AD-A123 927 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR MATHER AIR FORCE BASE CALIFORNIA(U) CH2M HILL GAINESVILLE FL JUN 82 F08637-80-G-0010 1/4

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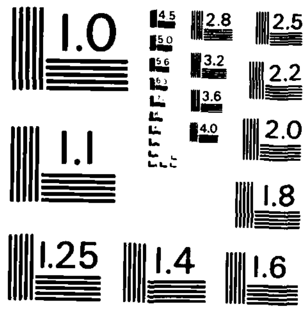
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INSTALLATION RESTORATION PROGRAM RECORDS SEARCH

For
Mather Air Force Base, California

CH2M HILL

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
TYNDALL AIR FORCE BASE, FLORIDA 32403
AND
AIR TRAINING COMMAND
RANDOLPH AIR FORCE BASE, TEXAS 78150

JUNE 1982

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, or the Department of Defense.

DISCLAIMER NOTICE

INSTALLATION RESTORATION
PROGRAM RECORDS SEARCH

For

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RANDOLPH AIR FORCE BASE, TEXAS 78150

By

CH2M HILL
Gainesville, Florida

June 1982

Contract No. F0863780 G0010 0013

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FOREWORD

FOREWORD

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Section II--Installation Description (base conditions, history, and organization).

Section III--Environmental Setting (meteorology, geology, hydrology, and ecology).

Section IV--Findings (activities, disposal site descriptions and assessments).

Section V--Conclusions

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LIST OF ACRONYMS, ABBREVIATIONS,
AND SYMBOLS USED IN THE TEXT

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS USED IN THE TEXT

AASF	Army Aviation Support Facility
ABG	Air Base Group
AC&W	Air Command and Warning
AFB	Air Force Base
AFESC	Air Force Engineering and Services Center
AGE	Aerospace Ground Equipment
AMS	Avionics Maintenance Squadron
ATC	Air Training Command
AVGAS	Aviation Gasoline
Bldg.	Building
bls	Below Land Surface
CE	Civil Engineering
CES	Civil Engineering Squadron
CESF	Civil Engineering Storage Facility
cm/s	Centimeters per Second
DCE	Trans-1,2-Dichloroethylene
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DPDO	Defense Property Disposal Office
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
FAA	Federal Aviation Administration
Fire Trng.	Fire Department Training
FMS	Field Maintenance Squadron
ft/day	Feet per Day
ft/ft	Feet per Foot
FTW	Flying Training Wing
ft/min	Feet per Minute
gal/mo	Gallons per Month
gal/yr	Gallons per Year
gpd	Gallons per Day
gpm	Gallons per Minute
IRP	Installation Restoration Program

JP	Jet Petroleum
lb/yr	Pounds per Year
Max.	Maximum
MEK	Methyl Ethyl Ketone
mg/l	Milligrams per Liter
mgd	Million Gallons per Day
Min.	Minimum
MMS	Munitions Maintenance Squadron
mo.	Month
MOGAS	Motor Gasoline
mph	Miles per Hour
msl	Mean Sea Level
ND	None Detected
NE	Northeast
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
POL	Petroleum, Oil, and Lubricants
ppb	Parts per billion
RCRA	Resource Conservation and Recovery Act
SAC	Strategic Air Command
TCE	Trichloroethylene
USAF	United States Air Force
μCi/ml	Microcurie per milliliter
μg/kg	Microgram per kilogram

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

A. INTRODUCTION

1. CH2M HILL was retained by the Air Force Engineering and Services Center (AFESC) on January 20, 1982, to conduct the Mather Air Force Base (AFB) records search under Contract No. F0863780 G0010 0013 with funds provided by the Air Training Command.

2. Department of Defense (DoD) policy was directed by Defense Environmental Quality Program Policy Memorandum 81-5 dated 11 December 1981 and implemented by Air Force message dated 21 January 1982 as a positive action to ensure compliance of Air Force installations with existing environmental regulations. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. The purpose of DoD policy 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 follow-on field work as determined from Phase I. Phase IIa consists of a preliminary survey to confirm or rule out the presence and/or migration of contaminants. If the Phase IIa work confirms the

presence and/or migration of contaminants, then Phase IIb field work would be conducted to determine the extent and magnitude of the contaminant migration. Phase III (not part of this contract) consists of a technology base development study 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 Mather AFB records search included a detailed review of pertinent installation records, contacts with 11 government agencies for documents relevant to the records search effort, and an onsite base visit conducted by CH2M HILL during the week of March 1 through March 5, 1982. Activities conducted during the onsite base visit included interviews with past and present base employees, ground tours of base facilities, and a helicopter overflight to identify past disposal areas.

B. MAJOR FINDINGS

1. The major industrial operations at Mather AFB involving hazardous chemicals and wastes have been in existence since 1941 and were expanded in 1959 with the construction of the Strategic Air Command (SAC) area. Major industrial operations include vehicle maintenance, plating and cleaning, aircraft maintenance and corrosion control, pneudraulics repair, AGE and non-powered AGE inspection and repair, and special weapons maintenance. These industrial operations generate varying quantities of waste oils, fuels, solvents, and cleaners. Trichloroethylene (TCE) was a

common solvent used in the past (1958-1974) for degreasing operations at the rate of about 80 drums per year. Waste TCE was generally mixed with other waste oils and solvents. The standard procedure for disposition of the majority of waste oils and solvents in the past has been: fire department training exercises and base landfills (1918-1922 and 1930-1932); fire department training exercises, base landfills and disposal sites, and salvage (1941-1970); salvage and fire department training exercises (1970-1974); salvage (1974-1981); and segregation with contractor salvage or disposal through the Defense Property Disposal Office (1981-present).

2. Interviews with past and present base employees resulted in the identification of 23 past disposal or spill sites at Mather AFB and the approximate dates that these sites were used (see Figure 24 for site locations).

3. Sampling of base wells since August 1979 by the bioenvironmental engineering staff has shown significant TCE contamination of the Air Command and Warning (AC&W) well and periodic, low-level TCE contamination of the K-9 well, the jet engine test cell well, the main base wells, and some of the family housing wells. Recent sampling of wells located west of the base by regulatory agencies shows low-level TCE contamination in some of the wells.

C. CONCLUSIONS

1. Water quality analyses of base wells and wells west of the base provide evidence that low levels

of TCE are present in the ground water beneath Mather AFB and the nearby off-base areas.

2. Twenty sites on base have been identified as having a potential for contaminant migration. In addition, two off-base industrial areas have been identified which may possibly be contributing to TCE in the ground water beneath Mather AFB.

3. Table 8, page V-3 presents a listing of the rated sites and their overall scores. The following sites are the high priority sites:

   a. The AC&W Disposal Site (Site No. 12)--This site was reportedly used in the past for disposal of TCE and transformer oil and is suspected to have contaminated the nearby AC&W well with TCE. The site is also a possible source of the low-level TCE contamination which has appeared periodically in some of the family housing wells.

   b. The "7100" Area Disposal Site (Site No. 7)--This site was commonly used in the past for disposal of waste oils and solvents from the main base shop areas and is a possible source of the low-level TCE contamination which has appeared periodically in the jet engine test cell well and in wells located west of the base.

   c. Drainage Ditch Site No. 3 (Site No. 15)--This site was subject to frequent waste oil and solvent spills in the past and is a possible source of the low-level TCE contamination in wells located west of the base.

d. Lower priority sites include the following:

- Drainage Ditch Sites No. 1 and 2 (Sites No. 13 and 14)
- The NE Perimeter Landfills No. 1 and 2 (Sites No. 3 and 4)
- The Weapons Storage Area Septic Tank (Site No. 17)
- The Firing Range Landfill Sites (Site No. 6)
- The Sanitary Sewer System east of Eknes Street (Site No. 23)

4. Areas of concern, other than disposal sites, are as follows:

a. Main base well No. 1 has never been sampled because of well pump problems. It is possible that contamination is also present in this well.

b. The base sewage treatment plant discharges to Morrison Creek. Any hazardous contaminants in the treated effluent, if present, would then migrate off-base by this surface-water pathway.

D. RECOMMENDATIONS

1. A major monitoring effort (Phase II of the Installation Restoration Program) should be implemented to pinpoint the source(s) and the extent of the TCE ground-water contamination. The

monitoring effort should be a phased approach, with initial monitoring and data collection at the highest priority sites. After the initial program, a determination should be made of the need for and extent of additional monitoring. The priority for monitoring at Mather AFB is considered high due in part to the State of California action level of 4.5 ppb for TCE.

2. Specifically, initial monitoring is recommended for the west ditch area, the "7100" area disposal site, the AC&W area, the northeast and east perimeters of the base, the sewage treatment plant, and Morrison Creek. Further details are provided in Section VI "Recommendations."

3. It is not the intent of Phase I to assess the exact depth or location of any ground-water monitoring wells, but to provide guidance to the Phase II contractor. The final details of the initial Phase II monitoring program outlined above, including sampling locations, sampling methodology, analyses required, sampling frequency, and monitoring well construction methods should be developed by OEHL.

4. The ATC Surgeon is responsible for recommending Phase II actions and for evaluating the results of the program.

I. INTRODUCTION

I. INTRODUCTION

A. BACKGROUND

The purpose of the Installation Restoration Program (IRP) is to identify, report, and correct environmental deficiencies from past disposal practices that could result in ground-water contamination and probable migration of contaminants beyond Department of Defense (DoD) installation boundaries. To implement the IRP, the DoD issued Defense Environmental Quality Program Policy Memorandum 81-5 (DEQPPM 81-5) on 11 December 1981, which was implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program.

To conduct the Installation Restoration Program records search for Mather AFB, the AFESC retained CH2M HILL with funds provided by Air Training Command (ATC) on January 20, 1982 under Contract No. FO863780 G0010 0013.

The records search comprises Phase I of the DoD Installation Restoration Program and is intended to review installation records to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration from the installation. Phase II (not part of this contract) consists of follow-on field work as determined from Phase I. Phase IIa consists of a preliminary survey to confirm or rule out the presence and/or migration of contaminants. If the Phase IIa work confirms the presence and/or migration of contaminants, then Phase IIb field work would be conducted to determine the extent and magnitude of the contaminant migration. Phase III (not part of this contract) consists of a technology base development study 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.

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 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

DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health or welfare that may have resulted from these past operations. The existence and potential for migration of hazardous material contaminants was evaluated at Mather AFB by reviewing the existing information and conducting an analysis of installation records. Pertinent information includes the history of operations, the geological and hydrogeological conditions which may contribute to the migration of contaminants and the ecological settings which indicate environmentally sensitive habitats or evidence of environmental stress.

D. SCOPE

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

The pre-performance meeting was held at Mather AFB, California, on January 19, 1982. Attendees at this meeting included representatives of AFESC, USAF OEHL, Air Training Command, Mather 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 Mather AFB records search.

A CH2M HILL representative conducted a preliminary visit to Mather AFB on February 17 and 18, 1982 to become familiar with the installation and to prepare for the records search team base visit.

The onsite base visit was conducted by CH2M HILL from March 1 through March 5, 1982. Activities performed during the onsite visit included a detailed search of installation records, ground and aerial tours of the installation, and interviews with 35 past and present base personnel. At the conclusion of the onsite base visit, the base Environmental Coordinator was briefed on the preliminary findings. The following individuals comprised the CH2M HILL records search team:

1. Mr. Norman Hatch, Project Manager (M.S. Chemistry, 1972; M.S. Environmental Engineering, 1973)

2. Mr. Greg McIntyre, Assistant Project Manager (M.S. Environmental and Water Resources Engineering, 1981)

3. Mr. Gary Eichler, Hydrogeologist (M.S. Engineering Geology, 1974)

4. Mr. Brian Winchester, Ecologist (B.S. Wildlife Ecology, 1973)

Resumes of these team members are included in Appendix A. Eleven government agencies were contacted for information and relevant documents. Appendix B lists the agencies contacted.

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

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

2. Major Gary Fishburn, USAF OEHL, Program Manager, Phase II

3. Mr. Ed Cullins, ATC, Command Representative

4. Mr. Jerry Oberhelman, Mather AFB, Environmental Coordinator

5. Capt. Ronald Hergenrader, Mather AFB, Chief of Bioenvironmental Engineering Services

E. METHODOLOGY

The methodology utilized in the Mather AFB records search is shown graphically on Figure 1. First, a review of past and present industrial operations is conducted at the base. Information is 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 base. The information obtained from interviewees was based upon their best recollection of past activities. A list of 35 interviewees from Mather AFB, with areas of knowledge and years at the installation, is given in Appendix C.

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

An aerial overflight and a general ground tour of identified sites is 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 surface-water bodies. These water bodies are inspected for any evidence of contamination or leachate migration.

A decision is then made, based on all of the above information, as to whether a potential exists for hazardous material contamination from any of the identified sites. If not, the site is deleted from further consideration. If minor operations and maintenance deficiencies are noted during the investigations, the condition is reported to the Base Environmental Coordinator for remedial action.

For those sites at which potential contamination is identified, the potential for migration of this contamination is evaluated by considering site-specific soil and ground-water conditions. If there is potential for on-base contaminant migration or other environmental concerns, the site is referred to the Base Environmental Coordinator for further action. If no further environmental concerns are identified, the site is deleted from consideration. If the potential for contaminant migration is considered significant, then the site is rated and prioritized using the site rating methodology described in Appendix I, "Hazard Assessment Rating Methodology."

The site rating indicates the relative potential for environmental impact at each site. For those sites showing a significant potential, recommendations are made to quantify the potential contaminant migration problem under Phase II of the Installation Restoration Program. For those sites showing a low potential, no Phase II work would be recommended.

II. INSTALLATION DESCRIPTION

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A. LOCATION

Mather AFB is located on 5,798 acres of land approximately 12 miles east of downtown Sacramento, California. The base is situated approximately midway between San Francisco and Lake Tahoe and is directly adjacent to the community of Rancho Cordova. The location map of Mather AFB is shown on Figure 2.

B. ORGANIZATION AND MISSION

The construction and activation of Mather AFB began in March 1918. After a few years as a flight training school, the base was inactivated in June 1922. The base was reactivated for a short period between March 1930 and November 1932 but was not involved in continuous military action again until World War II. The base was reactivated in 1941 and was rebuilt as a school for pilot and navigator training. Mather AFB officially resumed its training mission in December 1945, becoming the first school for navigator-bombardiers.

An important milestone in Mather's history was established in 1958 when the Strategic Air Command (SAC) assigned the 4134th Strategic Wing to Mather as a tenant organization. In February 1963 the 320th Bombardment Wing was activated and replaced the 4134th Strategic Wing. In April 1973, the 323rd Flying Training Wing was activated and assumed the navigator training mission, replacing the 3535th Navigator Training Wing. The change in organization marked the beginning of significant changes in the concept of undergraduate navigator training.

In July 1976, undergraduate navigator training for the U.S. Navy and U.S. Coast Guard, and support of the Marine Aerial Navigation School was assumed by the 323rd Flying Training Wing, which became the only navigation training wing to provide undergraduate and advanced training to all services under the Department of Defense.

The 323rd Flying Training Wing of the Air Training Command remains the current host unit. The primary mission is to "qualify non-rated officers as navigators; and provide the navigator with the technical training, experience, guidance and motivation required to operate the advanced navigation, bombing, missile, and electronic warfare systems used by the United States Armed Forces." There are 44 aircraft currently assigned to the training program. These include 31 T-37B aircraft and 13 T-43A aircraft. The total DoD work force on Mather AFB numbers 6,724, of whom 3,240 are military airmen; 1,641 are military officers; and 1,843 are civilians.

The major tenants at Mather AFB are listed below:

- 320th Bombardment Wing (SAC)
- Detachment 7, 24th Weather Squadron
- 2034th Communications Squadron
- 3506th USAF Recruiting Group
- Detachment 515, 3751st Field Training Squadron
- AFOSI Detachment 1904
- Detachment 3, 3314th Management Engineering Squadron
- Detachment 448, Area Audit Office
- USAF Civil Air Patrol Pacific Liaison Region
- Army Aviation Support Facility
- USAF Judiciary Area Defense Counsel
- 940th Air Refueling Group

-- Federal Aviation Administration

-- Air Force Commissary Services

A more detailed description of the base history and its mission is included in Appendix D.

III ENVIRONMENTAL SETTING

III. ENVIRONMENTAL SETTING

A. METEOROLOGY

Mather AFB and the surrounding Sacramento Valley have a Mediterranean-subtropical type of climate characterized by hot, dry summers and cool, moist winters. Average temperatures of the area range from the mid-40's during winter months to the mid-70's during the summer, with an average annual temperature of approximately 60°F. Maximum daily summer temperatures frequently reach 90°F and regularly surpass 100°F, while minimum winter temperatures seldom drop below 20°F. Summer temperatures may vary from 25°F to 40°F per day, with less variation usually occurring during winter months.

Most of the precipitation falls during winter and spring months, with over one-half of the total annual rainfall occurring during December, January, and February. Of an average annual rainfall of approximately 17.9 inches, 15.7 inches is usually recorded for November through April and 2.2 inches for May through October. Snowfall is rare. The mean annual evapotranspiration rate for the Sacramento area is approximately 45 inches/year. The net precipitation for the Mather AFB area (mean annual precipitation minus mean annual evapotranspiration) is approximately -27.1 inches per year, which provides a low driving force for contaminant migration.

A summary of meteorological data is presented in Table 1.

B. GEOLOGY

Mather AFB is located in the Great Valley Physiographic Province of central California (see Figure 3). The Great

Table 1
METEOROLOGICAL DATA FOR MATHER AIR FORCE BASE

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Ann.
Temperature (°F)													
Record High	72	76	84	92	102	111	112	110	111	101	85	72	112
Record Low	21	25	25	34	38	41	49	50	44	31	27	21	21
Normal Maximum	53	59	64	70	78	86	93	91	87	76	63	53	73
Normal Minimum	38	42	43	47	52	57	60	60	58	51	44	39	49
Precipitation (inches)													
Mean Total	3.4	2.7	2.5	1.7	0.5	0.2	0.1	0.1	0.2	1.1	2.4	3.0	17.9
Maximum in 24 Hours	2.6	3.0	1.9	4.3	1.1	0.8	1.3	1.0	1.9	4.4	2.6	2.2	4.4
Wind													
Mean Velocity (MPH)	6	6	7	6	7	7	7	7	6	5	5	5	6
Prevailing Direction	SSE	SSE	S	S	S	S	SSW	S	S	S	SSE	SSE	S

Source: Detachment 7, 24th Weather Squadron
Period of Observation: 9/41 - 1/46, 6/46 - 3/81

Valley extends from Red Bluff in the north, to Bakersfield, which is located approximately 400 miles to the south. The valley averages 40 miles in width. The Sacramento and the San Joaquin River Valleys together form the Great Valley Physiographic Province. The Sacramento Valley is further subdivided into the American Basin, the Yolo Basin, and alluvial plains of the Sacramento River. Mather AFB is located approximately 1 mile south of the American River in the American Basin.

The American and Yolo Basins are referred to as flood basins where overflow waters have deposited generally fine-grained materials in the past. The alluvial plains border the river channel and flood basins and extend almost to the valley boundaries. The valley is surrounded by low hills and terraces dissected by a number of stream channels. Some of the hills such as the Dunnigan, Rumsey, English, and Montezuma Hills attain elevations of 65 to 1,640 feet above the valley floor.

The principal physiographic features of the valley are the river channels, flood plains, alluvial plains and fans, and river flood plains. The American and the Yolo Basins occupy lands adjacent to the Sacramento flood plains in the vicinity of Mather AFB. These basins are broad, shallow troughs which lie between the natural levees and low alluvial plains and fans on both sides of the valley. These basins are typified by flat, poorly drained land which received flood waters in the past as the natural levees were overtopped. Sediments deposited in these basins are the fine-grained portion of the suspended load; the soils are heavy-textured clay and adobe (alluvial silt or clay used to make sun-dried bricks) types.

The topography at Mather AFB is typical of a relatively flat alluvial plain. As seen on Figure 4, elevations range from 170 feet above mean sea level (msl) on the east side of the base to approximately 70 feet above msl on the west side. The plain is dissected by tributaries of the Sacramento and American Rivers. Morrison Creek is the most prominent natural drainage feature at Mather AFB. This creek traverses the base from northeast to southwest and discharges to the Sacramento River. The east boundary of the base is bordered by the Folsom Canal, a man-made concrete-lined aqueduct which transmits water from Nimbus Dam to the Rancho Seco nuclear power plant. The natural drainage patterns at Mather AFB have been modified by construction of a series of storm drains.

Soil associations at Mather AFB consist mostly of gravelly or sandy loam to a depth of approximately 5 feet. Specific soil types and their occurrence at Mather AFB are illustrated on Figure 5. These soil associations include:

- Bear Creek gravelly loam
- Corning gravelly loam, undulating
- Perkins gravelly loam
- Redding gravelly loam
- San Joaquin loam, deep undulating
- San Joaquin loam, undulating

Although all of the above-listed soil associations occur in the Mather AFB area, most of the base itself is mantled by Corning gravelly loam, undulating Perkins gravelly loam, or Redding gravelly loam. These three soil types cover most of the base with the exception of a narrow band adjacent to Morrison Creek. These soil types are similar and differ only in elevation and relief. The Corning series occurs at higher elevations.

The Corning soils consist of reddish-brown gravelly loam which grades to a clay layer at approximately 3 feet below land surface (bls). The lower layer from 3 to 5 feet contains considerable clay and gravel. This soil is underlain by gravelly and cobbly materials which extend to considerable depth (approximately 20 feet).

The Perkins soils consist of brown or light brown gravelly loam which grades to a reddish-brown gravelly heavy clay loam at approximately 3 feet bls. This soil is also underlain by gravel but not as coarse as that underlying the Corning soil.

The Redding soils consist of reddish-brown or light reddish-brown gravelly loam which grades to gravelly clay at approximately 3 feet bls. A low-permeability layer occurring at depths of 20 to 40 inches and consisting of semi-consolidated gravelly and cobbly material is typical of this soil type.

Materials which underlie the valley and the adjacent mountains include Paleozoic and Mesozoic (70 to 400 million years ago) igneous, metamorphic, and marine sedimentary rocks. As illustrated on the geologic cross section taken in a west-east direction through the basin (Figure 6), these "basement rocks" occur at shallow depths at the basin edge but are very deep near the center. This basement complex is overlain by a thick sequence of Eocene (34 million years ago) marine and continental sedimentary rock which contains saline or brackish water. These rocks are impermeable and form the bottom of the basin, with no freshwater occurring below them.

A series of continental deposits, which are non-marine in origin and of post-Eocene age (younger than 34 million years), overlie the older sequence of Eocene and pre-Eocene rocks. These post-Eocene sediments generally contain freshwater and were deposited by streams flowing from the surrounding mountains into the subsiding depositional trough. This assemblage of predominantly sedimentary rocks also includes volcanic mud flows, lava flows, and ash deposits associated with the volcanism occurring in the middle to late Tertiary period (1 to 70 million years ago). Sutters Buttes, located approximately 50 miles north of Mather AFB, are prominent volcanic features which originated during the late Tertiary period.

The formations which are of particular importance in the Mather AFB area include the Victor, South Forks Gravels, Arroyo Seco Gravels, Fair Oaks, and Mehrten Formations, s well as various alluvial deposits and buried stream channels. Figure 7 illustrates areal geologic relationships in the Mather AFB vicinity. This map depicts the geologic formations which would be exposed at the surface if the soil cover were removed. These unconsolidated, subsurface sediments are closely allied with the soil associations discussed earlier. (Note the similarity between Figure 5, the Soil Map, and Figure 7, the Geologic Formations Below the Soil Cover.)

The Victor Formation consists of interbedded sand, silt, and clay with lenses of gravel. This formation includes buried meandering stream channel deposits composed of poorly sorted cobbles, gravel, and sand. Surficial materials of this deposit typically contain partially cemented layers, which results in very low vertical permeability (10^{-5} to 10^{-7} cm/sec). The Victor Formation thickens to the west but pinches out along a northeast-southwest formation contact line common with the outcrop of the South Fork Gravels. This contact line, as illustrated on Figure 7, crosses the base diagonally from northeast to southwest. The South Fork Gravels consist of stream-rounded cobbles and gravels in a matrix of iron-cemented sandy clay. The clay matrix results in extremely low infiltration rates and low permeability of this formation (10^{-5} to 10^{-7} cm/sec). This formation also terminates along a northeast-southwest contact line common with the outcrop of the Arroyo Seco Gravels.

The Arroyo Seco Gravels consist of well-rounded pebbles and cobbles in a matrix of iron-cemented sandy clay. The formation has a low permeability due to the clay matrix.

The Fair Oaks Formation underlies the Victor Formation and the South Fork Gravels at a depth of approximately 100-150 feet bls (-25 to -75 feet below msl). This formation consists of poorly bedded silt, clay, and sand with lenses of gravel and is quite similar in composition to the overlying Victor Formation, but quite different from the South Fork Gravels.

The Laguna Formation underlies the Fair Oaks Formation and consists of interbedded sand, silt, and clay with permeabilities ranging from low to high (10^{-4} to 10^{-1} cm/sec) depending on the relative amounts of sand and clay. The Fair Oaks and Laguna Formations together occur to a depth of approximately 400 feet bls (-325 feet below msl).

The Mehrten Formation, which underlies the Laguna Formation, is a distinctly different stratum. This formation consists of beds of clay and black volcanic sand. The permeability of the sand beds is quite high (10^{-1} cm/sec), whereas the clay beds have a very low permeability (10^{-7} cm/sec) and act as confining layers.

At Mather AFB the upper 600 feet of unconsolidated gravels, sands, silts, and clays are of importance to water supply and pollutant migration. Figures 8 through 13 illustrate geologic logs and well construction details of several base water supply wells. The logs illustrate the variable nature of the alluvial deposition in the Mather AFB area and reflect the nature of deposition. Figure 14 illustrates the location of these wells and the rest of the base supply wells. In addition, Figure 14 shows the locations of selected off-base wells which have been sampled for volatile organic compounds by the California Water

Quality Control Board. A discussion of the results is included in Section IV A.11 of this report "Available Water Quality Data."

C. HYDROLOGY

1. General Hydrology in the Vicinity of Mather AFB

Surface-water hydrology at Mather AFB is dominated by Morrison Creek, a tributary of the Sacramento River. The creek cuts across the southeast portion of the base and receives runoff and effluent discharge from Mather AFB (see Figure 4). The drainage system of the main base area consists of storm drains which discharge to perimeter ditches, which in turn discharge to Morrison Creek at the southwest corner of the base. The perimeter ditches have oil/water separators located at strategic points to catch and hold fuel/oil/solvent contaminants.

Mather Lake, located along the east boundary of the base, was created for recreational purposes by damming a small tributary of Morrison Creek. This lake receives and stores runoff from off-base via an aqueduct constructed over the Folsom South Canal. This canal, a concrete-lined aqueduct, extends along the east boundary of the base and transmits water from the Nimbus Dam to the Rancho Seco nuclear power plant.

Fresh ground water occurs at Mather AFB and the surrounding area in a wide variety of geologic materials within the post-Eocene (younger than 34 million years) continental deposits beneath the Sacramento Valley. Figure 15 illustrates the approximate thickness of these post-Eocene deposits which contain freshwater. Most of the ground water available for development is stored and moves through sand or sand and gravel strata which were deposited in the past by streams flowing into and through the valley.

Figure 16 illustrates the elevation of the base of freshwater in the vicinity of Mather AFB.

These past streams flowed from the upland areas in the Sierra Nevada, and transported the products of weathering and erosion into the valley. The products of erosion carried by the streams include rock particles, as well as dissolved minerals. The deposition of coarser materials, such as sand and gravel, has occurred along the stream channels. Throughout their existence, the streams have wandered across the valley floor in response to varying geologic and hydrologic conditions.

The direction and rate of ground-water movement is dependent on many factors, including permeability, elevation head, and hydraulic gradient. Under natural conditions where there is no removal of water by pumping, the ground water in the Mather AFB area moved from a potentiometric high near Folsom, generally southwest toward the Sacramento River, then turned south. Figure 17 illustrates the potentiometric surface in approximately 1912, a time when ground-water withdrawals were very low. This illustration can be interpreted as a baseline, natural ground-water condition as if no pumping were taking place. From this illustration it is clear that the natural ground-water flow is from the Sierra Nevada mountains to the Sacramento River, and that in 1912, the Sacramento River was receiving ground water as part of its base flow.

Potentiometric maps prepared at a later date show the influence that ground-water withdrawals have had on the aquifer. Figure 18 illustrates the potentiometric surface during the spring of 1968. From this illustration, it can be seen that ground-water flow in the Mather AFB area is influenced by the cone of depression caused by irrigation in the Elk Grove area located south and southwest of the base. The regional flow direction within the aquifer has probably remained about the same, but local variations in flow paths have undoubtedly occurred. Also of significance, the Sacramento River is now a source of ground-water recharge rather than a point of ground-water discharge as it was before heavy withdrawals began. Figure 19 is a potentiometric map prepared in the spring of 1980, which illustrates the same features as the 1968 map.

Comparing Figures 17 and 18 with Figure 19, an important point is clear. In 1912, or prior to any significant ground-water pumpage, the elevation of the ground water on the western portion of Mather AFB stood at approximately 60 feet above msl. Therefore, depth to ground-water level was then approximately 30 feet bls. As a result of increased ground-water use, the potentiometric surface at this same location currently (Spring 1982) stands at approximately 10 feet above msl. This represents a 50-foot decline in the water level during a 70-year period. The ground-water levels are higher on the eastern portion of the base since hydraulic head increases to the east toward the recharge areas at the base of the Sierra Nevada Mountains. Water levels on the eastern portion of the base have declined by approximately 50 feet since 1912.

In the Mather AFB area ground water occurs under three different conditions, i.e., confined, unconfined, and perched. A confined aquifer is one in which ground water is held under pressure by overlying and underlying beds of very low or no permeability. This type of aquifer is also referred to as an artesian aquifer. Confined aquifers are classified as leaky or nonleaky depending upon whether the confining beds allow some or no water to pass through. Water levels in artesian aquifers rise above the top of the aquifer and in some cases above land surface resulting in a flowing well. An unconfined aquifer is one in which ground water possesses a free surface open to the atmosphere. The upper surface of ground water under this condition is called the water table. A perched condition occurs when ground water is held above the regional water table by an impermeable layer.

The unconfined and perched occurrences are unimportant to water supply but of some significance with regard to pollutant migration. The surface soils and sediments to a depth of approximately 100-150 feet bls (-25 to -75 feet below msl on the western portion of the base) consist of dense interbedded sand, silt, and clay with lenses of metamorphic channel gravel and are part of the Victor Formation. This formation is moderately permeable throughout and highly permeable where old stream channels are encountered. Generally, the formation yields little water except where old channels are present. Some domestic and shallow irrigation wells are completed within this formation.

Water supply wells are completed within the deeper strata and generally withdraw water from the Fair Oaks, Laguna, and Mehrten Formations. Wells tapping the Fair Oaks and Laguna Formations have had reported yields up to 3,500 gpm with a drawdown of approximately 30 feet. The wells at Mather are generally completed such that they withdraw water from the Fair Oaks and Laguna Formations and the top of the Mehrten Formation. The wells range in depth from 200 to 585 feet and are of screened/gravel pack construction. Figure 14 illustrates the location of water supply wells at Mather AFB. Figures 8 through 13 illustrate geologic logs and construction details of selected wells at Mather AFB.

Aquifer transmissivity for the water-producing portions of the aquifers in the vicinity of Mather AFB are estimated to be in the range of 8,700 to 34,800 ft^2/day. Transmissivity is a measure of the ability of the aquifer to transmit water. The storage coefficient within the study area ranges from 0.06 to 0.09. The storage coefficient is the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

The source of water which recharges the formations in the Mather AFB area is precipitation, either directly as rainfall or indirectly as snow melt. Streams from the Sierra Nevada mountains carry runoff from rainfall and snow melt which percolates through the stream beds into the aquifer. Rainfall falling directly on the surface infiltrates through permeable soils to the aquifer. Due to the low permeability of most of the soils at Mather AFB, direct infiltration is not an important recharge mechanism except along stream channels or in areas where surficial materials have been disturbed (e.g., ditches, landfills, and dredged areas). Deep percolation of water supplied for irrigation also recharges the uppermost aquifer.

Infiltration through stream channels, particularly the American River, is the most significant source of recharge in the Mather AFB area. The major recharge areas lie adjacent to major streams such as the Sacramento and American Rivers. In the basin margin areas, where the streams flow from the rugged Sierra Nevada mountains under a high gradient, they are able to carry in suspension fairly coarse materials such as sand and gravel. As the streams enter the flat valley, their hydraulic gradients and velocities, are reduced significantly. The streams are no longer able to transport the coarser materials due to the decrease in velocity, and deposition of these materials occur. Coarse material is still carried downstream as bedload, but much is deposited at the valley margin. The coarse material carried as bedload, and that deposited at the valley margins, is very permeable and acts as a major conduit to recharge the deeper aquifers. The fact that recharge occurs at the valley margins is illustrated clearly by Figures 18 and 19, which depict a potentiometric high in the vicinity of Folsom, indicating recharge. These figures also illustrate the effects of recharge from the Sacramento River.

Only in those areas where the soil is sufficiently permeable is recharge either by irrigation or rainfall an important source of recharge. Soils containing low-permeability layers, as at Mather AFB, severely restrict downward movement of water. Clayey soils and clayey strata occurring within the Victor, South Fork Gravels, Arroyo Seco Gravels, and Fair Oaks Formations also impede recharge. However, in some areas the low-permeability layer, which generally occurs at 3 to 5 feet bls, has been breached or removed by excavation such as landfill trenches, sewer lines, and drainage ditches. In these areas recharge is much more likely.

Ground water is discharged from the aquifer system primarily by pumpage. Some water is lost by evapotranspiration; however, loss by pumpage is by far the most significant. Water lost by discharge to streams falls as rain, infiltrates the upper 2 or 3 feet of soil to the low-permeability layers and then moves horizontally, discharging to stream channels.

Ground-water quality in the Mather AFB vicinity is excellent for irrigation and domestic use. The chemical characteristics of this ground water are reflective of its origin, i.e., the crystalline and metamorphic rock areas to the east. In Sacramento County, fresh ground water ranges in thickness from 200-400 feet near the eastern portion of the county to an estimated 2,000 feet near the Sacramento River. As illustrated on Figure 16, discussed above, the estimated base of freshwater is approximately 1,200 feet below sea level; therefore, the thickness of freshwater at Mather AFB is approximately 1,180 feet.

2. Potential for Migration of Contaminants

At Mather AFB, there are several geologic factors which affect the potential for migration of contaminants. The base has relatively low relief and therefore runoff rates are also fairly low. This factor affects the infiltration rate because water from rainfall is retained for longer periods in the area. The upper soils are fairly permeable down to a clayey layer, which is fairly impermeable. Below the soil layer the strata become more permeable. In those areas where the clayey layer has been breached, infiltration into the underlying strata may be fairly high. The surfacial soils in the Mather AFB area contain a low-permeability layer just below the surface. In order for any significant pathway for ground-water contamination to eixst, this layer must be breached. The production zone for most water supply wells begins at approximately 100 to 150 feet bls (from -25 to -75 feet below msl on the west portion of the base). One well, at the Jet Engine Test Cell, once produced water from approximately 40 feet bls; however, due to declining water levels, this is no longer true. The strata occurring above the production zone consist of alternating layers of sand, silt, and clay of varying permeability. The leakage rate to the production zone is relatively higher in those areas where the upper strata are predominantly sand and silt, rather than clay.

In the vicinity of production wells the drawdown at the pumped well results in the highest head differential between the upper strata (possible source of contamination) and the production zone. The driving force, therefore, between the upper strata and the production zone is highest in the vicinity of the production wells. Three pollutant pathways are possible whereby contamination occurring in the upper strata could enter the production zone. The first is infiltration and leakage through the upper strata into the production zone. This is especially critical where the overlying strata are permeable due to a lack of clay and where the hardpan has been breached. Another contributing factor to this pathway of pollutant travel is screening of relatively shallow, permeable zones. In some of the production wells, perforation begins as shallow as 45 feet. This upper or first permeable zone is the first stratum to be contaminated and may be the only contaminated zone. Wells which tap these shallower zones in areas where contamination potential is high are more likely to be contaminated by surface sources than the deeper wells. The second contamination pathway is vertical movement of pollutants from a shallow source which has moved horizontally through the upper strata down the annular space between the casings or casing and hole. This is a common source of pollution and is related to past well construction practices whereby no seal or an inadequate seal is provided. A third possibility for pollution migration is a combination of the two pathways described above. That is, contaminants could infiltrate and leak into the shallowest production zone such as the 100- to 150-foot stratum. Once the shallow zone is contaminated, pollutants could travel horizontally to production wells and move vertically down the well gravel pack into lower producing zones.

Another contributing factor to the movement of pollutants horizontally is increased pumpage. The rate of travel of a particular pollutant in the production zone is dependent on the permeability of the strata, and the hydraulic gradient. As pumping from a particular area such as the Elk Grove area located southwest of the base increases, the hydraulic gradient also increases toward the center of pumping. The higher the gradient the faster the travel of a pollutant.

One of the most significant geologic features affecting contaminant migration in a horizontal direction are the old buried stream channels of the American River. Figure 20 illustrates the most prominent series of these channels in the Mather AFB area. This figure illustrates what is referred to as the superjacent stream channel deposits. These deposits are generally quite permeable (approximately 30 ft/day), as much as an order of magnitude higher than the surrounding sediments. Furthermore, the channel deposits are oriented in a southwest-northeast direction parallel to the regional flow of ground water at Mather AFB. This fact is significant for two reasons. First, there is a large industrial complex located directly upgradient and apparently directly over a buried stream channel. This stream channel, as illustrated on Figure 20, connects this complex with the northwest corner of Mather AFB. Second, and perhaps more important, this same channel continues under Mather AFB in a southwest direction toward the off-base areas which have reported TCE contamination. The significance of these channels and their orientation is best illustrated by calculations of ground-water velocity and resultant travel times. For example, a contaminant on the surface in an area where the low-permeability layer has been breached, such as at a landfill or disposal pit, could reach a buried stream channel by direct vertical infiltration. The contaminant would then move downgradient with the flow at the velocity dictated by permeability, hydraulic gradient, and porosity. Velocity can be estimated by using the modified form of Darcy's Law, which states:

$$V = \frac{Ki}{n}$$

where:

V = Average ground-water velocity (ft/day)
K = Permeability (ft/day)
i = Ground-water gradient (ft/ft)
n = Effective porosity (fraction)

The ground-water gradient in the vicinity of Mather AFB during the spring of 1980 (Figure 19) was 0.013 ft/ft. In the same area, stream channel permeability is estimated at 30 ft/day and porosity is assumed to be equivalent to specific yield or 0.25. Then, by Darcy's Law, ground-water velocity would be approximately 1.5 ft/day. This number can then be used to calculate travel time from a known distance.

For example, at a ground-water velocity of 1.5 ft/day, it would take approximately 10 years for contaminants to travel 1 mile. This does not take into account vertical infiltration rates in unsaturated sediments.

Contaminant movement from the surface to the highly permeable buried stream channels is retarded by the occurrence of low-permeability layers within the soil horizons and by the relatively thick sequence of unsaturated materials between the surface and the top of the aquifer. As discussed above, breaching the low-permeability layers within the soil horizon will increase the rate of vertical migration. If there is a significant amount of unsaturated sediment occurring above the water table, vertical infiltration rates will still be very low, even in those areas where this layer has been breached. Studies in the desert southwest have indicated that vertical infiltration rates in unsaturated, unconsolidated sediments being continuously irrigated are in the order of 10 to 20 feet per year. This rate would be much slower without the continued driving force of the applied irrigation water.

To illustrate this point, if a contaminant were introduced into a pond, the bottom of which breached the low-permeability soil layers, it would take from 2.5 to 5 years to travel 50 feet vertically.

Other factors affect vertical migration potential in the Mather AFB vicinity. Again, as mentioned above, breaching the low-permeability layers in the soil horizon greatly increases vertical infiltration rates. Surrounding Mather AFB to the north, northwest, and west is an area covered by gold mining dredge tailings. This operation consisted of mining by dredging the upper 20 to 30 feet of sediment and redepositing the gravel and cobbles as mining tailings. The result is that in those areas which have been mined (none occur on base) the permeability of the surficial materials (dredge tailings) is quite high. This is of some significance because a large industrial complex is located upgradient from Mather AFB and on top of dredge tailings.

The significance of a major set of buried stream channels was discussed above relative to horizontal movement of ground water. This major set of channels referred to as the superjacent set is only one of many such sets deposited as the American River meandered across the valley floor. As the stream continued to deposit fine grained material on the flood plain and carried coarse materials as stream bed load, a series of high permeable zones (buried stream channels) and low permeable zones (flood plains) built up on top of one another. In some areas, a buried stream channel may be isolated both above and below by the occurrence of fine grained materials from preceding and anteceding flood plains. Thus a contaminant reaching the uppermost buried stream channel would have to take a tortuous path before reaching the next set of channels. However, in many areas each succeeding stream channel (high permeability) is overlain and hydraulically connected to the next stream channel, thus greatly increasing the rate of vertical movement. Both are illustrated on Figure 21. This figure is a generalized cross-section illustrating the possible alignment of stream channels but does not apply to any specific area.

Another factor which affects vertical migration as well as horizontal movement of ground water is proximity to a pumping well. This factor is of little significance over large distance because the radius of influence from a pumping well is relatively small (<3,000 feet). However, a contaminant entering the aquifer near a pumping well would move rapidly towards that well. This is due to the fact that the hydraulic gradient within the radius of influence of the well is quite high, thus increasing significantly the ground-water velocity.

It is important to note that ground-water velocity calculations are based on a number of approximations and estimations and give only an order-of-magnitude estimate of the rate of contaminant migration. Travel-time calculations based on estimates of permeability do not take into account one of the most important processes for contaminant removal, that is, attenuation. Contaminants in ground water tend to be removed or reduced in concentration with time and distance traveled. Some of the mechanisms of contaminant attenuation include filtration, sorption, chemical processes, microbiological decomposition, and dilution. The rate of attenuation is at least as important as ground-water velocity in assuming contamination potential. The rate of attenuation varies for different contaminants and differing hydrogeologic settings. For example, a high clay content will result in a high adsorption rate for ions, especially cations, whereas a high sand content will result in a high rate of filtration. In the vicinity of Mather AFB, work on contaminant attenuation is in progress but has not yet been released.

D. ENVIRONMENTALLY SENSITIVE CONDITIONS

1. Vegetation

Of 5,798 acres on Mather AFB, approximately 3,000 acres are unimproved. Although the grasslands historically present in the region were dominated by perennial bunch grass species, these have given way to a variety of annual species, and the unimproved lands on Mather AFB now support a typical annual grassland community. Interspersed within the grasslands are numerous seasonal wetlands known as vernal pools, which are primarily confined to the Sacramento Valley. These small, low-permeability depressions generally fill with water in the winter and dry up during the spring, supporting an assemblage of annual plant species, unique to vernal pools, in the process.

2. Wildlife

Nineteen mammal, 60 bird, 9 reptile, and 3 amphibian species are considered indigenous to Mather AFB and adjoining lands (Mather AFB, 1981). Game species include black-tailed jack-rabbit, Audubon cottontail, ring-necked pheasant, mourning dove, California quail, and some waterfowl. Approximately 1,500 acres of unimproved land have been designated as wildlife preserves at Mather AFB and a tripartite cooperative agreement for the conservation and development of fish and wildlife exists between Mather AFB, the U.S. Fish and Wildlife Service, and the California Fish and Game Department.

