods
22nd Civil Engineering Squadron				
Carpenter	2507	X	--	Consumed in Use
Entomology	2502	X	--	Consumed in Use
Equipment	2519	--	--	
Exterior Electric	2508	X	X	DPDO
Extinguisher Repair	1223	--	--	
Golf Course Maintenance	6110	X	--	Consumed in Use
Heating	2507	--	--	
Interior Electric	2507	--	--	
Liquid Fuels Maintenance	385	X	X	Contract Removal
Metal/Welding Shop	2507	--	--	
Pavements	2519	X	--	Consumed In Use
Plumbing	2507	X	--	Consumed In Use
Power Plant	2606	X	X	DPDO, Sanitary Sewer
Power Production	2508	X	X	DPDO, Sanitary Sewer
Protective Coating Shop	2507	X	X	DPDO
Refrigeration	2517	X	X	Site No. 22
Sewage Treatement Plant	5903	X	--	Consumed in Use
Water Treatment Plant	6007	X	--	Consumed in Use
22nd Field Maintenance Squadron				
AGE Repair & Inspection	1221	X	X	DPDO
AGE Servicing	1221	X	X	DPDO
Battery Shop	1201	X	X	Sanitary Sewer (Neutralized)
Corrosion Control	452	X	X	DPDO
Electrical Systems	1201	X	X	DPDO
Engine Conditioning	1203	X	X	DPDO
Environmental Systems	1201	X	X	DPDO
Fuels Systems	1244	X	X	DPDO
Jet Engine Maintenance	1203	X	X	DPDO
Jet Engine Test Cell	1700	X	X	DPDO

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Shop Name	Present Location (Bldg No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Waste Management Methods
22nd Field Maintenance Squadron (continued)				
Machine Shop	453	X	X	DPDO
NDI Shop	1238	X	X	DPDO
Pneudraulics	1203	X	X	DPDO
Repair and Reclamation	1246	X	X	DPDO
Small Gas Engines	1203	X	X	DPDO
Structural Repair	453	X	--	Consumed in Use
Survival Equipment	355	--	--	
Welding Shop	453	--	--	
22nd Organizational Maintenance Squadron				
Non-powered AGE	457	X	X	DPDO
Tanker Maintenance	1214	X	X	DPDO
Tanker Phase	2303	X	X	DPDO
Wash Rack	1242	X	X	DPDO
22nd Avionics Maintenance Squadron				
Autopilot	1211	--	--	
Communications	1211	X	--	Consumed in Use
Inertial Navigation	1211	--	--	
Instrument	1211	--	--	
Radar Navigation	1211	--	--	
Training Devices	2300	X	--	Consumed in Use
22nd Supply Squadron				
Bulk Storage	2202	X	X	DPDO
Distribution (Fuels)	1217	X	X	DPDO
LOX	1254	--	--	
Motor Pool	422	X	--	Consumed in Use
Panero Hydrant	480	X	--	Consumed in Use
Pritchard Hydrant	1245	X	--	Consumed in Use
QC & Inspection	1217	--	--	
Supply Warehouse	2310	--	--	

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Shop Name	Present Location (Bldg No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Waste Management Methods
22nd Combat Support Group				
Arts & Crafts	938	--	--	
Auto Hobby	941	X	X	DPDO
Firing Range	6006	X	--	Consumed in Use
Graphics	2630	X	X	Sanitary Sewer/Dumpster
Photo Laboratory	2630	X	X	Sanitary Sewer (AG Recovery)
Printing Plant	434	X	X	Sanitary Sewer/Dumpster
Wood Hobby	941	--	--	
22nd Transportation Squadron				
Body, Welding, & Paint	429	X	X	DPDO
Battery, Wheel & Tire	429	X	X	Sanitary Sewer (Neutralized)
Fire Truck Maintenance	1224	X	X	DPDO
General/Special Purpose Vehicle Maintenance	429	X	X	DPDO
Packing & Crating	2405	--	--	
Rezfueling Maintenance	1250	X	X	DPDO
USAF Regional Hospital				
Clinical Laboratory	2990	X	X	DPDO, Sanitary Sewer
Dental Laboratory	768	X	--	Consumed in Use
Medical Maintenance and Supply	2990	--	--	
Dental Clinic	768	X	X	DPDO, Sanitary Sewer
Surgery Section	2990	--	--	
Pathology	2990	--	--	
Wards	2990	--	--	
Medical X-Ray & Nuclear Medicine	2990	--	--	

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Shop Name	Present Location (Bldg No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Waste Management Methods
33rd Communications Group				
Cable Maintenance	2620	--	--	
Crypto	2605	--	--	
DDC	2605	X	X	Sanitary Sewer
GCA	1210	--	--	
Inside Plant	2620	--	--	
LCC	2605	--	--	
Outside Plant	2620	--	--	
Radio & TV Repair	1212	--	--	
RCC	470	--	--	
TCC	2605	--	--	
Teletype Maintenance	2630	--	--	
DSTE Shop	2630	--	--	
163rd ANG Consolidated Aircraft Maintenance Squadron				
AGE Maintenance	440	X	X	DPDO
Avionics Maintenance	2315	X	X	DPDO
Egress & Fuel Cell	2272/2309	X	X	DPDO
Environmental & Electrical	2272	X	X	DPDO
Flightline (OMS)	2305	X	X	DPDO
Fuels Systems	2309	X	X	DPDO
Gun Services	2315	X	X	DPDO
Hydraulics/Pneudraulics	2272	X	X	DPDO
Inspection Docks	2305	X	X	DPDO
Jet Engine/Propulsion	458	X	X	DPDO
Munitions Maintenance/Storage	2275	X	X	DPDO
NDI Shop	1238	X	X	DPDO
Weapons Loading/Release	2315	X	X	DPDO
Wheel and Tire	2272	X	X	Sanitary Sewer (Neutralized)