3. Aquatic Systems

Two major aquatic systems occur on Mather AFB: Mather Lake and Morrison Creek. Mather Lake, with 64 acres of surface area, is a shallow sloping lake which reaches a depth of only 18 feet at full capacity. The lake is currently replenished by rain and runoff during the winter and often reduces to a surface area of 25 acres or less during dry summer months. Although this severely limits its carrying capacity for fish and other wildlife, some fishing for bass and catfish occurs.

Morrison Creek is the other major surface-water system receiving runoff and discharges from Mather AFB and comprises an environmentally important habitat for both fish and wildlife. A number of spills and fishkills have occurred in the past (Linn, 1982). A review of Mather files presents the following historic perspective on Morrison Creek:

- In 1953, Morrison Creek was a naturally intermittent stream except for treated wastewater from Mather AFB and cooling water from Proctor and Gamble.

- In 1955, an oil film was observed on the water surface and stream banks, originating from a drainage ditch entering the creek a few hundred yards downstream of the sewage treatment plant discharge.

- In 1965, a memo cited a recent incident involving disposal of a large quantity of insecticide in the base storm drainage system. An updated memo reported fish from a Morrison Creek fishkill contained 4.1 mg chlordane/kg of fish organs (wet weight) and that total hydrocarbons in the water were 400 mg/l, apparently an aliphatic carbonyl compound. Chlordane content of Morrison Creek sediments was 101-354 µg/kg sediment (dry weight).

- In 1966, a letter indicated that a recent fish kill in Morrison Creek was the result of an oily waste.

- A major fishkill occurred in 1970. At that time a phenolic paint stripping compound containing 15-25 percent phenols was used in SAC aircraft washing operations. Shortly prior to the fishkill, residue from the paint removal vat in the corrosion control facility was emptied into the sewer. Organisms killed included approximately 900 carp, 25 sunfish, 10 catfish, 1,000 tadpoles, 25 crawfish, and 10 adult frogs (Davis, 1970).

- In 1976, an internal memo reported a large amount of oil and grease at the 48-inch outfall at the west ditch. The memo further indicated that one potential source was from automobile oil changes performed over storm drain grates in dormitory areas.

4. Endangered Species

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

Although federally endangered vertebrates are known to have permanent populations within 50 miles of Mather AFB (Kobetich, 1978), none are known to occur on Mather AFB.

According to Craig and Gustafson (1981), the nearest known eagle nest sites are near Lake Pillsbury (Mendocino County) and in the vicinity of Chico (Butte

County). However, juvenile or non-breeding eagles occasionally pass through the Sacramento area. Peregrine falcons also regularly migrate through Sacramento County, and it is possible that some reside there (Craig and Gustafson, 1981).

Two Federally listed insects occur within 50 miles of Mather AFB. The threatened valley elderberry longhorn beetle is restricted to elderberry thickets in moist valley oak woodlands bordering the Sacramento, American, and San Juaquin Rivers. The designated critical habitat on the American River occurs from Goethe Park upstream to River Mile 15 and is located less than two miles northwest of the Mather AFB boundary. This habitat is upgradient with respect to ground water and is not adversely affected by activities on Mather AFB. The endangered Lange's metalmark butterfly occurs at a site approximately 50 miles southwest of Mather AFB in the vicinity of Antioch (U.S. Army Corps of Engineers, 1979).

State listed wildlife species reported within 50 miles of Mather AFB include the thicktail chub (designated endangered--now probably extinct), California black rail (rare) and giant garter snake (rare). It is very unlikely that these species occur on Mather AFB due to the lack of appropriate habitat.

Three Federally listed plant species occur within 50 miles of Mather AFB: the Antioch Dunes evening primrose, Contra Costa wallflower, and Crampton's orcutt grass. According to Kobetich (1978), it is highly unlikely that the first two plants would occur on Mather AFB because they are restricted in their entirety to the Antioch Dunes, Contra Costa County, California. The other plant, Crampton's orcutt grass, is known only from a single alkaline vernal lake bed occurring about 40 miles southwest of Mather AFB.

Although vernal pools occur in the Sacramento vicinity, this species has been collected from none of them.

Although a number of state listed plants occur within 50 miles of Mather AFB, only two species (both endangered) are known to occur within Sacramento County. These are Sacramento orcutt grass (*Orcuttia viscida*), which occurs in the vicinity of Phoenix Field, and Boggs Lake hedge hyssop (*Gratiola heterosepala*), which is found in the vicinity of Rio Linda (California Department of Fish and Game, 1979).

5. Environmental Stress

Most of the unimproved grassland areas on Mather AFB have been disturbed at one time or another; much of Morrison Creek has been cleared of former riparian vegetation, and some of the vernal pool areas have been variously ditched or filled in. However, many of these actions took place in the past, and the existing vegetation growing on the unimproved areas of Mather AFB is generally healthy, vigorous, and supporting the appropriate fauna. Natural stresses on Mather Lake occur due to seasonal drydowns. Facility-related stresses which historically occurred on Morrison Creek were previously discussed. Stresses on Morrison Creek have been substantially reduced in recent years, as evidenced by the lack of the once common fishkills.

Positive actions taken by the base include the installation of oil/water separators in the west and south drainage ditches, installation of numerous oil skimmers throughout the main base industrial areas, connection of industrial shop drains to the sanitary sewer, and implementation of a system for the segregation, collection and central storage of waste POL.

IV FINDINGS

IV. FINDINGS

A. ACTIVITY REVIEW

1. Summary of Industrial Waste Disposal Practices

The majority of industrial operations at Mather AFB have been in existence since 1941. Although the base was activated in 1918, it was inactivated during the periods 1922 through 1930 and 1932 through 1941. Therefore, the industrial operations and related wastes were comparatively small prior to 1941. In 1958 SAC initiated operations at Mather AFB which resulted in larger quantities of wastes being generated due to expanded maintenance requirements. Major industrial operations include the vehicle maintenance shops, plating and cleaning shop, corrosion control shop, pneudraulics shop, AGE, auto hobby shop, special weapons maintenance, and non-powered AGE. These industrial operations generate varying quantities of waste oils, fuels, solvents, and cleaners.

The quantities of waste oils, fuels, solvents, and cleaners generated at Mather AFB are relatively small, in comparison to those at bases having significant aircraft overhaul and maintenance missions. Generally, the quantity of any single industrial waste produced ranges from 3 to 7,200 gallons per year. The total quantity of waste oils, fuels, solvents, and cleaners currently generated ranges from 25,000 to 50,000 gallons per year. The above waste quantities are believed to be representative for the period from 1958 to present.

Standard procedures for past and present industrial waste disposal practices at Mather AFB are as follows:

- 1918 to 1922 and 1930 to 1932: Limited information was available during this time period; therefore, it was assumed that industrial wastes were collected and transported by shop personnel to either a base landfill for disposal or used in fire department training exercises.

- 1941 to 1970: Industrial wastes included waste oils, fuels, solvents, paint residues, thinners, and plating sludge. The final disposition of these wastes was landfill, fire department training, and salvage. The responsibility of collecting the wastes in 55-gallon drums and 200- to 500-gallon bowsers was assumed by the shop personnel who then transported the commingled wastes to a base landfill, the fire department training area, or to the POL waste storage area. The POL waste storage area was located adjacent to Facilities 3386 through 3389. Four 12,500-gallon underground POL storage tanks are located in the POL waste storage area. The wastes were stored until sold and removed by contractors.

- 1970 to 1974: Industrial wastes included waste oils, fuels, solvents, paint residues, thinners, and plating sludge. A program was initiated in approximately 1968 to place stricter control on the disposal of industrial wastes and by 1970 the program was in full operation. The disposal of industrial wastes in landfills, with the exception of paint slop and plating sludge, was halted and the majority of wastes were collected and transported to the Civil Engineering Storage Facility (CESF). Some POL wastes were still used in fire department training exercises through 1974. The collection and transportation of the wastes was still the responsibility of shop personnel. The CESF is located adjacent to and directly south of the POL waste storage area (Facilities 3386 through 3389). Eight 25,000-gallon underground storage tanks are located in the CESF: four are abandoned; three are for storage of contaminated JP-4 fuel; and one is for storage of POL wastes. The fuels and wastes were stored until sold and removed by contractors.

- 1974 to 1981: Industrial wastes included waste oils, fuels, solvents, paint residues, thinners, and plating sludge. In 1974, the practice of burning POL waste during fire department training exercises was halted. The burning of small quantities of contaminated JP-4 fuel with less than 10 percent contamination was resumed in 1979. The practices of disposing of plating sludge and paint slop in the base landfills were stopped in 1975 and 1980, respectively. The majority of industrial wastes were brought to the CESF for sale and removal by contractors.

- 1981 to present: Procedures have been established and are currently being implemented to segregate wastes during collection at the individual shop locations. Fifteen organizational "Accumulation Points" of hazardous and recoverable wastes have been designated, as well as a manager for each area to ensure the proper collection, handling, and transportation of wastes and to provide inspections and proper documentation. The majority of industrial wastes are currently turned in to the CESF for sale and removal by contractors through the Defense Property Disposal Office (DPDO).

2. Industrial Operations

The industrial operations at Mather AFB are primarily involved in the routine maintenance of assigned T-37, T-43, B-52G, and KC-135 aircraft. Appendix E contains a master list of the industrial operations.

A review of base records and interviews with past and present base employees resulted in the identification of those industrial operations where the majority of industrial chemicals were handled and hazardous wastes were generated. Table 2 summarizes the major industrial operations and includes the estimated quantities of wastes generated as well as the past and present disposal practices of these wastes, i.e., treatment, storage, and disposal. Description of the major industrial activities are included in the following paragraphs.

a. Vehicle Maintenance General Purpose Shops

The Vehicle Maintenance General Purpose Shops conduct activities in two main locations, Facility 3900 and Facility 2990, which have been in operation since 1951 and 1954, respectively. Routine minor maintenance and major overhaul, including body work, welding, and painting of gasoline-powered vehicles is performed. Wastes generated include waste oils (3,000 gal/yr), antifreeze (600 gal/yr),

Table 2
MAJOR INDUSTRIAL OPERATIONS SUMMARY

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
323 Transportation				
Vehicle Maintenance General Purpose Shops	3900 & 2990	Waste Oils[a]	3,000 gal/yr	Landfill, fire training, salvage; CESF[b], fire training; CESF
		Antifreeze	600 gal/yr	Sanitary sewer; CESF
		Battery Acid	240 gal/yr	Neutralization to sanitary sewer
Vehicle Maintenance Special Purpose Shops	3940	Carbon Tetrachloride	120 gal/yr	Landfill, fire training, salvage
		Trichloroethylene (TCE)	120 gal/yr	Landfill, fire training, salvage; CESF, fire training
		PD 680	120 gal/yr	CESF
		Denatured Alcohol	192 gal/yr	Landfill, fire training, salvage; CESF, fire training; CESF
		Cleaning Solvent	330 gal/yr	
Hospital				
Pathology Laboratory	650	Xylene	60 gal/yr	Sanitary sewer; CESF
323 FTW				
Photo Lab	2890	Developers and Fixers	1,440 gal/yr	Sanitary sewer; Silver recovery to sanitary sewer
		Glacial Acetic Acid	3 gal/yr	
323 FMS				
Plating and Cleaning Shop	4150	Plating Sludge	80 gal/yr	Landfill; CESF
		Nitric Acid Dragout	12 gal/yr	Neutralization to sanitary sewer

Table 2--Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
		Hydrochloric Acid Dragout	24 gal/yr	Neutralization to sanitary sewer
		Cleaning Compound Alkali	100 lb/yr	Sanitary sewer
		Carbon Remover Compound[c]	55 gal/yr	Landfill, fire training, salvage; CESF, fire training; CESF
		Plant Remover	165 gal/yr	
		Carbon Tetrachloride	275 gal/yr	Landfill, fire training, salvage
		TCE	275 gal/yr	Landfill, fire training, salvage; CESF, fire training
		1-1-1 Trichloroethane	275 gal/yr	CESF
		PD 680	685 gal/yr	Landfill, fire training, salvage; CESF, fire training; CESF
		Trichlorofluoroethane	900 gal/yr	CESF
Corrosion Control Shop	4150	Cleaning Compound	2,640 gal/yr	Sanitary sewer
		Paint Slop, Thinners	660 gal/yr	Landfill; CESF
		Cleaning Solvent	120 gal/yr	Landfill, fire training, salvage; CESF, fire training; CESF
		Acetone	120 gal/yr	
		Methyl Ethyl Ketone (MEK)	Consumed in Use	
		Naptha-Alaphatic		
		Ethyl Alcohol		
Battery Shop	4150	Battery Acid	48 gal/yr	Neutralization to sanitary sewer

Table 2 – Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
Propulsion Shop	4150	Waste Oils and JP-4	600 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
Pneudraulics Shop	4260	Skydrol[d]	240 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		JP-4	600 gal/yr	
		TCE	24 gal/yr	Landfill, fire training, salvage / CESF, fire training
		PD 680	24 gal/yr	CESF
Non-Destructive Inspection (NDI) Lab	4260	Penetrant	100 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		Emulsifier	100 gal/yr	
		1-1-1 Trichloroethane	Consumed in Use	
		Developers and Fixers	300 gal/yr	Sanitary sewer / Silver recovery to sanitary sewer
Electric Shop	4260	Citric Terpene	60 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
Aerospace Ground Equipment (AGE)	4348	TCE	300 gal/yr	Landfill, fire training, salvage / CESF, fire training
		PD 680	300 gal/yr	CESF
		Waste Oils	2,040 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		JP-4	2,400 gal/yr	
		Cleaning Compound	660 gal/yr	
323 AMS				
T-10, T-11 Simulator Maintenance	3860	Denatured Alcohol	12 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		Waste Oils	12 gal/yr	

Table 2 Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
		TCE	12 gal/yr	Landfill, fire training, salvage / CESF, fire training
		1-1-1 Trichloroethane	12 gal/yr	CESF
323 CES				
Protective Coating Shop	3308	Paint Slop, Thinners	600 gal/yr	Landfill / CESF
Power Production	3337	Waste Oils	1,200 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		Antifreeze	600 gal/yr	
		Battery Acid	96 gal/yr	Neutralization to sanitary sewer
323 ABG				
Auto Hobby Shop	3320	Waste Oils	3,600 gal/yr	Landfill, fire training, salvage / Contractor removal[e]
		Carbon Tetrachloride	600 gal/yr	Landfill, fire training, salvage
		TCE	600 gal/yr	Landfill, fire training, salvage / Contractor removal[e]
		PD 680	600 gal/yr	Contractor removal[e]
		Chevron-352 Solvent	480 gal/yr	
		Carbon Remover Compound	480 gal/yr	
320 MMS				
Equipment Maintenance	7009	Waste Oils	240 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF

Table 2--Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
Special Weapons	18015	Toluene	10 gal/yr	
		Denatured Alcohol	10 gal/yr	
		Acetone	5 gal/yr	
		MEK	5 gal/yr	
		TCE	5 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		PD 680	25 gal/yr	
		Methanol	25 gal/yr	
		1-1-1 Trichloroethane	5 gal/yr	
		Xylene	5 gal/yr	
320 OMS				
Non-Powered AGE	7033	JP-4	2,400 gal/yr	CESF
		Waste Oils	1,700 gal/yr	
320 FMS				
AGE	7022	Cleaning Compound	2,400 gal/yr	O/W separator to sanitary sewer
		Waste Oils	800 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		TCE	300 gal/yr	Landfill, fire training, salvage / CESF, fire training
		PD 680	300 gal/yr	CESF

Table 2 Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
Propulsion Shop	7024	TCE	100 gal/yr	Landfill, fire training, salvage / CESF, fire training
		PD 680	100 gal/yr	CESF
		Carbon Remover Compound	60 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		Waste Oils	500 gal/yr	
Corrosion Control Shop	7035	TCE	300 gal/yr	Landfill, fire training, salvage / CEFS, fire training
		PD 680	3,600 gal/yr	CESF
		MEK	400 gal/yr	
		Paint Stripper	100 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		Methyl Isobutyl Ketone	24 gal/yr	
		Cleaning Compound	7,200 gal/yr	O/W separator to sanitary sewer
Electric Shop	7045	Battery Acid	40 gal/yr	Neutralization to sanitary sewer
Environmental Systems	7045	Waste Oils	48 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		Cleaning Solvent	120 gal/yr	
Pneudraulics Shop	7045	Waste Oils	48 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		TCE	175 gal/yr	Landfill, fire training, salvage / CESF, fire training
		PD 680	175 gal/yr	CESF

Table 2 Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
Wheel and Tire Shop	7045	Waste Oils	48 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		TCE	200 gal/yr	Landfill, fire training, salvage / CESF, fire training
		PD 680	200 gal/yr	CESF
320 AMS				
Fire Control Shop	7020	Waste Oils	100 gal/yr	Landfill, fire training, salvage / CESF, fire training / CESF
		TCE	250 gal/yr	Landfill, fire training, salvage / CESF, fire training
		Perchloroethylene	250 gal/yr	CESF
Army Aviation Support Facility (AASF)	4850	Waste Oils	1,200 gal/yr	CESF, fire training / CESF
		TCE	300 gal/yr	CESF, fire training
		PD 680	300 gal/yr	CESF

[a]Waste oils include engine oil, synthetic oil, hydraulic fluid, and preservative oil.

[b]CESF–Civil Engineering Storage Facility, waste materials removed by contractor.

[c]Carbon remover compound contains cresylic acid and o-·ichlorobenzene.

[d]Skydrol–hydraulic fluid for T-43 aircraft.

[e]Oil is skimmed from the top of the oil/water separator and placed in a holding tank which is pumped out by a contractor twice a month.

and battery acid (240 gal/yr). Waste oils include engine oil, synthetic oil, hydraulic fluid, and preservative oil. The principal means of disposal of waste oils during the period from 1951 through 1970 was landfilling, burning at fire department training exercises, and delivery to the POL waste storage area for salvage. A program was initiated in approximately 1968 to place stricter control on the disposal of waste oils; by 1970 the program was in full operation, and the majority of waste oils were collected and brought to the Civil Engineering Storage Facility (CESF) for sale to contractors. In 1974 the practice of burning waste oils during fire department training exercises was halted, and since 1974 waste oils have been turned in to the CESF for sale to contractors or contractor removal. The antifreeze was flushed down the drain into the sanitary sewer until approximately 1980; since then, the antifreeze is collected and turned in to the CESF. The battery acid, which is generated from the servicing of lead batteries, is neutralized with baking soda (sodium bicarbonate) and discharged to the sanitary sewer.

b. Vehicle Maintenance Special Purpose Shop

The Vehicle Maintenance Special Purpose Shop is located in Facility 3940 and has been in operation since 1951. Maintenance of gasoline-powered vehicles, including engine cleaning, is performed. Wastes currently generated include PD 680 Type II (120 gal/yr), denatured alcohol (192 gal/yr), and cleaning solvent (330 gal/yr). PD 680 Type II is a petroleum distillate used as a safety cleaning solvent. Carbon tetrachloride (120 gal/yr) was used at this shop from 1951 through 1958, and TCE (120 gal/yr) was used from 1958 through 1974, when it was replaced by PD 680. The final disposition of the above wastes, has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1951 until

1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

c. Pathology Laboratory

The Pathology Lab is located in Mather AFB Hospital, Facility 650, and has been at this location since 1970. The only waste generated in the lab is xylene (60 gal/yr), which was poured down the drain to the sanitary sewer from 1970 to approximately 1977. Since 1977, the xylene has been turned in to CESF.

d. 323 FTW Photo Lab

The Photo Lab is located in Facility 2890 and has been in operation since 1953. The Photo Lab provides photographic support for the base. Wastes generated include developers and fixers (1,440 gal/yr) and glacial acetic acid (3 gal/yr). These wastes were discharged to the sanitary sewer from 1953 to 1960. Since 1960 these wastes have been processed for silver recovery prior to disposal to the sanitary sewer.

e. 323 FMS Plating and Cleaning Shop

The Plating and Cleaning Shop is located in Facility 4150 and has been at this location since 1963. From 1942 until 1963 the shop was located in Facility 4440. The electroplating processes conducted at the shop include cadmium, nickel, copper, and chrome plating. Cadmium and copper are plated using a cyanide process. Prior to 1976 the plating operation was a continuing operation (120 hours per month); since 1976 the frequency has been reduced. The plating dip tanks, which range in size from 30 to

600 gallons, are cleaned twice per year. The electroplating solutions are reused and the appropriate chemicals added to bring the solution up to specification. Wastes generated during normal operation and the tank cleaning operation include plating sludge (80 gal/yr), nitric acid dragout (12 gal/yr), hydrochloric acid dragout (24 gal/yr), alkali cleaning compound (100 lb/yr), carbon remover compound (55 gal/yr), paint remover (165 gal/yr), 1-1-1 trichloroethane (275 gal/yr), PD 680 (685 gal/yr), and trichlorofluoroethane (900 gal/yr). Carbon tetrachloride (275 gal/yr) was used at the shop from 1942 until 1958, and TCE (275 gal/yr) was used from 1958 until 1970. The plating sludge and filters used in filtering the plating solution were landfilled from 1942 until 1975; since 1975 the sludge and filters have been turned in to the CESF. The nitric acid and hydrochloric acid dragout are neutralized with sodium bicarbonate and discharged to the sanitary sewer. The alkali cleaning compound (soap) is flushed down the drain to the sanitary sewer. The final disposition of the carbon remover compound, paint remover, carbon tetrachloride, TCE, 1-1-1 trichloroethane, PD 680, and trichlorofluoroethane, (refer to Table 2), has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1942 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal. The plating shop wastewater discharge to the sanitary sewer is monitored weekly for cyanide and heavy metals. Recent results do not show the presence of significant concentrations of the above constituents in the plating shop wastewater.

f. <u>323 FMS Corrosion Control Shop</u>

The Corrosion Control Shop is located in Facility 4150 and has been at this location since 1963. From 1942 until 1963 the shop was located in Facility 4440. Corrosion control activities include cleaning, sanding, wiping, priming, repainting, and stenciling of aircraft. Wastes generated include cleaning compound (2,640 gal/yr), paint slop and thinners (660 gal/yr), cleaning solvent (120 gal/yr), and acetone (120 gal/yr). The cleaning compound is washed down the drain through an oil/water gravity separator to the sanitary sewer. The paint slop, which consists of paint residue and thinners, was disposed of in a base landfill until 1980. After 1980 the paint slop was turned in to the CESF. The final disposition of the cleaning solvent and acetone, has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1942 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal. Methyl ethyl ketone, naphtha-aliphatic, and ethyl alcohol are also used at the shop and are consumed in use.

g. <u>323 FMS Battery Shop</u>

The Battery Shop is located in Facility 4150 and has been at this location since 1963. From 1942 until 1963 the shop was located in Facility 4440. Wastes generated from the servicing of both lead and nickel-cadmium batteries consist primarily of waste battery acid (48 gal/yr). The battery acid is neutralized with baking soda (sodium bicarbonate) and then discharged into the sanitary sewer. The used battery casings are sent to Defense Property Disposal Office (DPDO) for salvage.

h. 323 FMS Propulsion Shop

The Propulsion Shop is located in Facility 4150 and has been at this location since 1963. From 1942 until 1963 the shop was located in Facility 4440. Wastes generated include waste oils and JP-4 fuel (600 gal/yr). The final disposition of the waste oils and JP-4, has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1942 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

i. 323 FMS Pneudraulics Shop

The Pneudraulics Shop is located in Facility 4260 and has been at this location since 1970. From 1960 to 1970 the shop was located in Facility 4677 and from 1956 to 1960 it was located outside Facilty 4474. The primary purpose of this shop is to service and repair all aircraft pneumatic and hydraulic equipment. Wastes generated include Skydrol (240 gal/yr), JP-4 fuel (600 gal/yr), and PD 680 (29 gal/yr). TCE (24 gal/yr) was used from 1958 until 1974. Skydrol is hydraulic fluid used in T-43 aircraft. The final disposition of the skydrol, JP-4 fuel, TCE, and PD 680 has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1956 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

j. <u>323 FMS Non-Destructive Inspection (NDI) Lab</u>

The NDI Lab is located in Facility 4260 and has been at this location since 1970. From 1960 to 1970 it was located in Facility 4677 and from 1956 to 1960, the shop was located outside Facility 4474. Non-destructive testing methods, including X-ray, magnaflux, and ultra sound, are performed to determine material defects of aircraft structures and component parts. Wastes generated include penetrant (100 gal/yr), emulsifier (100 gal/yr), and developers and fixers (200 gal/yr). Trichloroethane is also used in the lab but is consumed in use. The developers and fixers are processed for silver recovery prior to discharge to the sanitary sewer. The final disposition of the penetrant and emulsifier, has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1956 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

k. <u>323 FMS Electric Shop</u>

The Electric Shop is located in Facility 4260 and has been at this location since 1970. From 1960 to 1970 it was located in Facility 4677 and from 1956 to 1960, the shop was located outside Facility 4474. The only waste generated is citric terpene (60 gal/yr). The final disposition of the citric terpene has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1956 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

l. <u>323 FMS Aerospace Ground Equipment (AGE)</u>

The AGE Maintenance Shop is located in Facility 4348 and has been at this location since 1970. From 1960 to 1970 it was located in Facility 4677 and from 1956 to 1960, the shop was located outside Facility 4474. The responsibility of the AGE Maintenance shop is to repair, maintain, and periodically inspect all powered aerospace ground equipment. Wastes generated include PD 680 (300 gal/yr), waste oils (2,040 gal/yr), JP-4 fuel (2,400 gal/yr), and cleaning compound (660 gal/yr). TCE (300 gal/yr) was used at the shop from 1958 until 1970. The final disposition of the PD 680, waste oils, JP-4 fuel, cleaning compound, and TCE has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1956 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

m. <u>323 AMS T-10, T-11, Simulator Maintenance</u>

The T-10, T-11 Simulator Maintenance Shop is located in Facility 3860 and has been in operation since 1961. Routine maintenance of the T-10 and T-11 simulator is performed. Wastes generated include denatured alcohol (12 gal/yr), waste oils (12 gal/yr), and 1-1-1 trichloroethane (12 gal/yr). TCE (12 gal/yr) was used at the shop from 1961 until 1970. The final disposition of the denatured alcohol, waste oils, 1-1-1 trichloroethane, and TCE has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1961 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

n. 323 CES Protective Coating Shop

The Protective Coating Shop is located in Facility 3308 and has been in operation since 1961. The only waste generated is paint slop (600 gal/yr), which consists of paint residue and thinners. The paint slop was disposed of in a base landfill until approximately 1974; since 1974 the paint slop has been turned in to the CESF.

o. 323 CES Power Production

The Power Production Shop is located in Facility 3337 and has been in operation since 1942. Wastes generated include waste oils (1,200 gal/yr), antifreeze (600 gal/yr), and battery acid (96 gal/yr). The battery acid is neutralized with sodium bicarbonate and discharged to the sanitary sewer. The final disposition of the waste oils and antifreeze has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1942 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

p. 323 ABG Auto Hobby Shop

The Auto Hobby Shop is located in Facility 3320 and has been in operation since 1944. Wastes generated include waste oils (3,600 gal/yr), PD 680 (600 gal/yr), Chevron-352 solvent (480 gal/yr), and carbon remover compound (480 gal/yr). Carbon tetrachloride (600 gal/yr) was used at the shop from 1944 until 1958, and

TCE (600 gal/yr) was used from 1958 until 1970. Prior to 1970, all the above wastes were either disposed of in a base landfill, burned during fire department training exercises, or brought to the POL waste storage area for salvage. After the construction of an oil/water separator tank in 1970, the oils skimmed from the separator tank as well as those collected in the shop were placed in a 500-gallon holding tank which is pumped out by an off-base contractor bimonthly.

q. 320 MMS Equipment Maintenance Shop

The Equipment Maintenance Shop is located in Facility 7009 and has been in operation since 1961. The only waste generated is waste oil (240 gal/yr). The final disposition of the waste oil has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1961 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

r. 320 MMS Special Weapons Shop

The Special Weapons Shop is located in Facility 18015 and has been in operation since 1958. Wastes generated in the cleaning of weapons include toluene (10 gal/yr), denatured alcohol (10 gal/yr), acetone (5 gal/yr), MEK (5 gal/yr), TCE (5 gal/yr), PD 680 (25 gal/yr), methanol (25 gal/yr), 1-1-1 trichloroethane (5 gal/yr), and xylene (5 gal/yr). The final disposition of the above wastes has been as follows: landfill, fire training exercises, and delivery to the POL waste storage area for salvage from 1958 until 1970; fire training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

s. 320 OMS Non-Powered AGE

The Non-Powered AGE Maintenance Shop is located in Facility 7033 and has been in operation since 1978. The function of this shop is to maintain, dispatch, and service non-powered aerospace ground equipment. Wastes generated include waste oils (1,700 gal/yr) and JP-4 fuel (2,400 gal/yr). These wastes are turned in to the CESF for sale to contractors.

t. 320 FMS AGE

The AGE Maintenance Shop is located in Facility 7022 and has been in operation since 1962. Wastes generated include cleaning compound (2,400 gal/yr), waste oils (800 gal/yr), and PD 680 (300 gal/yr). TCE (300 gal/yr) was used from 1962 until 1974. The cleaning compound is washed down the drain and then passes through an oil/water separator (belt skimmer type) before discharging to the sanitary sewer. The final disposition of the waste oils, PD 680, and TCE has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1962 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

u. 320 FMS Propulsion Shop

The Propulsion Shop is located in Facility 7024 and has been in operation since 1962. Wastes generated include PD 680 (100 gal/yr), carbon remover compound (60 gal/yr), and waste oils (500 gal/yr). TCE (100 gal/yr) was used at the shop from 1962 until 1974. The final disposition of the above wastes has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1962 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

v. 320 FMS Corrosion Control Shop

The Corrosion Control Shop is located in Facility 7035 and has been in operation since 1959. Wastes generated include PD 680 (3,600 gal/yr), MEK (400 gal/yr), paint stripper (100 gal/yr), methyl isobutyl ketone (24 gal/yr), and cleaning compound (7,000 gal/yr). TCE (300 gal/yr) was used at the shop from 1959 until 1974. The cleaning compound is washed down the drain and then passes through an oil/water separator (belt skimmer type) before discharging to the sanitary sewer. The final disposition of the PD 680, MEK, paint stripper, methyl isobutyl ketone, and TCE has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1959 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

w. 320 FMS Electric Shop

The Electric Shop is located in Facility 7045 and has been in operation since 1958. The only waste generated from the servicing of lead and nickel-cadmium batteries is waste battery acid (40 gal/yr). The waste battery acid is neutralized with potassium hydroxide and discharged to the sanitary sewer. The used battery casings are sent to DPDO for salvage.

x. 320 FMS Environmental Systems Shop

The Environmental Systems Shop is located in Facility 7045 and has been in operation since 1958. The function of this shop is to repair aircraft air conditioning and pressurization systems. Wastes generated include waste oils (48 gal/yr) and cleaning solvent (120 gal/yr). The final disposition of the waste oils and cleaning solvent has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1958 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

y. 320 FMS Pneudraulics Shop

The Pneudraulics Shop is located in Facility 7045 and has been in operation since 1958. Wastes generated include PD 680 (175 gal/yr) and waste oils (48 gal/yr). TCE (175 gal/yr) was used at the shop from 1958 until 1974. The final disposition of the above wastes has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1958 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

z. <u>320 FMS Wheel and Tire Shop</u>

The Wheel and Tire Shop is located in Facility 7045 and has been in operation since 1958. Wastes generated include waste oils (48 gal/yr) and PD 680 (200 gal/yr). TCE was used at the shop from 1958 until 1974. The final disposition of the above wastes has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1958 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

aa. <u>320 AMS Fire Control Shop</u>

The Fire Control Shop is located in Facility 7020 and has been in operation since 1958. A vapor degreaser tank used for weapons cleaning is located in the shop. The vapor degreaser tank is cleaned twice per year, generating 75 gallons of waste perchloroethylene per cleaning operation. Wastes generated include waste oils (100 gal/yr) and perchloroethylene (250 gal/yr). TCE (250 gal/yr) was used from 1958 until 1974. The final disposition of the waste oils, perchloroethylene, and TCE has been as follows: landfill, fire department training exercises, and delivery to the POL waste storage area for salvage from 1958 until 1970; fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

bb. Sacramento Army Aviation Support Facility

The Sacramento Army Aviation Support Facility is located in Facility 4850 and has been in operation since 1970. Wastes generated include waste oils (1,200 gal/yr) and PD 680 (300 gal/yr). TCE (300 gal/yr) was used from 1970 until 1974. The final disposition of the above wastes has been as follows: fire department training exercises and delivery to the CESF for sale to contractors or contractor removal from 1970 until 1974; and from 1974 to present, delivery to the CESF for sale to contractors or contractor removal.

cc. Other

There are numerous other aircraft and vehicle maintenance operations which generate small amounts of wastes or which use hazardous materials that are consumed in the process (refer to Appendix E). The Housing Maintenance Shop (Facility 21042) generates small quantities of paint remover and thinners which are collected and turned in to the CESF. The Fuel Cell Shop (Facility 7005) generates small quantities of MEK, toluene, and cleaning solvent which are collected and turned in to the CESF.

3. Historical Summary of Major Solvent Usage

The use of TCE as a cleaning solvent at Mather AFB began in approximately 1958. TCE replaced carbon tetrachloride as the common solvent used in the industrial shops and flight line maintenance area. TCE was used until 1974, when its use was banned by the state, primarily for air pollution reasons. In 1974, 1-1-1 trichloroethane then replaced TCE as the common solvent used on-base. The approximate time frame in which the above solvents were used are shown on Figure 22.

The solvents are used extensively in the industrial shops on base for a multitude of cleaning activities. The solvents are used for the cleaning of aircraft and vehicle parts, often in dip tanks; for the cleaning of electronic parts; for weapons cleaning in vapor degreasing tanks; and for spot cleaning and degreasing in the washrack areas. An inventory conducted by base personnel around 1970 indicated that approximately 80 55-gallon drums of TCE were on hand and being used by the various industrial shops around the base. The 1970 TCE inventory is summarized in Table 3 and lists the building number, the quantity of drums on hand and, if known, the industrial activity at each location.

4. Fuels

The major fuel storage area at Mather AFB is located at Facilities 4005 and 4020, which house two aboveground, diked fuel storage tanks. The fuel storage tanks have a combined capacity of 1,260,000 gallons and contain JP-4 fuel. A complete inventory of POL storage tanks, including location, capacity, and type of POL stored, is included in Appendix F.

There is a 150-gallon underground leaded MOGAS fuel storage tank which was recently (February 1982) discovered to be leaking. The MOGAS storage tank is located at the sewage treatment plant and the total amount of fuel which leaked into the ground since its installation is estimated to be approximately 700 gallons.

Other than the leaking MOGAS storage tank mentioned above, the records search did not indicate any

Table 3
1970 TRICHLOROETHYLENE INVENTORY[a]

Facility Number	Quantity of Drums on Hand	Industrial Activity
2995	2	Motor Pool
3900	3	Motor Pool
3940	2	Motor Pool
4150	6	ATC Flight Line Maintenance
4260	3	ATC Flight Line Maintenance
4376	2	ATC Flight Line Maintenance
4474	8	ATC Flight Line Maintenance
4677	4	ATC Flight Line Maintenance
4840	6	ATC Flight Line Maintenance
7001	2	SAC Flight Line Maintenance
7009	3	Munitions and Equipment Maintenance
7010	2	SAC Flight Line Maintenance
7015	1	SAC Organizational Maintenance
7020	8	SAC Avionics Maintenance
7022	4	SAC Flight Line Maintenance
7024	3	SAC Flight Line Maintenance
7035	6	SAC Flight Line Maintenance
10100	1	Radio Maintenance
10400	2	--
10450	2	Security Policy Armory
10525	2	--
12500	3	Small Arms Firing Range
18015	3	Special Weapons Maintenance
Total	80	

[a]Inventory represents a single inventory and does not necessarily relate to use factors.

significant problems with leaky tanks, major fuel spills, or suspected fuel-saturated areas.

The major fuel tanks are cleaned approximately once every 3 years. The quantities of sludge generated during a cleaning operation are small. Until recently, the sludge was weathered and then buried inside the diked area at the fuel tank farm. Leaded AVGAS fuel was used at Mather AFB in the past. Sludge generated from the cleaning of AVGAS fuel tanks was also buried inside the diked area at the fuel tank farm. This area is marked with a sign reading "Danger, Tetraethyl Lead Burial Site." Leaded AVGAS is no longer used at Mather AFB. In recent years, the sludge has been hauled off-base by a contractor for proper disposal at an approved site.

5. Abandoned Tanks

There are 12 known abandoned storage tanks on Mather AFB. The location, capacity, and type of POL which was stored in these tanks are summarized in Appendix G. These tanks are currently either empty or "pickled." Pickled tanks contain a mixture of water and rust inhibitor.

6. Fire Department Training Activities

Fire department training activities have been common since the activation of the base. Past and present fire department training activities at Mather AFB are as follows:

- 1918 to 1922; 1930 to 1932; 1941 to 1945: Fire Department Training Area No. 1 was used. This site was located approximately 500 yards east by southeast of the main base water storage reservoir. POL wastes, which included commingled waste oils, fuels, and solvents, were used for the training exercises. The POL wastes were transported from the flight line shop area to the fire department training area in drums and bowsers. Approximately 50 to 250 gallons of POL waste were used per exercise. The frequency of exercises was once per week. The POL waste was poured onto a simulated aircraft located in a bermed area and set on fire.

o 1945 to 1947: During this time period, Fire Department Training Area No. 2 was used. This site was located west of the Base Operations Building underneath the current aircraft parking ramp. Approximately 50 to 200 gallons of POL waste were used per exercise and the exercises were conducted on a daily basis. The training exercises were conducted within an earthen berm and the same procedures which were conducted at Fire Department Training Area No. 1 were followed.

o 1947 to 1958: Fire Department Training Area No. 3 was located in an old revetment adjacent to the existing main base fire station and was in use from 1947 to 1958. The training exercises were conducted on a daily basis using 100 to 500 gallons of POL waste per exercise. As with the previous sites, some solvents were commingled with the POL waste. The same procedures used at the previous sites were followed.

- 1958 to present: Fire department training exercises are currently conducted at the Existing Fire Department Training Area which is located south of the sewage treatment plant and adjacent to the "7100" Area Disposal Site. From 1958 to 1974, training exercises were conducted on a daily basis using 100 to 500 gallons of POL waste per exercise. The exercises are conducted in a compacted area within an earthen berm. In 1974, the practice of burning POL waste during the training exercises was halted. In 1974, two above-ground 1,000-gallon storage tanks for the storage of JP-4 fuel and a manifold system to transport the fuel from the storage tanks to the simulated aircraft were installed at the site. From 1974 to 1979, only clean JP-4 fuel was used in the exercises. The frequency of exercises was reduced to once per quarter and 600 to 800 gallons of clean JP-4 fuel was used per exercise. Since 1979, contaminated JP-4 with less than 10 percent contamination has been used at the site. The exercises are still conducted on a quarterly basis using 600 to 800 gallons of contaminated JP-4 per exercise.

7. Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are among the most chemically and thermally stable organic compounds known to man. Because of their stability, PCBs, once introduced into the environment, persist for long periods of time and are not readily biodegradable.

Possible sources of PCBs at Mather AFB are electrical transformers and capacitors. All out-of-service transformers are stored in Facility 4235. Of the 43 out-of-service transformers in storage, 39 have been tested and 4 are awaiting testing. Of the 39 transformers tested 2 contain greater than 500 ppm of PCBs; 6 contain between 50 and 500 ppm of PCBs; and 31 contain less than 50 ppm of PCBs. There are 13 in-service transformers containing PCBs, each containing between 7 and 48 gallons of transformer oil. Also, there are 105 in-service capacitors containing PCBs. All out-of-service transformers containing PCBs are stored temporarily awaiting proper contractor disposal through the DPDO.

There is no record of any major PCBs spills from leaking transformers. However, information obtained during the interviews indicated that transformer oil, which may have been contaminated with PCBs, has been disposed of at two known sites. One interviewee reported disposing of an unknown quantity of transformer oil in the "7100" Area Disposal Site. Another interviewee estimated that 1,225 gallons of transformer oil was disposed of at the AC&W Disposal Site between 1960 and 1966.

8. Pesticides

Pesticides are commonly used at Mather AFB for pest and weed control. The entomology shop controls the use and handling of all the pesticides, while Civil Engineering Roads and Grounds controls the use of herbicides. The pesticides are used to control mosquitos, flies, roaches, rats, ants, termites, California ground squirrels, sea gulls, and pigeons, as well as undesirable weeds and overgrowth.

The major pesticides currently used on-base are: Malathion, D-Tox 4E, Diazinon, Ficam W, Earwig bait, Resmenthrin, Round Up, Spike 80W, Prineep 42, Atratol 80W, Hyvar X weed killer, Aatrex-Nine-O, and Fenocil. All pesticides are EPA-registered chemicals. Proper preparation and application procedures are followed. All empty pesticide containers are triple rinsed prior to disposal. Rinse water is used for dilution water when the next batch is mixed. Currently, all rinsed empty containers are placed in a dumpster for contractor removal. Prior to 1974, the empty containers were disposed of in a base landfill.

The only reported incident involving improper handling of pesticides occurred in 1965 when the disposal of a large quantity of insecticide in the base storm drainage system caused a fishkill in Morrison Creek. Both DDT and 2,4-D were used in the past. Approximately 300 to 400 pounds per year of DDT were used prior to the mid-1960's. DDT and 2,4-D are no longer used at Mather AFB. There was no indication of any significant contamination problems, other than the Morrison Creek fishkill mentioned above, resulting from past pesticide usage.

9. <u>Wastewater Treatment</u>

The sanitary and industrial wastewater from Mather AFB is treated at the base sewage treatment plant. The average daily flow from sanitary sources is 900,000 gallons per day (gpd), and the average daily flow from industrial sources is 150,000 gpd. The industrial wastewater contribution amounts to approximately 14 percent of the total average daily flow. Some industrial wastewater receives pretreatment, by oil/water separators located in the industrial shop areas, for the removal of floating oils and greases.

The sewage treatment plant provides secondary treatment by means of a trickling filter plant. The basic plant has dual treatment facilities designed for a hydraulic loading of 850,000 gpd. Subsequent additions and modifications increased the flow capacity to 1,300,000 gpd. The installation of four series-connected oxidation ponds, which provide an additional 120 days retention of the plant effluent, allows proper operation of the plant at the existing loadings.

The effluent from the plant is discharged into Morrison Creek. The treated effluent is routinely monitored for biochemical oxygen demand, suspended solids, settleable matter, cyanide, and total coliform bacteria as required by the state discharge permit. The treated effluent is also monitored periodically for heavy metals, phenols, cyanide, oil and grease, and surfactants. Recent sampling results do not indicate the presence of significant concentrations of any of the above constituents in the treated effluent.

The waste sludge from the treatment plant is anaerobically digested and then dewatered in sludge drying beds. The dewatered sludge was used as a soil conditioner by the base golf course in the past. However, since mid-1980, the sludge has been stockpiled adjacent to the plant. The sludge drying beds are underlain by a leachate collection system which collects the leachate and returns it to the influent of the treatment plant.

Mather AFB is scheduled to connect into the Sacramento County Regional Waste Treatment System in 1982. At that time the total combined sanitary and industrial wastewater will be contracted to be discharged to the regional system for treatment.

There are seven in-service belt skimmer oil/water separators located on-base: one in the west ditch, one in the south ditch, and five connected to various industrial shops and washracks to provide pretreatment of the industrial wastewater prior to discharging to the sanitary sewer. One out-of-service skimmer is located at Facility 3991. The location of all eight skimmers is shown in Figure 23. An inventory of all belt skimmer oil/water separation facilities appears in Appendix H. In addition to the belt skimmers, there are numerous other oil/water gravity separation tanks and oil and grease traps located at various sites on Mather AFB.

10. Other Activities

The review of the records and information obtained in the interviews produced no evidence of past or present storage, disposal, or handling of biological or chemical warfare agents at Mather AFB.

All explosive ordnance disposal activities are conducted at the demolition and burn facility located at Facility 12600. This facility has been in existence since 1961. Primarily starter cartridges and small munitions are burned at the facility. There is a 225-pound explosive limit and any large munitions are sent off-base for proper disposal.

11. Available Water Quality Data

The bioenvironmental engineering staff at Mather AFB is responsible for taking periodic samples from drainage ditches, the plating shop discharge to the sanitary sewer, the sewage treatment plant discharge to Morrison Creek, Morrison Creek downstream from the sewage treatment plant discharge, and 15 water wells on-base.

a. Water Well Analyses

Mather AFB obtains water from six separate water well/treatment systems on-base. The average annual water demand is about 3.5 million gallons per day (mgd). A summary of the six water supply systems is given below:

Location	Number of Wells	Well Depth (ft)	Perforation Depth (ft)	Average Well Capacity (mgd)	Treatment
Main Base	4	500-584	186-571	0.6-1.3	Chlorination
Family Housing	6	400-584	205-500	0.6-1.7	Iron and Manganese Removal, Chlorination, Fluoridation
Golf Course	2	390-403	No Data	1.0	None
AC&W	1	250	198-244	0.077	None
K-9 (SAC Ordnance)	1	250	No Data	0.043	Chlorination
Jet Engine Test Cell	1	200	39-79+	0.024	Chlorination

The golf course wells are used only for irrigation, whereas the jet engine test cell well is used primarily for fire protection and wash water for jet engine testing. The AC&W well is currently used only to provide water for fire protection.

The wells are analyzed periodically for heavy metals, pesticides, and trihalomethanes. Recent test results show that no heavy metals or pesticides are present in the well supplies. Trihalomethane analyses show very low levels, generally less than 1 part per billion (ppb), which is well below the EPA standard of 100 ppb.

b. Trichloroethylene Ground-Water Contamination

According to news media reports trichloroethylene (TCE) ground-water contamination was first discovered in the Sacramento area in early August 1979 in wells located northeast and upgradient from Mather AFB.

Mather AFB began testing its wells in late August 1979. The first results indicated no contamination; however, subsequent testing showed the presence of TCE in several of the wells. Table 4 gives a summary of TCE sampling results at Mather AFB from August 24, 1979, through August 26, 1981. TCE sampling efforts are continuing. A discussion of the results to date is given below:

i. Main Base Wells

In general, the main base wells are clean although some low-level TCE values were found during the early testing. Main base well No. 2 had positive TCE results on October 15, 1979 (1.3 ppb) and on January 17, 1980 (13.9 ppb). A duplicate sample on January 17, 1980 gave negative TCE results, placing the 13.9-ppb value in question. Main base well No. 3 showed trace TCE (less than 1 ppb) on February 14, 1980. All other TCE sampling results for main base well No. 3 were negative. Main base well No. 4 had positive TCE results on November 21, 1979 (4.9 ppb) and January 17 and February 14, 1980 (trace levels less than 1 ppb). Sampling results since then show no TCE present in main base well No. 4.

ii. Family Housing Wells

In general, the family housing wells are clean although some low-level TCE values have been found in some of the wells. A TCE level of 2.8 ppb was found in

Table 4
TCE SAMPLING RESULTS AT MATHER

Sample Location	Trichloroethylene (TCE) Sampling Results, parts per bil											
	1979											
	24 Aug.	29 Aug.	14 Sept.	25 Sept.	4 Oct.	15 Oct.	30 Oct.	21 Nov.	19 Dec.	17 Jan.	14 Feb.	28
WELLS												
Main Base No. 2		ND[b]				1.3		ND	ND	13.9[c]	Trace[d]	
Main Base No. 3		ND					ND	ND	ND		Trace	N
Main Base No. 4		ND					ND	4.9	ND	Trace	Trace	
Housing No. 1	ND	ND					ND	ND	ND	ND	Trace	N
Housing No. 2		ND				ND		ND	ND	ND	Trace	N
Housing No. 3		ND					ND	ND	ND	ND	Trace	N
Housing No. 4		ND					ND	ND	ND	ND	Trace	N
Housing No. 5		ND					ND	ND	ND		Trace	N
Housing No. 6		ND					ND	ND	2.8	ND	Trace	N
AC&W Well		ND	30.2	17.1	25.8	17.6		15.1	58.2[e]	16.0		1.
K-9 Well[g]		4.3	ND	ND		Trace		1.7	Trace	ND	ND	
Golf Course No. 1		ND							ND			
Golf Course No. 2	ND	ND							ND			N
Jet Engine Test Cell						1.2		ND	ND	ND	Trace	
DISTRIBUTION SYSTEM												
Golf Club House					Trace[h]					ND	ND	
152 Dean Terrace								10.7	2.2	ND	Trace	
211 Branch Drive									2.5	ND	ND	
Building 4625								1.5	1.6	ND	ND	
Plating Shop (Bldg. 4150)									4.2	ND	ND	
Hospital Laboratory								3.0	1.9	ND	ND	

[a]All analyses performed by USAF OEHL, Brooks AFB, Texas.
[b]ND = none detected.
[c]Duplicate sample gave negative TCE results.
[d]Trace—detectable but not quantifiable.
[e]TCE level reduced to 4 ppb after bailing for 2 minutes.
[f]Four samples were taken; the highest TCE value was 12.4 ppb. The other samples had TCE levels of 11.3 ppb, 3.2 ppb, and 8.4 ppb.
[g]Also known as SAC Ordnance well.
[h]Connected to AC&W well at time of sampling.

AD-A123 927 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR MATHER AIR FORCE BASE CALIFORNIA(U) CH2M HILL GAINESVILLE FL JUN 82 F08637-80-G-0010

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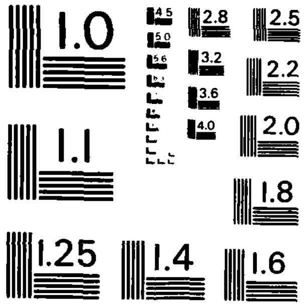

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

Table 4
ESULTS AT MATHER AFB

ing Results, parts per billion (ppb)[a]												
1980									1981			Average of All Results
17 Jan.	14 Feb.	28 Feb.	27 Mar.	1 May	5 June	17 July	21 Aug.	15 Sept.	8 Jan.	8 Apr.	26 Aug.	
13.9[c]	Trace[d]		ND	ND	ND	ND	ND		ND	ND	ND	1.09
	Trace	ND	ND	ND							ND	<.01
Trace	Trace		ND		ND	ND	ND		ND	ND	ND	<0.4
ND	Trace	ND	ND								ND	<0.01
ND	Trace	ND	ND									<0.01
ND	Trace	ND	ND									<0.01
ND	Trace	ND	ND			ND	ND		ND	ND	ND	<0.01
	Trace	ND	ND								ND	<0.01
ND	Trace	ND	ND	ND	ND	ND	ND			ND	ND	<0.21
16.0		1.7	3.6	15.5	18.9	16.6	112	12.4[f]	ND	ND	19.3	21.1
ND	ND		ND	ND		ND	ND		ND		Trace	<0.33
			ND								ND	ND
		ND									ND	ND
ND	Trace		Trace		ND	ND	ND		Trace	Trace	Trace	<0.14
ND	ND		Trace	ND							ND	<0.03
ND	Trace		ND	ND	ND	ND	Trace		ND	ND	Trace	<1.1
ND	ND		ND		ND	ND	ND		ND		ND	<0.3
ND	ND		ND	ND	ND	ND	ND		ND	ND[h]	ND	0.26
ND	ND		ND	ND	ND						ND	0.60
ND	ND		ND		ND	ND	ND		ND	ND	ND	0.45

.4 ppb.

2

family housing well No. 6 on December 19, 1980; and trace TCE levels (less than 1 ppb) were found in all of the family housing wells on February 14, 1980. Sampling results since then show no TCE present in any of the family housing wells.

iii. AC&W Well

The AC&W well has consistently shown positive TCE results. This well was sampled 18 times from August 1979 to August 1981, and TCE was found in 15 of the sampling episodes. The highest TCE value for this well (112 ppb) was reported on August 21, 1980. The use of the AC&W well for potable water was discontinued in October 1979, and the well is currently used only to provide water for fire protection. Sampling results since the August 21, 1980 high TCE value have shown much lower TCE levels, with no TCE detected on the January 8 and April 8, 1981 sampling dates. The most recent sample (August 26, 1981) showed a TCE level of 19.3 ppb.

iv. K-9 (SAC Ordnance Well)

The K-9 well has shown low level TCE results periodically since sampling began in August 1979. The highest TCE level (4.3 ppb) was found during the first sampling episode on August 29, 1979. Subsequent sampling showed 1.7 ppb on November 21, 1979, and trace levels on October 15 and December 19, 1979, and on August 26, 1981.

v. Jet Engine Test Cell Well

The jet engine test cell well, like the K-9 well, has shown periodic low-level TCE results since sampling of this well began in October 1979. The highest TCE level (1.2 ppb) was found on October 15, 1979, while trace levels were found on August 14 and March 27, 1980, and on January 8, April 8, and August 26, 1981.

vi. Golf Course Wells

TCE has never been found in any of the samples taken from the golf course wells.

vii. Distribution System Sampling Points

In general, low-level TCE results have been found in all of the distribution system sampling points. The highest TCE level (10.7 ppb) was found at the Dean Terrace family housing sampling point on November 21, 1979. The 10.7-ppb value is questionable since TCE was not detected in any of the family housing wells, which were all sampled on the above date. Positive TCE results were also found on the above date at the Building 4625 and the Hospital Laboratory main base sampling points. Positive TCE results ranging from 1.6 to 4.2 ppb were found at the family housing and main base distribution system sampling points on December 19, 1979. The main base and family housing wells were also sampled on the above date, with family housing well No. 6 showing the only positive result (2.8 ppb). Sampling results since December 19, 1979, have shown no TCE at the Branch Drive, Building 4625, Plating Shop, and Hospital Laboratory sampling points; and no TCE or only trace TCE at the Dean Terrace and golf club house sampling points.

c. TCE Guidelines

There are currently no TCE water quality standards adopted by law by the State of California or the EPA. However, the State Department of Health Services has chosen a TCE level of 4.5 ppb as an "initial action level" for examining ground-water supplies. The "true value" TCE level is determined as the average of at least the last five samples. Based on the above guidelines, the AC&W well is the only well in the initial action level category at Mather AFB. As stated previously, this well is no longer used for potable purposes. It is anticipated that the EPA will eventually adopt a TCE standard between 5.0 and 500 ppb. According to cancer risk studies, an individual drinking two liters of water per day containing 4.5 ppb of TCE over a 70-year lifetime would have a statistical probability of one additional chance in one million of contracting cancer.

d. Off-Base Wells

The Central Valley Regional Water Quality Control Board and the Sacramento County Health Department have sampled numerous private wells throughout the Rancho Cordova area since the initial discovery of TCE ground-water contamination in August 1979. Figure 14 shows the locations of the Mather AFB wells and several nearby off-base wells which have been sampled for TCE. Test results from 1981 and 1982 have shown low-level TCE contamination (5.1 to 9.3 ppb) in three private residence wells located in the Happy Lane and Mather Camelia Mobile Home Park area. These wells are in close proximity to the northwest boundary of Mather AFB. The most recent samples taken in January 1982 showed positive TCE results in the wells on Happy Lane (8.0 and 9.3 ppb). Another volatile organic component, trans-1,2-dichloroethylene (DCE), was also found in both of the wells and was present at a 22-ppb level in one of the wells. As a point of information, it is anticipated that the EPA will eventually adopt a DCE standard between 1.0 and 100 ppb. This compound may be useful as a "tracer" aid in the identification of the source of the contamination. A volatile organic scan for 28 compounds was conducted once in January 1980 on Mather AFB wells and distribution system sampling points. The compound trans-1, 2-dichloroethylene was not detected during this sampling.

The off-base wells showing TCE contamination are old (1946-1952) and shallow (97-130 feet). Newer and deeper wells (150+ feet) near the contaminated wells have tested clean, indicating that the contaminated ground water is in the shallow zone above 150 feet.

e. Soil Sampling

A former employee at the AC&W site recalled the past practice of routinely disposing of waste solvents and oils by dumping the wastes into a "pipe in the ground" behind the AC&W (now FAA) radar site (see Page IV-54 for further details). The employee recalled the approximate location of the past disposal site, which was close to the AC&W well (within 100 feet) which has consistently shown TCE contamination. The base bioenvironmental engineering staff collected soil samples in November 1979 to determine the exact location of the past disposal site and the extent of soil contamination. A backhoe was used to excavate an area approximately 30 feet long and 15 feet wide. Excavation depths ranged from 4 feet at the edges to a maximum of 6 feet at the center of the site. Seven soil samples were collected at 3- to 6-foot depths and analyzed for TCE and PCBs. The results were negative.

f. Drainage Ditches

The east and west drainage ditches are monitored periodically for heavy metals, oil and grease, phenols, cyanide, and surfactants. Recent sampling results do not show the presence of significant concentrations of any of the above constituents at the drainage ditch sampling points.

g. Plating Shop

The plating shop wastewater discharge to the sanitary sewer is monitored periodically for cyanide and heavy metals. Recent results do not show the presence of significant concentrations of any of the above constituents in the plating shop wastewater discharge.

h. Sewage Treatment Plant

The Mather AFB sewage treatment plant effluent is routinely monitored for biochemical oxygen demand, suspended solids, settleable matter, cyanide, and total coliform bacteria as required by the state discharge permit. The treated effluent is also monitored periodically for heavy metals, phenols, cyanide, oil and grease, and surfactants. Recent sampling results do not indicate the presence of significant concentrations of any of the above constituents in the treated effluent.

i. Morrison Creek

Morrison Creek is monitored routinely by the base at a point 1 mile downstream of the sewage treatment plant discharge. Routine monitoring required by the state discharge permit includes phenols, oil and grease, and surfactants. All discharges from the base (drainage ditches and sewage treatment plant effluent) enter Morrison Creek prior to this sampling point. Recent results do not show the presence of significant concentrations of any of the above constituents at the Morrison Creek sampling point.

Some water and sediment sampling of Morrison Creek was conducted during a recent investigation at the Sacramento Army Depot, which is located approximately 4.5 miles southwest of Mather AFB. The results are presented in a November 1981 report "Environmental Contamination Survey and Assessment of Sacramento Army Depot." Water and bottom sediment samples were collected at three locations, including the creek entry and exit points, and analyzed for pesticides, heavy metals, volatile and semivolatile organic compounds, and radioactivity. The results showed the presence of low levels of lindane, lead, zinc, copper, cadmium, chromium, chloroform, and several semivolatile organic compounds in some of the samples. TCE was not detected in any of the samples. The report concluded that the constituent levels found in the Morrison Creek water and sediment samples were insignificant and did not pose a threat to human health or the environment.

B. DISPOSAL SITES IDENTIFICATION AND EVALUATION

Interviews with 35 past and present base personnel (Appendix C) resulted in the identification of 23 disposal and spill sites at Mather AFB. The approximate locations of these sites are shown on Figure 24. A summary of the approximate dates that the major sites were in use is given on Figure 25.

A preliminary screening was performed on all 23 identified past disposal and spill 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., page I-5, based on all of the above information, a determination was made whether a potential exists for hazardous material contamination in any of the identified sites. For those sites where hazardous material contamination was considered significant, a determination was made whether a significant potential exists for contaminant migration from these sites. TCE was generally used as the reference indicator for potential contaminant migration pathways due to its presence in the area ground water. 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 applications to the Air Force Installation Restoration Program. The HARM system considers four aspects of the hazard posed by a specific site: the waste and its characteristics, potential pathways for waste contaminant migration, the receptors of the contamination, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating. A more detailed description of the HARM system is included in Appendix I. Copies of the completed rating forms are included in Appendix J. A summary of the overall hazard ratings is given in Table 5.

The following is a description of each site including a brief discussion of the rating results for the site.

1. Landfills

Sanitary landfill sites at Mather AFB from pre-1942 until 1974 are discussed below. Since 1974, all general refuse from Mather AFB has been collected by contractor and disposed off-base in Sacramento County landfills.

- Site No. 1, referred to as the Runway Overrun Landfill, was the original base landfill which was in operation prior to 1942. Some of the material from this landfill was excavated during construction of the runway. This site was used for all general refuse from the base. It is possible that some POL wastes, including commingled oil and solvents, went to this landfill; however, quantities would have been small because of the

Table 5
SUMMARY OF RESULTS OF SITE ASSESSMENTS

Site No.	Site Description	Subscores (% of Maximum Possible Score in Each Category) Receptors	Pathways	Waste Characteristics	Overall Score (Sum of Subscores/3)	Page Reference of Site Rating Form
1	Runway Overrun Landfill	53	33	40	42	J-1
2	"8150" Area Landfill	56	33	50	46	J-3
3	NE Perimeter Landfill No. 1	48	27	70	48	J-5
4	NE Perimeter Landfill No. 2	48	27	80	52	J-7
5	NE Perimeter Landfill No. 3	44	27	40	37	J-9
6	Firing Range Landfill Sites	48	33	60	47	J-11
7	"7100" Area Disposal Site	56	80	100	79	J-13
8	Fire Department Training Area No. 1	53	33	60	49	J-15
9	Fire Department Training Area No. 2	54	27	60	47	J-17
10	Fire Department Training Area No. 3	51	33	60	48	J-19
11	Existing Fire Department Training Area	56	33	64	51	J-21
12	AC&W Disposal Site	56	100	100	85	J-23
13	Drainage Ditch Site No. 1	53	80	80	71	J-25
14	Drainage Ditch Site No. 2	58	80	60	66	J-27
15	Drainage Ditch Site No. 3	53	80	100	78	J-29
17	Weapons Storage Area Septic Tank	59	80	40	60	J-31
18	Old Burial Site	54	33	40	42	J-33
19	Fuel Tank Sludge Burial Site	59	33	30	41	J-35
20	MOGAS Spill Site	50	33	48	44	J-37
23	Sanitary Sewer System East of Eknes Street	57	27	70	51	J-39

small-scale flight line industrial operations prior to 1942. The overall rating score for this site is 42. The relatively high receptors category subscore of 53 is due primarily to the proximity of this site to Main Base Well No. 1 (960 feet) and to the reservation boundary (900 feet). The waste characteristics subscore is low (40) due to the suspected small quantities of waste solvents which may have been disposed of at the site. The pathways category subscore is also low (33), with the highest rating factor being the close proximity of the site to a nearby drainage ditch (approximately 650 feet). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 2, referred to as the "8150" Area Landfill Site, was the main sanitary landfill for the entire base from 1942 until 1950. A portion of the SAC alert area is constructed over this landfill site. Information concerning the operation of this site is meager. However, it was common practice during this time to dispose of POL wastes in fire department training areas and in landfills. Therefore, it is possible that some POL wastes were disposed of at this site. The overall rating score for this site is 46. The receptors category subscore of 56 is due primarily to the proximity of this site to the AC&W well (2,480 feet) and to the base housing residential area (3,400 feet). The waste characteristics subscore of 50 is due to the suspected medium quantities of waste solvents which may have been disposed of at the site. The pathways category subscore is low (33), with the highest rating factor being the close proximity of the site to a nearby drainage ditch (approximately 20 feet). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 3, referred to as NE (Northeast) Perimeter Landfill No. 1, was the main sanitary landfill for the entire base from 1950 until 1967. The operation consisted of narrow trenches, approximately 300 feet long, 25 feet wide, and 18 feet deep. The waste was placed in the trench, then burned and buried on a daily basis. The operation started at the western edge and worked toward the eastern edge of the site. During this time, the individual industrial shops were responsible for the collection and disposal of POL wastes. Several interviewees indicated that POL wastes in drums were disposed of at this site. The use of TCE began at Mather AFB in about 1958; therefore, some TCE waste may have been disposed of at this site. The quantities are suspected to be small, however, since the major modes of disposal of POL wastes prior to 1966 were in fire department training areas and at Site No. 7, which is discussed later. Other items which were reportedly disposed of at this site included hospital wastes, waste paints and thinners, and empty pesticide containers. The overall rating score for this site is 48. The receptors category subscore of 48 is due primarily to the proximity of this site to the reservation boundary (50 feet). The waste characteristics subscore of 70 is due to the suspected large quantities of waste solvents and thinners which may have been disposed of at the site. The pathways category subscore is low (27). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 4, referred to as the NE Perimeter Landfill No. 2, was the main sanitary landfill for the entire base from 1967 until 1971. The site is adjacent to and east of Site No. 3. Operation was similar to that of Site No. 3 and included trenches with daily burning and burial of the waste. A POL waste disposal pit was reportedly located at the northeast corner of this site and was in operation for about 2 years from 1967 to 1968. The pit was approximately 40 feet long, 40 feet wide, and 10 feet deep. The POL waste was reportedly transported to the pit in 500-gallon bowsers and dumped into the pit. TCE was in use on-base at this time, and may have been present in the POL waste. The overall rating score for this site is 52. The receptors category subscore of 48 is due primarily to the proximity of this site to the reservation boundary (50 feet). The waste characteristics subscore of 80 is due to the confirmed medium quantities of waste solvents which have been disposed of at this site. The pathways category subscore is low (27). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 5, referred to as the NE Perimeter Landfill No. 3, was the main sanitary landfill for the entire base during 1971. This site was in use for only 1 year and consisted of a single trench, approximately 300 feet long, 25 feet wide, and 18 feet deep. Burning was prohibited in 1971 and was not conducted at this site. Some small quantities of POL waste in drums may have been disposed of at this site. However, the main modes of POL waste disposal at this time were fire department training and central collection and recycle. Interviews indicated that the Sacramento Army Depot also used Sites 3, 4, and 5 for trash disposal. The overall rating score for this site is 37. The receptors category subscore of 44 is low since this site is not as close to the reservation boundaries as Sites 3 and 4. The waste characteristics subscore of 40 is due to the suspected small quantities of solvents which may have been disposed of at this site. The pathways subscore low (27). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 6, referred to as the Firing Range Landfill Site, was the main sanitary landfill site for the entire base from 1972 until 1974 when on-base sanitary landfill operations ceased. The operation consisted of two trenches south of a drainage swale, each approximately 40 feet wide, 150 feet long, and 20 to 30 feet deep; and one trench north of the same drainage swale approximately 40 feet wide, 150 feet long and 18 feet deep. These sites are clearly distinguishable because the cover extends 7-12 feet above ground level. The sites were used primarily for garbage and household trash disposal. Some waste thinners and paint slop in drums were also reportedly disposed of at this site. It is also possible that small quantities of POL wastes in drums were sent here; however, this was not a common practice. The overall rating score for this site is 47. The receptors category subscore of 48 is due primarily to the proximity of this site to the reservation boundary (50 feet). The waste characteristics subscore of 60 is due to the confirmed small quantities of waste thinners which have been disposed of at this site. The pathways category subscore is low (33). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 7, referred to as the "7100" Area Disposal Site, is located south of the sewage treatment plant and has been in use since 1953. This site was also known as the "non-burn dump" and the "construction rubble disposal site." It is currently used for disposal of inert construction rubble, but was reportedly used in the past as a "catch-all" site for all types of wastes except household garbage, which was sent to the base sanitary landfills for disposal. The site was originally a gravel borrow pit which was excavated in 1953 for construction of the SAC area. The borrow pit was originally about 40 feet deep and has been completely filled with refuse. This site was reportedly used as a major disposal site for POL wastes from 1953 until about 1966 and was operated concurrently with the sanitary landfill sites. Bowsers (500 gallon capacity) from the industrial shop areas were routinely transported to this site for disposal of POL wastes. TCE was in common use at Mather AFB during most of this time, and may have been commingled with the waste oils disposed of at this site. The practice was curtailed in 1966 when an oily seepage was observed leaching into an adjacent borrow pit. Other wastes reportedly disposed of included empty drums, sludge from the plating shop dip tanks (approximately 80 gallons per year until 1975), absorbent sand used in cleaning oil and solvent spills, and one known incident of disposal of transformer oil which may have contained PCBs, paint chips, and waste paints and thinners. This was in addition to trash and construction debris which was routinely disposed of at this site. The overall rating score for this site is 79. The receptors category subscore of 56 is due primarily to the proximity of this site to the jet engine test cell well (2,800 feet) and to the base boundary (50 feet). The waste characteristics subscore of 100 is due to the confirmed large quantities of waste solvents which have been disposed of at this site. The pathways subscore is high (80) since this site is located upgradient of the jet engine test cell well where low-level TCE contamination has been detected periodically. Although this site is located slightly downgradient of the wells to the west of the base where TCE has been detected, it is considered a suspect source due to the confirmed disposal of large quantities of contaminants.

2. Fire Department Training Areas

The locations of four fire department training areas were determined from the records search. These sites are discussed below:

- Site No. 8, referred to as Fire Department Training Area No. 1, was the original fire training area at Mather AFB and was located approximately 500 yards east by southeast of the main base water storage reservoir. The site was used until 1945. The fire department training exercises were conducted once per week in a cleared area with an earthen berm. POL wastes from the flight line shop areas were transported to the site in drums and containers. Quantities of POL waste used per exercise ranged from 50 to 250 gallons. Some solvents were commingled with the POL waste; however, TCE was not in use during this time and would not have been present in the POL waste. The overall rating score for this site is 49. The receptors subscore of 53 is due primarily to the proximity of the site to Main Base Well No. 1 (1,300 feet) and to the reservation boundary (500 feet). The waste characteristics subscore of 60 is due to the confirmed small quantities of waste solvents which have been disposed of at the site. The majority of the solvents would have been destroyed in the burning operations. The pathways subscore is low (33). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 9, referred to as Fire Department Training Area No. 2, was located west of the Base Operations Building underneath the current aircraft parking ramp. This site was used from 1945 until 1947. The fire department training exercises were conducted on a daily basis in a cleared area with an earthen berm using 50 to 250 gallons of POL waste per exercise. As with Site No. 8, some solvents were commingled with the POL waste; however, TCE was not in use during this time and would not have been present in the POL waste. The overall rating score for this site is 47. The receptors subscore of 54 is due primarily to the proximity of the site to main base well No. 2 (1,200 feet). The waste characteristics subscore of 60 is due to the confirmed small quantities of waste solvents which have been disposed of at the site. The majority of the solvents would have been destroyed in the burning operations. The pathways subscore is low (27). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 10, referred to as Fire Department Training Area No. 3, was located in an old revetment adjacent to the existing main base fire station and was in use from 1947 until 1958. The fire department training exercises were conducted on a daily basis using 100-500 gallons of POL waste per exercise. As with the previous sites, some solvents were commingled with the POL waste; however, TCE was not in use during this time and would not have been present in the POL waste. The overall rating score for this site is 48. The receptors subscore of 51 is due primarily to the proximity of the site to a nearby off-base residential area (2,200 feet). The waste characteristics subscore of 60 is due to the confirmed small quantities of waste solvents which have been disposed of at the site. The majority of the solvents would have been destroyed in the burning operations. The pathways subscore is low (33). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 11, the Existing Fire Department Training Area, is located south of the sewage treatment plant and adjacent to the "7100" Area Disposal Site (Site No. 7). This site has been in use since 1958. The frequency of fire department training exercises was daily until 1974 and quarterly since 1974. The exercises are conducted in a cleared area with an earthen berm. From 1958 until 1974, POL wastes from the flight line shops were transported to the site in containers and used in the exercises at the rate of 100 to 500 gallons per exercise. In 1974, two 1,000-gallon above-ground storage tanks were installed for storage at JP-4. From 1974-1979, only clean JP-4 was used in the exercises (600-800 gallons per exercise). Since 1979, contaminated JP-4 which has been recovered from aircraft (does not contain oils or solvents) has been used. The overall rating score for this site is 51. The receptors category subscore of 56 is due primarily to the proximity of this site to the jet engine test cell well (3,000 feet) and to the reservation boundary (300 feet). The waste characteristics subscore of 64 is due to the confirmed medium quantities of waste solvents which have been disposed of at the site. The majority of the solvents would have been destroyed in the burning operations. The pathways category subscore is low (33), with the highest rating factor being the close proximity of this site to Morrison Creek (approximately 600 feet). Even though this site is located upgradient of the jet engine test cell well where low-level TCE contamination has been detected periodically, it is not as highly suspect as nearby Site No. 7.

3. Other Sites

Ten sites other than landfills or fire department training areas were also determined from the records search. These sites are discussed below.

- Site No. 12, referred to as the AC&W Disposal Site, is located in the Air Command and Warning (AC&W) area of the base. The site was constructed in the late 1950's as part of the Air Defense Command early warning system. The 668 AC&W Squadron, which operated the site jointly with the FAA, left Mather AFB in 1966. The site is currently occupied by the FAA and SAC Security Police Headquarters. It was reportedly common practice from 1960, and possibly prior to 1960, until 1966 for personnel at the AC&W radar site to dispose of waste solvents and oils into a waste disposal pipe located approximately 100 feet southwest of the AC&W well. One interviewee recalled disposing of waste TCE used for cleaning air intake filters and transformers, and transformer oil which may have contained PCBs. Waste quantities were estimated at about 120 gallons per year of TCE and about 130 gallons per year of transformer oil. Assuming that this practice occurred from 1958 until 1966, approximately 1,200 gallons of TCE and 1,000 gallons of transformer oil would have been disposed of by this method. An additional 150 gallons of waste TCE was generated during a major equipment renovation in the early 1960's; and an additional 225 gallons of waste transformer oil was generated during the removal of three large power transformers in 1966. These wastes were also reportedly disposed of in the waste disposal pipe.

The pipe was described as about 10 inches in diameter with a removable cap. Recent investigations to find the pipe and soil sampling to determine the extent of contamination were described previously in Section A.11, page IV-41. Other wastes reportedly disposed of included waste engine oils, carbon tetrachloride, and antifreeze. The overall rating score for this site is 85. The receptors category subscore of 56 is due primarily to the close proximity of this site to the AC&W well (100 feet) and to the base family housing residential area (2,400 feet). The waste characteristics subscore is high (100) because of the confirmed large quantities of TCE and transformer oil which have been disposed of at the site. The pathways category subscore is high (100) because this site is suspected to have caused TCE contamination in the nearby AC&W well. Because of its upgradient location, the site is also a suspect source of the TCE contamination which has been detected periodically in some of the family housing wells.

- Site No. 13, referred to as Drainage Ditch Site No. 1, is located adjacent to a former aircraft washrack operation which was located across the street from the main base water storage reservoir. The washrack was a major industrial operation in use from about 1960 until 1973 for B-52 and T-29 aircraft. Operations included aircraft depainting and grease removal. TCE was used for the grease removal. It was reportedly a common problem in this area that waste oil and solvents, possibly including TCE were poured directly into an oil skimmer located adjacent to a nearby drainage ditch. This practice overloaded the skimmer, and the waste oils and solvents overflowed into the drainage ditch. Prior to installation of the skimmer in 1968, it was possible that these wastes were poured directly into the drainage ditch which, at this point, is an unlined open ditch leading into a concrete culvert under the runway. The overall rating score for this site is 71. The receptors category subscore of 53 is due primarily to the proximity of this site to main base well No. 1 (400 feet) and to the reservation boundary (400 feet). The waste characteristics subscore of 80 is due to the confirmed medium quantities of waste solvents and paint strippers which have been disposed of at this site. The pathways category subscore is high (80) because some TCE may have been disposed of at the site and, therefore, the site is a suspect source of low-level TCE contamination which has been detected periodically in nearby main base wells 2, 3, and 4.

o Site No. 14, referred to as Drainage Ditch Site No. 2, is an unlined open ditch located between Building 2950 and the motor pool area. During the late 1960's, it was reported that waste oils and solvents were dumped directly into this ditch. A past waste inventory indicated that 7 drums of TCE was on hand in the motor pool. It is possible that some of this TCE was also dumped into the ditch. It is not known how long this method of disposal was practiced. The overall rating score for this site is 66. The receptors category subscore of 58 is due primarily to the proximity of this site to main base well No. 4 (600 feet) and to the reservation boundary (500 feet). The waste characteristics category subscore of 60 is due to the confirmed small quantities of waste solvents which may have been disposed of at this site. The pathways category subscore is high (80) because some TCE may have been disposed of at the site and, therefore, the site is a suspect source of the low-level TCE contamination which has been detected periodically in nearby main base wells 2, 3 and 4.

- Site No. 15, referred to as Drainage Ditch Site No. 3, is the site of the existing west ditch oil skimmer. The west ditch is an unlined open drainage ditch which receives the storm drainage from the entire main base area, including the ATC and SAC shops. It is located adjacent to and directly west of the SAC area of the base. After installation of the skimmer in 1967, it was reported that waste oils and solvents were dumped directly into the skimmer, thereby overloading the skimmer and causing the waste oils and solvents to overflow into the ditch. A past waste inventory indicated that about 30 drums of TCE were on hand in the SAC area. It is possible that some of this TCE was included in the wastes which overflowed into the ditch. One of the interviewees indicated that, prior to the installation of the skimmer, an underground tank was located at this site for POL waste disposal and that this area was commonly referred to as the waste oil disposal site. This tank was evidently removed when the skimmer was installed. It is possible that this site was subject to frequent spills and dumping of POL waste on the ground and in the ditch. Many of the floor drains in the shop areas are also connected to the storm sewer system, and it is possible that waste oils and solvents from inside the shops (spills and cleaning) also entered the west ditch.

Current practice is to connect all floor drains to the sanitary sewer. The overall rating score for this site is 78. The receptors category subscore of 53 is due primarily to the proximity of the site to wells west of the base (800 feet). The waste characteristics subscore is 100 due to the confirmed large quantities of waste solvents disposed of at this site. The pathways category subscore is high (80) because TCE may have been disposed of at the site and its slightly upgradient location from off-base wells where TCE contamination has been detected.

Because of its proximity to nearby off-base wells, the entire west ditch, including the oil skimmer site, must be considered a suspect source of contamination.

- Site No. 16, referred to as the Electron Tube Burial Site, is located in the SAC alert area directly under existing Building 8170. One of the interviewees recalled (unconfirmed) that, in the late 1950's, approximately 60 radioactive (low-level) electron tubes were buried in 15-foot-deep auger holes at this site. The electron tubes were placed in gallon-size containers and encased in concrete. Low-level radioactive electron tubes are not considered a hazardous waste. Since the tubes were encased in concrete, no pathways for contaminant migration exist and therefore, this site was not rated. The current Nuclear Regulatory Commission (NRC) accepted practice is to dispose of electron tubes in a sanitary landfill.

- Site No. 17, referred to as the Weapons Storage Area Septic Tank, is located at the SAC weapons storage area. This septic tank was in use until 1978, at which time the weapons storage area was connected to the sanitary sewer system. Although this septic tank was designated for domestic sewage only, due to the remoteness of this area, it is possible that some waste solvents were disposed of in the septic tank. There are no major industrial operations in this area; however, small quantities of solvents are used for wipe-down of weapons parts. A past waste inventory indicated that 3 drums of TCE were on hand in this area; therefore, it is possible that some TCE was disposed of in the septic tank. The overall rating score for this site is 60. The receptors category subscore of 59 is due primarily to the proximity of the site to the K-9 well (800 feet), to the reservation boundary (3,800 feet), and to the base family housing residential area (3,400 feet). The waste characteristics category subscore of 40 is due to the suspected small quantities of waste solvents, which may have been disposed of at the site. The pathways category subscore is high (80) because this site may contain some TCE and it is located close to the K-9 well where low-level TCE contamination has been detected periodically.

- Site No. 18, referred to as the Old Burial Site, is located in the existing parking lot adjacent to Building 4120. Some old cans and debris were encountered recently during installation of this parking lot. One of the interviewees indicated that this area was used in the past to temporarily bury various items including tool boxes, various stock items, and some containerized ethyl mercaptan that was used in gas line testing. Another interviewee indicated that this site was used as a general refuse landfill during the late 1940's. The overall rating score for this site is 42. The receptors category subscore of 54 is due primarily to the proximity of the site to the reservation boundary (650 feet) and to a nearby off-base residential area (650 feet). The waste characteristics subscore of 40 is due to suspected small quantities of containerized chemicals which may have been disposed of at the site. The pathways category subscore is low (33). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 19, referred to as the Fuel Tank Sludge Burial Site, is located inside the diked area containing the two main aboveground JP-4 storage tanks. The area is marked with a sign reading "Danger, Tetraethyl Lead Burial Site." The site contains sludge from fuel tank cleaning operations including sludge from the cleaning of leaded AVGAS fuel tanks. The tanks were cleaned about once every 3 years, and sludge quantities were small. The sludge was weathered and then buried inside the diked area. The overall rating score for this site is 41. The receptors category subscore of 59 is due primarily to the proximity of the site to off-base wells (1,400 feet), to the reservation boundary (400 feet) and to a nearby off-base residential area (400 feet). The waste characteristics subscore of 30 is due to the confirmed small quantities of dried fuel tank sludge containing lead (solid) which was disposed of at the site. The pathways category subscore is low

(33). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Site No. 20, referred to as the MOGAS Spill Site, is the site of a 150-gallon underground leaded MOGAS fuel storage tank which was recently discovered to be leaking at the sewage treatment plant. The tank supplies fuel for an emergency power generator, and the entire contents of the tank leaked from the tank over a 2-week period. The total amount of fuel which has leaked into the ground from the tank since it was installed is estimated to be about 700 gallons. The overall rating score for this site is 44. The receptors category subscore of 50 is due primarily to the proximity of the site to the reservation boundary (800 feet). The waste characteristics subscore of 48 is due to the confirmed small quantity of leaded MOGAS which leaked from the site and the low persistence of the MOGAS, since some biodegradation takes place in the soil. The pathways category subscore is low (33). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

- Sites 21 and 22, referred to as the Asphalt Rubble Storage Sites, are sites where asphalt rubble is stored on the ground in designated areas near the sewage treatment plant. These sites do not contain hazardous wastes; therefore, they were not rated.

- Site No. 23 is referred to as the Sanitary Sewer System East of Eknes Street. The base sanitary sewer system receives some industrial wastes from the shop areas. It is possible that some solvents, including TCE, from the shop areas (spills, washdowns, etc.) were discharged to the sanitary sewer system in the past. Therefore, leaks in the sanitary sewer system must be considered suspect sources of TCE ground-water contamination in the main base area. A recent inflow/infiltration study (1980) of the Mather AFB sanitary sewer system concluded that the main base contributes over 50 percent of the infiltration for the entire base during wet-weather periods. During dry-weather periods, it is possible that some exfiltration may also be occurring. The study also concluded that the main base area east of Eknes Street was the primary source of the infiltration. The main base wells are also located in the area east of Eknes Street. Specifically, sanitary sewers along 4th, 6th, 7th, and Eknes Streets were found to be affected by root intrusion. The overall rating score for this site is 51. The receptors category subscore of 57 is due primarily to the proximity of the site to main base wells No. 2 and 3 (600 feet). The waste characteristics subscore of 70 is due to the suspected large quantities of waste solvents which may have been discharged to the sanitary sewer system. The pathways category subscore is low (27). There is no direct or indirect evidence of ground-water or surface-water contamination at this site.

4. Suspect Sources of TCE Ground-Water Contamination

The surficial soils in the Mather AFB area contain a low-permeability layer just below the surface. In order for any significant pathways for ground-water contamination to exist, this low-permeability layer must be breached. It is possible that some incidental spillage and dumping of waste oils and solvents on the ground has occurred throughout the main base industrial areas. However, the low net precipitation (-27 inches per year) and the presence of the low-permeability layer make it unlikely that these incidents could have resulted in ground-water contamination. Fire department training exercises have been conducted in the past using POL wastes including commingled waste oils and solvents. However, these exercises were conducted in compacted areas and a combination of factors including low permeability, the burning operations, and the low net precipitation make it unlikely that the fire department training exercises could have resulted in ground-water contamination.

Disposal sites at Mather AFB where breaching of the hardpan has probably occurred include base landfills, the "7100" Area disposal site, the Weapons Storage Area septic tank, the AC&W area waste disposal pipe, and the unlined open drainage ditches in the main base area. Any of the above sites where past TCE disposal is confirmed or suspected are suspect sources for TCE ground-water contamination.

An industrial area, located northeast and upgradient from Mather AFB, is known to have serious TCE ground-water contamination. It is possible that contaminated ground water from this area may have migrated to Mather AFB. However, due to the distance involved (approximately 5 miles) and the relatively slow movement of ground water (.05-1.5 ft/day), the probability of contaminant migration from this area is low.

Another off-base industrial area, also located northeast and upgradient from Mather AFB, was formerly the site of a large industrial complex where testing of Saturn rockets was performed in the 1960's. Operations ceased about 10 years ago, and the area is currently an industrial park. Although there were no large-scale manufacturing operations, TCE was probably used in cleaning operations associated with the rocket testing. The proximity of this area (about 1 mile) from Mather AFB makes the probability of ground-water contaminant migration to Mather AFB relatively higher than the other industrial area which is located a greater distance away from the base.

Figure 26 shows the relative locations of Mather AFB and nearby industrial areas.

V CONCLUSIONS

V. CONCLUSIONS

A. Information obtained through interviews with past and present base personnel, base records and shop folders, and field observations indicates that hazardous wastes, including TCE, have been disposed of on Mather AFB property in the past. Water quality analyses of base wells provide evidence that TCE contamination is present in the ground water beneath Mather AFB.

B. The surficial soils in the Mather AFB area contain a low-permeability layer just below the surface. In order for any significant pathways for ground-water contamination to exist, this layer must be breached. Disposal sites at Mather AFB where breaching of the low-permeability layer has probably occurred include base landfills, the "7100" Area disposal site, the AC&W area waste disposal pipe, and the unlined open drainage ditches in the main base area. Any of the above sites where past TCE disposal is confirmed or suspected are possible sources of the TCE in the ground water.

C. An industrial area northeast and upgradient of Mather AFB is known to have serious ground-water contamination. However, due to the distance (approximately 5 miles) and the relatively slow movement of ground water, (.05 to 1.5 ft/day), it is possible but not likely that this area is a source of the TCE ground-water contamination at Mather AFB. Another industrial area, also located northeast and upgradient of Mather AFB, is the site of a former industrial complex where testing of Saturn rockets was performed in the 1960's. No ground-water monitoring data has been obtained from this area. Due to its close proximity (1 mile) to the base, this area has a relatively higher probability of ground-water contaminant migration to Mather AFB than the other industrial area which is located farther from the base.

E. Table 6 presents a priority listing of the rated sites and their overall scores. The following sites are possible sources for TCE ground-water contamination:

1. <u>Site No. 12 (AC&W Disposal Site)</u>

   This site was commonly used in the past for disposal of TCE and transformer oil and is suspected to have contaminated the nearby AC&W well. The site is also a possible source of the low-level TCE contamination which has appeared periodically in some of the family housing wells.