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Shop Name	Present Location (Bldg No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Waste Management Methods
303rd Aerospace Rescue and Recovery Squadron				
AGE Maintenance	440	X	X	DPDO
Avionics Maintenance	2307	X	X	DPDO
Engine & Propulsion	2303	X	X	DPDO
Fabric & Parachute	307	--	--	
Flightline	2307	X	X	DPDO
Fuel Systems & Sheet Metal	2307	X	X	DPDO
Pneudraulics	2307	X	X	DPDO
452nd Consolidated Aircraft Maintenance Squadron				
AGE Maintenance	440	X	X	DPDO
Avionics Maintenance	2303	X	X	DPDO
Corrosion Control	452	X	X	DPDO
Electrical Systems	2303	X	X	DPDO
Environmental Systems	2303	X	X	DPDO
Fuel Cell Repair	2303	X	X	DPDO
NDI Shop	1238	X	X	DPDO
Phase Dock	2306	X	X	DPDO
Pneudraulics	2303	X	X	DPDO
Propulsion & Jet Engine	458	X	X	DPDO
Repair & Reclamation	2303	X	X	DPDO
Sheet Metal	453	--	--	
Survival Equipment	355	--	--	
Welding Shop	453	--	--	

Appendix F

INVENTORY OF EXISTING POL STORAGE TANKS

DATE 05-27-83 THIS LIST IS UNCLASSIFIED

PREPARED: 27 SEP 83 AVIATION FUEL TANKAGE INCLUDING TANK INSPECTIONS FOR TANKS 5000 GALLONS AND OVER

INSTALLATION	TANK FAC-ID-NUM	CAPACITY		TYPE TANK	TYPE ROOF	TYPE CONST	STATUS	PRODUCT	PHYSICAL ENTRY LAST	DUE	CONDITIONS FILTER	COATER	WATER DRAIN	RECOVERY	FLOOR COND	WAIVER DATE
MARCH	02203 01	054300	BBL	BULK	FLOATING	ABOVE	ACTIVE	JP4	0781	0785	YES	YES	YES	YES	SAT	
	02204 02	054000	BBL	BULK	FLOATING	ABOVE	ACTIVE	JP4	0481	0489	YES	YES	YES	YES	SAT	
	02205 01	030000	BBL	BULK	FLOATING	ABOVE	INACT	AVGAS			YES	YES	YES	YES	SAT	
	10003 01	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 02	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 03	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 04	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 05	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 06	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 07	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 08	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 09	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 10	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 11	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 12	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 13	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 14	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 15	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 16	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003 17	050000	GAL	OPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003 18	050000	GAL	OPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				

DATE 09-27-83 THIS LIST IS UNCLASSIFIED

PREPARED: 27 SEP 83

AVIATION FUEL TANKAGE INCLUDING TANK INSPECTIONS FOR TANKS 5000 GALLONS AND OVER

INSTALLATION	FAC-ID-NUM	TANK NUM	CAPACITY		TYPE TANK	TYPE ROOF	TYPE CONST	STATUS	PRO-DUCT	PHYSICAL ENTRY LAST	PHYSICAL ENTRY DUE	CONDITIONS FIL-TER	CONDITIONS COAT-ED	CONDITIONS WATER DRAIN	CONDITIONS REC-OVERY	CONDITIONS FLOOR COND	WAIVER DATE
MARCH	10003	19	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	20	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003	21	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	22	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003	23	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	24	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003	25	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	26	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003	27	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	28	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003	29	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	30	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10003	31	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	32	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	33	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	34	050000	GAL	CPER		BELOW	ACTIVE	JP4	0282	0285	NO	NO				
	10003	41	025000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10006	01	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10006	02	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10006	03	050000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				
	10006	04	052000	GAL	CPER		BELOW	ACTIVE	JP4	0382	0385	NO	NO				

THIS PRODUCT CONTAINS UNCLASSIFIED DATA

09-27-83 THIS LIST IS UNCLASSIFIED

ARED: 27 SEP 83 AVIATION FUEL TANKAGE INCLUDING TANK INSPECTIONS FOR TANKS 5000 GALLONS AND OVER

ALLATION	TANK FAC-ID-NUM	CAPACITY	TYPE TANK	TYPE ROOF	TYPE CONST	STATUS	PRODUCT	****	****	PHYSICAL ENTRY LAST	DUE	FILTER	COATED	WATER DRAIN	RECOVERY	FLOOR COND	WAIVER DATE
H	10806 05	050000 GAL	CFER		EELON	ACTIVE	JF4			0292	0385	NC	NO				
	10806 06	050000 GAL	CFER		EELON	ACTIVE	JF4			0382	0385	NC	NC				