2. <u>Site No. 7 ("7100" Area Disposal Site)</u>

   This site was commonly used in the past for disposal of waste oils and solvents from the main base shop areas. Its location makes it a possible source of the low-level TCE contamination which has appeared periodically in the jet engine test cell well and in wells located west of the base.

3. <u>Site No. 15 (Drainage Ditch Site No. 3)</u>

   This site was subject to frequent waste oil and solvent spills in the past as a result of the past common practice of dumping of POL wastes directly into the west ditch skimmer. The entire west ditch, which drains the main base area, was also the recipient of POL wastes from floor drains, spills, and washdowns in the main base shop areas. Due to its location, this site and the west ditch are possible sources of TCE contamination in wells located west of the base.

Table 6
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
12	AC&W Disposal Site	85
7	"7100" Area Disposal Site	79
15	Drainage Ditch Site No. 3	78
13	Drainage Ditch Site No. 1	71
14	Drainage Ditch Site No. 2	66
17	Weapons Storage Area Septic Tank	60
4	NE Perimeter Landfill No. 2	52
11	Existing Fire Department Training Area	51
23	Sanitary Sewer System East of Eknes Street	51
8	Fire Department Training Area No. 1	49
10	Fire Department Training Area No. 3	48
3	NE Perimeter Landfill No. 1	48
6	Firing Range Landfill Sites	47
9	Fire Department Training Area No. 2	47
2	"8150" Area Landfill	46
20	MOGAS Spill Site	44
1	Runway Overrun Landfill	42
18	Old Burial Site	42
19	Fuel Tank Sludge Burial Site	41
5	NE Perimeter Landfill No. 3	37

4. <u>Sites No. 13 and 14 (Drainage Ditch Sites No. 1 and 2)</u>

These sites were subject to frequent spills and dumping of waste oil and solvents in the past from main base area industrial operations. Their locations make them possible sources of the low-level TCE contamination which has appeared periodically in the main base wells.

5. <u>Sites No. 3 and 4 (NE Perimeter Landfills No. 1 and 2)</u>

Waste oils and solvents were disposed of at these landfill sites in the past, although in much smaller quantities than at Site No. 7. The upgradient location of these landfills make them possible sources of the low-level TCE contamination which has appeared periodically in the main base wells and in some of the family housing wells. However, this site was in operation for only a short time (1 year) and is less suspect than the NE Perimeter Landfills No. 1 and 2.

6. <u>Site No. 17 (Weapons Storage Area Septic Tank)</u>

This site is located near the K-9 well where low-level TCE contamination has appeared periodically. Small quantities of TCE were used in the Weapons Storage Area in the past for weapons wipe-down, and there is a possibility that some waste TCE may have been disposed of in this septic tank.

7. <u>Site No. 11 (Existing Fire Training Area) and Site No. 6 (Firing Range Landfill Site)</u>

   Small quantities of solvents and thinners may also have been disposed of at the above sites. It is possible, but not likely, that ground-water contamination may be occurring from these sites.

8. <u>Site No. 23 (Sanitary Sewer System East of Eknes Street)</u>

   The main base sanitary sewer system east of Eknes Street and in the vicinity of the main base wells is subject to significant infiltration during wet weather. Exfiltration during dry weather may be a cause of the low-level contamination which has appeared periodically in the main base wells.

9. The remaining sites (1, 2, 8, 9, 10, 18, 19, and 20) are not suspect sources of ground-water contamination at Mather AFB.

F. Areas of concern, other than disposal sites, include main base well No. 1 and the discharge from the base sewage treatment plant.

   1. Main base well No. 1 has never been sampled because of well pump problems. It is possible that contamination is also present in this well.

   2. The base sewage treatment plant discharges to a series of four polishing ponds, the last of which discharges to Morrison Creek. Any hazardous contaminants in the treated effluent, if present, would then migrate off the base by this surface-water pathway. The treated effluent is monitored routinely for conventional water quality

parameters as required by the state, and periodically for heavy metals, phenols, and cyanide. A volatile organics analysis (VOA) scan will provide additional useful information.

VI RECOMMENDATIONS

VI RECOMMENDATIONS

A. A major monitoring effort (Phase II of the Installation Restoration Program) should be implemented to pinpoint the source(s) and the extent of the TCE ground-water contamination. The monitoring effort should be a phased approach, with initial monitoring and data collection at the highest priority sites. After the initial program, a determination should be made of the need for and extent of additional monitoring. The priority for monitoring at Mather AFB is considered high due in part to the State of California action level of 4.5 ppb for TCE.

B. Tables 7 and 8 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses. Specifically, initial monitoring is recommended for the west ditch area, the "7100" area disposal site, the AC&W area, the northeast and east perimeters of the base, the sewage treatment plant, and Morrison Creek. Approximate monitoring well locations are shown on Figure 27.

C. For the west ditch area, two monitoring wells should be installed west of the ditch near the base perimeter, and one background monitoring well should be installed east of the ditch at the approximate locations shown on Figure 27. The wells should be installed to the first production zone (approximately 150 feet) and screened from 10 feet above to 20 feet below the water table. Geophysical measurements should be taken prior to installation of the monitoring wells to locate the presence, if any, of buried stream channels in the west ditch area. This information will be useful in the final design and location of the monitoring wells. These wells should be analyzed for volatile organic compounds, including TCE, carbon tetrachloride, and

Table 7
RECOMMENDED ANALYSES

Sample Type	Volatile Organic Compounds	Phenols	Heavy Metals	Cyanide	PCB's	Pesticides
	Parameters					
Monitoring Wells						
West Ditch Area	X	X	X	X		
"7100" Area Disposal Site	X	X	X	X	X	X
AC&W Area	X				X	
Northeast and East Perimeter Background Wells	X		X			X
Soil Samples						
AC&W Area	X				X	
Sediment Samples						
West Ditch	X	X	X	X		
Stabilization Pond No. 1	X	X	X	X		X
Water Quality Samples						
Sewage Treatmer Plant	X					
Morrison Cree'	X					

Table 8
RATIONALE FOR RECOMMENDED ANALYSES

Parameter	Rationale
Volatile organic compounds	Organic solvents used on-base (past and present). Some off-base wells known to be contaminated with volatile organic compounds, mainly TCE. Some on-base wells known to contain low TCE levels.
Phenols	Phenolic cleaner and paint stripper used in past.
Heavy metals (cadmium, nickle, chromium, lead, and silver)	Potential sources identified (plating operations, leaded fuel).
Cyanide	Potential source identified (plating operations).
PCBs	Suspected disposal of small quantities at two sites.
Pesticides (including DDT, Chlordane, and 2,4-D)	Commonly used at Mather AFB in past. Small quantities may have been disposed of at two sites. Some off-base wells (northeast and upgradient) known to be contaminated with pesticides.

trans-1, 2-dichloroethylene, phenols, cyanide, and suspect heavy metals (chromium, lead, cadmium, nickle, and silver). The trans-1, 2-dichloroethylene has been found in significant concentrations in wells located west of the base which have been contaminated with TCE, and can be useful as a "tracer compound" in determining the source of the TCE contamination. In addition, sediment samples should be collected in the ditch, one north and one south, of the west ditch skimmer. The sediment samples should be collected at least once and analyzed for the above parameters.

D. For the "7100" Area Disposal Site (Site No. 7) three monitoring wells should be installed along the perimeter road west and south of the site at the approximate locations shown on Figure 27. A background monitoring well should also be located between the family housing area and Site No. 7 at the approximate location shown on Figure 27. All wells should be installed to the first production zone (approximately 150 feet) and screened from 10 feet above to 20 feet below the water table. These wells should be analyzed for the same parameters as those for Item C above, with the addition of pesticides (DDT, chlordane, and 2,4-D), and PCBs.

E. For the AC&W area, three monitoring wells should be installed downgradient and one background monitoring well should be installed upgradient of the AC&W area at the approximate locations shown on Figure 27. Depth and screening of the wells should be the same as for Items C and D above. The wells should be analyzed for volatile organic compounds, and PCBs. Prior to installation of the monitoring wells, a television survey should be conducted at the AC&W well to obtain well construction details, including the condition of the casing and the depths of perforations. This information will be useful for the final design of the monitoring wells in the AC&W area. In addition, geophysical measurements should be made at the AC&W disposal site (Site No. 12) to try and locate the waste disposal pipe.

F. Five background monitoring wells should be installed along the northeast and east perimeter of the base at the approximate locations shown on Figure 27. The wells will serve as indicators of upgradient background water quality and will indicate if ground-water contamination is migrating onto the base from off-base industrial areas. The wells should be installed to the first production zone (approximately 150 feet) and screened from 10 feet above to 20 feet below the water table. The wells should be analyzed for volatile organic compounds, pesticides (including DDT, chlordane, and 2,4-D) and suspect heavy metals (chromium, cadmium, lead, nickle, and silver). In addition, geophysical measurements should be made in the northeast perimeter area, at the approximate locations shown on Figure 27, to locate the presence, if any, of buried stream channels in this area. The information will be useful in the final design and location of the northeast perimeter background monitoring wells.

G. For the sewage treatment plant and Morrison Creek, it is recommended that samples of the sewage treatment plant influent and effluent and of Morrison Creek upstream and downstream of the sewage treatment plant discharge be analyzed for volatile organic compounds. In addition, it is recommended that a bottom sediment sample from stabilization pond No. 1 be collected and analyzed for volatile organic compounds, phenols, cyanide, pesticides, and suspect heavy metals (chromium, cadmium, lead, nickle, and silver).

H. Any new monitoring wells should be carefully constructed to prevent the possibility of accidental introduction of contaminants into the aquifer by migration through improperly constructed wells and casings. All monitoring wells and existing base wells should be surveyed into a common datum in order to record accurate ground-water levels for the determination of local hydraulic gradients.

I. The final details of the initial Phase II monitoring program including specific sampling locations, sampling methodology, analyses required, sampling frequency, and monitoring well construction methods, should be developed by OEHL. It is not the intent of Phase I to assess the exact depth or location of any ground-water monitoring wells, but to provide guidance to the Phase II contractor.

J. The ATC Surgeon is responsible for recommending Phase II actions and for evaluating the results of the program.

FIGURES

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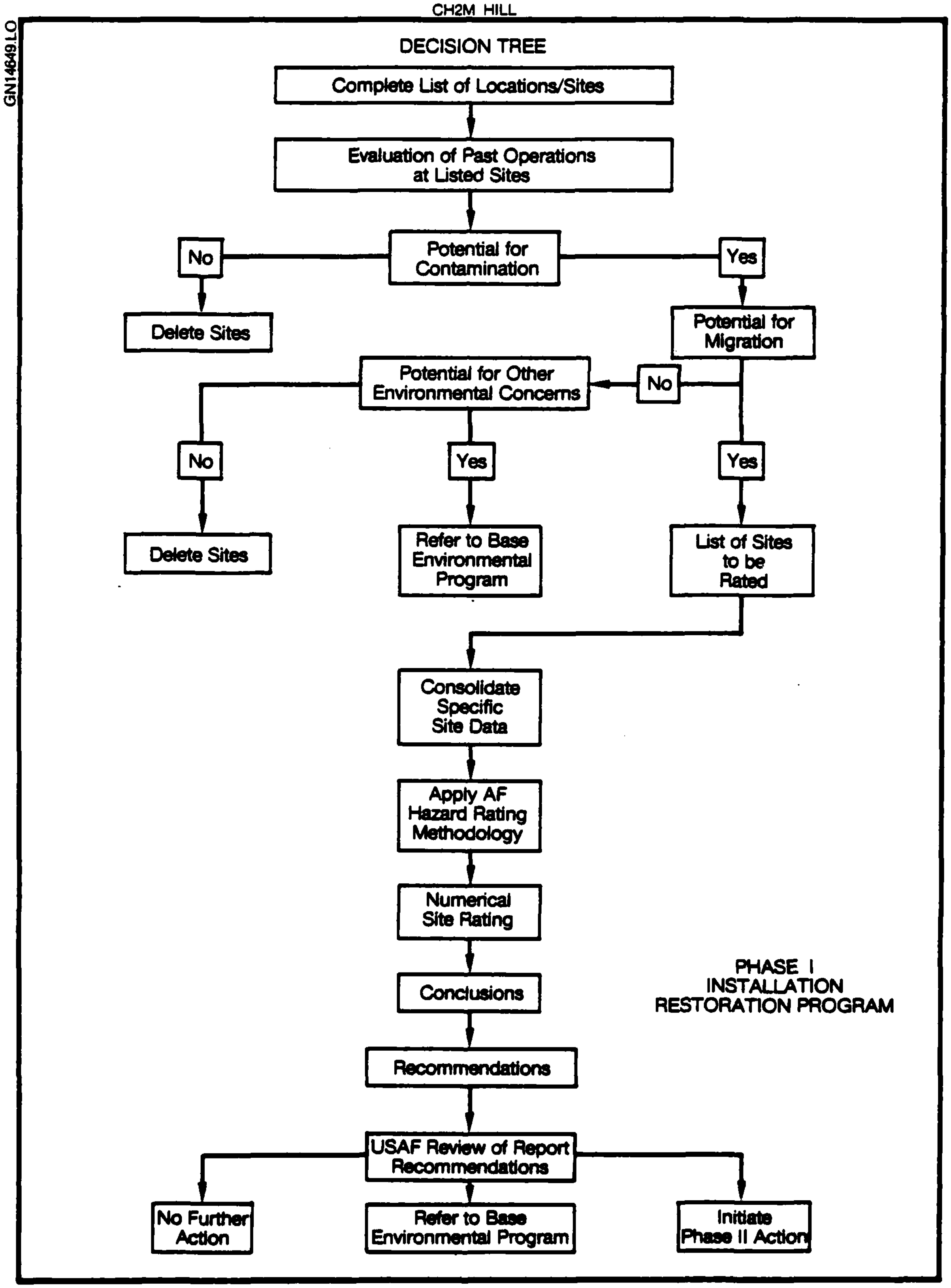

FIGURE 1. Records Search Methodology.

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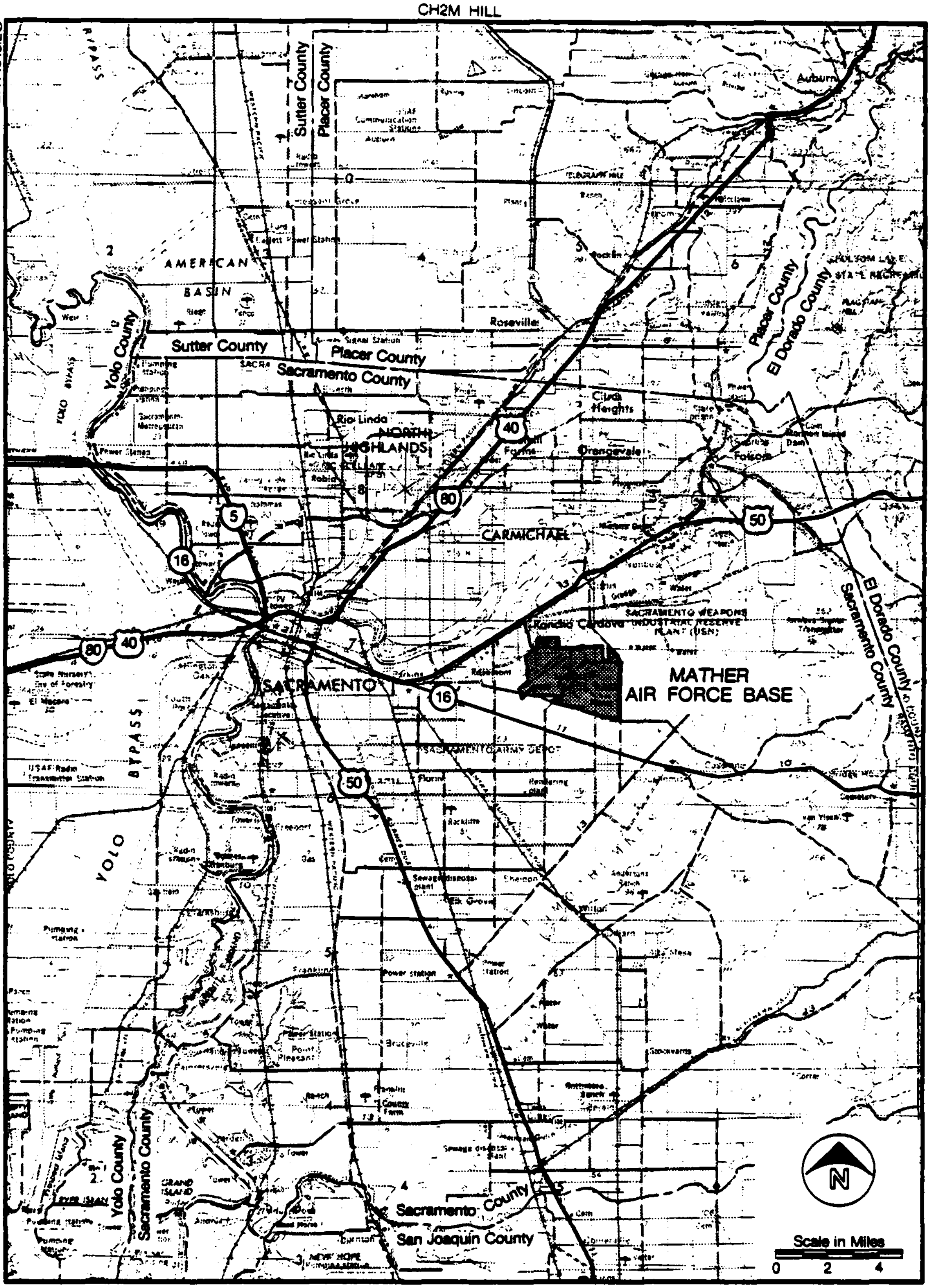


FIGURE 2. Location map of Mather AFB.

CH2M HILL

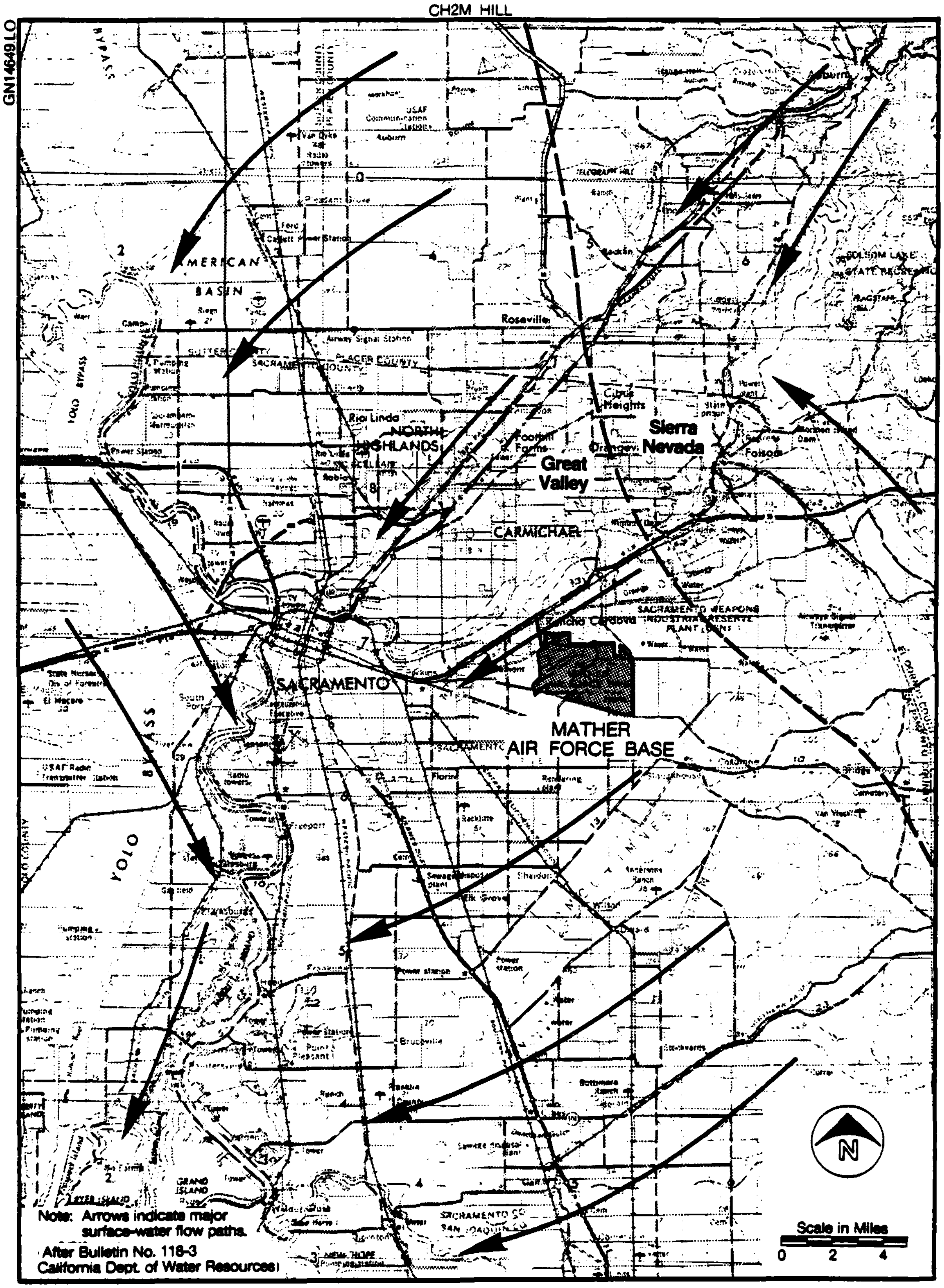
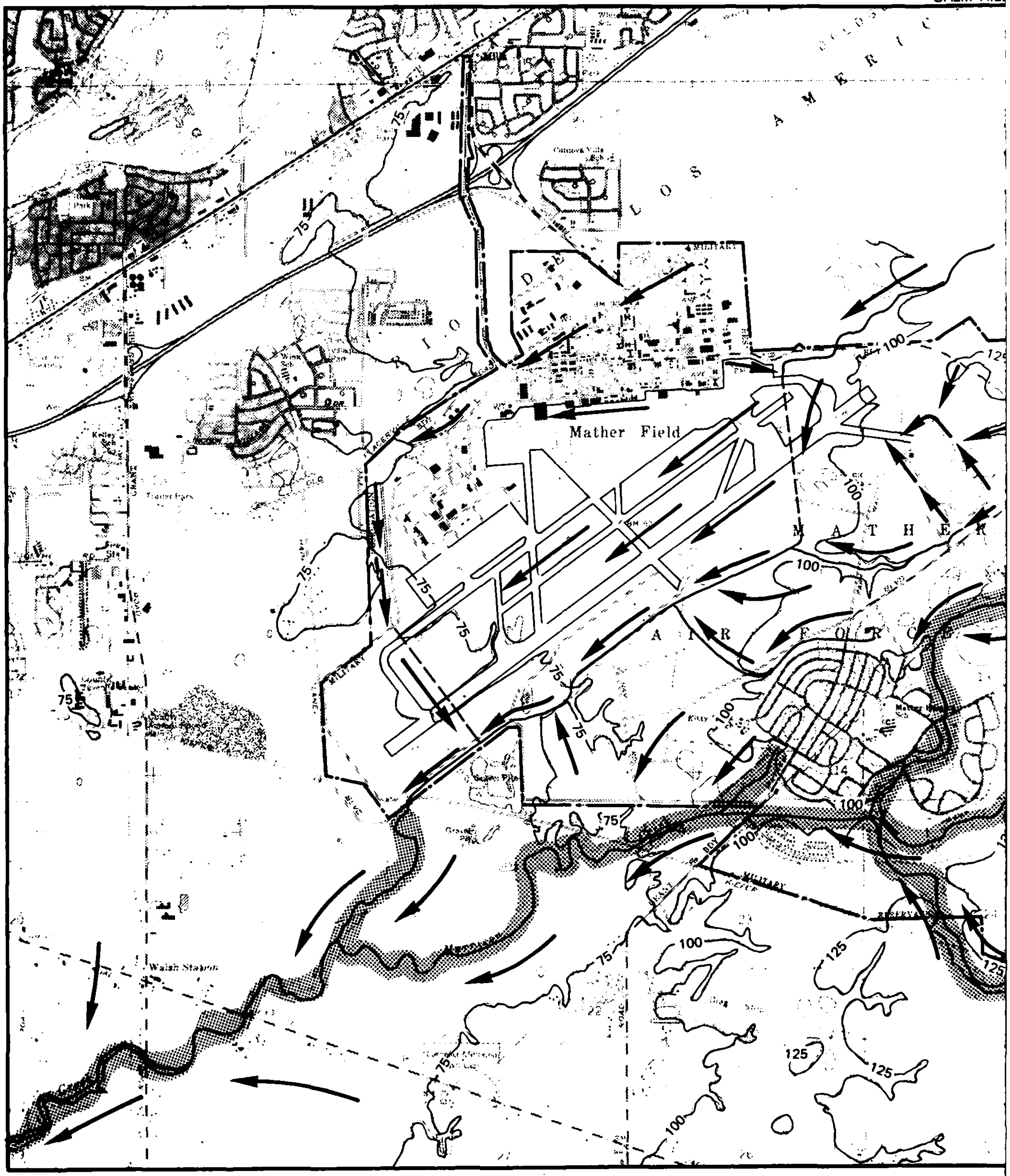
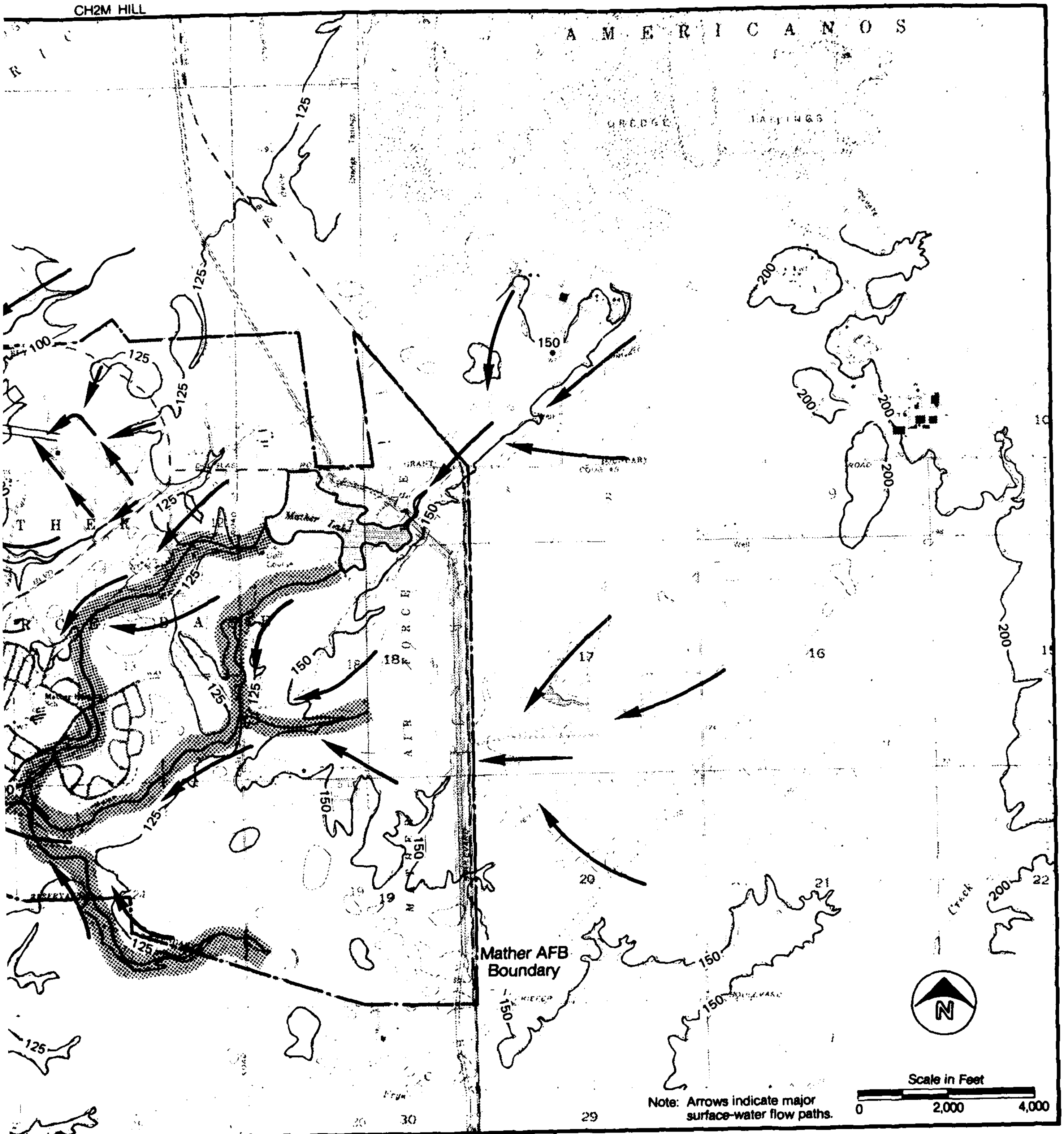


FIGURE 3. Physiographic map.



Topography and surface d



aphy and surface drainage map.

FIGURE 4.

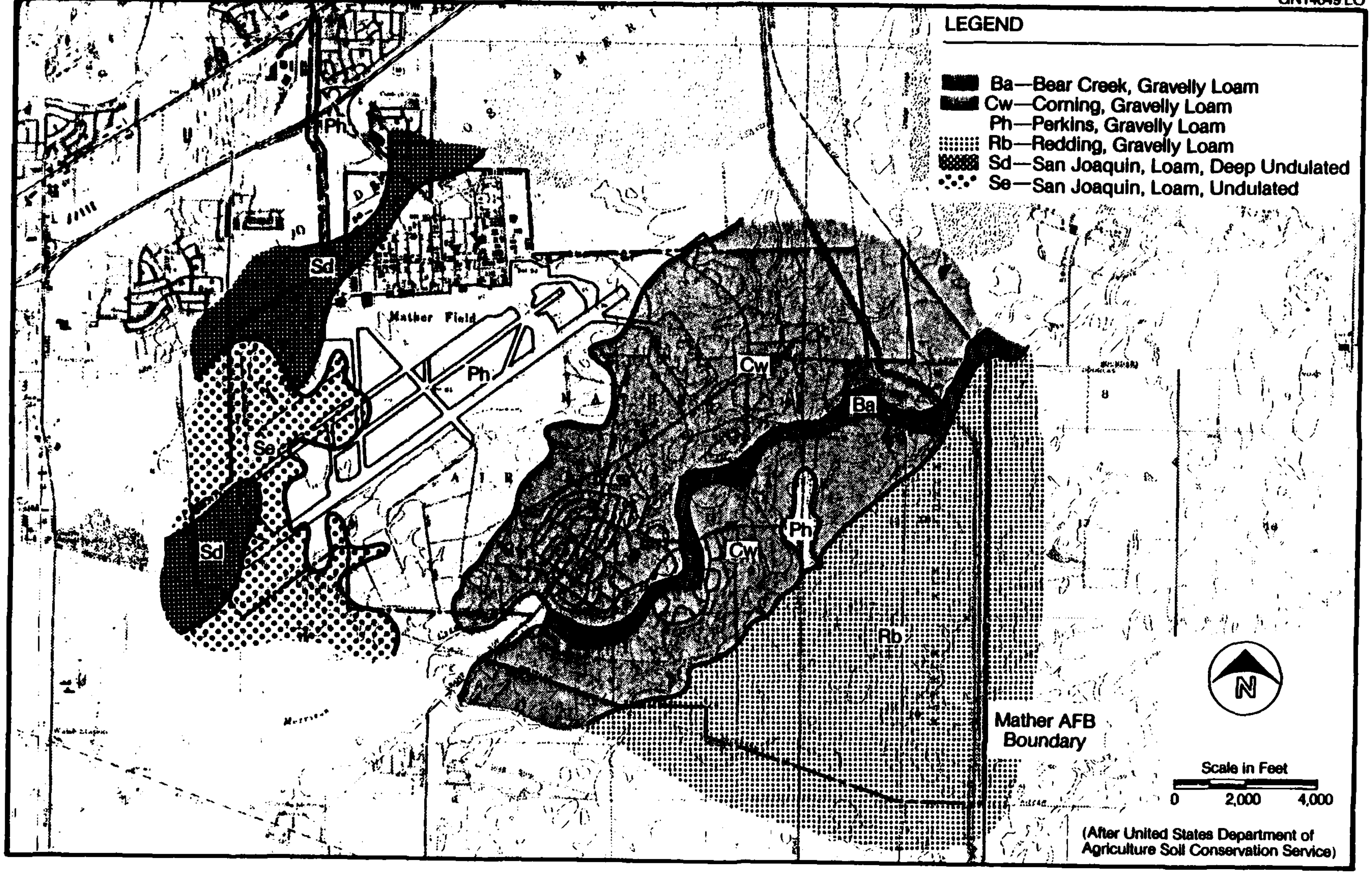


FIGURE 5. Soil map:

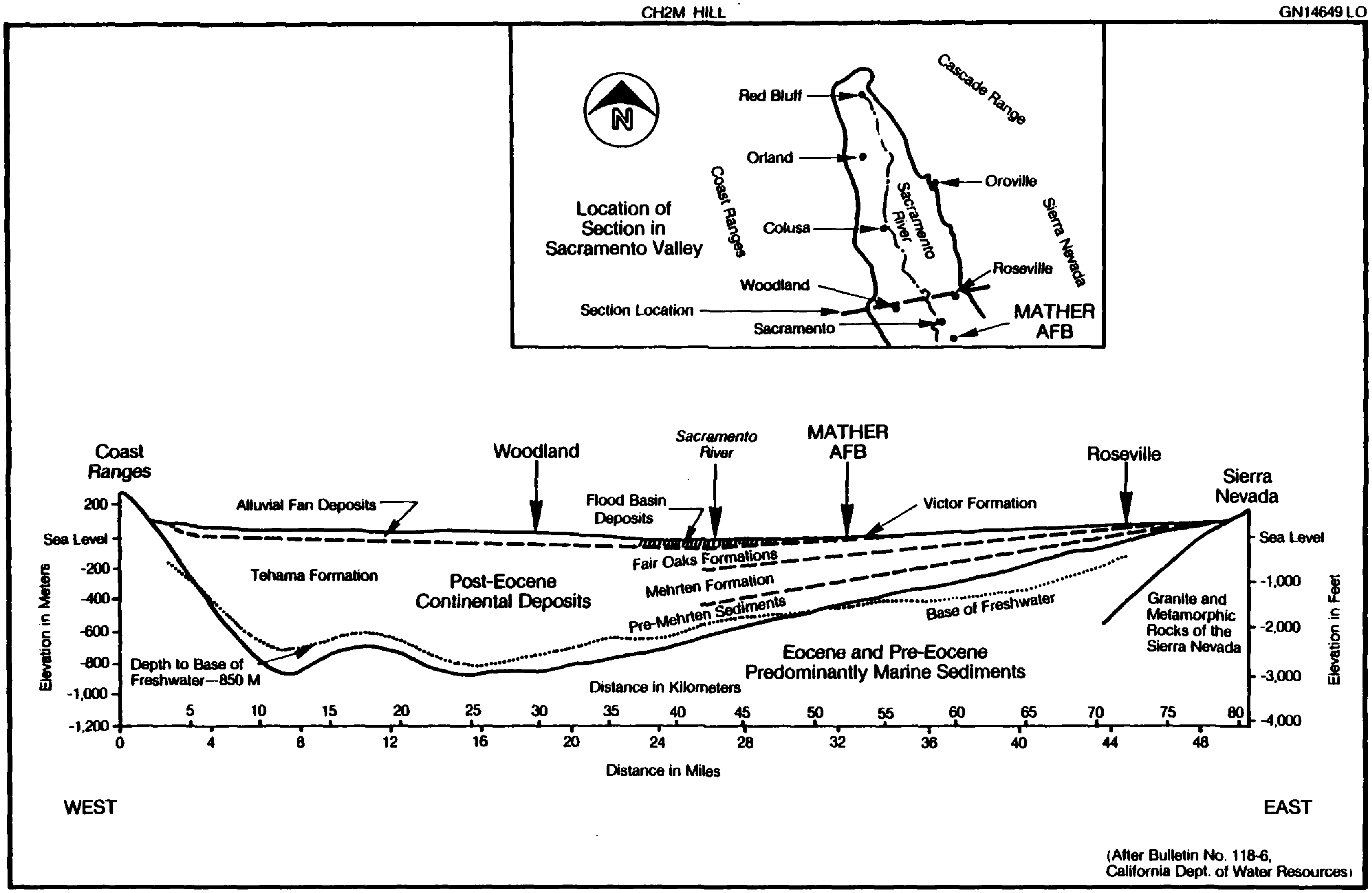


FIGURE 6. Generalized west-east geologic section in the vicinity of Mather AFB.

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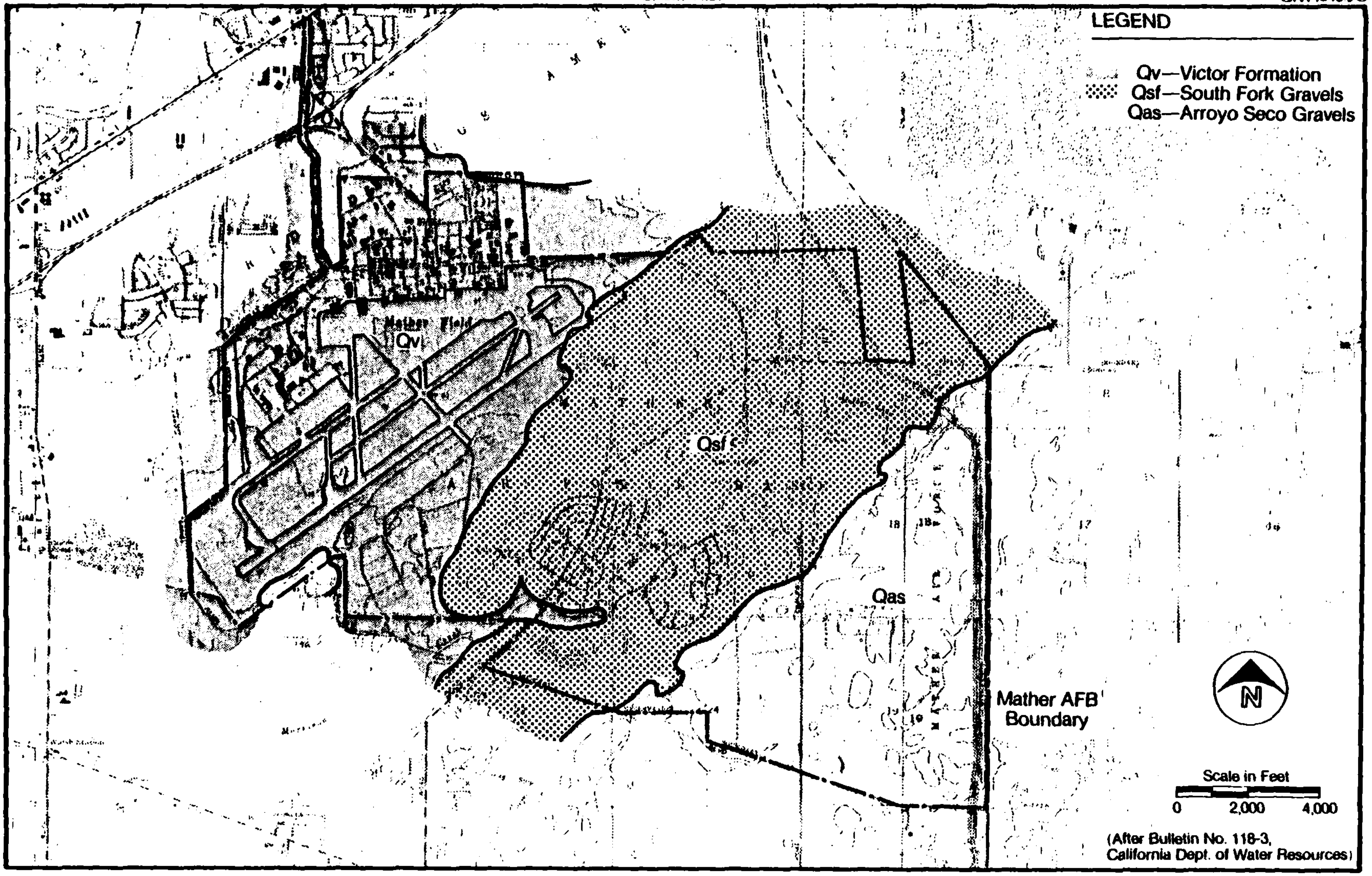

FIGURE 7. Geologic formations below the soil cover.

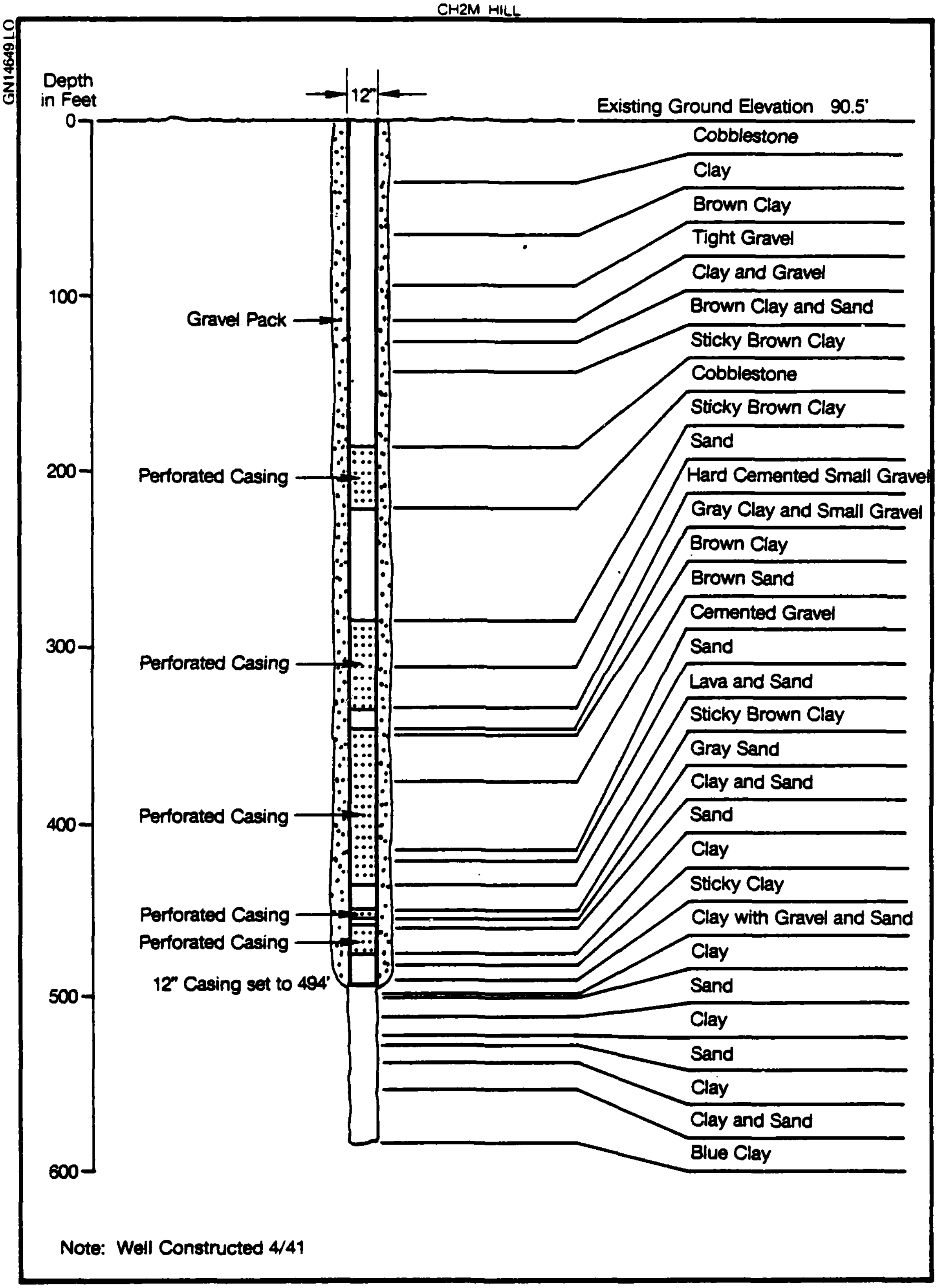

FIGURE 8. Main base Well No. 2—Well Log.

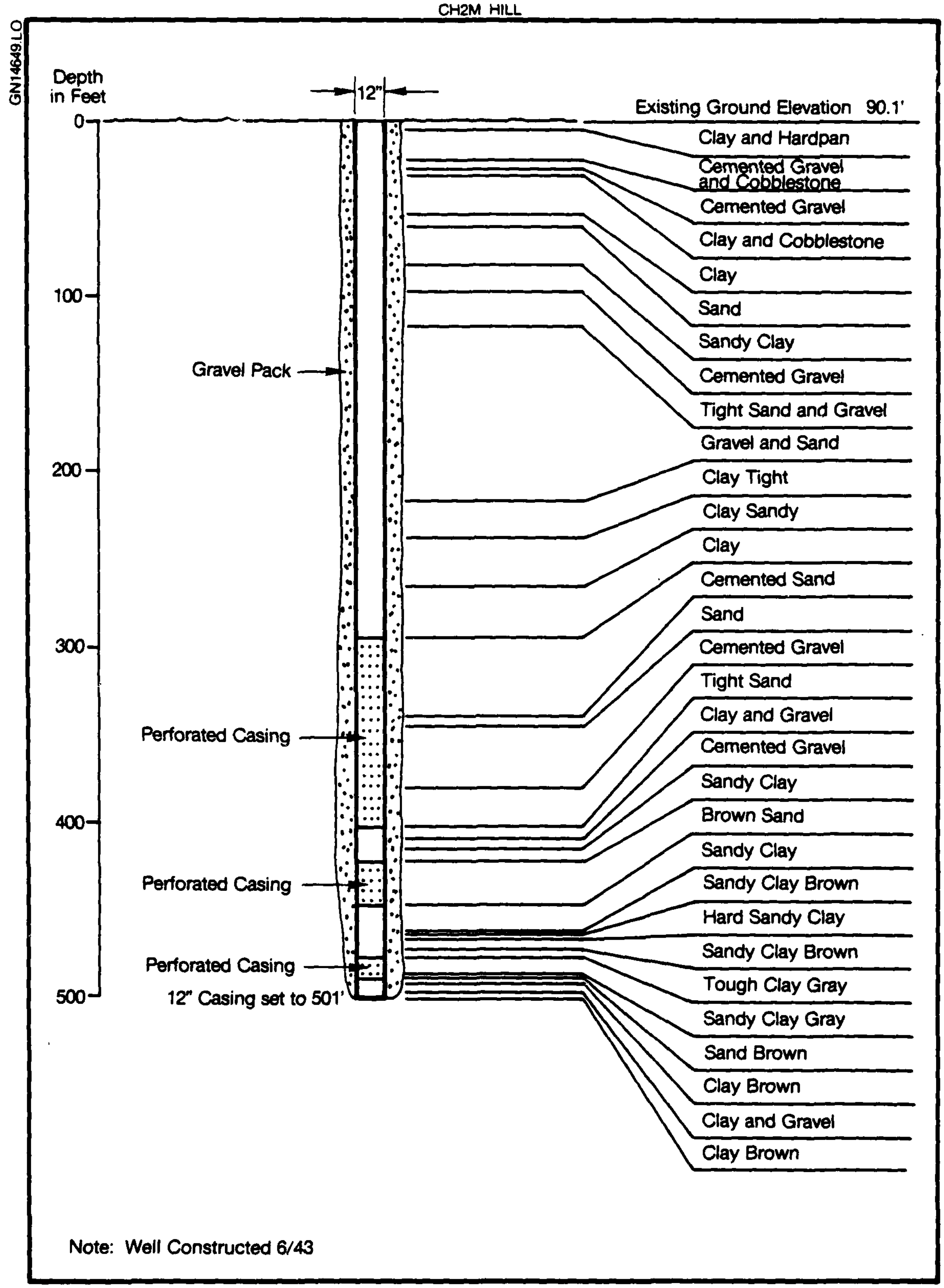

FIGURE 9. Main base Well No. 3—Well Log.

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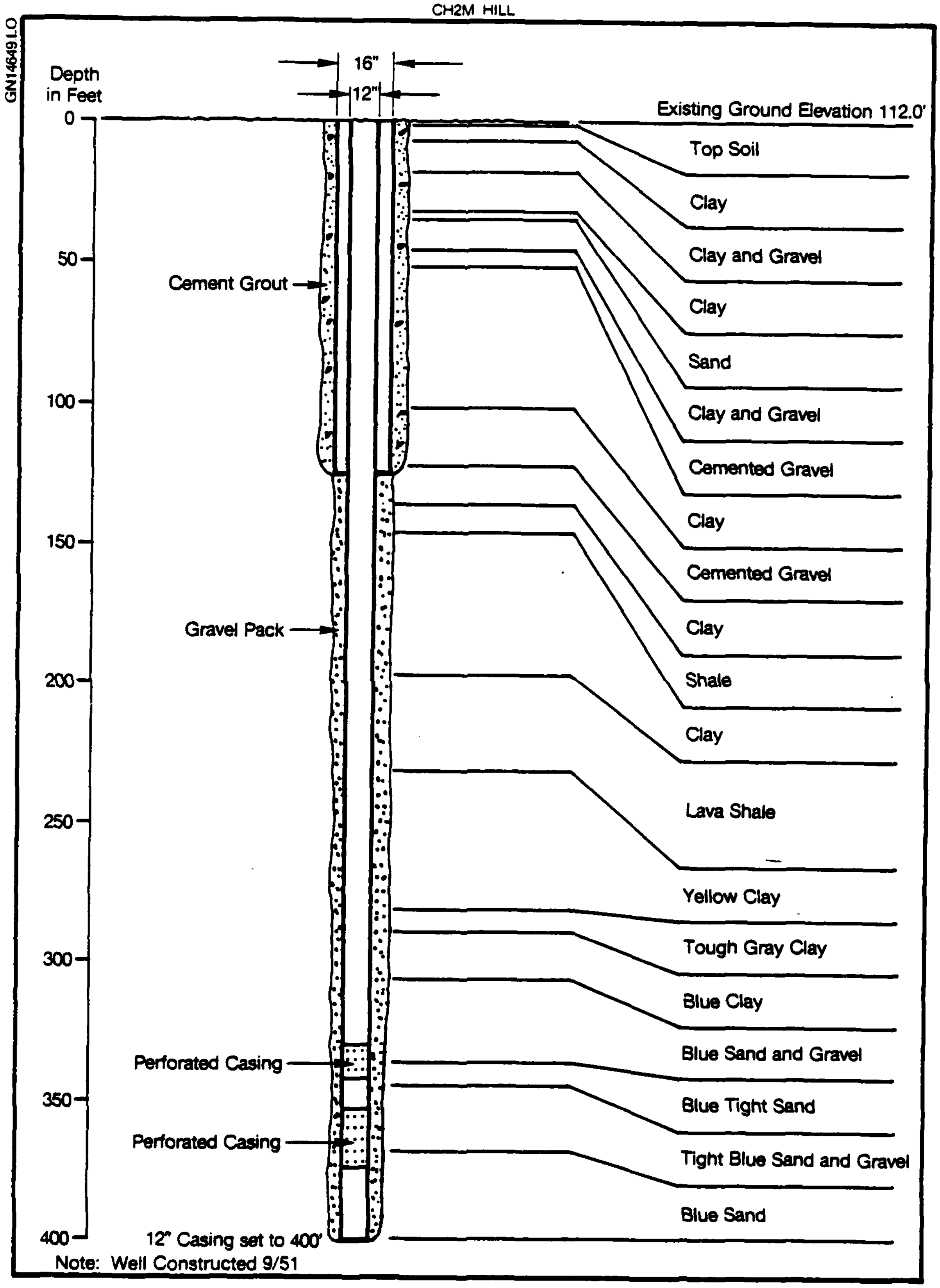

FIGURE 10. Base housing Well No. 1—Well Log.

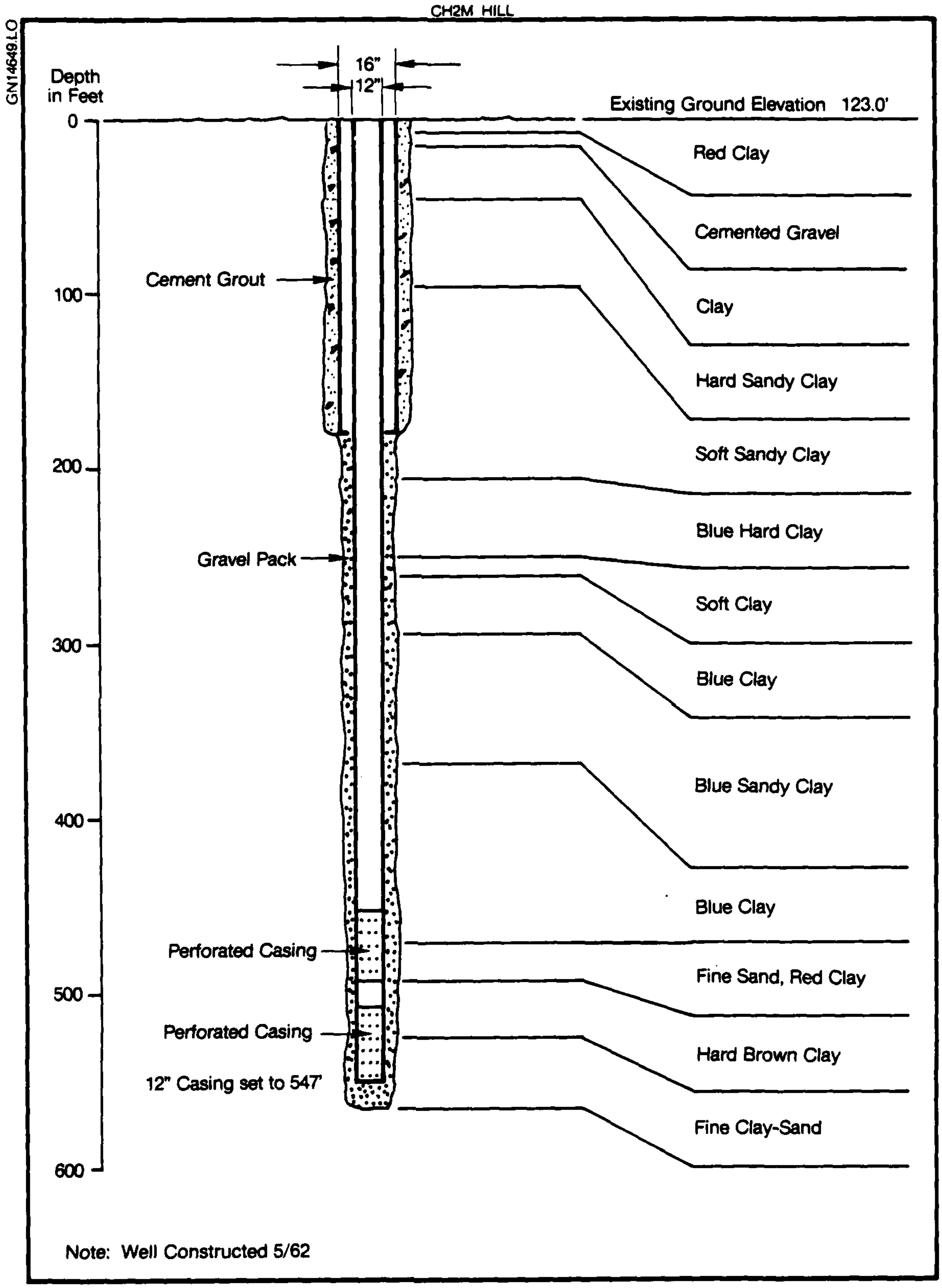

FIGURE 11. Base housing Well No. 5—Well Log.

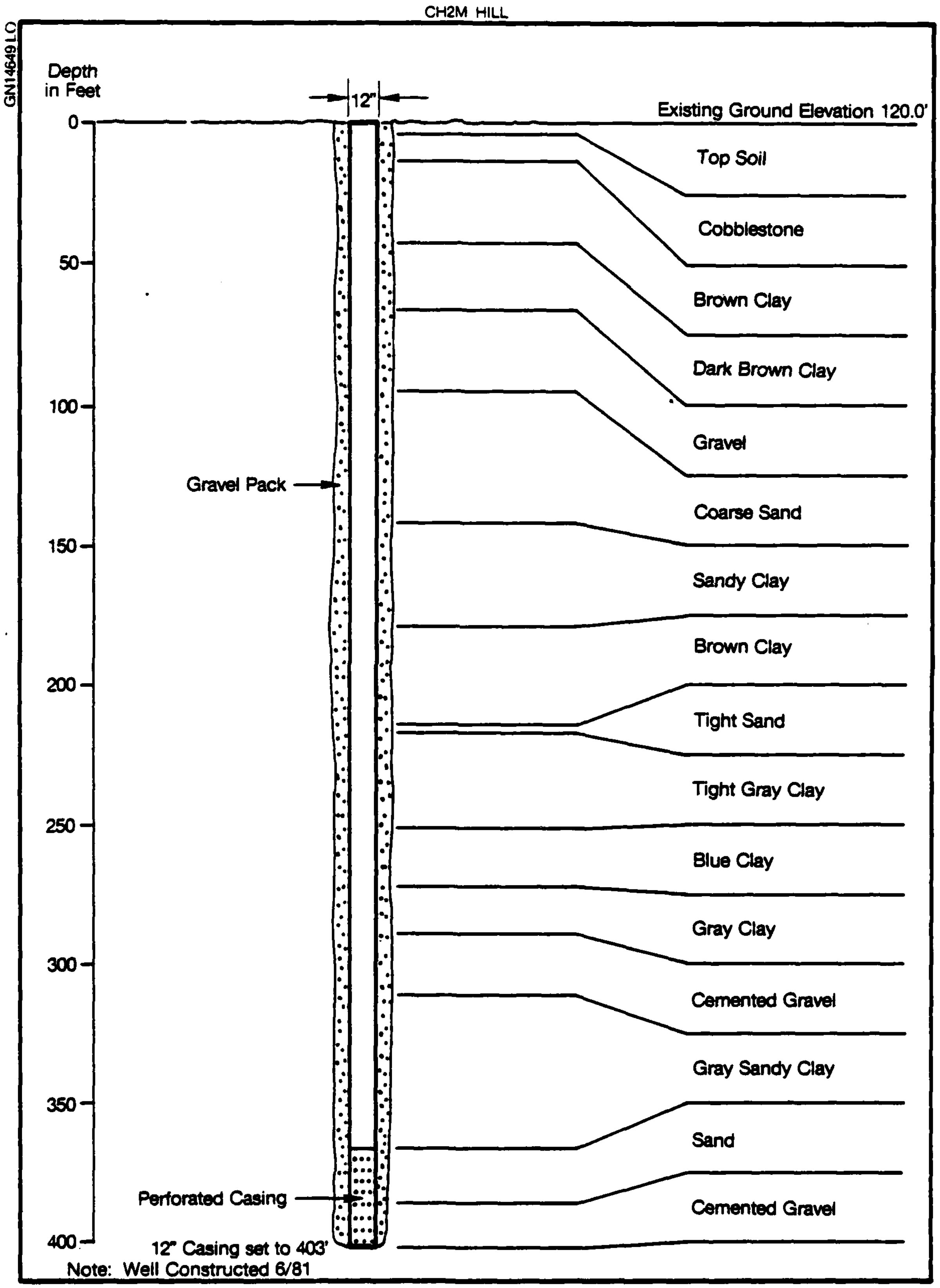

FIGURE 12. Golf course Well No. 2—Well Log.

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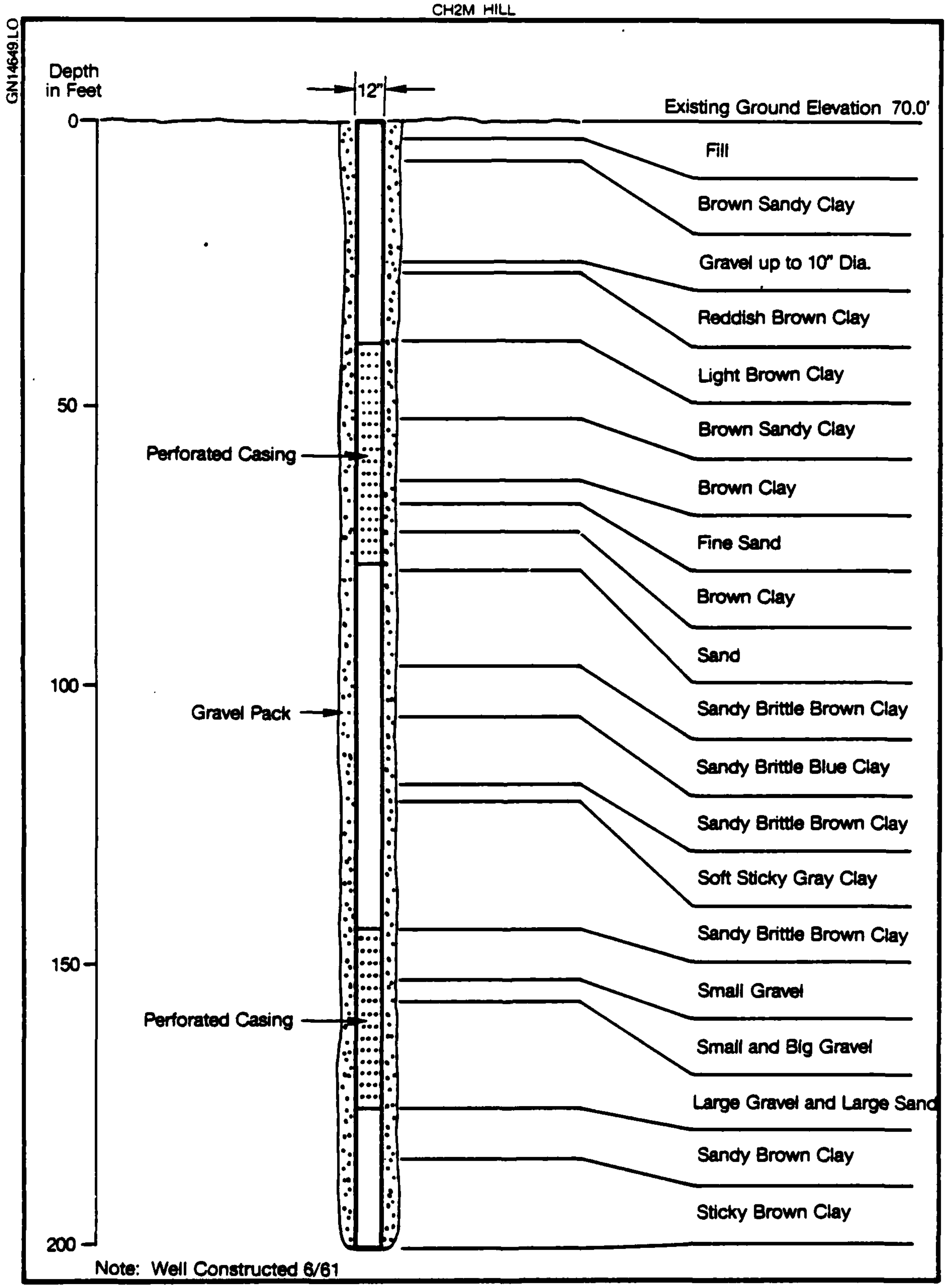

FIGURE 13. Jet engine test cell well—Well Log.

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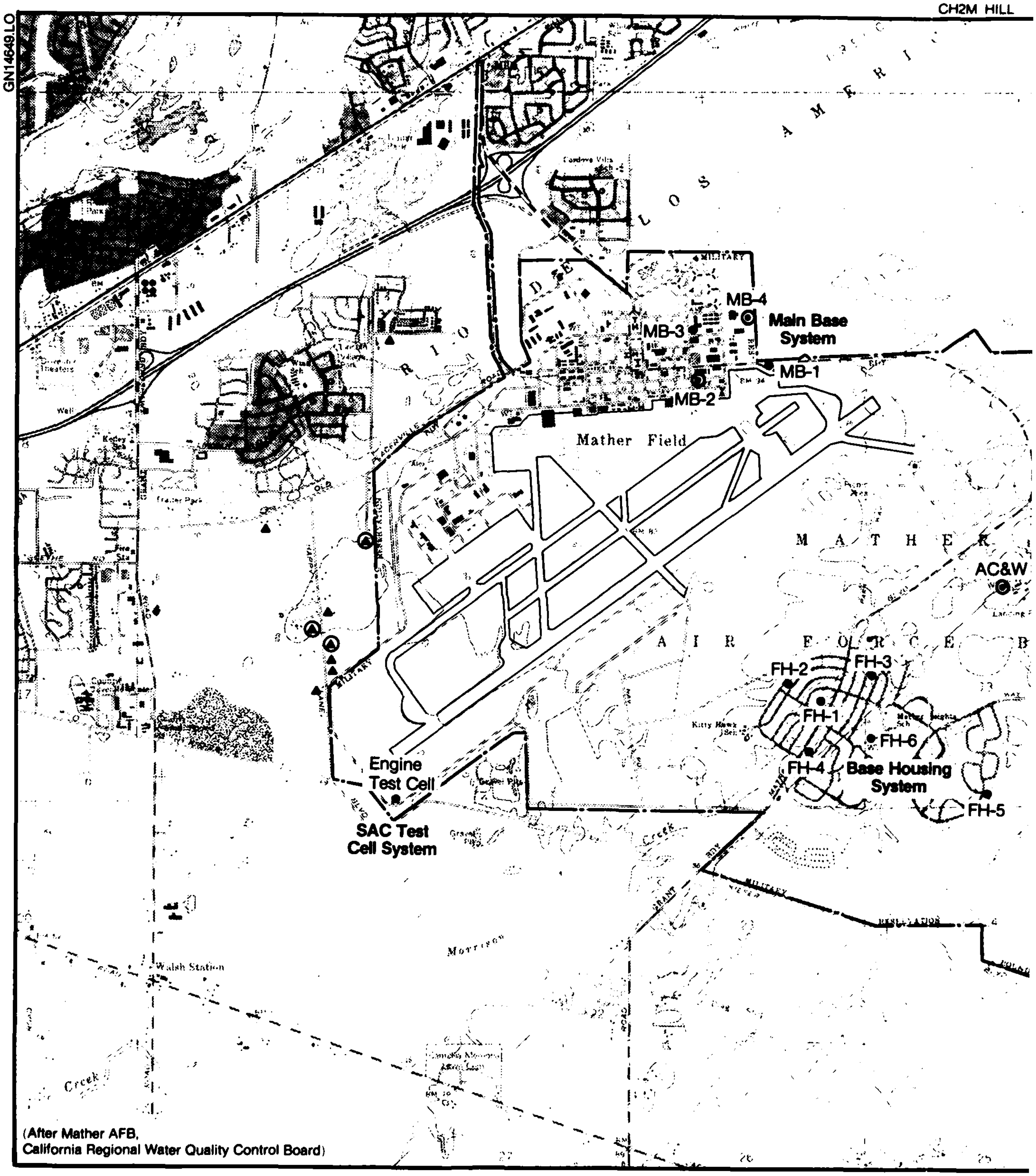

Location map of base wells and nearby off-base wells

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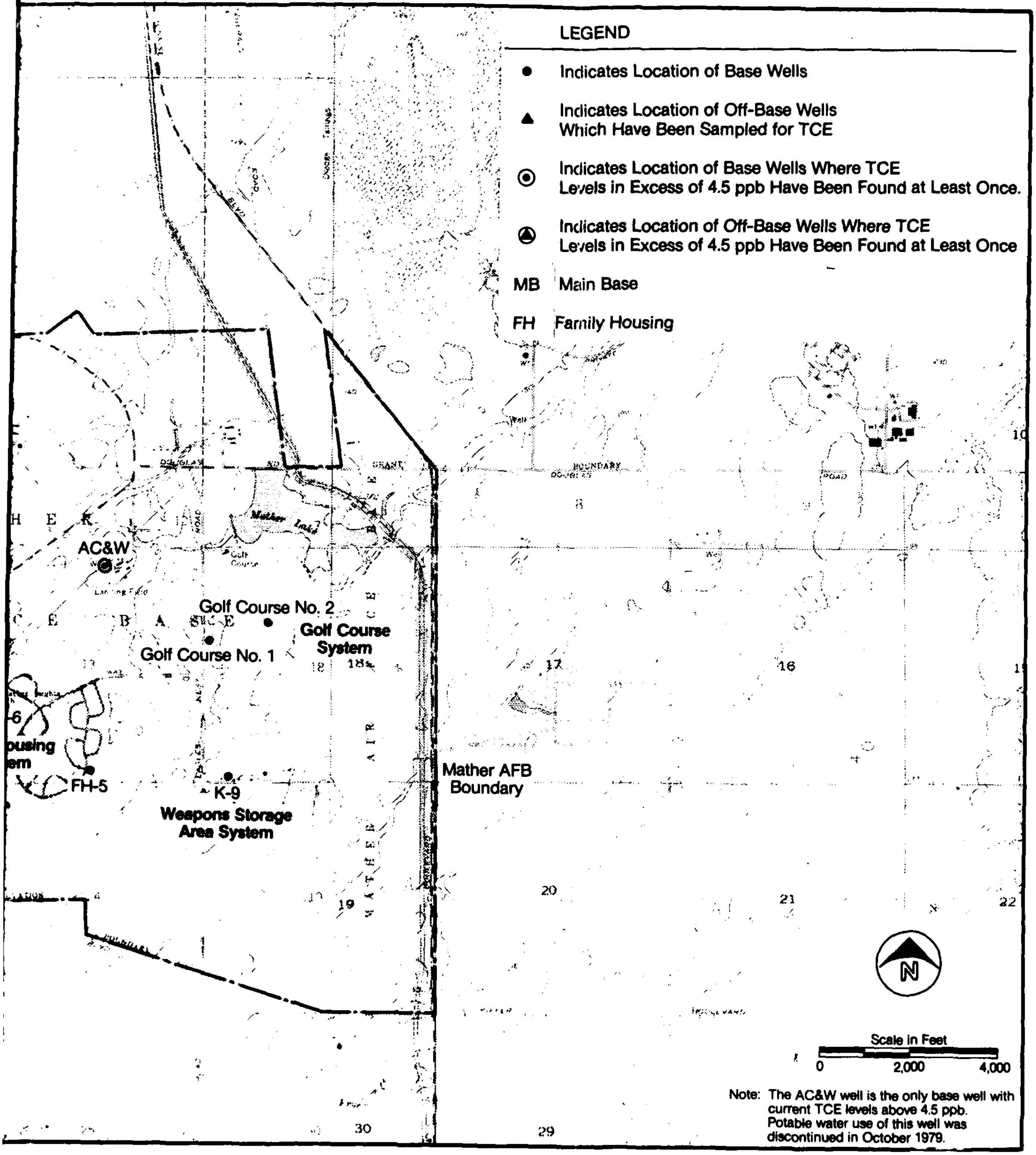

y off-base wells which have been sampled for TCE.

FIGURE 14.

2

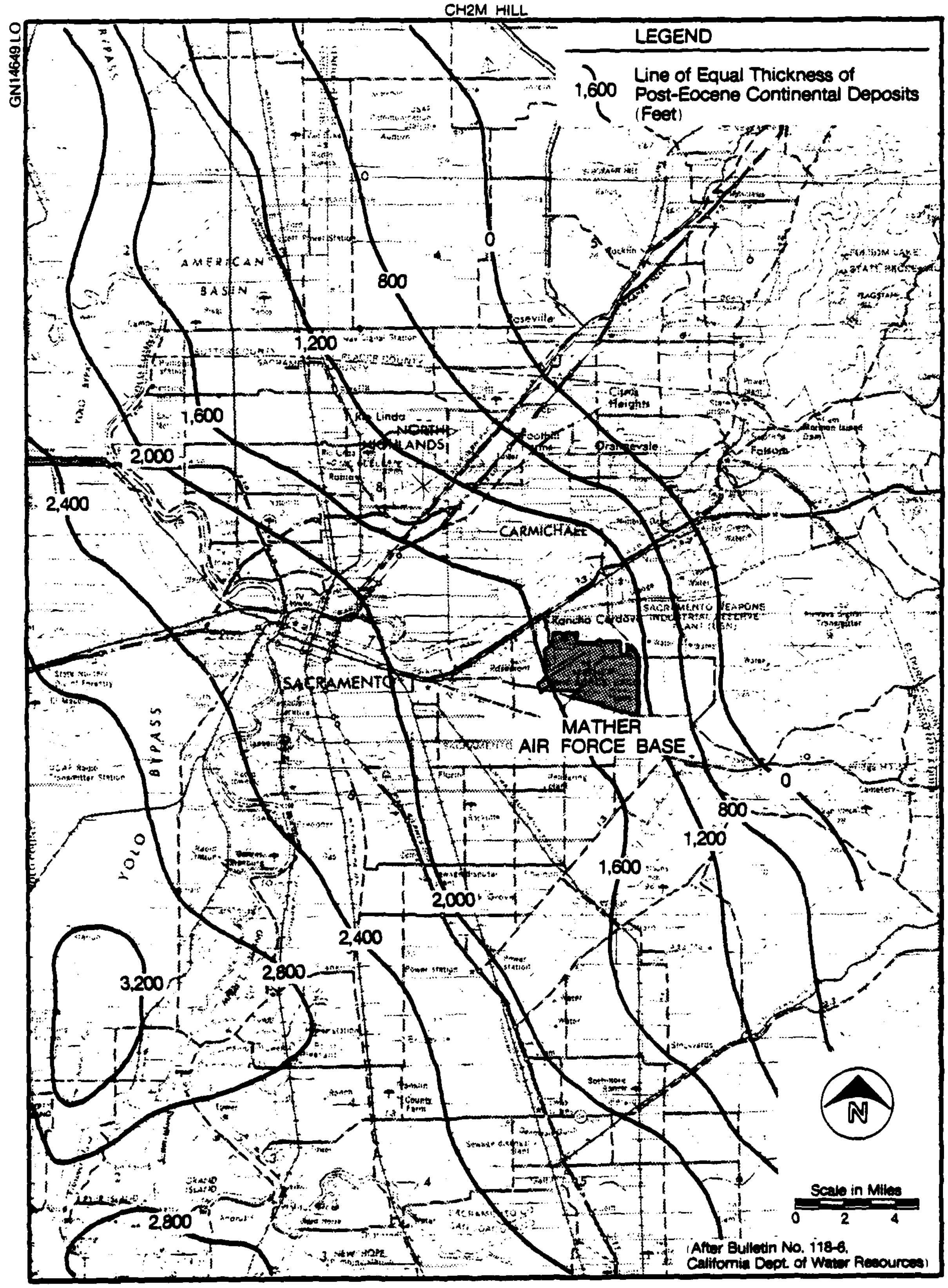

FIGURE 15. Thickness of the Post-Eocene continental deposits in the vicinity of Mather AFB.

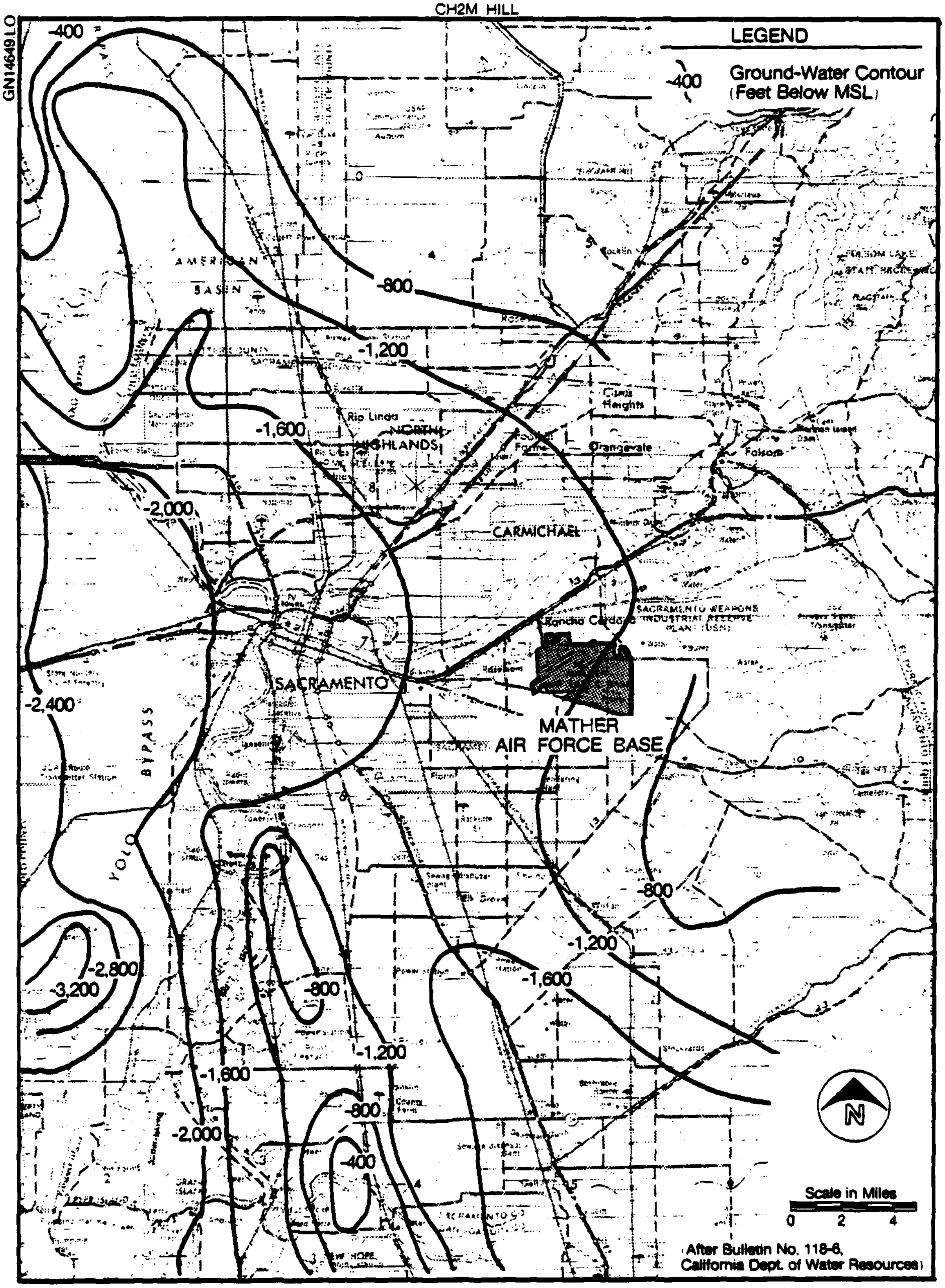

FIGURE 16. Base of fresh ground water.

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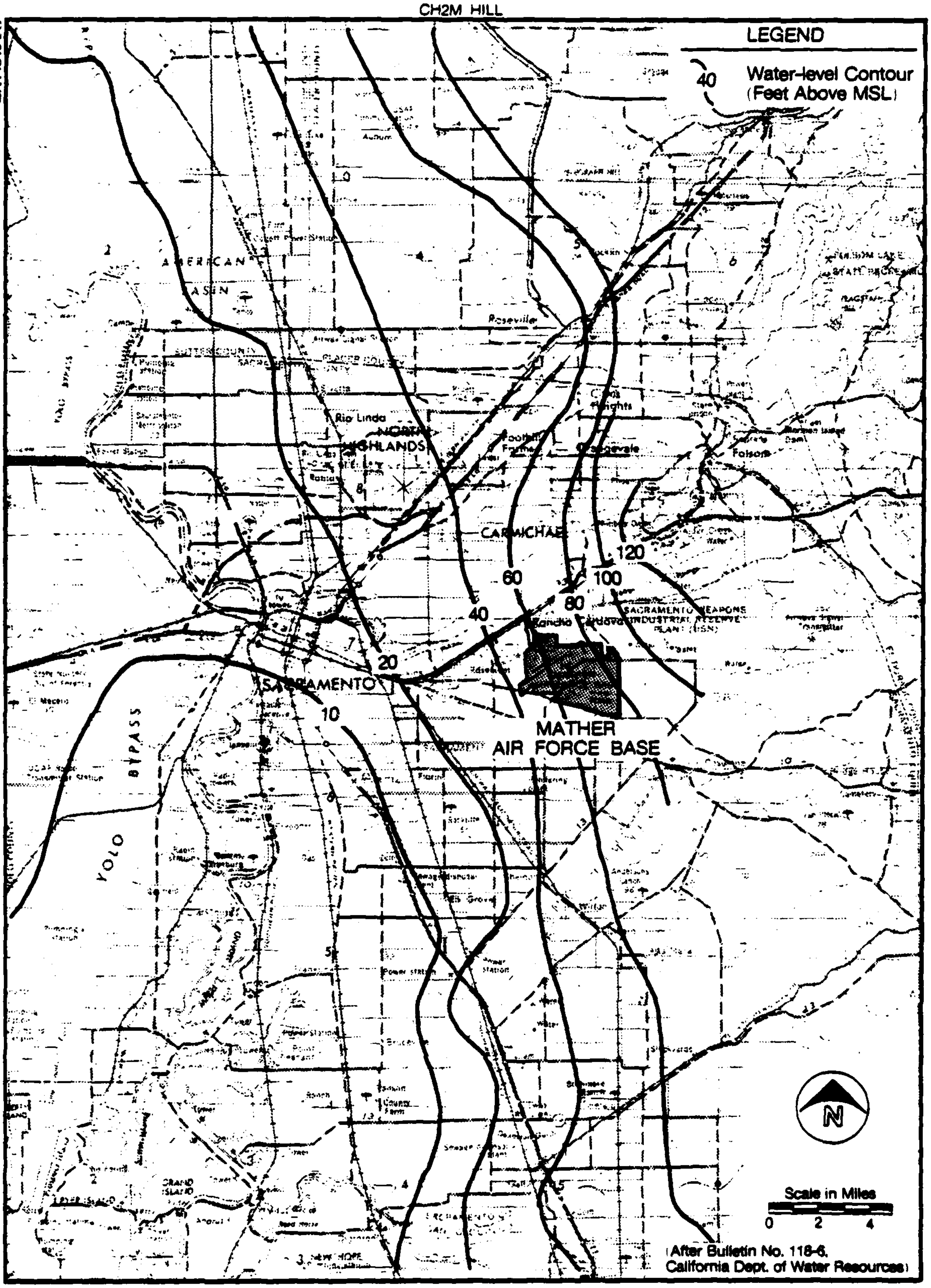

FIGURE 17. Water-level contours for natural conditions, assumed to be for 1912.

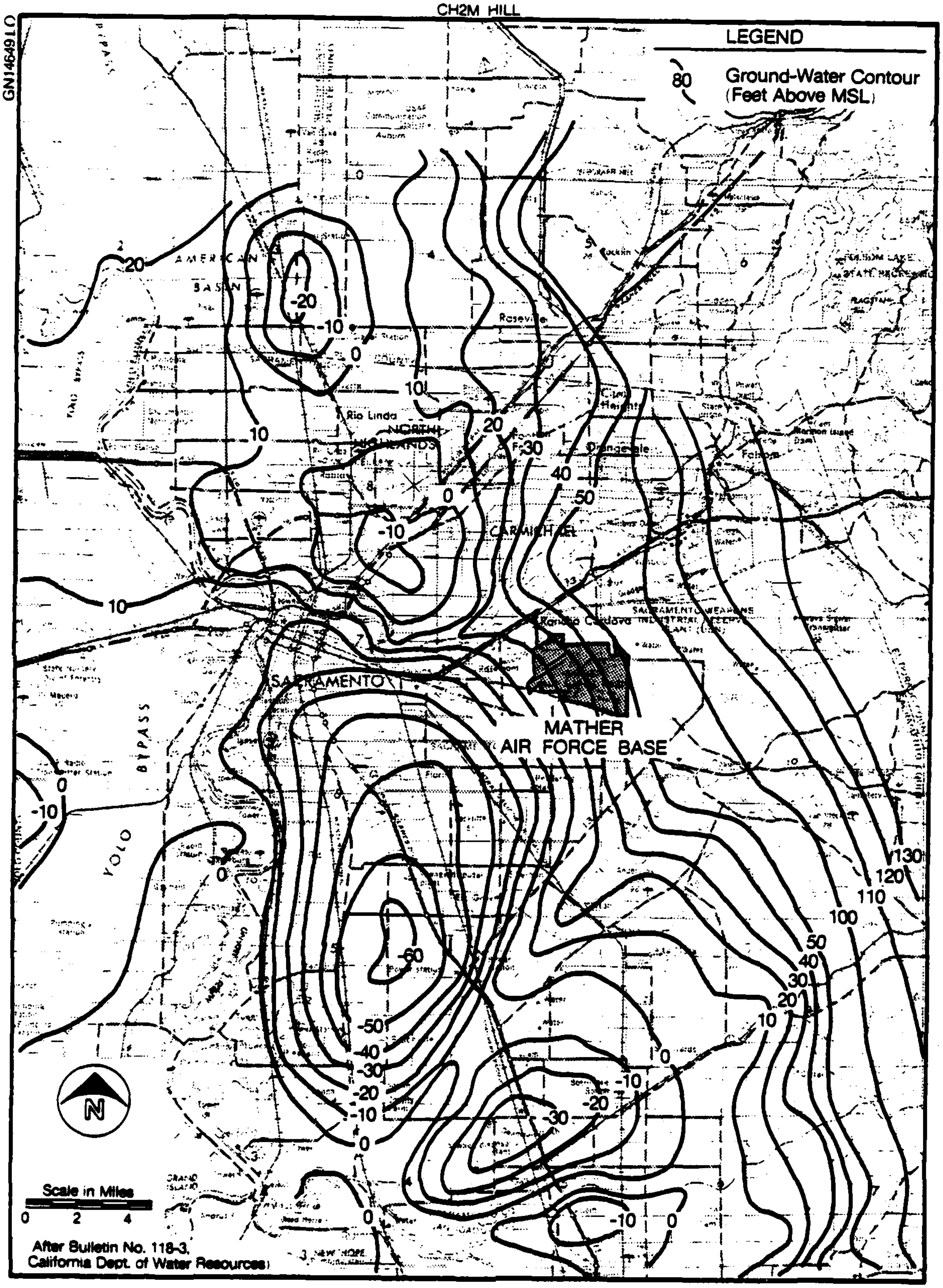

FIGURE 18. Ground-water contours—Spring 1968.