H PYDRCSTATIC PRESSURE TEST DUE 1984

THIS PRODUCT CONTAINS
UNCLASSIFIED DATA

Current as of Jan 83

BASE CE HEATING AND POWER PRODUCTION FUEL TANKS

BLDG #	TANK SIZE	NUMBER OF TANKS	GRADE	PHONE #	WORK ORDER	ORGAN. CODE	SHOP CODE
602	6,000 Gal	1	#2	3195	A01800	900	PW
1311	400 Gal	1	#1	↕	↕	↕	↕
1272	300 Gal	1	#1				
260	15,000 Gal	1	#1				
470	2,000 Gal	1	#1				
1300	300 Gal	1	#1				
1800	300 Gal	1	#1				
2150	300 Gal	1	#1				
1630	435 Gal	1	#1				
2991	5,000 Gal	2	#1				
3008	5,000 Gal	1	#1				
1212	300 Gal	1	#1				
3406	1,000 Gal	1	#1				
5044	2,500 Gal	1	#2				
5901	300 Gal	1	#1				
2622	1,500 Gal	1	#1				
2302 ✓	1,500 Gal	1	#1	3195	A01810	900	PW
ALERT (NO#)	2,500 Gal	1	#2	2937	53-0	909	HV
2990	15,000 Gal	1	#2	↕	A01510	910	↕
340	6,650 Gal	1	#2		A01540	909	
3404	8,000 Gal	1	#2		A01520	↕	
3409	8,000 Gal	1	#2		A00120		
3417-18	6,650 Gal	1	#2		A01250		
1244	8,000 Gal	1	#2		A01430		
5042	4,000 Gal	1	#2		A01950		
5041	200 Gal	1	#2		A01260		
7051	1,000 Gal	1	#2		A07810		
962	10,000 Gal	1	#2		A01420		
2413	2,500 Gal	1	#2		A01810		
2414	1,000 Gal	1	#2		A01920		
5039	700 Gal	1	#2	2937	A01620		HV
2606	10,000 Gal	2	#2	2193	A01270		HC
[illegible]	550 Gal	1	#2	2937	A01350	909	HV

535 1 UNDERGROUND ABANDON - 10,000 GAL - '74
OLD FUEL REMOVED - '80
H2O OIL

3418
3417 - 3,000 OIL '80 ABANDON.
- STILL HOLDING OIL.

Appendix G

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 the USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M 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 CH2M 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 refe ·ed 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.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1). The site rating form is provided on Figure 2 and the rating factor guidelines are provided in Table 1.

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, the potential pathways for waste contaminant migration, and any efforts to contain the contamination. 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 groundwater 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. Scores for sites at which there is no containment are not reduced. 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

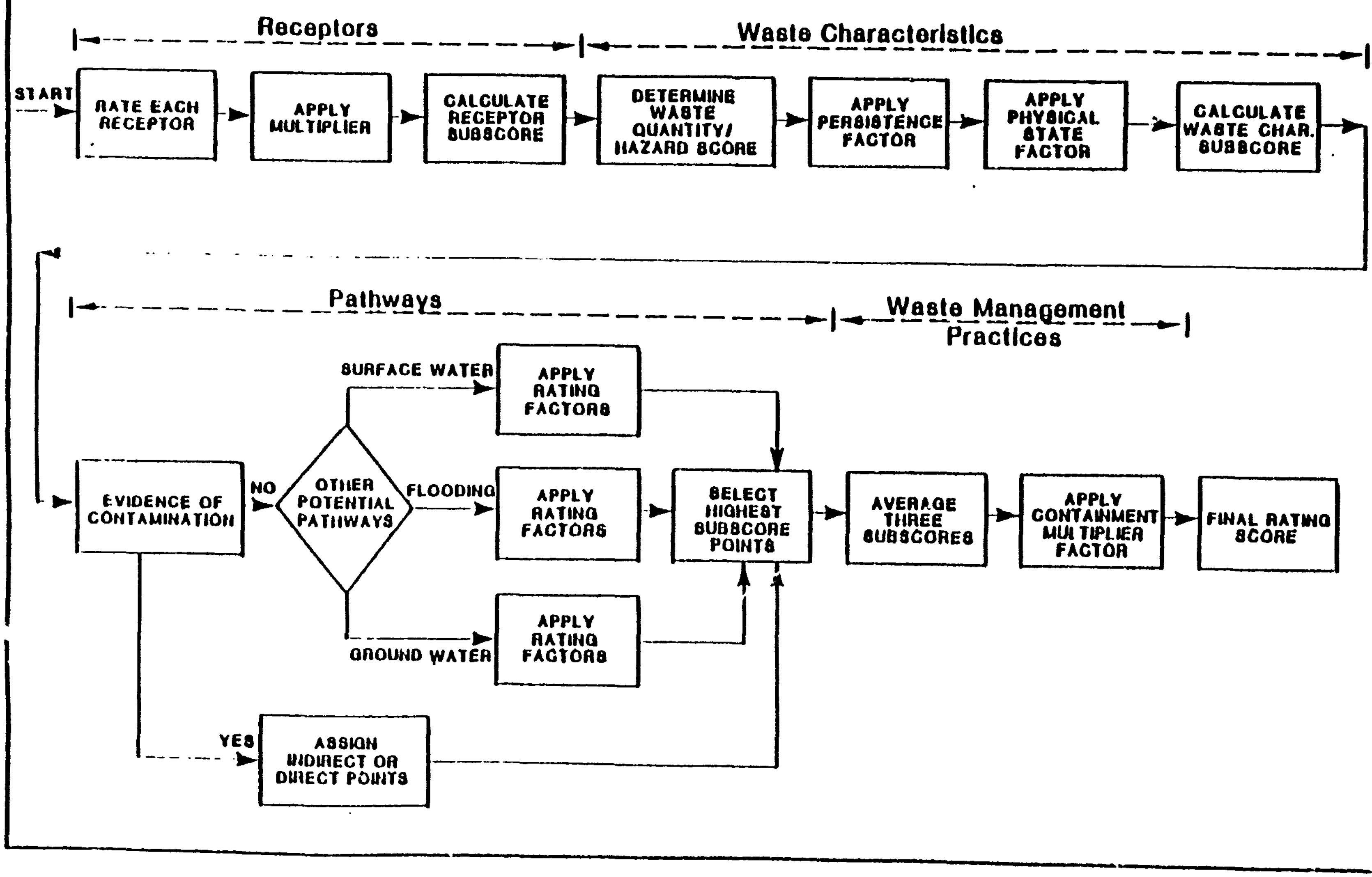


FIGURE 2

HAZARDOUS ASSESSMENT RATING 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 ______ = ______

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) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
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
HAZARDOUS 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	1-15	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

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)	S = Suspected confidence level
o Verbal reports from interviewer (at least 2) or written information from the records	o No verbal reports or conflicting verbal reports and no written information from the records
o Knowledge of types and quantities of wastes generated by shops and other areas on base	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 Factors	Rating Scale Levels 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

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

Multiply Point Rating Persistence Criteria	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

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.