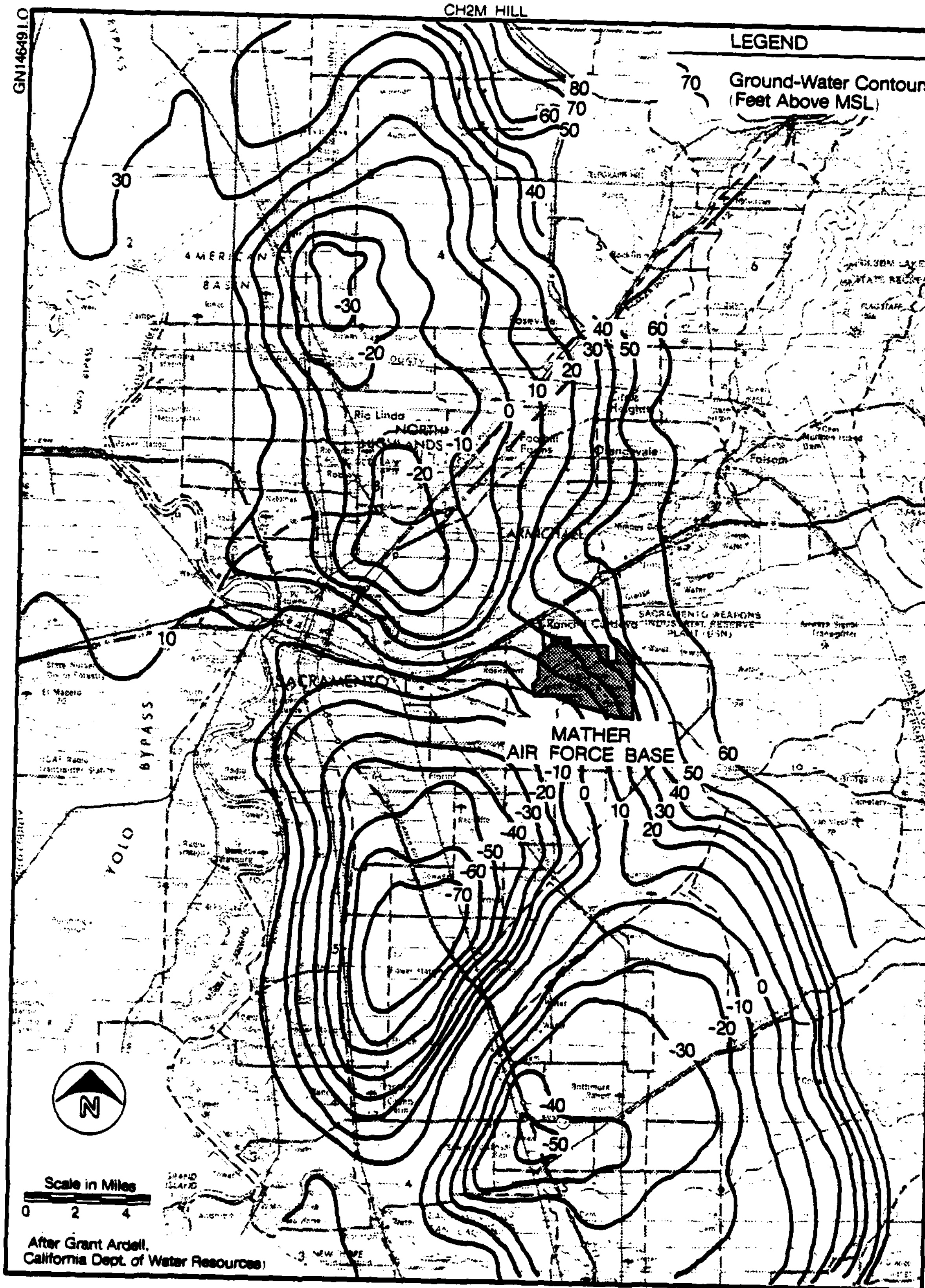

FIGURE 19. Ground-water contours—Spring 1980.

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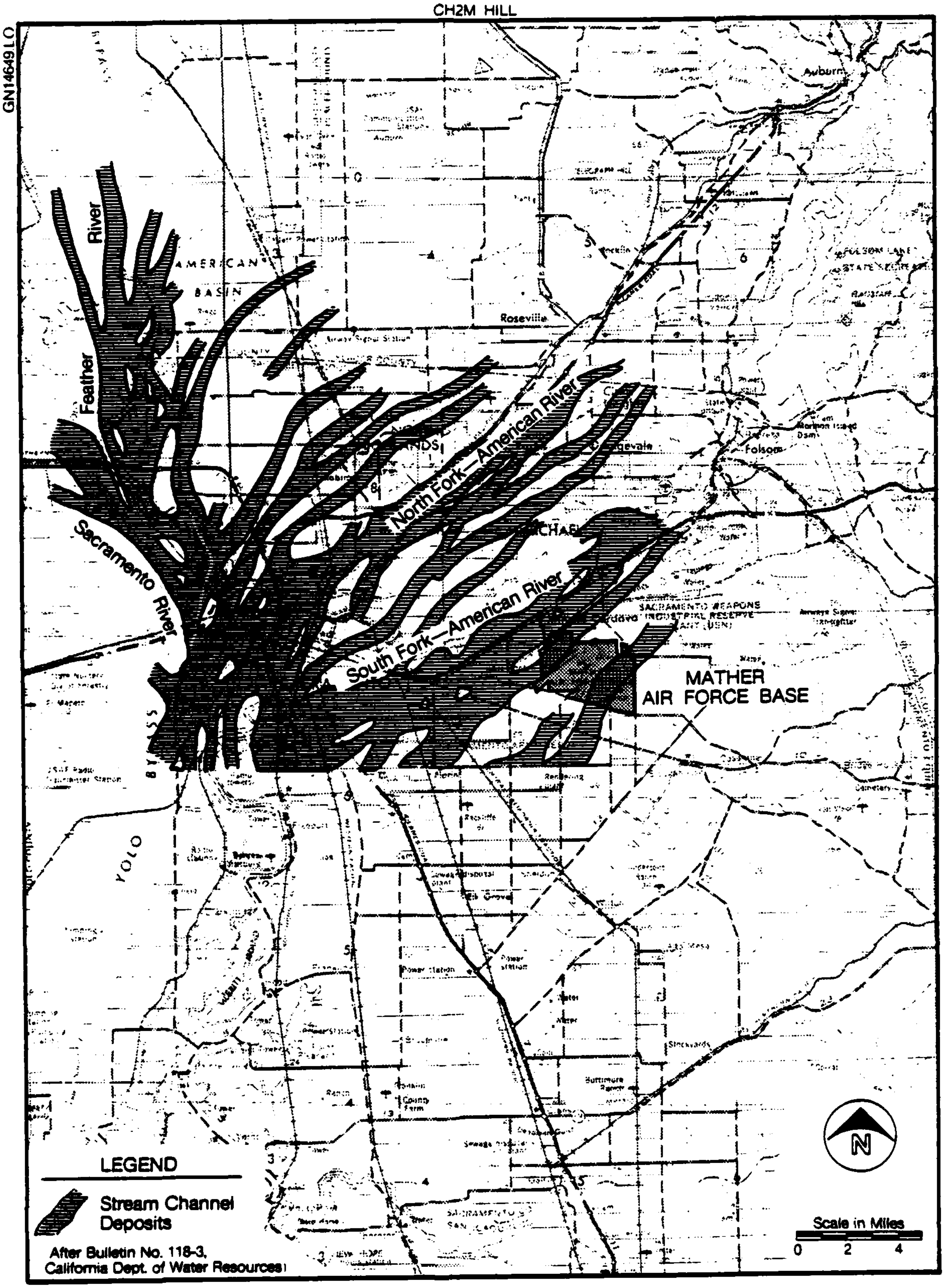

FIGURE 20. Superjacent stream channel deposits.

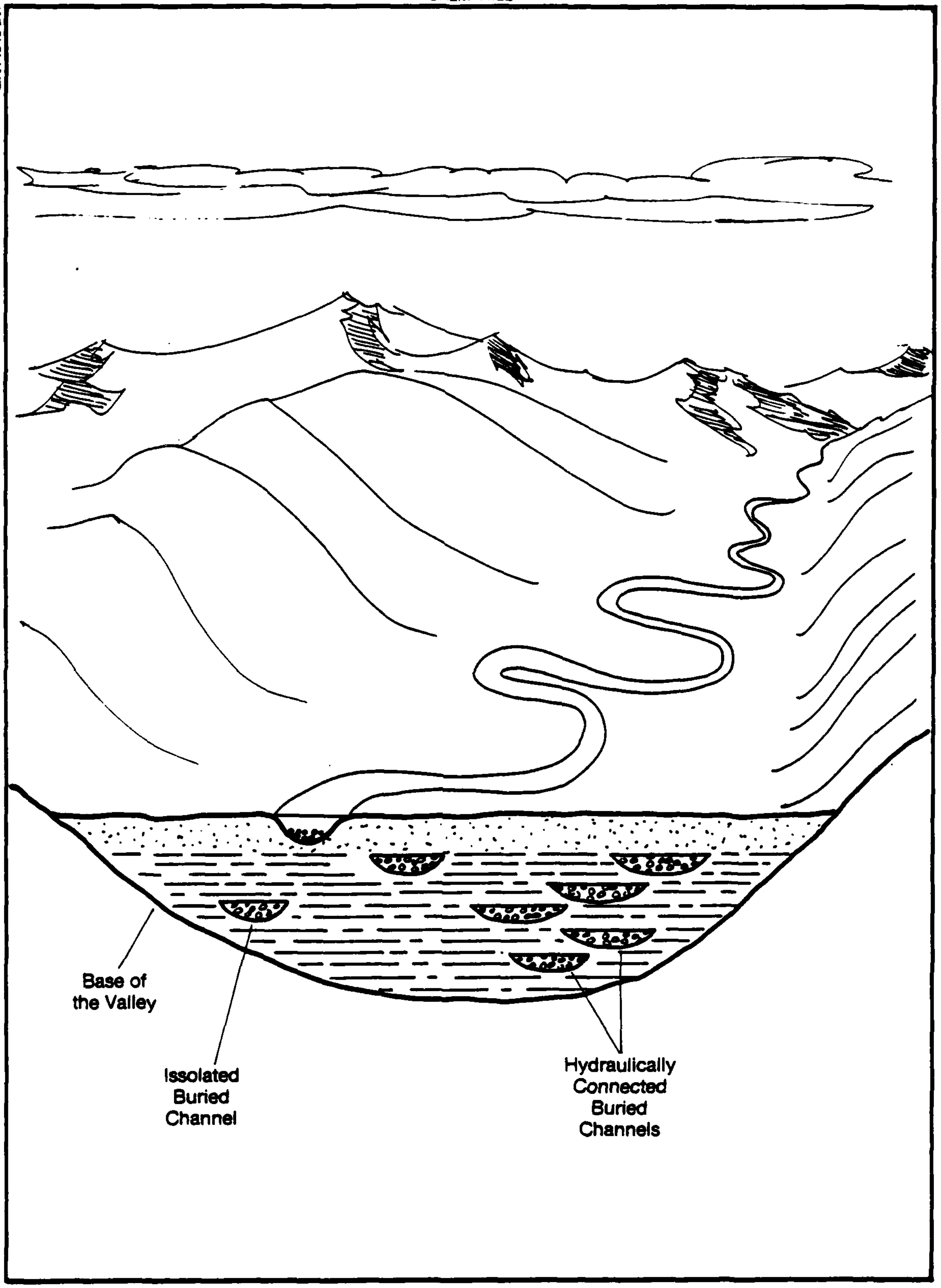

FIGURE 21. Generalized cross section illustrating vertical alignment of buried stream channels.

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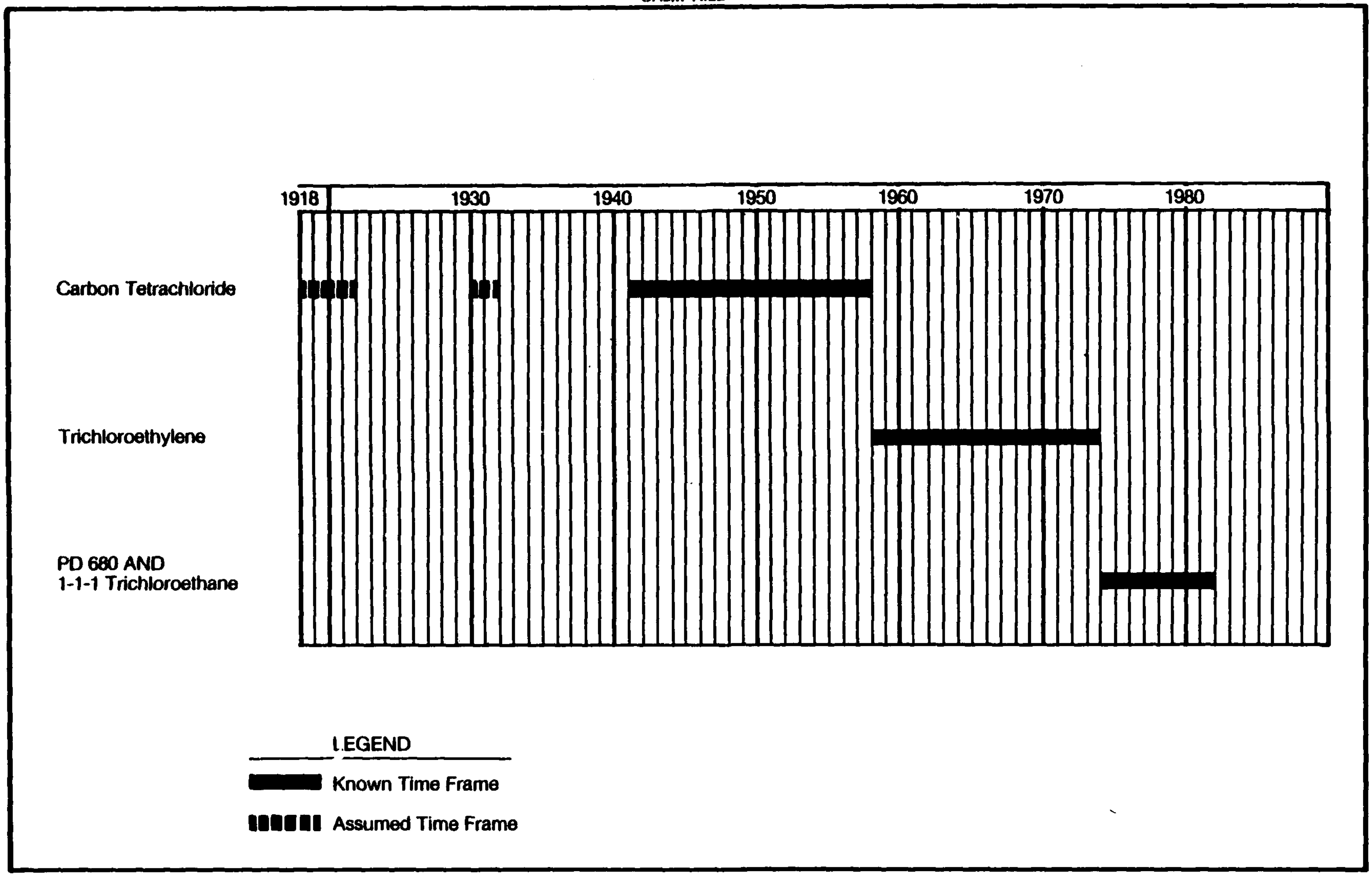

FIGURE 22. Historical summary of major solvent usuage at Mather AFB.

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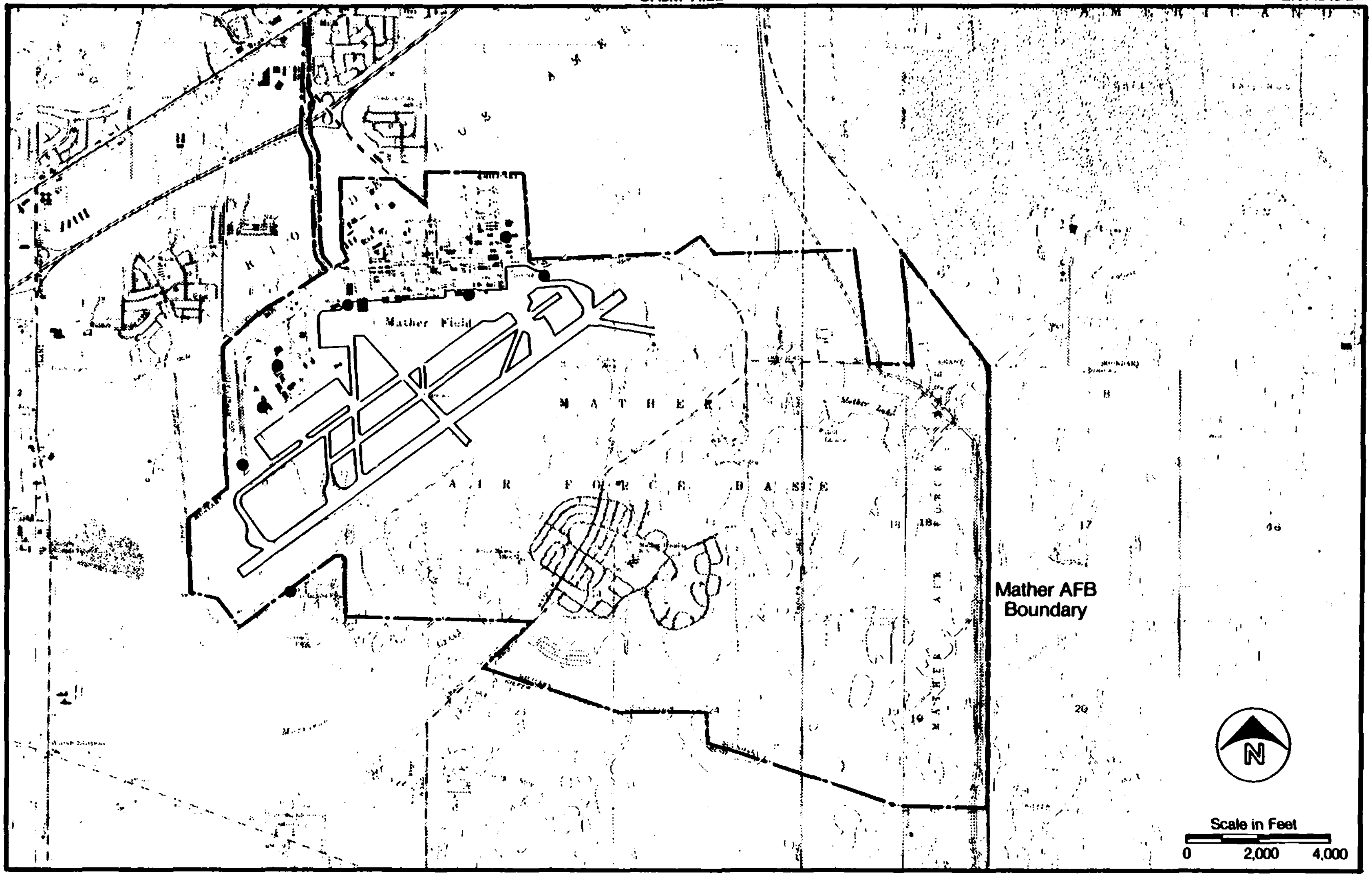

FIGURE 23. Location map of belt skimmer oil/water separation facilities at Mather AFB.

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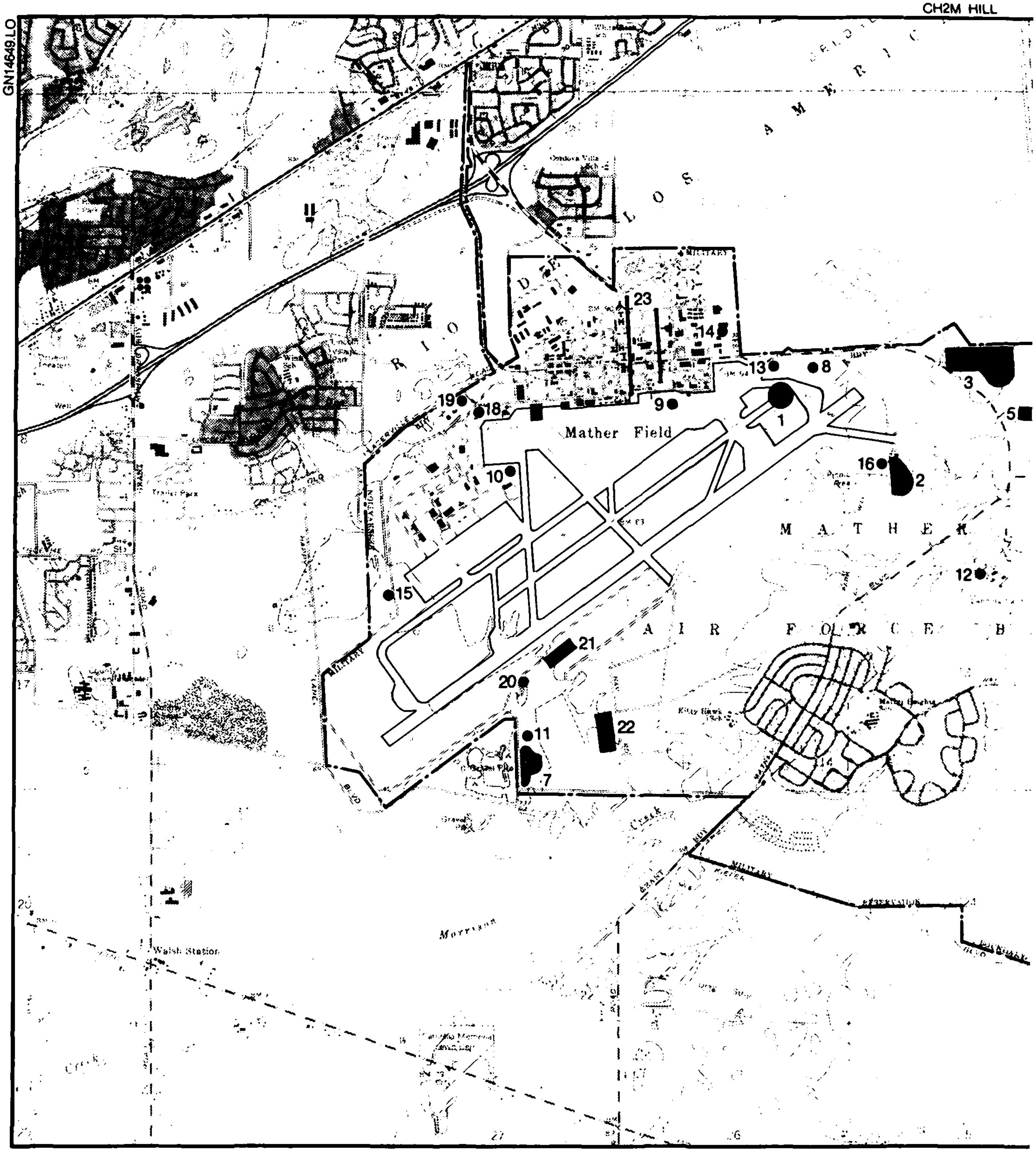

Location map of identified disposal sit

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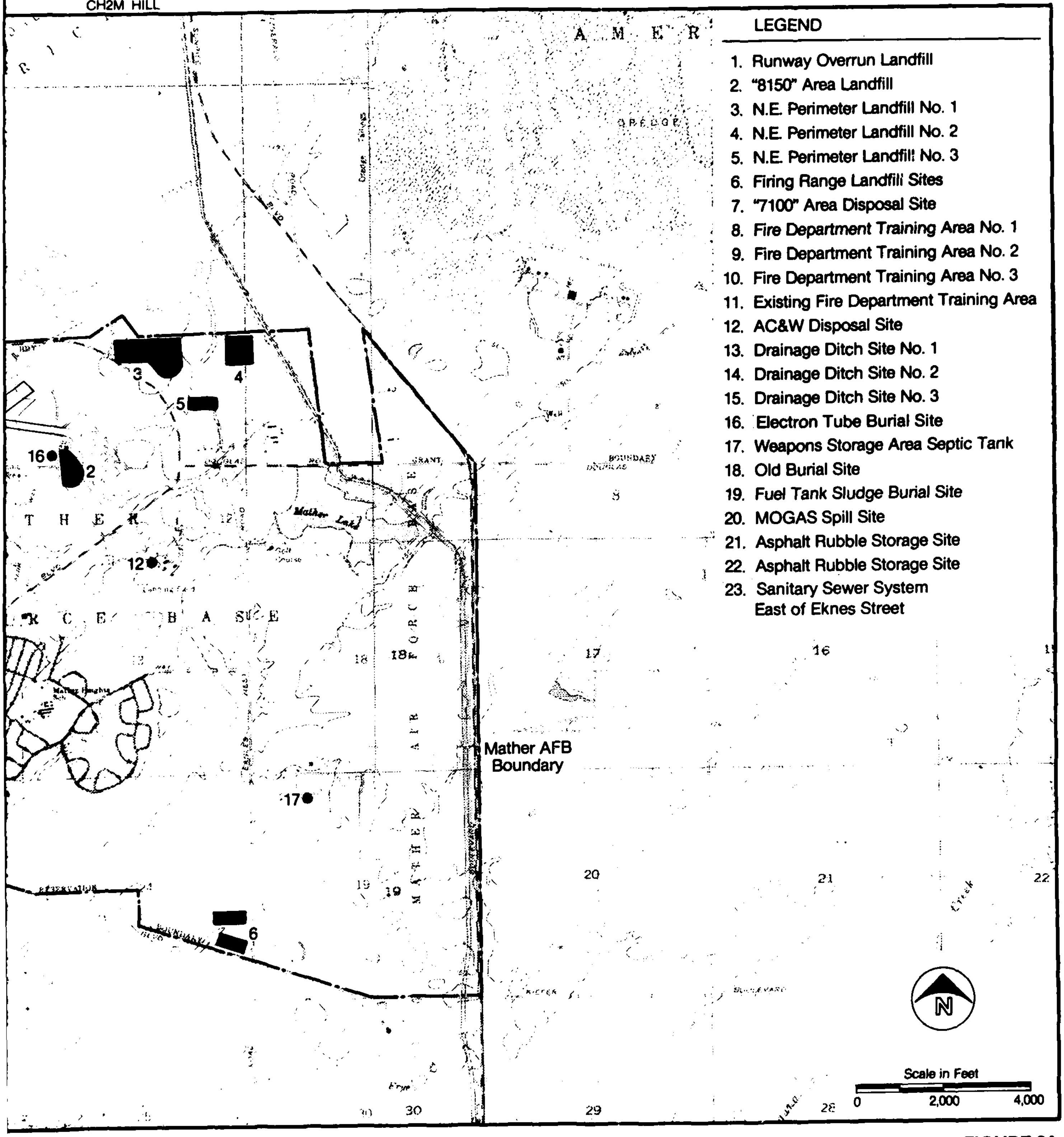

p of identified disposal sites at Mather AFB.

FIGURE 24.

2

CH2M HILL GN14649 LO

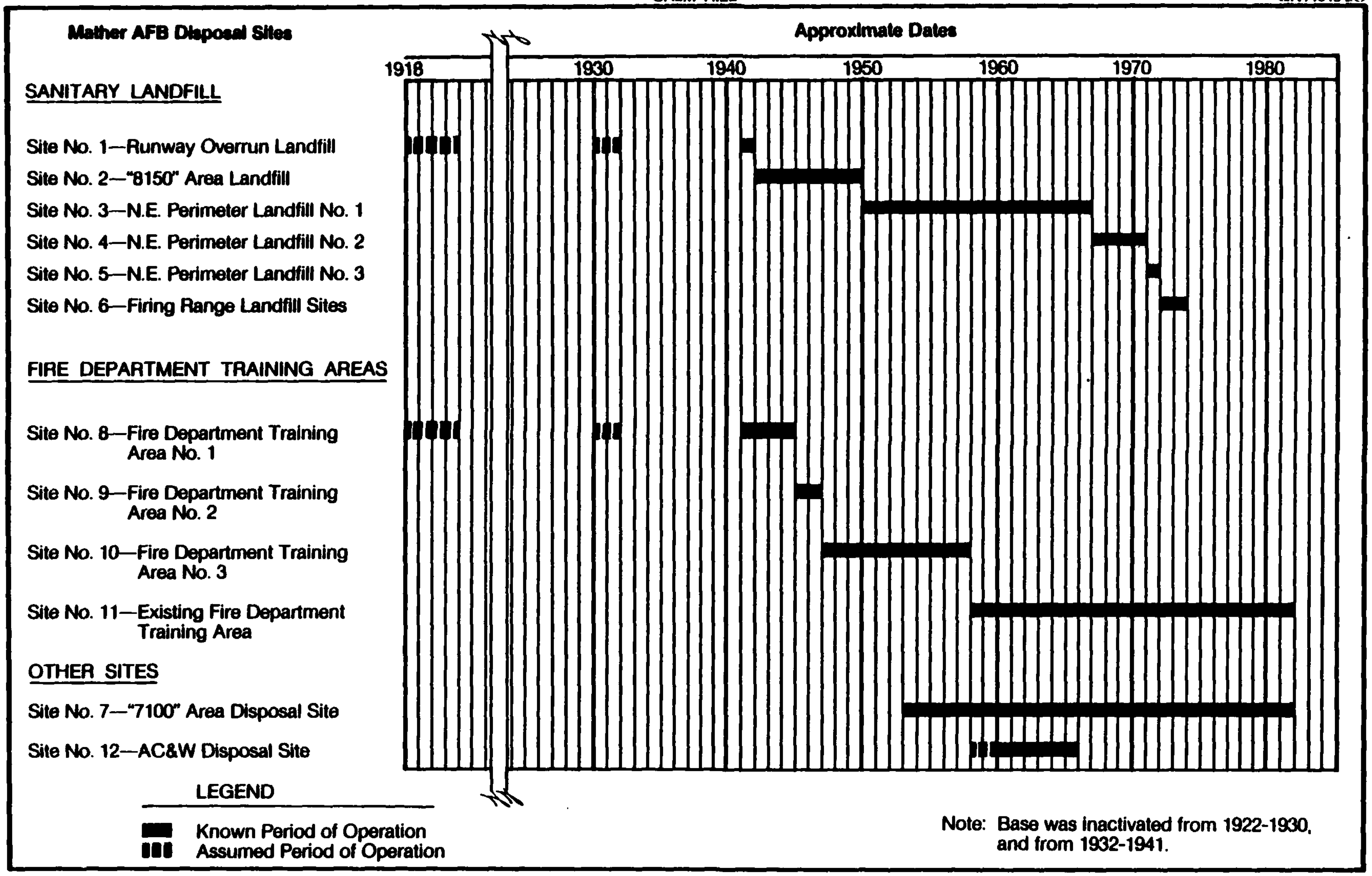

FIGURE 25. Historical summary of activities at major disposal sites at Mather AFB.

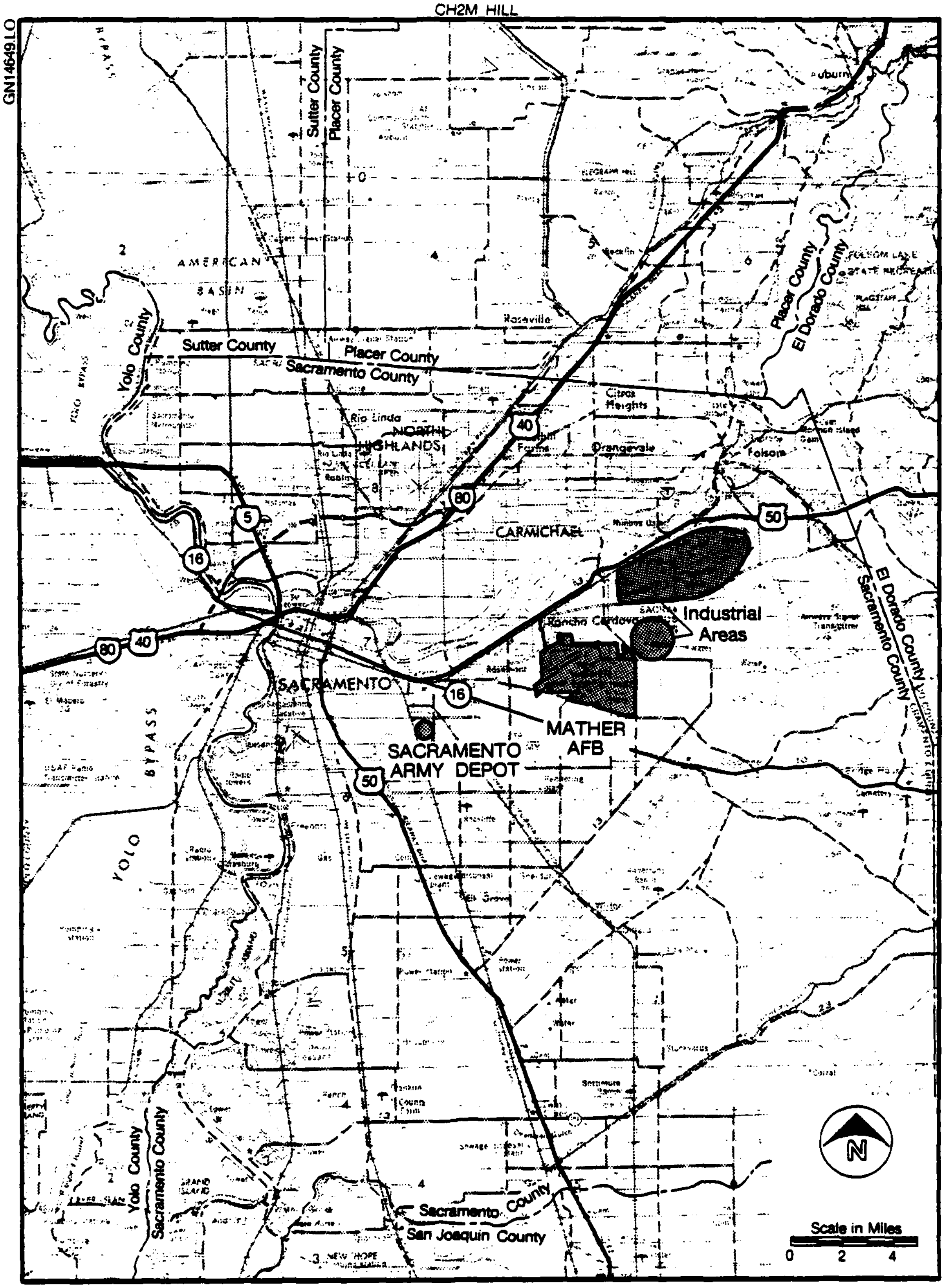

FIGURE 26. Location of Mather AFB and nearby industrial areas.

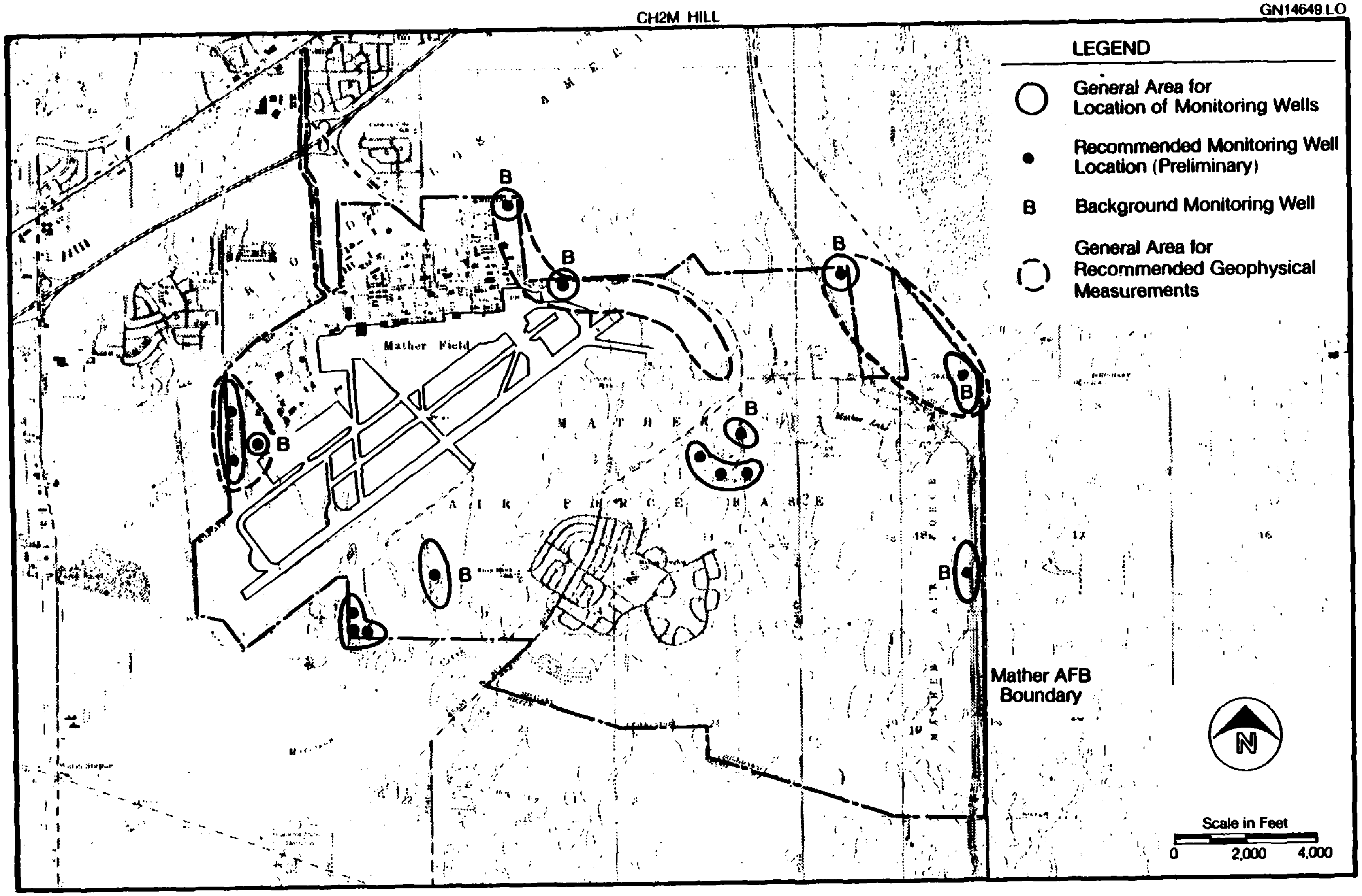

FIGURE 27. Preliminary recommended monitoring well locations at Mather AFB.

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REFERENCES

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Appendix A
RESUMES OF TEAM MEMBERS

■ NORMAN N. HATCH, JR.
Industrial Wastewater and Hazardous Waste Projects Manager

Education

M.S., Environmental Engineering, University of Florida, 1973
M.S., Analytical Chemistry, University of Florida, 1972
B.S., Chemistry, University of New Hampshire, 1969

Experience

Mr. Hatch joined CH2M HILL in 1973 and is currently the Manager of the Industrial Wastewater Reclamation Department. His 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. Examples of his work include:

- Overall responsibility for hazardous materials disposal site records searches for 12 U.S. Air Force installations throughout the United States. The purpose of the records searches is to assess the potential for hazardous contaminant migration from past disposal practices and to recommend follow-up actions.

- Assistance in a comprehensive RCRA compliance program for Gulf Oil Company's Port Arthur Refinery.

- Project manager of a feasibility study for treatment of high nitrogen industrial wastewater from the Air Products and Chemicals, Inc., manufacturing facility in Pensacola, Florida. Treatment technologies investigated included aerated lagoons, oxidation ponds, anaerobic treatment ponds, spray irrigation, activated carbon, and air stripping.

- Project manager of a comprehensive treatability and process selection study for the American Cyanamid Fibers Division plant in Milton, Florida. Investigations included spray irrigation, deep well injection, activated sludge, rotating biological contactors, anerobic contact treatment, activated carbon, ion exhange, and chemical coagulation.

- Project manager for several other treatability and process selection studies for industrial clients including Arizona Chemical Company, Kaiser Agricultural Chemicals, Engelhard Industries, and Production Plating Company.

- Assistance in the negotiation of NPDES permits for Air Products and Chemicals, Inc., American Cyanamid, and Kaiser Agricultural Chemicals.

- Lead engineer on an ozone disinfection feasibility study for the City of Philadelphia's Queen Lane Water Treatment Plant. Also served as chief process engineer for the subsequent design of chemical feed systems at the Queen Lane Plant.

NORMAN N. HATCH, JR.

- Process design and design of chemical feed and sludge handling facilities for the Alexander City, Alabama, Water Treatment Plant.
- Process design and design of chemical feed system modifications for the St. Augustine, Florida, Water Treatment Plant.
- Project manager for the design of water treatment facilities, including lime softening, zeolite softening, and granular activated carbon adsorption for a sugar mill in south Florida.
- Project manager for development of a comprehensive water system master plan, including raw water supply, treatment, and distribution systems for the Fort Pierce Utilities Authority, Fort Pierce, Florida.
- Project manager for a feasibility study of direct wastewater reuse for potable water for the City of St. Petersburg, Florida.
- Project manager for the planning, supervision, and performance of pilot plant investigations for the removal of hydrogen sulfide from potable water for the Orlando Utilities Commission, Orlando, Florida.
- Cost-effective analysis and process selection for treatment of combined domestic and paper mill wastewater for the City of Harriman, Tennessee.
- Preparation of various segments of 201 facilities plans for Monroe County (Florida Keys); Lake City, Florida; Alachua County, Florida; Puerto Rico; and Live Oak, Florida.

Before joining CH2M HILL, Mr. Hatch was employed with the E.I. du Pont de Nemours Photo Products Plant in Parlin, New Jersey.

Membership in Organizations

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

Professional Engineer Registration

Florida
Georgia

GREGORY T. MCINTYRE
Environmental Engineer

Education

M.S., Environmental and Water Resources Engineering, Vanderbilt University, 1981
B.S., Environmental Engineering, University of Florida, 1980

Experience

Mr. McIntyre's responsibilities at CH2M HILL involve projects dealing with laboratory and pilot treatability studies, industrial waste treatment processes, and hazardous wastes. Since joining the firm in September 1981, his project-related assignments have included:

- Participation in wastewater characterization, laboratory pilot plant treatability study, evaluation of existing pretreatment, and conceptual design for equalization and aerobic biological treatment of industrial wastewater for Hercules, Inc.

- Hazardous materials disposal site records search for the U.S. Air Force to assess the potential for hazardous contaminant migration from past disposal practices and to recommend follow-up actions.

While in graduate school working as a research assistant, some of Mr. McIntyre's activities included:

- Researching the removal of heavy metals, including copper, zinc and trivalent chromium, using a large-scale adsorbing colloid foam flotation pilot plant.

- Experimental verification of the mathematical model of a continuous flow flotation column.

Professional Registration

E.I.T., Florida

Membership in Organizations

American Water Works Association
Water Pollution Control Federation
Tau Beta Pi

Publications

"Inexpensive Heavy Metal Removal By Foam Flotation." (Coauthors E. L. Thackston, J. J. Rodriguez, and D. J. Wilson). *Proceedings of the 35th Annual Purdue Industrial Waste Conference*, May 1981. *Proceedings of the International Conference on Heavy Metals in the Environment*, Amsterdam, September 1981. *Proceedings of the 2nd Mediterranean Congress of Chemical Engineering*, Barcelona, Spain, October 1981.