B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
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 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	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-hour rainfall	<1.0 inch	1.0 to 2.0 inches	2.1 to 3.0 inches	>3.0 inches	8

B-2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Ground-Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to + 20 inches	Greater than +20 inches	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

Table 1--Continued

B-3 Potential for Ground-Water Contamination--Continued

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
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 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

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

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- 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

Fire Protection 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-6-3, then leave blank for calculation of factor score and maximum possible score.

Appendix H

SITE RATING FORMS

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 1 - Landfill No. 1

LOCATION: West of existing wastewater treatment plant

DATE OF OPERATION OR OCCURRENCE: 1941 to 1965

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Incinerator Wastes, Rubble

SITE RATED BY: CH2M HILL

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	2	10	20	30
C.	Land use/zoning within 1 mile radius	1	3	3	9
D.	Distance to reservation boundary (adjacent)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	87	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 48

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) M

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 1.0 = 30

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 three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	32	108
Subscore (100 x factor score subtotal/maximum score subtotal)				30
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **30**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	30
Pathways	30
Total 108 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**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 2 - Landfill No. 2

LOCATION: Between Runway #14-32 and Highway 395, south of Van Buren Boulevard

DATE OF OPERATION OR OCCURRENCE: 1942 - 1951

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Old Camp Haan landfill

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary (900')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	89	180

Receptors subscore (100 x factor score subtotal/maximum 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) M

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 1.0 = 30

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **37**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	49
Waste Characteristics	30
Pathways	37
Total 116 divided by 3 =	39 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

39 x 1.0 = **39**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 3 - Landfill No. 3

LOCATION: South of Runway #12-30

DATE OF OPERATION OR OCCURRENCE: Early 1950s to 1960

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Area contains 2 fire training sites, 1 fuel spill site

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (adjacent)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	86	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 48

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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 <u>37</u>

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	100
Pathways	37
Total 185 divided by 3 =	62
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

62 x 1.0 = <u>62</u>

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 4 - Landfill No. 4

LOCATION: Plummer Road

DATE OF OPERATION OR OCCURRENCE: Early 1950s to 1980

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Primary base landfill, continued unauthorized dumping

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary (2000')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	73	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 41

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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	48	108
Subscore (100 x factor score subtotal/maximum score subtotal)				44
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	1	8	8	24
Direct access to groundwater	0	8	0	24
		Subtotals	48	114
Subscore (100 x factor score subtotal/maximum score subtotal)				42

C. Highest pathway subscore

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

Pathways Subscore 44

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	41
Waste Characteristics	100
Pathways	44
Total 185 divided by 3 =	62
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

62 x 1.0 = 62

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 5 - Landfill No. 5

LOCATION: Cactus Avenue

DATE OF OPERATION OR OCCURRENCE: 1954 - 1974

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: General base wastes, continued unauthorized dumping

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary (adjacent)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	89	180

Receptors subscore (100 x factor score subtotal/maximum 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) 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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	48	108
Subscore (100 x factor score subtotal/maximum score subtotal)				44
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	2	8	16	24
Net precipitation	0	6	6	18
Soil permeability	3	8	18	24
Subsurface flows	1	8	8	24
Direct access to groundwater	0	8	0	24
		Subtotals	48	114
Subscore (100 x factor score subtotal/maximum score subtotal)				42

C. Highest pathway subscore

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

Pathways Subscore 44

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	49
Waste Characteristics	100
Pathways	44
Total 193 divided by 3 =	64
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

64 x 1.0 = 64

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 6 - Landfill No. 6

LOCATION: Eastern Perimeter Adjacent to Riding Club

DATE OF OPERATION OR OCCURRENCE: 1955 - 1968

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Deep trenches, general base wastes

SITE RATED BY: CH2M HILL

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 (800')	3	10	30	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (adjacent)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	108	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 60

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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	32	108
Subscore (100 x factor score subtotal/maximum score subtotal)				30
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **30**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	60
Waste Characteristics	100
Pathways	30
Total 190 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**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 7 - Landfill No. 7

LOCATION: Water Treatment Plant

DATE OF OPERATION OR OCCURRENCE: 1958 - 1962, 1963 - 1965

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: General Base Wastes, Demolition Debris

SITE RATED BY: CH2M HILL

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 (2000')	3	10	30	30
C.	Land use/zoning within 1 mile radius	1	3	3	9
D.	Distance to reservation boundary (500')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	97	180

Receptors subscore (100 x factor score subtotal/maximum 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) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) M

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 1.0 x 30

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (200' to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **37**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	30
Pathways	37
Total 121 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**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 8 - Fire Department Training Area No. 1

LOCATION: West of Building 1223

DATE OF OPERATION OR OCCURRENCE: mid-1940's to 1954

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Unconfirmed area visible on aerial photographs

SITE RATED BY: CH2M HILL

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 (4000')	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (3000')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	92	180

Receptors subscore (100 x factor score subtotal/maximum 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) L
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

70 x 1.0 = 70

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

70 x 1.0 x 70

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration Not applicable (pavement cover)				
Distance to nearest surface water		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24
		Subtotals		108
Subscore (100 x factor score subtotal/maximum score subtotal)				--
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 28

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51
Waste Characteristics	70
Pathways	28
Total 149 divided by 3 =	50
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

50 x 1.0 = 50

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 9 - Fire Department Training Area No. 2

LOCATION: Southeast of Runway #12-30

DATE OF OPERATION OR OCCURRENCE: 1954 - 1978

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Burning of all waste POL through 1972

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (500')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	86	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 48

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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (200' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **37**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	100
Pathways	37
Total 185 divided by 3 =	62 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

62 x 1.0 = **62**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 10 - Fire Department Training Area No. 3

LOCATION: Southeast of Runway #12-30

DATE OF OPERATION OR OCCURRENCE: 1978 - Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Recovered JP-4 burning only, lined burn area, unlined sump

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (1200')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	80	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 44

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 x 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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (200' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	5	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	44
Waste Characteristics	48
Pathways	37
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

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 12 - East March Sludge Drying Beds

LOCATION: Vicinity of Bldg. No. 1267 at the south end of parking apron

DATE OF OPERATION OR OCCURRENCE: 1938 - 1977

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Unlined beds contained sludge from former wastewater treatment plant

SITE RATED BY: CH2M HILL

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	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (300')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	94	180

Receptors subscore (100 x factor score subtotal/maximum 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) S
3. Hazard rating (H = high, M = medium, L = low) M

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 x 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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (300' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	52
Waste Characteristics	40
Pathways	37
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

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 13 - West March Sludge Drying Beds

LOCATION: Adjacent to present wastewater treatment plant

DATE OF OPERATION OR OCCURRENCE: 1941 - 1946 and 1955 - Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Unlined beds contain sludge from present wastewater treatment plant

SITE RATED BY: CH2M HILL

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	2	10	20	30
C.	Land use/zoning within 1 mile radius	1	3	3	9
D.	Distance to reservation boundary (300')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	37	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) **48**

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) S
3. Hazard rating (H = high, M = medium, L = low) M

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 x **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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (300' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	40
Pathways	37
Total 125 divided by 3 =	42
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

42 x 1.0 = 42

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 14 - East March Effluent Pond

LOCATION. Southeast of Alert Hangar - off base

DATE OF OPERATION OR OCCURRENCE: 1938 - 1977

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Holding pond for effluent from former wastewater treatment plant

SITE RATED BY: CH2M HILL

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 (2,800')	3	10	30	30
C.	Land use/zoning within 1 mile radius	1	3	3	9
D.	Distance to reservation boundary (off-base)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	97	180

Receptors subscore (100 x factor score subtotal/maximum 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) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) M

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 1.0 x 30

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (600' from drainage ditch)	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	32	108
Subscore (100 x factor score subtotal/maximum score subtotal)				30
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 30

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	30
Pathways	30
Total 114 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

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 15 - Couderas Effluent Pond

LOCATION: Off base - Southeast of West March Wastewater Treatment Plant

DATE OF OPERATION OR OCCURRENCE: 1941 - 1946 and 1955 - Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Holding pond for effluent from current wastewater treatment plant

SITE RATED BY: CH2M HILL

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 (2700')	3	10	30	30
C.	Land use/zoning within 1 mile radius	1	3	3	9
D.	Distance to reservation boundary (off base)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	97	180

Receptors subscore (100 x factor score subtotal/maximum 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) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) M

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 1.0 x 30

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (100' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **37**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	30
Pathways	37
Total 121 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**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 17 - Swimming Pool Fill

LOCATION: On U Street between DeKay and K Streets

DATE OF OPERATION OR OCCURRENCE: 1979 or 1980 (Filled in)

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Possible drum wastes, paint cans, solvents in fill for former pool

SITE RATED BY: CH2M HILL

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 (2000')	3	10	30	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (4000')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	102	180

Receptors subscore (100 x factor score subtotal/maximum 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) M
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

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 1.0 x 50

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration Not applicable (pavement over surface)				
Distance to nearest surface water		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24
		Subtotals		108
Subscore (100 x factor score subtotal/maximum score subtotal)				--
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 30

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	57
Waste Characteristics	50
Pathways	28
Total 135 divided by 3 =	45
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

45 x 0.95 = 43

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 1[illegible] - Aircraft Isolation Area

LOCATION: End of Runway #14-32, North of Taxiway #5

DATE OF OPERATION OR OCCURRENCE: 1961 - 1965 primarily

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Area contains waste fuels and solvents, upgradient of Wells No. 1 and 3

SITE RATED BY: CH2M HILL

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 (2000')	3	10	30	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (3000')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	102	180

Receptors subscore (100 x factor score subtotal/maximum 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) 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 1.0 = 80

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 x 80

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 indirect evidence exists, proceed to B.

Subscore 80

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (400' from drainage ditch)		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24
		Subtotals		108
Subscore (100 x factor score subtotal/maximum score subtotal)				--
2. Flooding		1		3
		Subscore (100 x factor score/3)		--
3. Groundwater migration				
Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24
		Subtotals		114
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 80

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	57
Waste Characteristics	80
Pathways	80
Total 217 divided by 3 =	72
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

72 x 1.0 = 72

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 19 - Liquid Fuels Pump Station Overflow

LOCATION: Building 1245

DATE OF OPERATION OR OCCURRENCE: 1973

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: 1,000 gallon JP-4 Spill

SITE RATED BY: CH2M HILL

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	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (1200')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	88	180

Receptors subscore (100 x factor score subtotal/maximum 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 three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (100' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	0
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	49
Waste Characteristics	48
Pathways	37
Total 134 divided by 3 =	45 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

45 x 1.0 = 45

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 20 - Tank Truck Spill Site

LOCATION: Near Fire Training Area No. 3, Southeast of Flightline

DATE OF OPERATION OR OCCURRENCE: 1973

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: 5,000 gallon JP-4 Spill

SITE RATED BY: CH2M HILL

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (Adjacent)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	95	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 53

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 0.8 = 64

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.0 x 64

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (100' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	53
Waste Characteristics	64
Pathways	37
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 1.0 = 51

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 21 - Bulk Fuels Storage Area

LOCATION: Southwest of Buildings 2203, 2204, and 2205

DATE OF OPERATION OR OCCURRENCE: 1976

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: 10,000 gallon JP-4 Spill

SITE RATED BY: CH2M HILL

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 (2,500')	3	10	30	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (800')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	104	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 58