GREGORY T. MCINTYRE

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"Experimental Verification of the Mathematical Model of a Continuous Flow Flotation Column." (Coauthors J. E. Kiefer, J. J. Rodriguez, and D. J. Wilson). *Separation Science and Technology*. (In Press)

"Pilot Plant Study of Copper, Zinc, and Trivalent Chromium Removal by Adsorbing Colloid Foam Flotation." M.S. Thesis, Vanderbilt University, 1981.

■ **GARY E. EICHLER**
Hydrogeologist

Education

M.S., Engineering Geology, University of Florida, 1974
B.S., Construction and Geology, Utica College of Syracuse University, 1972

Experience

Mr. Eichler has been responsible for ground-water projects for both water supply and effluent disposal. Studies have included site selection, well design, construction services, monitoring and testing programs, determination of aquifer characteristics, and well field design. In addition, Mr. Eichler has conducted numerous studies to determine pollution potential of toxic and hazardous wastes. Types of projects for which Mr. Eicher has been directly responsble for include:

- Exploration drilling, testing, and design of well fields for potable water supply with an installed capacity of over 65 mgd.
- Determination of pollutant travel time and direction of movement at hazardous waste disposal sites.
- Geophysical logging and testing programs for deep disposal wells for both municipal and hazardous waste.
- Aquifer modeling studies completed to predict effects of future ground-water withdrawal.
- Determination of saltwater intrusion potential and design of associated monitoring programs.

Prior to joining CH2M HILL in 1976, Mr. Eichler was an engineering geologist with Environmental Science and Engineering, Inc., of Gainesville, Florida. Responsibilities there included project management, soils investigations, siting studies, ground-water and surface-water reports, and Federal and state environmental impact studies. He has professional capabilities in the following areas.

- Hydrogeology. Water supply well location, aquifer testing, well field layout, injection well testing and monitoring program design, and well construction inspection.
- Water resources inventory. Potentiometric mapping, water yield, and availability determinations.
- Site investigations. Determination of subsurface conditions, primarily in soil media. Determination of stratigraphic correlation and associated physical properties for engineering design.
- Environmental permitting. Federal, state, regional, and local permit studies associated with industrial and mining projects.

GARY E. EICHLER

- Clay mineralogy. Clay mineral reactions primarily associated with lime stabilization for highways and other engineering projects. Participated in a Brazilian highway project and developed laboratory analysis for lime-soil reactions.

- Engineering geology. Geologic exploration, soil property determinations for engineering design, and water and earth materials interactions associated with construction.

- Geophysics. Well logging and interpretation.

Mr. Eichler directed the laboratory analysis of tropical soils to determine engineering properties and reaction potential with lime additives for a Brazilian highway project. He also assisted in the preparation and presentation of a seminar on lime stabilization sponsored by the National Lime Association.

Membership in Organizations

American Institute of Professional Geologists
American Water Resources Association
Association of Engineering Geologists
Geological Society of America
Southeastern Geological Society
National Water Well Association

Publications

Engineering Properties and Lime Stabilization of Tropically Weathered Soils. M.S. thesis, Department of Geology, *University of Florida*. August 1974.

Certifications

Certified Professional Geologist
Certificate No. 4544

BRIAN H. WINCHESTER
Ecologist

Education

B.S., Wildlife Ecology, University of Florida, 1973

Experience

Mr. Winchester's primary responsibility is project management. He has broad experience in study design and implementation of field sampling programs, data interpretation, impact assessment and prediction, impact mitigation and remedial method development, report preparation and review, and expert consultation at client/agency hearings. He has successfully prepared numerous Environmental Impact Statements (EIS's), Developments of Regional Impact (DRI's), and environmental assessments for a variety of industries, utilities, and public agencies.

- EIS Studies—Designed and directed terrestrial and wetland biology studies for alternative Trident Submarine Base sites in Florida, Georgia, South Carolina, Virginia, and Rhode Island. Conducted biota inventories and assessed impacts of maintenance dredging along the 300-mile Gulf Intracoastal Waterway, Louisiana. Mapped biotic communities and assessed impacts of watercourse channelization on the 9-square-mile California Lake Watershed, Florida.

- DRI Studies—Managed or assisted in preparing five phosphate mine DRI's in central Florida. Helped develop mining and reclamation plans and provided technical input at client/agency hearings. Also provided biological baseline and impact assessment data for beneficiation plant sitings. Conducted biotic community inventories, delineated wetlands, and prepared DRI's for three proposed residential developments in central and southern Florida.

- Wetlands Studies—Assessed capacity of a 450-acre swamp in northeastern Florida to assimilate secondarily treated sewage. Investigated feasibility of enhancing wet prairie wetlands in southern Mississippi with municipal wastewater. Assessed impacts of water-table drawdown on Florida wetland vegetation in Palm Beach and Pasco Counties. Developed cost-effective, time-effective methodology for estimating the ecological value of freshwater wetlands and applied the technique to over 800 wetlands in central peninsular Florida; prepared wetland maps for Pasco, Pinellas, Hillsborough, Manatee, and Collier Counties; and assessed potential dredge and fill impacts on numerous wetlands.

- Industry Studies—Managed two 2-year biological monitoring studies assessing potential impacts of industrial effluents in upper Escambia Bay, Florida. Conducted baseline terrestrial and estuarine aquatic quarterly sampling for a proposed clean fuels facility in Jacksonville, Florida. Predicted SO_2 and NO_X air emission impacts on vegetation for a proposed caprolactam facility in southern Alabama.

- Hazardous Waste Studies—Assessed ecological impacts associated with hazardous substances and their disposal at 13 USAF installations located throughout the U.S.

- Power Plant Studies—Studied aquatic biota entrained at a Miami generating station. Assessed impacts of blowdown on plant communities surrounding two Florida generating stations. Assessed alternative transmission line ROW's in Alachua County. Assisted in delineation of biotic communities for a generating station expansion in Crystal River, Florida. Prepared environmental assessments for siting power plants in western and northeastern Washington.

- Transportation/Corridor Studies—Evaluated biological impacts associated with alternative routings of major new highways in Pinellas and Duval Counties, Florida. Assessed environmental impacts of upgrading a telephone communications corridor extending from Windermere to Tampa. Prepared an ecological assessment for a proposed interstate highway interchange in Flagler County.

- Rare and Endangered Biota Research—Managed research on the ecology and management of a recently rediscovered endangered mammal. Conducted numerous endangered biota inventories.

Membership in Organizations

Ecological Society of America
City of Gainesville Hazardous and Nuclear Waste Committee

Publications

"Assessing Ecological Value of Central Florida Wetlands: A Case Study." *Proceedings of the Eighth Annual Conference on the Restoration and Creation of Wetlands* (in press). 1981.

"Valuation of Coastal Plain Wetlands in the Southeastern United States." *Symposium on Progress in Wetlands Utilization and Management* (in press). 1981.

"An Approach to Valuation of Florida Freshwater Wetlands," (with L. D. Harris). *Proceedings of the Sixth Annual Conference on the Restoration and Creation of Wetlands*. pp. 1-26. 1979.

"Ecology and Management of the Colonial Pocket Gopher: A Progress Report," (with R. S. DeLotelle, J. R. Newman, and J. T. McClave). *Proceedings of the Rare and Endangered Wildlife Symposium*, Athens, Georgia. pp. 173-184. 1978.

"The Current Status of the Colonial Pocket Gopher," (with R. S. DeLotelle). *Oriole* 43:33-35. 1978.

"The Ecological Effects of Arsenic Emitted From Non-Ferrous Smelters," (with F. E. Benenati and T. P. King). U.S. EPA, EPA 560/6-77-011. 1976.

Appendix B
OUTSIDE AGENCY CONTACT LIST

Appendix B
OUTSIDE AGENCY CONTACT LIST

1. California Regional Water Quality Control Board, Central Valley Region
   Sacramento, California
   Mr. Stan Phillippe, Mr. Tom Pinkos,
   Mr. Bob Matteoli, Ms. Liese Schadt,
   Mr. Gregory Vaughn
   916/322-9095

2. County of Sacramento Health Department
   Sacramento, California
   Mr. Ken Knight
   916/366-2093

3. California Department of Health Services
   Hazardous Materials Management Group
   Sacramento, California
   Mr. Jim Pappas
   916/323-5508

4. California Department of Health Services
   Sanitary Engineering Section
   Sacramento, California
   Mr. Bert Ellsworth, Mr. Carl Lischeske
   916/445-1736

5. Environmental Protection Agency, Region IX
   Hazardous Materials Branch
   San Francisco, California
   Mr. Fred Hoffman
   415/974-8191

6. California Department of Water Resources
   Sacramento, California
   Mr. Carl Hauge, Mr. Grant Ardell
   916/322-7166

7. California Department of Fish and Game
   Sacramento, California
   Mr. Jack Linn
   916/355-7030

8. U.S. Fish and Wildlife Service
   Sacramento, California
   Mr. Ralph Swanson
   916/440-2791

9. Dr. John F. Mann, Jr.
   Consulting Ground Water Geologist
   La Habra, California
   916/697-9604

10. U.S. Geological Survey
    Water Resources Division
    Sacramento, California
    916/484-4147

11. Sacramento County Planning and Community
    Development Commission
    Sacramento, California
    916/440-6141

Appendix C
MATHER AFB RECORDS SEARCH
INTERVIEW LIST

Appendix C
MATHER AFB RECORDS SEARCH INTERVIEW LIST

Interviewee	Area of Knowledge	Years at Installation
1	Exterior Lineman	22
2	Sanitation Superintendent	35
3	Water and Wastewater Treatment	32
4	Environmental Planning	29
5	Environmental Planning	1
6	Engineering and Environmental Planning	14
7	Operations	2
8	Operations	6
9	Entomology	11
10	Entomology	27
11	ATC Maintenance	30
12	AC&W Area	11
13	Environmental Planning	15
14	Bioenvironmental Engineering	3
15	SAC Corrosion Control	3
16	Fire Department	35
17	Fire Department	26
18	Fire Department	30
19	ATC Aero Repair	26
20	Explosive Ordnance Disposal	7
21	Sanitary Landfill Operation	25
22	Roads and Grounds Maintenance	22
23	Paint Shop	17
24	Liquid Fuels	29
25	Sheet Metal Shop	28
26	SAC Maintenance	23
27	ATC Plating Shop	30
28	SAC Aerospace Ground Equipment	7
29	POL Waste Disposal	8
30	Fuels Operations	10
31	AC&W Area	21
32	AC&W Area	23
33	Exterior Electric	10
34	AC&W Area	16
35	Civil Engineering	5

Appendix D
INSTALLATION HISTORY

Appendix D
INSTALLATION HISTORY

In October 1917, the Sacramento Chamber of Commerce launched a campaign for Sacramento to be chosen as a site for the training of Army aviators. The land was obtained in February 1918 by the Chamber of Commerce and presented to the United States Government by the community of Sacramento. Construction of the base began the following month. On May 2, 1918, the installation was named in memory of Second Lieutenant Carl Spencer Mather, who had been killed in an air training crash near Ellington Field, Texas, in January 1918.

The first aviators arrived at Mather Field on June 8, 1918, and the first flight from the base was made 4 days later. Flight training was discontinued on January 8, 1919. In the months that followed, activities were reduced to mostly caretaker duties with occasional air patrols by the forestry service. In June 1922, the field was inactivated. Mather Field was reopened on March 3, 1930 in preparation for the "War Games" held by the Air Corps the following month. On November 1, 1932, Mather Field was again inactivated.

Reactivated in 1941, Mather Field was rebuilt as a school for pilot and navigator training. In 1944, the base became a port of aerial embarkation--and later a port of debarkation--under the Air Transport Command, and many additional facilities were built. Mather Field resumed its training mission in December 1945, becoming the first school for navigator-bombardiers.

An important milestone in Mather's history was established in 1958 when Strategic Air Command (SAC) activated and assigned the 4134th Strategic Wing to Mather as a tenant organization. More than $20,000,000 was spent to construct additional buildings and other facilities for the SAC operation. On February 1, 1963, the 320th Bombardment Wing was activated and assigned to Mather, replacing the 4134th Strategic Wing, which was inactivated.

In 1961, electronic warfare officer training was transferred to Mather from Keesler AFB, Mississippi. By August 1961, electronic warfare upgrade, refresher, and familiarization training courses were being taught.

It was decided in 1964 that undergraduate navigator training would be relocated to Mather from James Connally AFB, Texas. This action unified all related navigator training into one composite mission under the 3535th Navigator Training Wing.

On April 1, 1973, the 3535th Navigator Training Wing was inactivated and the navigator training mission was assumed by the 323rd Flying Training Wing, which was activated the same day. This change in organization marked the beginning of significant changes in the concept of undergraduate navigator training.

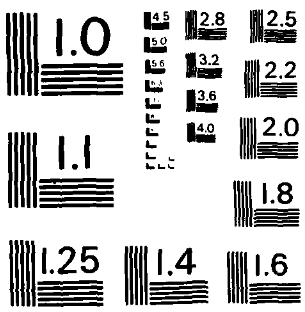
Under the new course concept called "Undergraduate Navigator Training System," jet aircraft were used for the first time in undergraduate navigator training. Additionally, the new course incorporated a complex of highly sophisticated simulators as part of the improved instruction.

After more than 20 years of operation, the use of the Convair T-29 "Flying Classroom" for navigator training was phased out by March 1975. The phase-out of the T-29 began with the arrival of the new jet-powered Boeing T-43 Airborne Navigator Trainer aircraft in September 1973. A year later, the Cessna T-37 jet trainer was introduced to the navigation training program.

AD-A123 927 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR MATHER AIR FORCE BASE CALIFORNIA(U) CH2M HILL GAINESVILLE FL. JUN 82 F08637-80-G-0010

3/4

UNCLASSIFIED F/G 13/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Undergraduate navigator training for the U.S. Navy and U.S. Coast Guard, and support of the Marine Aerial Navigation School--which relocated to Mather from Corpus Christi, Texas--was assumed by the 323rd Flying Training Wing in July 1976. With the establishment of the interservice undergraduate navigator training program, the 323rd Flying Training Wing became the only navigation training wing to provide undergraduate and advanced navigation training to all services under the Department of Defense.

A major revision to the undergraduate navigator training program was implemented in October 1978. The revised program reduced the number of training days for the basic undergraduate navigator course and initiated two additional courses: Advanced Navigation and Tactical Navigation. This was the most extensive revision of the undergraduate navigator training program since the introduction of the T-43 Airborne Navigator Trainer aircraft.

PRIMARY MISSION

The 323rd Flying Training Wing of the Air Training Command remains the current host unit at Mather AFB. The primary mission is to "qualify non-rated officers as navigators; and provide the navigator with the technical training experience, guidance and motivation required to operate the advanced navigation, bombing, missile, and electronic warfare systems used by the United States Armed Forces."

TENANT MISSION

The major tenants at Mather AFB and their missions are summarized below:

320th Bombardment Wing (SAC)

The mission of the 320th Bombardment Wing is to maintain the capability to conduct long-range bombardment operations using assigned weapons and to sustain the capability to engage in effective air refueling operations. Performance of the mission involves effective utilization of assigned bombers, tankers, and air-to-ground missiles in conducting readiness training while maintaining a portion of the Wing's force on immediate reaction ground alert.

Detachment 7, 24th Weather Squadron (MAC)

Det 7, 24WS provides meteorological support to all units assigned to Mather AFB as well as to transient aircrews.

2034th Communications Squadron (AFCS)

The Squadron provides Mather AFB and its tenants with communications and air traffic control services.

3506th USAF Recruiting Group (ATC)

The 3506th is currently responsible for recruiting Air Force personnel from 13 western states, including Alaska, Hawaii, Guam and the Philippines, plus the western tip of Texas, Kansas, and Nebraska.

Det 515, 3751st Field Training Squadron (ATC)

This Detachment is responsible for onsite aircraft maintenance training and OJT advisory service at Mather AFB. The Detachment trains USAF and civilian personnel in the aircrew and maintenance support areas on the T-43, T-37, B-52, KC-135, and on-the-job training.

AFOSI Detachment 1904

Det 1904 is a detachment of AFOSI District 19, Travis AFB, California. Upon request, AFOSI provides professional investigative services to commanders of all Air Force activities in the criminal, fraud, and counterintelligence areas.

Det 3, 3314th Management Engineering Squadron (ATC)

This Squadron provides management advisory services to base operating officials, develops manpower standards and evaluates applicability of standard to base functions, and prepares local mission, manpower management, and organization directives in accordance with command policy.

Det 448, Area Audit Office, Air Force Audit Agency

The mission of this Detachment is to provide base officials with an independent, objective, and constructive evaluation of the effectiveness and efficiency with which managerial responsibilities (including financial, operational, and support activities) are carried out.

USAF Civil Air Patrol Pacific Liaison Region (AU)

Duties include supervising liaison offices in California, Nevada, Oregon, Washington, Alaska, and Hawaii and advising and assisting the Civil Air Patrol Region Commander in the management of resources and development of training.

Army Aviation Support Facility (ARNG)

Duties include providing centralized control and proper use and operation of the aviation assets assigned to northern California. To accomplish this mission, they are authorized 55 full-time administrative and maintenance technicians. In addition, approximately 70 assigned part-time pilots fly support missions as part of their training requirements.

USAF Judiciary Area Defense Counsel

The Counsel performs as defense counsel in courts-martial proceedings, Article 32 investigations, administrative separation actions, and interrogation situations.

HQ 940th Air Refueling Group (AFRES)

In peacetime, the mission of the 940th AREFG is to develop and maintain the operational capability to conduct strategic warfare tasking identified in Strategic Air Command (SAC) Emergency War Orders and supporting OPLANS.

In wartime and periods of post mobilization, the 940th AREFG will be assigned to the Strategic Air Command and will execute those missions and tasking as directed by Hq SAC.

Federal Aviation Administration (FAA)

The Airway Facilities Section Field Office at Mather AFB processes and remotes to the Oakland Air Traffic Control Center (ARTCC) radar/beacon data used in controlling northern California and western Nevada.

OL AAA, AFCOMS/SVC, Air Force Commissary Services

This activity is responsible for requisitioning, receiving, storing, issuing, and selling authorized subsistence items to food service dining halls and commissary patrons.

Appendix E
MASTER LIST OF INDUSTRIAL OPERATIONS

Appendix E
MASTER LIST OF INDUSTRIAL ACTIVITIES

Name	Present Location and Dates (Bldg. No.)	Past Location and Dates (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal
323 Transportation					
Vehicle Maintenance Shops					
--Body, Welding, and Paint	2990 1954-Pres	--	X		Consumed in use
(Two locations)	3900 1951-Pres	--	X		Consumed in use
--Tire	2992 1961-Pres	--			
--Machine	3900 1951-Pres	--			
--General Purpose	3900 1951-Pres	--	X	X	CESF[a]
--Dynomometer	3940 1951-Pres	--			
--Special Purpose	3940 1951-Pres	--	X	X	Consumed in use, CESF
Packing and Crating Shop	4302 1941-Pres	--			
Refueling Maintenance Shop	2898 1967-Pres	--	X		Consumed in use
Hospital					
--Boiler Plant	650 1970-Pres	--	X		Consumed in use
--Dental Clinic	650 1970-Pres	--	X		Consumed in use
--Medical Laboratory	650 1970-Pres	--	X	X	Dilution to sanitary sewer
--*Pathology*	650 1970-Pres	--	X	X	CESF
323 Supply					
Base Supply	4200 1953-Pres	--	X		Storage
Fuels Maintenance	4120 1961-Pres	4424 1942-1961	X		Storage
323 FTW					
Photo Lab	2890 1953-Pres	--	X	X	Dilution to sanitary sewer
Silk Screen	2950 1974-Pres	3847 1951-1974			
Paint Shop	2950 1974-Pres	3847 1951-1974	X		Consumed in use
Carpentry	2950 1974-Pres	3847 1951-1974	X		Consumed in use
Sheet Metal, Welding	2950 1974-Pres	3847 1951-1974	X		Consumed in use
Electronics	2950 1974-Pres	3847 1951-1974	X		Consumed in use
Film Library	2950 1974-Pres	3847 1951-1974			
Life Support	4677 1981-Pres	--	X		Consumed in use
323 FMS					
Welding Shop	4150 1963-Pres	4440 1942-1963	X		Consumed in use
Structural Repair Shop	4150 1963-Pres	4440 1942-1963	X		Consumed in use
Plating and Cleaning Shop	4150 1963-Pres	4440 1942-1963	X	X	CESF

[a]CESF - Civil Engineering Storage Facility

Appendix E--Continued

Name	Present Location and Dates (Bldg. No.)	Past Location and Dates (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal
323 FMS--Continued					
Corrosion Control Shop	4150 1963-Pres	4440 1942-1963	X	X	CESF
Battery Shop	4150 1963-Pres	4440 1942-1963	X	X	Neutralized to sanitary sewer
Machine Shop	4150 1963-Pres	4440 1942-1963			
Propulsion Shop	4150 1963-Pres	4440 1942-1963			
Pneudraulics Shop	4260 1970-Pres	4677 1960-1970 Outside 4474 1956-1960	X	X	CESF
Inspections	4260 1970-Pres	4677 1960-1970 Outside 4474 1956-1960			
Egress Shop	4260 1970-Pres	4677 1960-1970 Outside 4474 1956-1960			
Electric Shop	4260 1970-Pres	4677 1960-1970 Outside 4474 1956-1960	X	X	CESF
NDI Lab	4260 1970-Pres	4677 1960-1970 Outside 4474 1956-1960	X	X	Dilution to sanitary sewer, CESF
Aero Repair, Tire, Fuel Cell	4260 1970-Pres	4677 1960-1970 Outside 4474 1956-1960			
AGE	4348 1970-Pres	4677 1960-1970 Outside 4474 1956-1960	X	X	CESF
Survival Equipment	7050 1958-Pres	--			
323 AMS					
Avionics Shop	4473 1961-Pres	--	X		Consumed in use
T-10, T-11 Simulator Maintenance	3860 1961-Pres	--	X	X	CESF
323 CES					
Fire Department	7075 1958-Pres	--	X		Consumed in use
Liquid Fuels Management	3386 1942-Pres	--	X		
Heating and Ventilation	3332 1942-Pres	--			
Road and Grounds	2474 1942-Pres	--	X		Consumed in use
Refrigeration	3354 1942-Pres	--	X		
Interior Electric	3306 1942-Pres	--	X		
Exterior Electric	3354 1942-Pres	--	X		
Golf Course Maintenance	8868 1966-Pres	--	X		Consumed in use
Carpentry	3306 1942-Pres	--			
Protective Coating	3308 1961-Pres	--	X	X	CESF
Plumbing	3332 1942-Pres	--			
Power Production	3337 1942-Pres	--	X	X	CESF
Welding and Sheet Metal	3335 1942-Pres	--			

Appendix E--Continued

Name	Present Location and Dates (Bldg. No.)	Past Location and Dates (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal
323 CES--Continued					
Entomology	3474 1970-Pres	3328 1942-1970	X	X	Consumed in use, cans triple rinse to dumpster
Water Plant	3975 1941-Pres	--			
Sewage Plant	7133 1941-Pres	--			
Housing Maintenance	21042 1942-Pres	--	X	X	CESF
323 ABG					
Auto Hobby	3320 1944-Pres	--	X	X	Oil/water separator, contractor removal
Craft Center	2425 1964-Pres	--			
Small Arms Range	12500 1965-Pres	--			
Reproduction	3374 1942-Pres	--			
320 MMS					
Munitions Maintenance	7009 1961-Pres	--			
Equipment Maintenance	7009 1961-Pres	--	X	X	CESF
Conventional Weapons	18070 1958-Pres	--	X		Consumed in use
Special Weapons	18015 1958-Pres	--	X	X	Consumed in use, CESF
SRAM	18018 1975-Pres	--			
320 OMS					
Non-powered AGE	7033 1978-Pres	--	X	X	CESF
Tanker Phase	7040 1959-Pres	--			
Bomber Phase	7015 1959-Pres	--			
320 FMS					
AGE	7022 1962-Pres	--	X	X	Oil/water separator, CESF
Propulsion	7024 1962-Pres	--	X	X	Oil/water separator, CESF
Corrosion Control	7035 1959-Pres	--	X	X	Oil/water separator, CESF
Survival Equipment	7056 1958-Pres	--			
Electric Shop	7045 1958-Pres	--	X	X	Neutralized to sanitary sewer
Environmental Systems	7045 1958-Pres	--	X	X	CESF
Pneudraulics	7045 1958-Pres	--	X	X	CESF
Wheel and Tire	7045 1958-Pres	--			
Egress	7045 1958-Pres	--			
Jet Engine Test Cell	7099 1961-Pres	--			
Fuel Cell	7005 1963-Pres	--	X	X	CESF
320 AMS					
Avionics Shops --Fire Control	7020 1958-Pres	--	X	X	CESF

Appendix E--Continued

Name	Present Location and Dates (Bldg. No.)	Past Location and Dates (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal
320 AMS--Continued					
--Bomber Navigation	7020 1958-Pres	--			
--Doppler	7020 1958-Pres	--			
--Flight Control/Instrument	7020 1958-Pres	--			
--Radar	7020 1958-Pres	--			
--Electronic Counter Measures	7020 1958-Pres	--			
AASF-SAC	4850 1970-Pres	--	X	X	CESF

Appendix F
INVENTORY OF EXISTING POL STORAGE TANKS

Appendix F

INVENTORY OF EXISTING POL STORAGE TANKS

Facility No.	Type POL	Capacity (gal)	Type of Tank
650 (North Tank)	Fuel Oil	8,500	Underground
650 (South Tank)	Fuel Oil	8,500	Underground
651	Fuel Oil	500	Underground
1210	Fuel Oil	2,000	Underground
1214	Fuel Oil	2,000	Underground
1216	Fuel Oil	2,000	Underground
1218	Fuel Oil	2,000	Underground
1220	Fuel Oil	2,000	Underground
1222	Fuel Oil	2,000	Underground
1224	Fuel Oil	2,000	Underground
1226	Fuel Oil	2,000	Underground
1234	Fuel Oil	2,000	Underground
2410	Waste Oil	250	Underground
2774	Fuel Oil	3,000	Underground
3167	MOGAS	25,000	Underground
3168	MOGAS	25,000	Underground
3169	MOGAS	25,000	Underground
3170	Diesel	25,000	Underground
3273	MOGAS	25,000	Underground
3274	MOGAS	25,000	Underground
3275	Diesel	25,000	Underground
3276	Diesel	25,000	Underground
3320	Waste Oil	250	Underground
3390	MOGAS	8,000	Underground
3390	Diesel	8,000	Underground
3800	Fuel Oil	800	Underground
4150	Fuel Oil	6,000	Underground
CESF[a] - 4305	Contaminated JP-4	25,000	Underground
CESF - 4306	Contaminated JP-4	25,000	Underground
CESF - 4307	Contaminated JP-4	25,000	Underground
CESF - 4308	Waste Oil	25,000	Underground
7021	MOGAS	2,000	Underground
7021	JP-4	2,000	Underground
7021	JP-4	2,000	Underground
8150	Fuel Oil	2,000	Underground
10,100	Fuel Oil	500	Underground
10,300	Fuel Oil	8,000	Underground
10,550	Fuel Oil	500	Underground
18,010	Fuel Oil	5,000	Underground
18,015	Fuel Oil	1,500	Underground
18,018	Fuel Oil	6,000	Underground
18,020	Fuel Oil	700	Underground
40,571	JP-4	10,000	Underground
4005	JP-4	840,000	Aboveground/diked
4020	JP-4	420,000	Aboveground/diked

[a]CESF - Civil Engineering Storage Facility

Appendix F--Continued

Facility No.	Type POL	Capacity (gal)	Type of Tank
7010	Fuel Oil	1,000	Aboveground
7010	Fuel Oil	1,000	Aboveground
7015 (North Tank)	Fuel Oil	2,000	Aboveground
7015 (South Tank)	Fuel Oil	2,000	Aboveground
7033	Fuel Oil	3,000	Aboveground
7035 (North Tank)	Fuel Oil	2,000	Aboveground
7035 (South Tank)	Fuel Oil	2,000	Aboveground
7040 (North Tank)	Fuel Oil	2,000	Aboveground
7040 (South Tank	Fuel Oil	1,000	Aboveground
AC&W (A)[a]	Fuel Oil	34,000	Aboveground
AC&W (B)	Fuel Oil	34,000	Aboveground

[b]Currently being converted to water storage tank for fire protection.

Appendix G
ABANDONED POL TANK LOCATION SUMMARY

Appendix G
ABANDONED POL TANK LOCATION SUMMARY

Facility No.	Type POL Previously Stored	Capacity (gal)	Type of Tank
3288	Unknown	25,000	Underground
3289	Unknown	25,000	Underground
3290	Unknown	25,000	Underground
3291	Unknown	25,000	Underground
3390	POL Waste	12,500	Underground
3395	POL Waste	12,500	Underground
3396	POL Waste	12,500	Underground
3397	POL Waste	12,500	Underground
4309	Unknown	25,000	Underground
4310	Unknown	25,000	Underground
4311	Unknown	25,000	Underground
4312	Unknown	25,000	Underground

Appendix H
INVENTORY OF BELT SKIMMER OIL/WATER
SEPARATION FACILITIES

Appendix H
INVENTORY OF BELT SKIMMER OIL/WATER SEPARATION FACILITIES

Location	Description	Date of Installation	Discharge
Facility 7100	South Ditch	1977	South Ditch
Facility 40611	West Ditch	1969	West Ditch
Facility 7035	SAC Corrosion Control Shop	1971	Sanitary Sewer
Facility 4251	Washrack	1969	Sanitary Sewer
Facility 4771	Washrack	1969	Sanitary Sewer
Next to Facility 2950	Motor Pool Washrack	1969	Sanitary Sewer
Facility 7022	SAC AGE and Propulsion Shop	1971	Sanitary Sewer
Facility 3991	Washrack/Abandoned	1969	Drainage Ditch

Appendix I
HAZARDOUS ASSESSMENT RATING METHODOLOGY

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

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

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

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

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

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

PURPOSE

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

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

DESCRIPTION OF MODEL

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

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

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 in 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, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

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

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

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

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

FIGURE 1

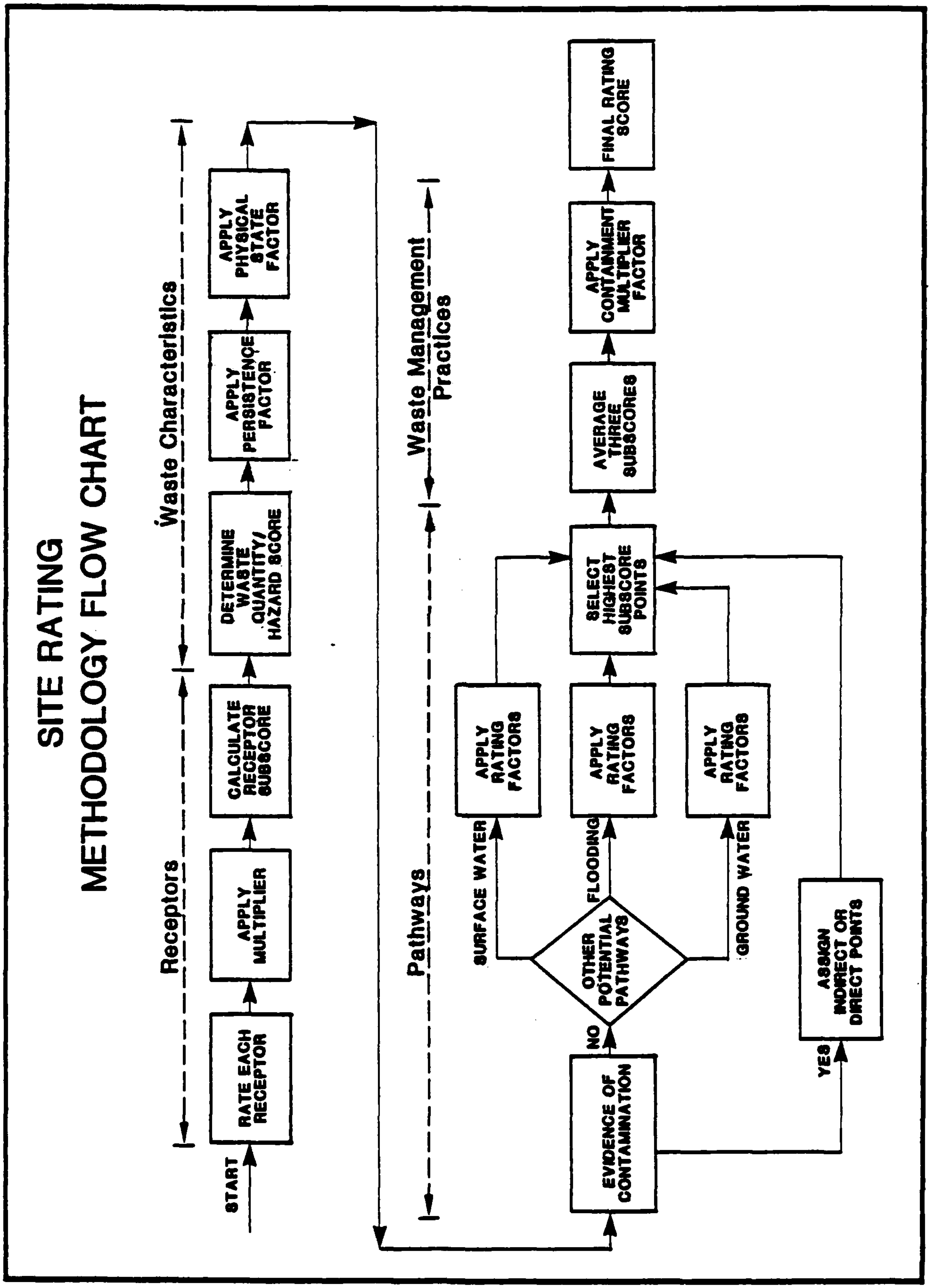

SITE RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
Pathways
Waste Management Practices
EVIDENCE OF CONTAMINATION
NO
YES
OTHER POTENTIAL PATHWAYS
SURFACE WATER
FLOODING
GROUND WATER
APPLY RATING FACTORS
APPLY RATING FACTORS
APPLY RATING FACTORS
ASSIGN INDIRECT OR DIRECT POINTS
SELECT HIGHEST SUBSCORE POINTS
AVERAGE THREE SUBSCORES
APPLY CONTAINMENT MULTIPLIER FACTOR
FINAL RATING SCORE

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

TABLE 1 (Continued)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

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

S = Suspected confidence level

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

A-3 Hazard Rating

Hazard Category	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)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

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

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

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

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

B. Persistence Multiplier for Point Rating

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

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0 50

TABLE 1 (Continued)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

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 Factor	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 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casi[illegible] subs[illegible]e fl[illegible]es, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES (Cont'd)

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:

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

Surface Impoundments:

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

Spills:

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

Fire Proection Training Areas:

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

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

Appendix J
SITE RATING FORMS

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 1, Runway Overrun Landfill

LOCATION Mather AFB Grid 4-L, Quadrant 5 (Approximate Location)

DATE OF OPERATION OR OCCURRENCE Prior to 1942

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Original Base Landfill

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	96	180

Receptors subscore (100 X factor score subtotal/maximum score 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) 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 = 40

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	53
Waste Characteristics	40
Pathways	33

Total 134 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 No. 2, "8150" Area Landfill Site

LOCATION SAC Alert Area, Grid 6-N Quadrants 1, 2, 3, 5, 6, 7

DATE OF OPERATION OR OCCURRENCE 1942-1950

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Main Sanitary Landfill for Entire Base

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
Subtotals			101	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 56

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 = 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 evidence or indirect evidence exists, proceed to B.

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
		Subtotals	36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

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	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	–	8	–	
		Subtotals	24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	56
Waste Characteristics	50
Pathways	33
Total 142 divided by 3 =	46 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

46 x 1.0 = $\boxed{46}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 3, NE Perimeter Landfill No. 1

LOCATION Mather AFB, Grid 3-P and Grid 3-Q, Quadrants 13, 14 & 15

DATE OF OPERATION OR OCCURRENCE 1950-1967

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Main sanitary landfill for entire base

SITE RATED BY N. Hatch and G. McIntyre

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	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	86	180

Receptors subscore (100 X factor score subtotal/maximum score 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) 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 = 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 evidence or indirect evidence exists, proceed to B.

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			28	108

Subscore (100 X factor score subtotal/maximum score subtotal) 26

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

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	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 27

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	70
Pathways	27

Total 145 divided by 3 = 48 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

48 x 1.0 = 48

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 4, NE Perimeter Landfill Site No. 2

LOCATION Mather AFB, Grid 3-R

DATE OF OPERATION OR OCCURRENCE 1967-1971

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Main sanitary landfill for entire base

SITE RATED BY N. Hatch and G. McIntyre

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	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	86	180

Receptors subscore (100 X factor score subtotal/maximum score 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) 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 = 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 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	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
		Subtotals	20	108

Subscore (100 X factor score subtotal/maximum score subtotal) 19

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

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	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
		Subtotals	24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 27

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	80
Pathways	27
Total 155 divided by 3 =	52 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

52 x 1.0 = 52

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 5, NE Perimeter Landfill No. 3

LOCATION Mather AFB, Grid 4-O, Quadrant 3 & 4, Grid 4-R, Quadrant 12 & 16

DATE OF OPERATION OR OCCURRENCE 1971

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Main sanitary landfill for entire base

SITE RATED BY N. Hatch and G. McIntyre

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	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	80	180

Receptors subscore (100 X factor score subtotal/maximum score 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) 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 = 40

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			20	108

Subscore (100 X factor score subtotal/maximum score subtotal) 19

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 27

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	44
Waste Characteristics	40
Pathways	27

Total 111 divided by 3 = 37 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

37 x 1.0 = $\boxed{37}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 6, Firing Range Landfill Sites

LOCATION Mather AFB, Grid 16-R, Quad. 3, 7 & 11; Grid 17-R, Quad. 2, 3, 6, 7 & 10

DATE OF OPERATION OR OCCURRENCE 1972-1974

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Main sanitary landfill for entire base - 2 sites

SITE RATED BY N. Hatch and G. McIntyre

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	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	86	180

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

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

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

Subscore —

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
		Subtotals	36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
		Subtotals	24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	48
Waste Characteristics	60
Pathways	33
Total 141 divided by 3 =	47 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

47 x 1.0 = 47

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 7, "7100" Area Disposal Site

LOCATION Mather AFB, Grid 12-F, Quad. 8, 12, 15, 16; Grid 13-F, Quad. 13 & 14

DATE OF OPERATION OR OCCURRENCE 1953-Present

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Past common disposal site for non-putrescible refuse

SITE RATED BY N. Hatch and G. McIntyre

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	100	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 56

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 evidence or indirect evidence exists, proceed to B.

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			28	108

Subscore (100 X factor score subtotal/maximum score subtotal) 26

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water N A	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

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	56
Waste Characteristics	100
Pathways	80
Total 236 divided by 3 =	79
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

79 x 1.0 = $\boxed{79}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 7, Fire Department Training Range No. 1
LOCATION Mather AFB, Grid 4-M, Quads. 13 & 14 (approximate location)
DATE OF OPERATION OR OCCURRENCE pre 1942 until 1945
OWNER/OPERATOR Mather AFB
COMMENTS/DESCRIPTION Original fire department training area
SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	96	180

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	53
Waste Characteristics	60
Pathways	33

Total 146 divided by 3 = 49 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

49 x 1.0 = 49

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 9, Fire Department Training Area No. 2

LOCATION Mather AFB, Grid 5-I, Quad. 5 (approximate location)

DATE OF OPERATION OR OCCURRENCE 1945-1947

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Fire training done daily

SITE RATED BY N. Hatch and G. McIntyre

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	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
Subtotals			98	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			28	108

Subscore (100 X factor score subtotal/maximum score subtotal) 26

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 27

IV. WASTE MANAGEMENT PRACTICES

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

Receptors 54
Waste Characteristics 60
Pathways 27

Total 141 divided by 3 = 47 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

47 x 1.0 = 47

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 10, Fire Department Training Area No. 3

LOCATION Mather AFB, Grid 6-E, Quad. 1, (approximate location)

DATE OF OPERATION OR OCCURRENCE 1947-1958

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Fire training done daily

SITE RATED BY N. Hatch and G. McIntyre

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	3	3	9	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	91	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51
Waste Characteristics	60
Pathways	33

Total 144 divided by 3 = 48 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

48 x 1.0 = 48

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 11, Existing Fire Department Training Area

LOCATION Mather AFB, Grid 12-F, Quadrant 10

DATE OF OPERATION OR OCCURRENCE 1958 - present

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Daily burns until 1974, quarterly burns since 1974

SITE RATED BY N. Hatch and G. McIntyre

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	100	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 56

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 = 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 evidence or indirect evidence exists, proceed to B.

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	56
Waste Characteristics	64
Pathways	33
Total 153 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 No. 12, AC & W Disposal Site

LOCATION Mather AFB, Grid 8-P, Quadrant 6

DATE OF OPERATION OR OCCURRENCE 1958 - 1966

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Disposal of Tce and transformer oil

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	101	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 56

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 evidence or indirect evidence exists, proceed to B.

Subscore 100

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		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) ______

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding		1		100

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		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to ground water		8		
Subtotals				90

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 100

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	56
Waste Characteristics	100
Pathways	100
Total 256 divided by 3 =	85 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

85 x 1.0 = $\boxed{85}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 13, Drainage Ditch Site No. 1

LOCATION Mather AFB, Grid 4-K, Quadrant 5

DATE OF OPERATION OR OCCURRENCE 1968-1970

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Other spills probable between 1960 and 1968

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	96	180

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

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 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 evidence or indirect evidence exists, proceed to B.

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

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	53
Waste Characteristics	80
Pathways	80

Total 213 divided by 3 = 71 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

71 x 1.0 = $\boxed{71}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 14, Drainage Ditch Site No. 2
LOCATION Mather AFB, Grid 3-K, Quadrant 14
DATE OF OPERATION OR OCCURRENCE late 1960's
OWNER/OPERATOR Mather AFB
COMMENTS/DESCRIPTION Other spills probable prior to this time
SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	104	180

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

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

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

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

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	58
Waste Characteristics	60
Pathways	80
Total 198 divided by 3 =	66 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

66 x 1.0 = 66

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 15, Drainage Ditch Site No. 3

LOCATION Mather AFB, Grid 9-C, Quadrant 13

DATE OF OPERATION OR OCCURRENCE late 1960's

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Other spills probable prior to this time

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
Subtotals			96	180

Receptors subscore (100 X factor score subtotal/maximum score 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) 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 evidence or indirect evidence exists, proceed to B.