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 0.8 = 80

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 x 80

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (400' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	58
Waste Characteristics	80
Pathways	37
Total 175 divided by 3 =	58
	Gross Total Sc

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

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 22 - Waste Oil Pit/TCE Tank

LOCATION: Northwest of Present Base Museum (Building 420)

DATE OF OPERATION OR OCCURRENCE: Unknown period prior to 1941; and 1958 to 1972

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Unconfirmed waste oil pit and suspected TCE contamination

SITE RATED BY: CH2M HILL

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 (500')	3	10	30	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (3000')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	102	180

Receptors subscore (100 x factor score subtotal/maximum 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) — L
2. Confidence level (C = confirmed, S = suspected) — S
3. Hazard rating (H = high, M = medium, L = low) — H

Factor Subscore A (from 20 to 100 based on factor score matrix) — 70

B. Apply persistence factor

Factor Subscore A x Persistence Factor = Subscore B

70 x 1.0 = 70

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

70 x 1.0 x **70**

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 indirect evidence exists, proceed to B.

Subscore 80

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration Not Applicable (Pavement Cover)				
Distance to nearest surface water (adjacent to drainage ditch)		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24
		Subtotals		108
Subscore (100 x factor score subtotal/maximum score subtotal)				--
2. Flooding		1		3
Subscore (100 x factor score/3)				--
3. Groundwater migration				
Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24
		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 80

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	57
Waste Characteristics	70
Pathways	80
Total 207 divided by 3 =	69
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

69 x 1.0 = 69

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 23 - Engine Test Cell

LOCATION: South of Taxiway No. 2

DATE OF OPERATION OR OCCURRENCE: 1951 to Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Potential fuels, solvents, and oil spills during testing

SITE RATED BY: CH2M HILL

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 (3,500')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	74	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 41

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) S
3. Hazard rating (H = high, M = medium, L = low) H

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

50x 1.0 = 50

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 x 50

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (400' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	41
Waste Characteristics	50
Pathways	37
Total 128 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

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 24 - Main Oil/Water Separator

LOCATION: South of Flightline Apron

DATE OF OPERATION OR OCCURRENCE: 1974 to Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Receive runoff water from flightline and parking apron zone

SITE RATED BY: CH2M HILL

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 (300')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	84	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 47

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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 = 100

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **37**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	47
Waste Characteristics	100
Pathways	37
Total 184 divided by 3 =	61
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

61 x 1.0 = **61**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 25 - Flightline Drainage Channel

LOCATION: South of Flightline Apron and Shop Area

DATE OF OPERATION OR OCCURRENCE: Prior to 1940 to Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Recieve runoff water from flightline and parking apron zone

SITE RATED BY: Ch2M HILL

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 (adjacent)	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	84	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 47

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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (adjacent to drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	47
Waste Characteristics	100
Pathways	37
Total 184 divided by 3 =	61
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

61 x 1.0 = 61

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 26 - Flightline Shop Zone

LOCATION: Along Flightline

DATE OF OPERATION OR OCCURRENCE: During Lifetime of Base

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Zone generates solvents and spent TCE wastes, fuel spills, waste oils

SITE RATED BY: CH2M HILL

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 (500')	3	10	30	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	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	102	180

Receptors subscore (100 x factor score subtotal/maximum 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) 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 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 x 100

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 indirect evidence exists, proceed to B.				
				Subscore	--
B.	Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
	1. Surface water migration				
	Distance to nearest surface water (800' from drainage ditch)	2	8	16	24
	Net precipitation	0	6	0	18
	Surface erosion	0	8	0	24
	Surface permeability	0	6	0	18
	Rainfall intensity	2	8	16	24
			Subtotals	32	108
	Subscore (100 x factor score subtotal/maximum score subtotal)				30
	2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)			0
	3. Groundwater migration				
	Depth to groundwater	1	8	8	24
	Net precipitation	0	6	0	18
	Soil permeability	3	8	24	24
	Subsurface flows	0	8	0	24
	Direct access to groundwater	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		30

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	57
Waste Characteristics	100
Pathways	30
Total 187 divided by 3 =	62
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

62 x 1.0 = 62

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 27 - Civil Engineering Storage Yard

LOCATION: Vicinity of Building No. 2506

DATE OF OPERATION OR OCCURRENCE: Approximately 1940 to Present

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Storage area for oils, refrigeration fluids, solvents, transformers

SITE RATED BY: CH2M HILL

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 (1,000')	3	10	30	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (800')	3	6	18	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	104	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 58

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 1.0 = 80

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 x 80

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 indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface water migration, flooding, and groundwater migration. Select the highest rating, and proceed to C.				
1. Surface water migration				
Distance to nearest surface water (300' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
	Subscore (100 x factor score/3)			0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	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 **37**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	58
Waste Characteristics	80
Pathways	37
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**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 30 - TCE Disposal Area

LOCATION: East Side of Building 1211

DATE OF OPERATION OR OCCURRENCE: Approximately mid-1950's to mid-1970's

OWNER/OPERATOR: March AFB

COMMENTS/DESCRIPTION: Area potentially received solvents and possibly TCE during periodic dumps and spills

SITE RATED BY: CH2M HILL

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	2	10	20	30
C.	Land use/zoning within 1 mile radius	2	3	6	9
D.	Distance to reservation boundary (1,500')	2	6	12	18
E.	Critical environments within 1 mile radius of site	0	10	0	30
F.	Water quality of nearest surface water body	1	6	6	18
G.	Groundwater use of uppermost aquifer	2	9	18	27
H.	Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by groundwater supply within 3 miles of site	3	6	18	18
			Subtotals	92	180

Receptors subscore (100 x factor score subtotal/maximum 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) S
3. Hazard rating (H = high, M = medium, L = low) H

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 x 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 indirect evidence exists, proceed to B.

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water (100' from drainage ditch)	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	40	108
Subscore (100 x factor score subtotal/maximum score subtotal)				37
2. Flooding	0	1	0	3
		Subscore (100 x factor score/3)		0
3. Groundwater migration				
Depth to groundwater	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to groundwater	0	8	0	114
		Subtotals	32	28
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 37

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51
Waste Characteristics	40
Pathways	37
Total 128 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

Appendix I

GLOSSARY OF TERMS

Appendix I
GLOSSARY OF TERMS

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semisorted sediment in the bed of the stream or on its flood plain or delta, or as a code or fan at the base of a mountain slope; especially such a deposit of fine-grained texture deposited during time of flood.

AQUA SYSTEM - A type of refueling system relying on the operating principle of fuel displacement by water addition to a confined tank.

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater to yield economically significant quantities of groundwater to wells and springs.

BOWSER - A small mobile tank used to recover and transport POL products.

CONFINING STRATA - A strata of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

CONTAMINANT - As defined by section 104(a)(2) of CERCLA, shall include, but not be limited to, any element, substance, compound, or mixture, including disease causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformation, in such organisms or their offspring.

DOWNGRADIENT - A direction that is hydraulically down slope. The downgradient direction can be determined through a potentiometric survey or through the evaluation of existing water level elevations referenced to a common datum (mean sea level).

EP TOXICITY - A laboratory test designed to identify if solid waste is hazardous. A liquid extract from the solid waste is analyzed for selected metals and pesticides. If one or more of the parameters tested for is present in concentration greater than a maximum value then the solid waste is considered a hazardous waste in accordance with RCRA definition.

EVAPOTRANSPIRATION - Evaporation from the ground surface and transpiration through vegetation.

FRACTURES - As a mineral characteristic, the way in which a mineral breaks when it does not have cleavage. May be conchoidal (shell-shaped), fibrous, hackly, or uneven.

GROUNDWATER - All subsurface water, especially that part that is in the zone of saturation.

HAZARDOUS WASTE (expanded version of the RCRA definition) - A solid waste which because of its quantity, concentration, or physical, chemical or infectious characteristics may -

(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible, illness; or

(B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.

INDURATED - Pertaining to a compact rock or soil hardened by the action of pressure, cementation, and especially heat.

JOINTS - A break in a rock mass where there has been no relative movement of rock on opposite sides of the break.

LEACHING - The separation or dissolving out of soluble constituents from a rock or ore body by percolation of water.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal and moderate proportions of clay, silt, and sand particles, and usually containing organic matter (humus) with a minor amount of gravelly material.

METAMORPHOSED (METAMORPHIC) - Pertaining to the process of mineralogical and structural adjustment of solid rocks to physical and chemical conditions which have been imposed at depth below the surface zones of weathering and cementation, and which differ from the conditions under which the rocks in question originated.

MIGRATION (Contaminant) - The movement of contaminants through pathways (groundwater, surface water, soil, and air).

NET PRECIPITATION - Mean annual precipitation minus mean annual evapotranspiration. Evapotranspiration is sometimes estimated by pan evaporation measurements.

PD-680 (Type I and Type II) - A military specification for aliphatic petroleum distillate used as a safety cleaning solvent. The primary difference between PD-680 Type I and Type II is the flash point of the material. The flash points are 100°F and 140°F for PD-680 Types I and II, respectively. Currently, only Type II is authorized for use at Air Force installations.

PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

POTENTIOMETRIC SURFACE - An imaginary surface that represents the static head of groundwater and is defined by the level to which water will rise in a cased well.

SOIL HORIZONS -

(A) A-Horizon - The uppermost mineral horizon of a soil; zone of leaching.

(B) B-Horizon - Occurs below the A-Horizon; the mineral horizon of a soil or the zone of accumulation.

(C) C-Horizon - Occurs below the B-Horizon; a mineral horizon of a soil consisting of unconsolidated rock material that is transitional in nature between the parent material below and the more developed horizons above.

STRATA - Plural of stratum.

STRATUM - A single and distinct layer, of homogeneous or gradational sedimentary material (consolidated rock or unconsolidated earth) of any thickness, visually separable from other layers above and below by a discrete change in the character of the material deposited or by a sharp physical break in deposition, or by both.

STRINGERS - Thin sedimentary bed.

UNSATURATED ZONE (Vadose Zone or Zone of Aeration) - A subsurface zone containing water under pressure less than that of the atmosphere, including water held by capillarity; and containing air or gases generally under atmospheric pressure. This zone is limited above by the land surface and below by the surface of the zone of saturation.

UPGRADIENT - A direction that is hydraulically up slope. The upgradient direction can be determined through a potentiometric survey or through the evaluation of existing water level elevations referenced to a common datum (mean sea level).

WATER TABLE - The upper limit of the portion of the ground completely saturated with water.

Appendix J

LIST OF ACRONYNS, ABBREVIATIONS, AND SYMBOLS USED IN THE TEXT

Appendix J
LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS USED IN THE TEXT

AFB	Air Force Base
AFESC	Air Force Engineering and Services Center
AFRES	Air Force Reserves
AG	Aboveground
AGE	Aerospace Ground Equipment
AMS	Avionics Maintenance Squadron
ANG	Air National Guard
ARRS	Aerospace Rescue and Recovery Squadron
ARW	Air Refueling Wing
AVGAS	Aviation Gasoline
Bldg.	Building
bls	Below Land Surface
BOD_5	Biochemical Oxygen Demand (5-day)
BX	Base Exchange
°C	Degrees Celsius (Centigrade)
CAMS	Consolidated Aircraft Maintenance Squadron
CE	Civil Engineering
CES	Civil Engineering Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
cm/sec	Centimeters per Second
COD	Chemical Oxygen Demand
CSG	Combat Support Group
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DLA	Defense Logistics Agency
DoD	Department of Defense
DPDO	Defense Property Disposal Office
DWR	Department of Water Resources (California)
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
FAA	Federal Aviation Administration

FMS	Field Maintenance Squadron
ft	Foot (Feet)
ft/min	Feet per Minute
gal/yr	Gallons per Year
gm/kg	Grams per Kilogram
gpd	Gallons per Day
gpm	Gallons per Minute
GSA	General Services Administration
HARM	Hazard Assessment Rating Methodology
IRP	Installation Restoration Program
JP	Jet Petroleum
lb	Pounds
lb/yr	Pounds per Year
MAJCOM	Major Command
MEK	Methly Ethyl Ketone
mg/l	Milligrams per Liter
mgd	Million Gallons per Day
MIBK	Methyl Isobutyl Ketone
mo.	Month
MOGAS	Motor Gasoline
mph	Miles per Hour
msl	Mean Sea Level
NDI	Non-Destructive Inspection
No.	Number
NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
OMS	Organizational Maintenance Squadron
PCBs	Polychlorinated Biphenyls
PD-680	Petroleum Distillate (Safety Solvent)
POL	Petroleum, Oil, and Lubricants
ppb	Parts per Billion
ppm	Parts per Million
RCRA	Resource Conservation and Recovery Act
SAC	Strategic Air Command
SCS	Soil Conservation Service
TCE	Trichloroethylene

TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TRANS	Transportation Squadron
TSS	Total Suspended Solids
TTHMs	Total Trihalomethanes
UG	Underground
USAF	United States Air Force
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOC	Volatile Organic Compound
$\mu g/l$	Micrograms per Liter

Appendix K

REFERENCES

Appendix K
REFERENCES

1. California Department of Water Resources, Southern District. Groundwater Quality in Menifee, Winchester, and South Perris Subareas. District Report. March 1979.

2. California Department of Water Resources. Investigation of Ground Water Conditions in the San Jacinto River Valley. Preliminary Level Report. July 1969

3. California Department of Water Resources. Santa Ana River Investigation. Bulletin No. 15. April 1956.

4. California Department of Water Resources. Upper Santa Ana River Drainage Area Land Use and Water Use Survey, 1964. Bulletin No. 71-64. July 1966.

5. California Department of Water Resources. Water Level Map for Spring 1970.

6. California Department of Water Resources. Water Wells Drillers' Reports.

7. California Department of Water Resources, Southern District. Water Resources Evaluation of the San Jacinto Area. District Report. April 1978.

8. California Division of Mines and Geology. Santa Ana Geologic Map Sheet. 1966. Scale 1:250,000.

9. Correspondence (November 2, 1982) from USAFRH/SGPB to 22CES/DE. Subject: Sampling for Radium-226 and Radium-228, Total Trichrolomethane and TCE, and Attachments 4 and 5.

10. Eastern Municipal Water District. Water Analyses. Hemet, California.

11. Inland Foundation Engineering, Inc., Consulting Soil Engineers, Hemet, California. Preliminary Soil Investigation, Sunnymead Feeder, Sunnymead Area, Riverside County, California. October 28, 1980.

12. Jahns, R. H. Geology of Southern California. California Division of Mines. Bulletin No. 170. 1964.

13. March Air Force Base. Department of the Air Force. Environmental Narrative, Riverside, California. December 15, 1975, revised April 25, 1977. (Tab A-1)

14. March Air Force Base, Department of the Air Force. Map of the Comprehensive Plan, Water Supply System. September 30, 1967, last revised September 30, 1982. Sheet No. 1. (Tab G-1)

15. March Air Force Base, Department of the Air Force. Chemical and Bacteriological Analysis of Water. Collection date January 27, 1969. (Wells No. 1, 3-6; plant effluent, Lake Mathews.)

16. March Air Force Base, Department of the Air Force. Map of Soil Borings Plan and Location of USGS Monuments. September 30, 1967, last revised September 30, 1982. (Tab C-6)

17. March Air Force Base, Department of the Air Force. Base Plan-Small Scale. September 30, 1967, revised September 30, 1982. (Tab C-2)

18. March Air Force Base, Department of the Air Force. Map of Buried Rubble" September 30, 1967, last revised September 30, 1982. (Tab C-7)

19. March Air Force Base, Department of the Air Force. March AFB, SAC, Real Property Study. April 6, 1983; and USAF Real Property Inventory Detail List. October 19, 1983.

20. March Air Force Base, Department of the Air Force. Environmental Protection Brochure. Volumes 1 and 2. (No Date).

21. March Air Force Base, Department of the Air Force. Welcoming Guide (June 1983).

22. March Air Force Base, Department of the Air Force. AWS Climatic Brief, March AFB, CAlifornia. June 1979.

23. March Air Force Base, Department of the Air Force. Various shop files,environmental sampling data,and hazardous waste inventory from the Office of Bioenvironmental Engineering.

24. March Air Force Base, Department of the Air Force. Various hazardous waste manifests and correspondence, fuel spill notifications, chemical and hazardous waste inventories, water supply and wastewater effluent sampling reports and correspondence,and other related documents per the Pre-Performance Meeting Minutes from the Office of the 22nd Civil Engineering Squadron.

25. Office of the Historian, Headquarters 15th Air Force, March Air Force Base. The March Field story, 60th Anniversary 1918-1978.

26. Riverside County Flood Control and Water Conservation District. Well Records.

27. Soil Conservation Service. Soils of Western Riverside County.

28. State Water Resources Control Board and Regional Water Quality Control Board, Santa Ana Region. Water Quality Control Plan Report, Santa Ana River Basin. Part I, Vol. I, and Part II, Vol. I and II. April 1975.