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
		Subtotals	36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding NA	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
		Subtotals	24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

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	53
Waste Characteristics	100
Pathways	80

Total 233 divided by 3 = 78 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

78 x 1.0 = 78

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 17, Weapons Storage Area Septic Tank

LOCATION Mather AFB, Grid 14-S, Quadrant 2

DATE OF OPERATION OR OCCURRENCE — —

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION — —

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	107	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 59

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 = 40

III. PATHWAYS

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

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

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			28	108

Subscore (100 X factor score subtotal/maximum score subtotal) 26

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding NA	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water N A	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

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	59
Waste Characteristics	40
Pathways	80

Total 179 divided by 3 = 60 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

60 x 1.0 = 60

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 18, Old Burial Site

LOCATION Mather AFB, Grid 4-E, Quadrant 16

DATE OF OPERATION OR OCCURRENCE late 1940's, 1950's

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Temporary burial of stock items

SITE RATED BY N. Hatch and G. McIntyre

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	3	3	9	9
D. Distance to reservation boundary	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	97	180

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

II. WASTE CHARACTERISTICS

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

1. Waste quantity (S = small, M = medium, L = large) 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 = 40

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
		Subtotals	36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
		Subtotals	24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	40
Pathways	33
Total 127 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 No. 19, Fuel Tank Sludge Burial Site

LOCATION Mather AFB, Grid 5-D, Quadrants 9 & 5

DATE OF OPERATION OR OCCURRENCE ~every 3 years

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Sludge contained lead - 1950's

SITE RATED BY N. Hatch and G. McIntyre

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	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	107	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 0.5 = 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 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	59
Waste Characteristics	30
Pathways	33

Total 122 divided by 3 = 41 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

41 x 1.0 = 41

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 20, Avgas Spill Site

LOCATION Mather AFB, Grid 11-F, Quadrants 13 & 14

DATE OF OPERATION OR OCCURRENCE 1981 & 1982

OWNER/OPERATOR Mather AFB

COMMENTS/DESCRIPTION Leaking Avgas storage tank

SITE RATED BY N. Hatch and G. McIntyre

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	2	3	6	9
D. Distance to reservation boundary	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	90	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 50

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

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

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

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
Subtotals			36	108

Subscore (100 X factor score subtotal/maximum score subtotal) 33

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
Subtotals			24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 33

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	50
Waste Characteristics	48
Pathways	33

Total 131 divided by 3 = 44 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

44 x 1.0 = $\boxed{44}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE No. 23, Sanitary Sewer System east of Eknes Street
LOCATION Mather AFB, Grid 2-I
DATE OF OPERATION OR OCCURRENCE Pre 1940's to present
OWNER/OPERATOR Mather AFB
COMMENTS/DESCRIPTION Area of sewer system affected by root intrusion
SITE RATED BY N. Hatch and G. McIntyre

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	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. Ground water 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 ground-water supply within 3 miles of site	3	6	18	18
Subtotals			102	180

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

II. WASTE CHARACTERISTICS

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

1. Waste quantity (S = small, M = medium, L = large) 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 = 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 evidence or indirect evidence exists, proceed to B.

Subscore --

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	0	8	0	24
		Subtotals	28	108

Subscore (100 X factor score subtotal/maximum score subtotal) 26

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	100

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water NA	-	8	-	-
		Subtotals	24	90

Subscore (100 x factor score subtotal/maximum score subtotal) 27

C. Highest pathway subscore.

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

Pathways Subscore 27

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	57
Waste Characteristics	70
Pathways	27

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

Appendix K
DRILLER'S LOGS FOR WELLS AT MATHER AFB

NOTE: The attached driller's logs were reproduced with permission from Mather AFB.

State No. 8N/6E-11L

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

DISTRICT

Owner MATHER AIR FORCE BASE

Address

Tenant

Address

State No. 08N06E11B01M

Other No. BASE WELL #1

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin No.

U.S.G.S. Quad. CARMICHAEL Quad. No.

NW 1/4 NE 1/4 Section 11, Twp. 8N, Rge. 6E Base & Meridian

Description CHECK AT MAIN GATE. ASK DIRECTIONS TO WATER PUMPING PLANT BUILDING # 3975

Reference Point description AIR LINE & PRESSURE GAGE

which is AT ft. above/below land surface. Ground Elevation 90.1

Reference Point Elev. 90.1 ft. Determined from

Well: Use DOM, MUNI, INDUSTRIAL Condition Depth 532

Casing, size 12" in., perforations 262-411, 423-464, 470-482, 486-491, 511-517

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.

Type of Material Perm. Rating Thickness

Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. Depth to Bot. Gr.

Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.

Driller R. L. NORRIS

Date drilled MAY 1941 Log, filed YES open (1) X confidential (2)

Equipment: Pump, type TURBINE make BJ

Serial No. Size of discharge pipe in.

Power, Kind ELECTRIC Make

H. P. Motor Serial No.

Elec. Meter No. Transformer No.

Yield 1225 G.P.M. Pumping level 70' ft.

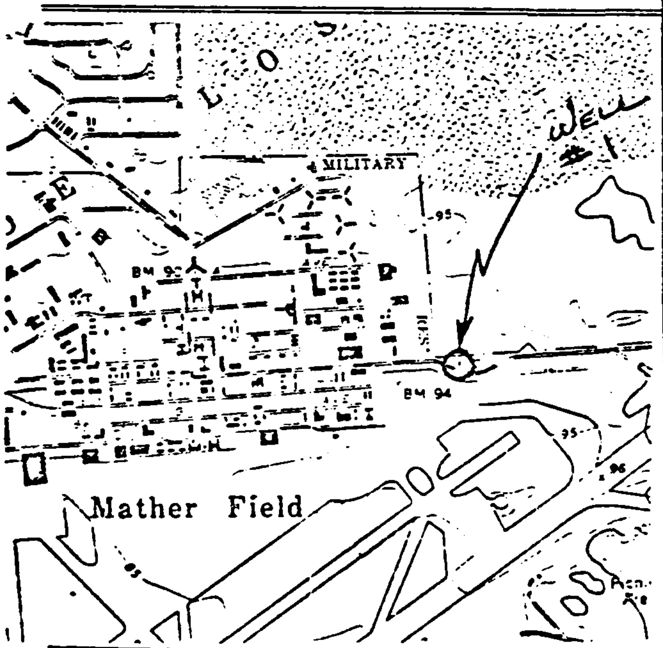
Water Analysis: Min. (1) San. (2) H.M. (3)

Water Levels available: Yes (1) No

Period of Record: Begin End

Collecting Agency:

Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

Recorded by: R. J. PLIMPTON

Date 1-31-58

DWR 429 (Rev. 4 70)

USGS-CAL-T1
May 1948

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

No. [illegible]

Other Nos. 204

WELL LOG

State California County Sacramento Subarea Mills

Owner Mather Field, Well No. 1, 1??

Location 1550 feet north, 2050 feet west of SE corner of section 11 ([illegible]

Drilled by Morris Address

Date May 1941 Casing diam. 12" Land-surf. alt. 90

Source of data Owner

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Gravel and clay		18
	Cobble and clay		[illegible]
	Clay, sandy		7[illegible]
	Gravel, cemented		[illegible]
	Clay, brown		175
	Clay, brown sandy		[illegible]
	Clay, hard brown		252
	Clay		[illegible]
	Sand, water		2[illegible]
	Gravel, cemented water		[illegible]
	Sand water		391
	Sand, brown water		[illegible]
	Clay, brown sandy		425
	Sand, [illegible], water		[illegible]
	Gravel, cemented, water		461
	Sand, [illegible] brown		[illegible]
	Sand, cemented brown water		482
	Clay sand		[illegible]
	Sand, water		491
	Clay sand		[illegible]
	Sand water		517
	Clay, sand		[illegible]
	Perforated 262-411, 423-461, 470-482, 4[illegible]-491, 511-517'		
	[illegible]		
	recommended setting pump 70' below top of well		

Record by Date Sheet of

State No. 8N/6E-11C·

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

DISTRICT

Owner: MATHER AIR FORCE BASE
Address:
Tenant:
Address:

State No. 08N06E11C02M
Other No. BASE WELL #2

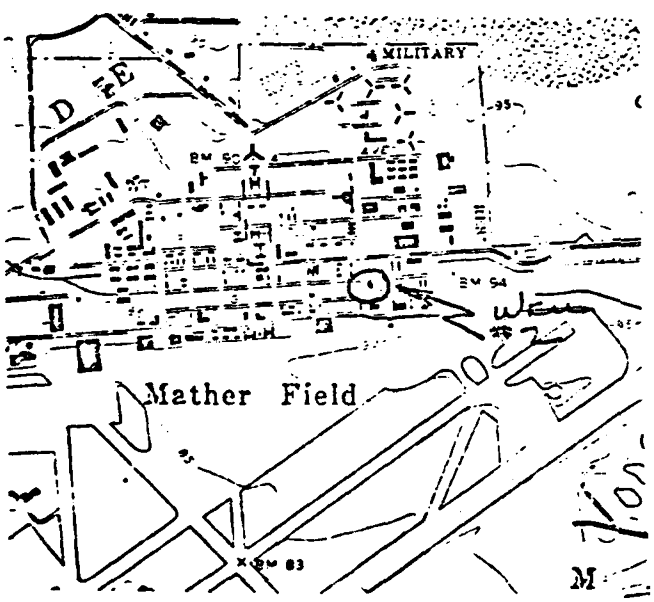
Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐
Location: County SACRAMENTO Basin No.
U.S.G.S. Quad. CARMICHAEL Quad. No.
NE ¼ NW ¼ Section 11, Twp. 8N, Rge. 6E (M) Base & Meridian
Description: IN BUILDING 3795 AT F AVENUE & GILBERT STREET

Reference Point description

which is ft. above/below land surface. Ground Elevation 90.5 ft.
Reference Point Elev. ft. Determined from
Well: Use Condition Depth 534 ft.
Casing, size 12" in., perforations

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐
Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.
Type of Material Perm. Rating Thickness
Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. Depth to Bot. Gr.
Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.
Driller R.L. NORRIS
Date drilled 4/1941 Log, filed YES open (1) X confidential (2)
Equipment: Pump, type make
Serial No. Size of discharge pipe in.
Power, Kind ELECTRIC Make
H. P. Motor Serial No.
Elec. Meter No. Transformer No.
Yield 1400 G.P.M. Pumping level ft.

Water Analysis: Min. (1) San. (2) H.M. (3)
Water Levels available: Yes (1) No
Period of Record: Begin End
Collecting Agency:
Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

1963 NUMBERED FOR BULLETIN 133
11/80 " " FOR U.S.G.S.

Recorded by: HEDELL
Date 11/14/80

USGS-CAL-T1
May 1948

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

No. [illegible]

Other Nos. [illegible]

WELL LOG

State [illegible] County [illegible] Subarea [illegible]

Owner [illegible] Field Well No. 2

Location 4350 feet north, 3000 feet west of SE corner of section 11 [illegible]

Drilled by [illegible] Address

Date April 1941 Casing diam. 12" Land-surf. alt. [illegible].5

Source of data [illegible]

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Cobblestones Clay		35 [illegible]
	Clay, brown Gravel, [illegible]		54 [illegible]
	Clay and gravel Clay and sand, brown		125 [illegible]
	Clay, sticky brown Cobblestones and clay, water		[illegible] [illegible]
	Clay, sticky brown Sand - water		265 [illegible]
	Gravel and sand, hard cemented water Clay, gray and small gravel		335 [illegible]
	Clay, brown Sand, brown, water		350 [illegible]
	Gravel, cemented Sand, water		415 [illegible]
	Lava and sand Clay, sticky, brown		435 [illegible]
	Sand, gray, water Clay and sand		455 [illegible]
	Sand, water Clay		465 [illegible]
	Clay, sticky Clay with gravel and sand		490 [illegible]
	Clay [illegible]		[illegible] [illegible]
	Clay [illegible]		522 [illegible]
	Clay [illegible] sand		[illegible] [illegible]
	Clay, lime Perforated [illegible], 2[illegible]5-311, 311-3[illegible], 347-37[illegible], 37[illegible]-4[illegible], 450-455, 45[illegible]-476'		[illegible]
	1460 [illegible], [illegible] test, drawdown 29' 32' water level.		

3 Record by [illegible] Date Sheet of

State No. 8N/6E-2N1

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

DISTRICT

Owner MATHER AIR FORCE BASE
Address
Tenant
Address

State No. 08N06E02N01M
Other No.
BASE WELL #3

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin No.

U.S.G.S. Quad. CARMICHAEL Quad. No.

SW 1/4 SW 1/4 Section 2, Twp. 8N, Rge. 6E M Base & Meridian

Description
GILBERT STREET & B AVENUE BUILDING # 2745

Reference Point description

which is ft. above/below land surface. Ground Elevation 90.1 ft

Reference Point Elev. ft. Determined from

Well: Use DOMESTIC, MUNI, INDUSTRIAL Condition Depth 501 ft.

Casing, size 12" in., perforations
CASED 501'

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.

Type of Material Perm. Rating Thickness

Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. Depth to Bot. Gr.

Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.

Driller R. L. NORRIS

Date drilled 6.5.1943 Log, filed YES open (1) X confidential (2)

Equipment: Pump, type make

Serial No. Size of discharge pipe in.

Power, Kind ELECTRIC Make

H. P. Motor Serial No.

Elec. Meter No. Transformer No.

Yield G.P.M. Pumping level ft.

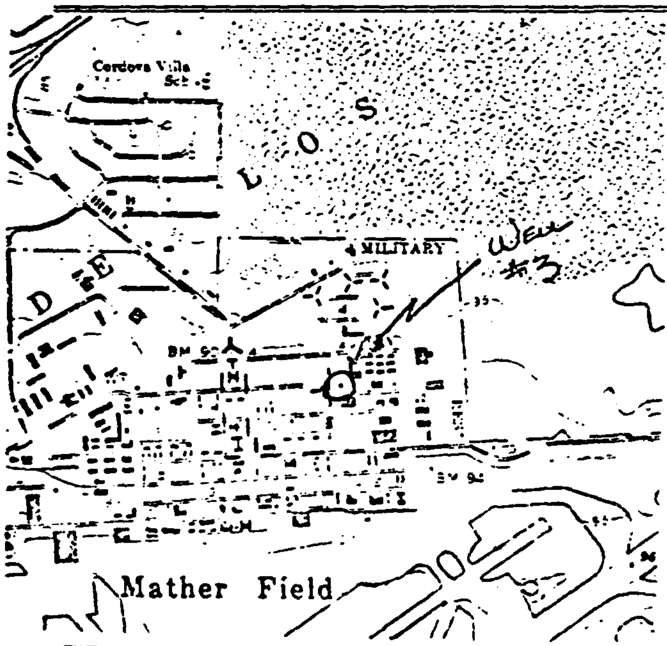
Water Analysis: Min. (1) San. (2) H.M. (3)

Water Levels available: Yes (1) No

Period of Record: Begin End

Collecting Agency:

Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

11/50 NUMBERED FOR U.S.G.S.
1963 NUMBERED IN BULLETIN 133

Recorded by: ARDELL
Date 11/14/50

DWR 429 (Rev. 4 70)

USGS-CAL-T1
May 1948

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

No. [illegible]

Other Nos. [illegible]

WELL LOG

State California County Sacramento Subarea [illegible]ills

Owner [illegible]ather Field, [illegible]ell #3 USGS [illegible]

Location 350 feet north, 3850 feet west of Se corner of section 2 ([illegible]) [illegible]

Drilled by [illegible]orris Address

Date [illegible] 1943 Casing diam. 12" ([illegible]) Land-surf. alt. [illegible]

Source of data Owner

(Enter type of well, perforations, yield, and drawdown at end of log)

Correlation	Material	Thickness (feet)	Depth (feet)
	Clay and hardpan		4
	Cemented gravel and cobbles		[illegible]
	Gravel, cemented		27
	Clay and cobbles		[illegible]
	Clay		53
	Sand		[illegible]
	Clay, sandy		82
	Gravel, cemented		[illegible]
	Sand and gravel		117
	no data		[illegible]
	Clay, tough		238
	Clay, sandy		[illegible]
	Clay		294
	Sand, cemented, water		[illegible]
	Sand water		345
	Gravel, cemented water		[illegible]
	Sand, tight water		402
	Clay and gravel		[illegible]
	Gravel, cemented		415
	Clay, sandy		[illegible]
	Sand, brown water		447
	Clay, sandy		[illegible]
	Clay, sandy brown		[illegible]
	[illegible]		467
	Clay, sandy brown		47[illegible]
	[illegible]		[illegible]
	Clay, sandy grey water		487
	Sand, [illegible]		[illegible]
	Clay, brown		4[illegible]
	[illegible] gravel [illegible]		[illegible]
	Clay brown		501
	[illegible] test [illegible] drawdown		
	Perforated 4[illegible]9-477, 447-422, 402-294'		

Record by [illegible] Date [illegible] Sheet ___ of ___

State No. 8N/6E-2F

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

DISTRICT ______

Owner: MATHER AIR FORCE BASE

Address: ______

Tenant: ______

Address: ______

State No. 08N06E02P01 M

Other No. BASE WELL #4

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin ______ No. ______

U.S.G.S. Quad. CARMICHAEL Quad. No. ______

SE ¼ SW ¼ Section 2, Twp. 8N, Rge. 6E, Base & Meridian

Description: IN BUILDING # 2930

Reference Point description ______

which is ______ ft. above/below land surface. Ground Elevation 95 ft

Reference Point Elev. ______ ft. Determined from ______

Well: Use DOM, MUNI, INDUSTRIAL Condition ______ Depth ______ ft

Casing, size ______ in., perforations ______

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name ______ Depth to Top Aq. ______ Depth to Bot. Aq. ______

Type of Material ______ Perm. Rating ______ Thickness ______

Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. ______ Depth to Bot. Gr. ______

Supp. Aquifer ______ Depth to Top Aq. ______ Depth to Bot. Aq. ______

Driller ______

Date drilled ______ Log, filed ______ open (1) ______ confidential (2) ______

Equipment: Pump, type ______ make ______

Serial No. ______ Size of discharge pipe ______ in.

Power, Kind ELECTRIC Make ______

H. P. ______ Motor Serial No. ______

Elec. Meter No. ______ Transformer No. ______

Yield ______ G.P.M. Pumping level ______ ft.

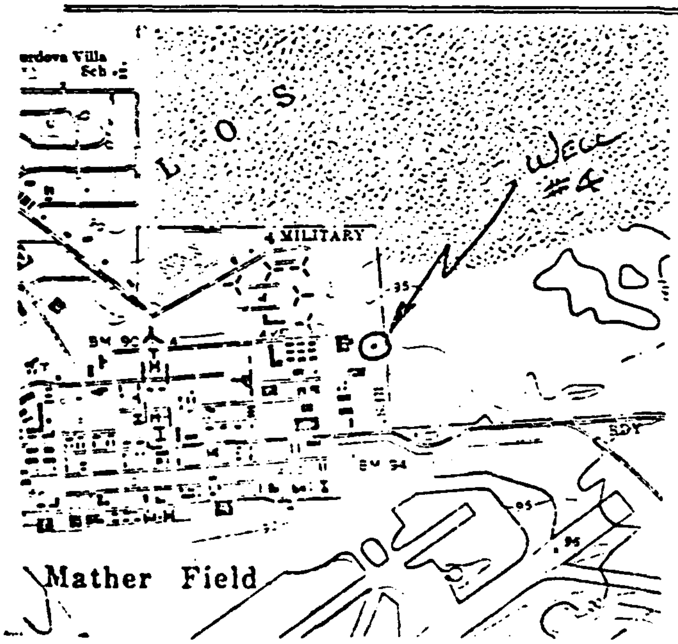
Water Analysis: Min. (1) ______ San. (2) ______ H.M. (3) ______

Water Levels available: Yes (1) ______ No ______

Period of Record: Begin ______ End ______

Collecting Agency: ______

Prod. Rec. (1) ______ Pump Test (2) ______ Yield (3) ______



REMARKS

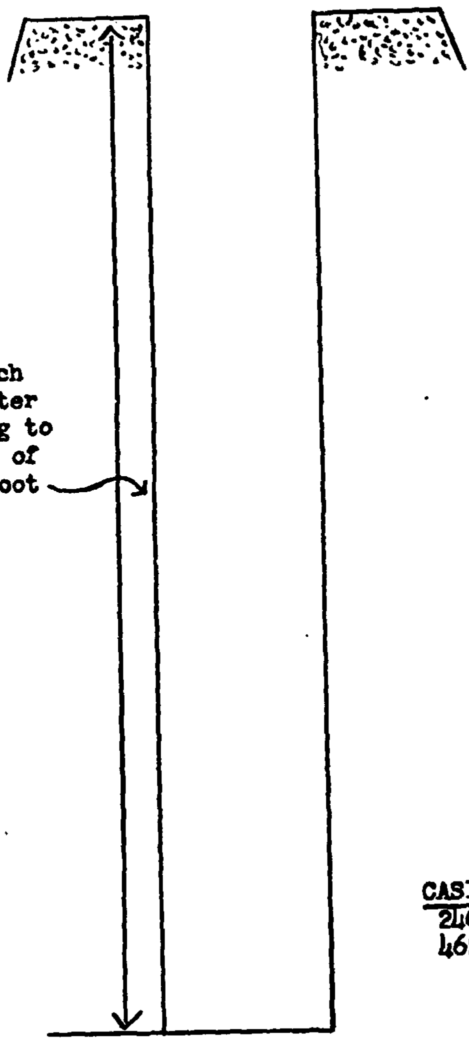
1963 NUMBERED FOR BULLETIN 133

11/80 " " FOR U.S.G.S.

Recorded by: ARDELL

Date 11/14/80

12-inch
Diameter
Casing to
Depth of
500 Foot



FORMATIONS ENCOUNTED DURING DRILLING
OF WELL # 4 , Base Cantonment Area

0 Ft.	to	3 Ft.	- Gravel & Hardpan
3 '	to	20 '	- Cemented Gravel
20 '	to	28 '	- Gravel & Cobbles
28 '	to	34 '	- Clay
34 '	to	48 '	- Sand
48 '	to	86 '	- Sandy Clay
86 '	to	116 '	- Cemented Gravel
116 '	to	208 '	- Gravel & Sand
208 '	to	246 '	- Tight Clay
246 '	to	264 '	- Sandy Clay
264 '	to	297 '	- Clay
297 '	to	345 '	- Cemented Sand
345 '	to	382 '	- Cemented Gravel
382 '	to	410 '	- Tight Sand
410 '	to	422 '	- Sandy Clay
422 '	to	445 '	- Brown Clay
445 '	to	462 '	- Sandy Clay
462 '	to	477 '	- Tough Clay Sandy
477 '	to	490 '	- Sandy Clay Gray
490 '	to	492 '	- Clay Brown
492 '	to	500 '	- Clay & Gravel Hard

CASING PERFORATED:
246 Ft. to 422 Ft.
462 ' to 490 '

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

State No. 8N/6E-14.J

WELL DATA

DISTRICT ____

Owner: MATHER AIR FORCE BASE
State No. 08N06E14J01M
Address:
Other No. HOUSING #1
Tenant:
Address:

Type of Well: Hydrograph [ ] Key [ ] Index [ ] Semiannual [ ]

Location: County SACRAMENTO Basin ____ No. ____

U.S.G.S. Quad. CARMICHAEL Quad. No. ____

NE ¼ SE ¼ Section 14, Twp. 8N, Rge. 6E, M Base & Meridian

Description: WEST OF MATHER BLVD & NORTH OF FOSTER CIRCLE (SOUTH END)

Reference Point description ____

which is ____ ft. above/below land surface. Ground Elevation 112 ft

Reference Point Elev. ____ ft. Determined from ____

Well: Use MUNICIPAL Condition ____ Depth 500 ft.

Casing, size 12" in., perforations 280-290, 322-500

CASED TO 500'

Measurements By: DWR [ ] USGS [ ] USBR [ ] County [ ] Irr. Dist. [ ] Water Dist. [ ] Cons. Dist. [ ]

Chief Aquifer: Name ____ Depth to Top Aq. ____ Depth to Bot. Aq. ____

Type of Material ____ Perm. Rating ____ Thickness ____

Gravel Packed? Yes [ ] No [ ] Depth to Top Gr. ____ Depth to Bot. Gr. ____

Supp. Aquifer ____ Depth to Top Aq. ____ Depth to Bot. Aq. ____

Driller R.L. NORRIS

Date drilled 9.10.1951 Log, filed YES open (1) ____ confidential (2) X

Equipment: Pump, type ____ make ____

Serial No. ____ Size of discharge pipe ____ in.

Power, Kind ELECTRIC Make ____

H. P. ____ Motor Serial No. ____

Elec. Meter No. ____ Transformer No. ____

Yield ____ G.P.M. Pumping level ____ ft.

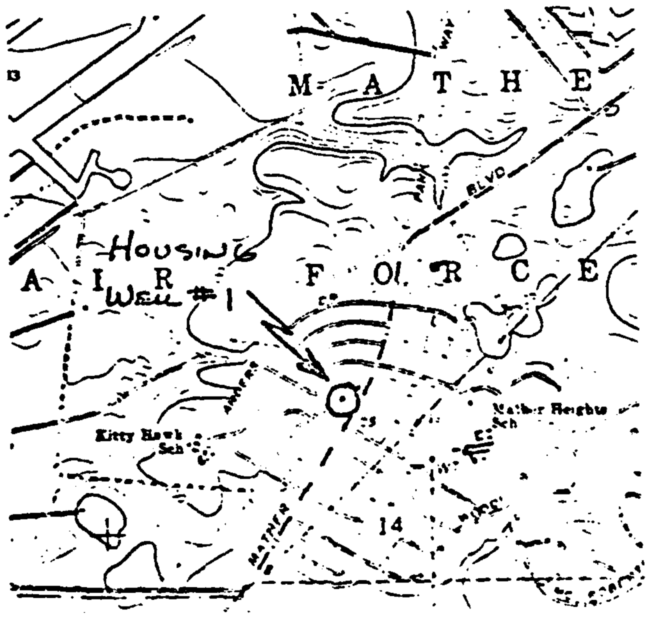
Water Analysis: Min. (1) ____ San. (2) ____ H.M. (3) ____

Water Levels available: Yes (1) ____ No ____

Period of Record: Begin ____ End ____

Collecting Agency: ____

Prod. Rec. (1) ____ Pump Test (2) ____ Yield (3) ____



REMARKS

1963 NUMBERED FOR BULLETIN 133
11/80 " " FOR USGS

Recorded by: ARDELL
Date 11-14-80

DWR 429 (Rev. 4/70)

ORIGINAL
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DIVISION OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

DIVISION OF WATER RESOURCES

8N/6E-17 SHEET 1

MATHER FIELD WELL # 1

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

209

Do Not Fill In
State Well No.
Other Well No.
Region

(1) Driller:
Name R. L. Norris & Son
Address 3200 -P- Street
Sacramento, California
License No. 89774 Classification C-57

(2) Proposed use or uses (check):
Domestic ☒ Municipal ☐
Irrigation ☐ Industrial ☐
Domestic and Irrigation ☐ Test well ☐
Other

(3) Equipment used (check):
Rotary ☐
Cable ☒
Dug well ☐
Other

Owner:
Name Wherry Housing Project
Address Mather Field
Sacramento, California

(4) Type of work (check):
New well ☒ Reconditioning of well ☐
Deepening existing well ☐

(5) Well log:
Total depth of well 500 ft.

Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (loose, packed, cemented, soft, hard, brittle).

Depth From Ground Surface		Formation	
0 ft. to	7 ft.	Red clay	
7 " "	14 "	Yellow clay & rocks	
14 " "	26 "	Rocks	
26 " "	36 "	Yellow clay	
36 " "	57 "	Cemented gravel	
57 " "	98 "	Brown clay	
98 " "	118 "	Brown sandy clay	
118 " "	125 "	Brown clay	
125 " "	130 "	" "	
130 " "	162 "	Brown sandy clay	
162 " "	176 "	Tough Red clay	
176 " "	234 "	Tough yellow clay	
234 " "	268 "	Hard brown clay	
268 " "	284 "	Tough lava clay	
284 " "	294 "	Brown sand	443' to 459' Blue Clay
294 " "	298 "	Lava clay -	459' to 478' Blue sand
298 " "	308 "	Blue clay	478' to 488' Sand & Gravel
308 " "	314 "	Blue sandy clay	488' to 500' Fine sand
314 " "	324 "	Tough blue clay	
324 " "	332 "	Blue sandy clay	
332 " "	378 "	Fine blue sand	
378 " "	391 "	Fine sand & gravel	
391 " "	395 "	Blue clay	
395 " "	423 "	Fine blue sand	
428 " "	443 "	Sand & gravel	

If additional space is required, continue on DWR Form No. 246—Supplement, and attach to respective report copies.

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(6) Casing left in well:

LENGTH FT.	DIAMETER INCHES	SINGLE, DOUBLE, WELDED, OTHER	LBS. PER FOOT OR GAGE OF CASING	SEATING BELOW GROUND SURFACE
125	16	single	3/16" plate steel	125
500	12	Dbl. H. R. S.	12 gage	500

10"x7/8"x16" Steel shoe
8"x3/4"x12" Forged steel shoe
Type and size of shoe or well ring ...... Welded joints—☒ Yes ☐ No

Housing No. 1

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

State No. 8N/6E-14

WELL DATA

DISTRICT

Owner MATHER AIR FORCE BASE

State No. 08N06E14K01 M

Address

Other No. HOUSING #2

Tenant

Address

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin No.

U.S.G.S. Quad. CARMICHAEL Quad. No.

NW ¼ SE ¼ Section 14, Twp. 8N, Rge. 6E Base & Meridian

Description NORTH CORNER OF SCHUMAKER & DEAN TERRACE

Reference Point description

which is ft. above/below land surface. Ground Elevation 184

Reference Point Elev. ft. Determined from

Well: Use MUNICIPAL Condition Depth 500

Casing, size 12" in., perforations 205-209, 370-386, 478-485

CASED TO 500'

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.

Type of Material Perm. Rating Thickness

Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. Depth to Bot. Gr.

Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.

Driller R.L. NORRIS

Date drilled 7-18-1951 Log, filed YES open (1) confidential (2) X

Equipment: Pump, type make

Serial No. Size of discharge pipe in.

Power, Kind Make

H. P. Motor Serial No.

Elec. Meter No. Transformer No.

Yield G.P.M. Pumping level ft.

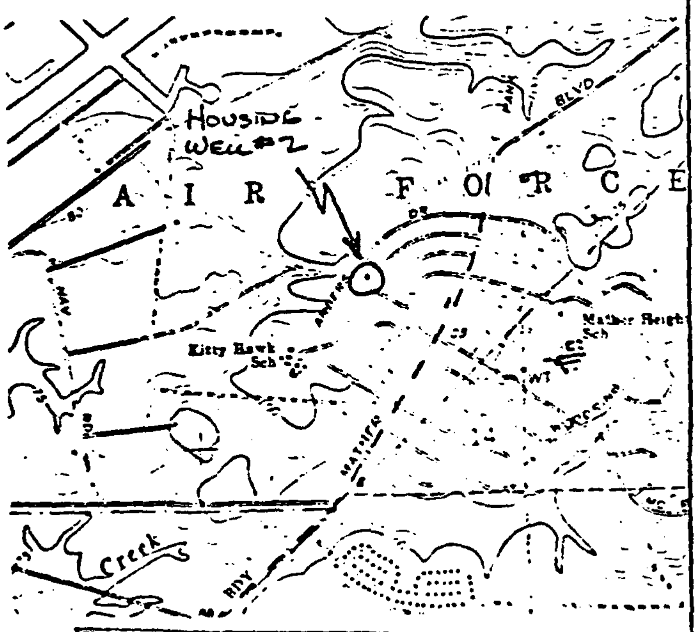
Water Analysis: Min. (1) San. (2) H.M. (3)

Water Levels available: Yes (1) No

Period of Record: Begin End

Collecting Agency:

Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

1963 NUMBERED FOR BULLETIN 133
11/80 " " FOR USGS

Recorded by: ARDEN
Date 11-14-80

DWR 429 (Rev. 3-70)

ORIGINAL
[illegible]
[illegible]
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

MATHER FIELD WELL # 2

Sheet 1
8N/6E-14K1

Do Not Fill In
State Well No. ____
Other Well No. ____
Region ____

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

(1) Driller:
Name R. L. Norris & Son
Address 3200 -P- Street
Sacramento, California
License No. 89774 Classification C-57

Owner:
Name Wherry Housing Project
Address Mather Field
Sacramento, California

(2) Proposed use or uses (check):
Domestic [X] Municipal [ ]
Irrigation [ ] Industrial [ ]
Domestic and Irrigation [ ] Test well [ ]
Other ____

(3) Equipment used (check):
Rotary [ ]
Cable [X]
Dug well [ ]
Other ____

(4) Type of work (check):
New well [X] Reconditioning of well [ ]
Deepening existing well [ ]

(5) Well log:
Total depth of well 500 ft.

Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (loose, packed, cemented, soft, hard, brittle).

Depth From Ground Surface			
0 ft. to 32 ft.	Red Clay & Rock		
32 " " 44 "	yellow & brown clay		
44 " " 63 "	Cemented gravel		
63 " " 89 "	Brown sandy clay		
89 " " 98 "	Sand & Gravel		
98 " " 104 "	Brown clay		
104 " " 139 "	Tight sand & cemented gravel		
139 " " 152 "	Brown clay		
152 " " 178 "	Brown sandy clay		
178 " " 206 "	Tough brown clay		
206 " " 249 "	fine sand mixed in yellow clay		
249 " " 280 "	Brown clay		
280 " " 284 "	Packed sand		
284 " " 296 "	Tough Brown Clay		
296 " " 312 "	Blue clay		
312 " " 318 "	Fine blue sand		
318 " " 344 "	Fine sand & clay		
344 " " 348 "	Cemented gravel		
348 " " 357 "	Blue clay		
357 " " 386 "	Cemented gravel		
386 " " 394 "	Blue clay	476' to 478'	Gravel
394 " " 403 "	Blue sandy clay	478' " 498'	Packed Sand
403 " " 452 "	Fine black sand	498' " 500'	Blue clay
452 " " 473 "	Black sandy clay		
473 " " 476 "	Blue clay		

If additional space is required, continue on DWR Form No. 246—Supplement, and attach to respective report copies.

(6) Casing left in well:

LENGTH FT.	DIAMETER INCHES	SINGLE, DOUBLE, WELDED, OTHER	LBS. PER FOOT OR GAGE OF CASING	SEATING BELOW GROUND SURFACE
143	16	single	3/16" plate steel	143
500	12	Dbl H.P.S.	12 gage.	500

10"x7/8"x16" Steel shoe
8"x3/4"x12" Forged steel shoe.
Type and size of shoe or well ring ____ Welded joints—[X] Yes [ ] No

D W R Form No. 246 REGIONAL WATER POLLUTION CONTROL BOARD COPY

WHERRY HOUSING AREA WATER WELL #3
BLDG. 14992

Well #3 is located 120 feet Northwest of the center of Johnson Avenue and 115 feet Southwest of the center of Branch Drive. The nearest main sewer, located 24 feet Northwest of the well, is 6 inches in diameter and is of vitrified clay. The sewer lies in an impervious stratum. The soil is impervious to a depth of 14 feet. The well is 500 feet deep. The inner casing extends from 18 inchesabove the ground surface to the bottom of the well and seats in sand. The highest perforations are at 280 feet. The outer casing extends 18 inches above the ground surface to a depth of 125 feet and seats in an imperviuos clay stratum. The well is grouted between the outer 16 inch casing and the 12 inch casing to a depth of 125 feet with cement grout.

Results of well pumping test after construction:

Date of Test - 10 September 1951
Depth of Water when Test started - 76 feet
gpm at completion of test - 1020
Drawdown at completion of Test - 88 feet
Length of Time Tested - 40 hrs
Temperature of Water - 67°

Distance to Nearest Well:

Well #1 - 1390 feet
Well #2 - 1990 feet
Well #4 - 2370 feet

Well Data:

Diameter of Well - 16 inches
Depth of Well - 500 feet
Static Water Level - 68 feet
Drawdown - 13 feet
Pump Setting Depth - 170 feet
Well Capasity - 1020 gpm
Pumping Level - 81 feet
Cased Depth - 500 feet
Diameter of Casing - 12 inches

*NOTE: New bowl assembly installed on deep well turbine. Pump setting lowered by 20 feet. May 1960.

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DIVISION OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

SHEET 1

Do Not Fill In
State Well No.
Other Well No.
Region

MATHER FIELD WELL # 3

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

(1) Driller:
Name R. L. Norris & Son
Address 3200 -F- Street
Sacramento, California
License No. 89774 Classification C-57

Owner:
Name Wherry Housing Project
Address Mather Field
Sacramento, California

(2) Proposed use or uses (check):
Domestic ☒ Municipal ☐
Irrigation ☐ Industrial ☐
Domestic and Irrigation ☐ Test well ☐
Other

(3) Equipment used (check):
Rotary ☐
Cable ☒
Dug well ☐
Other

(4) Type of work (check):
New well ☒ Reconditioning of well ☐
Deepening existing well ☐

(5) Well log:
Total depth of well 400 ft.

Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (loose, packed, cemented, soft, hard, brittle).

Depth From Ground Surface (ft.) from	to (ft.)	Formation
0	1	Top soil
1	5	Red clay
5	19	Rocks
19	25	Yellow clay
25	49	Cemented gravel
49	69	Red Clay
69	86	Brown sandy clay
86	92	Brown sand
92	112	Brown clay
112	126	Sand & Gravel
126	138	Lava clay
138	189	Brown clay
189	218	White clay
218	278	Brown clay
278	304	Tough Brown Clay
304	332	~~SS%~~ Brown sandy clay
332	335	~~XXXXXXX~~ Gravel
335	345	Sandy clay
345	356	Cemented gravel
356	368	Blue clay & gravel
368	374	Blue clay
374	390	Sand & Gravel
390	400	Black sand & gravel

If additional space is required, continue on DWR Form No. 246—Supplement, and attach to respective report copies.

(6) Casing left in well:

LENGTH FT.	DIAMETER INCHES	SINGLE, DOUBLE, WELDED, OTHER	LBS. PER FOOT OR GAGE OF CASING	SEATING FEET BELOW GROUND SURFACE
130	16	single	3/16" plate steel	[illegible]
400	~~XXXXXXXXX~~. 12	Dbl. H. R. S.	12 gage	400

10"x7/8"x16" Steel shoe
8"x3/4"x12" Forged steel shoe

Type and size of shoe or well ring ...... Welded joints—X Yes ☐ No

STATE WATER POLLUTION CONTROL BOARD COPY

State No. 8N|6E-14R

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

DISTRICT ________

Owner: MATHER AIR FORCE BASE
Address: ________
Tenant: ________
Address: ________

State No. 08N06E14RC1M
Other No. HOUSING #4

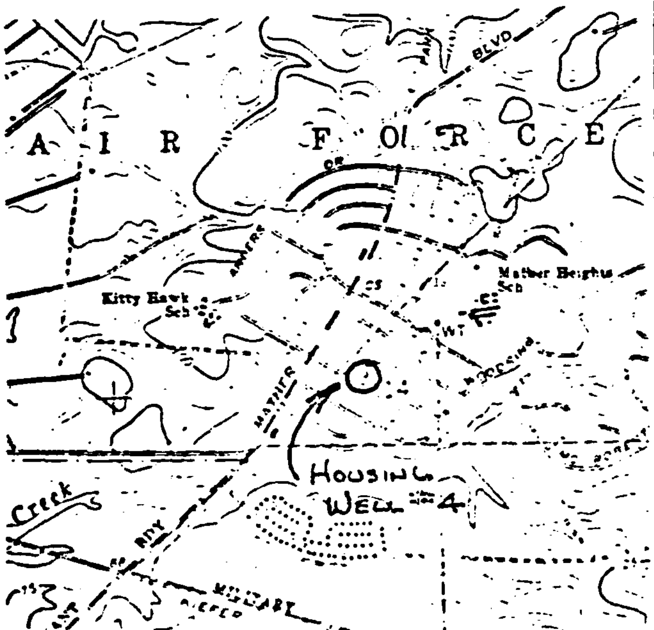
Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐
Location: County SACRAMENTO Basin ________ No. ________
U.S.G.S. Quad. CARMICHAEL Quad. No. ________
SE ¼ SE ¼ Section 14, Twp. 8N, Rge. 6E, S Base & Meridian
Description: NORTH OF COCHRAN DRIVE & WEST OF NURTZ WAY

Reference Point description ________

which is ________ ft. above/below land surface. Ground Elevation ________ ft.
Reference Point Elev. ________ ft. Determined from ________
Well: Use MUNICIPAL Condition ________ Depth 400 ft.
Casing, size 12" in., perforations ________

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐
Chief Aquifer: Name ________ Depth to Top Aq. ________ Depth to Bot. Aq. ________
Type of Material ________ Perm. Rating ________ Thickness ________
Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. ________ Depth to Bot. Gr. ________
Supp. Aquifer ________ Depth to Top Aq. ________ Depth to Bot. Aq. ________
Driller R.L. NORRIS
Date drilled 6.14.1951 Log, filed YES open (1) ________ confidential (2) X
Equipment: Pump, type ________ make ________
Serial No. ________ Size of discharge pipe ________ in.
Power, Kind ELECTRIC Make ________
H. P. ________ Motor Serial No. ________
Elec. Meter No. ________ Transformer No. ________
Yield ________ G.P.M. Pumping level ________ ft.

Water Analysis: Min. (1) ________ San. (2) ________ H.M. (3) ________
Water Levels available: Yes (1) ________ No ________
Period of Record: Begin ________ End ________
Collecting Agency: ________
Prod. Rec. (1) ________ Pump Test (2) ________ Yield (3) ________



REMARKS

1963 NUMBERED FOR BULLETIN 133
11/80 " " FOR USGS

Recorded by: ACDELL
Date 11.14.80

DWR 429 (Rev. 4-70)

ORIGINAL
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DIVISION OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES

Mather Field Well # 4 — 9N/6E-05/P5 no. 4

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

Sheet 1
9N/6E-14P1
Do Not Fill In
State Well No.
Other Well No.
Region

(1) Driller:
Name R. L. [illegible] & Son
Address [illegible] -B- Street
Sacramento, California
License No. 32774 Classification C-57

Owner:
Name [illegible] Housing Project
Address Mather Field
Sacramento, California

(2) Proposed use or uses *(check)*: Domestic ☒ Irrigation ☐ Domestic and Irrigation ☐ Other........ Municipal ☐ Industrial ☐ Test well ☐

(3) Equipment use *(check)*: Rotary ☐ Cable ☒ Dug well ☐ Other........

(4) Type of work *(check)*: New well ☒ Reconditioning of well ☐ Deepening existing well ☐

(5) Well log:
Total depth of well 400 ft.

Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (*loose, packed, cemented, soft, hard, brittle*).

Depth From Ground Surface (ft.)	to (ft.)	Formation
0	1	Top soil
1	7	Clay
7	18	Clay & gravel
18	32	Clay
32	35	Sand
35	46	Clay & gravel
46	52	Cemented gravel
52	102	Clay
102	123	Cemented Gravel
123	137	Clay
137	147	Shale
147	198	Clay
198	220	Lava shale
220	232	Lava Clay
232	282	Yellow clay
282	290	Tough gray clay
290	307	Blue clay
307	317	Sand & clay
317	337	Blue sand & gravel
337	345	Blue tight sand
345	359	Tight blue sand & gravel
359	400	Blue sand

If additional space is required, continue on DWR Form No. 246—Supplement, and attach to respective report copies.

(6) Casing left in well:

Length ft.	Diameter inches	Single, double, welded, other	Lbs. per foot or gage of casing	Seating below ground surface
125	16	single	8 ga.	125
400	12	Dbl. [illegible]	12 ".	400

10" x 7/8" x 16" Steel shoe
8" x 3/4" x 12" Forged steel shoe

Type and size of shoe or well ring ...... Welded joints— ☒ Yes ☐ No

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

State No. 8N/6E-13P

WELL DATA

DISTRICT

Owner: MATHER AIR FORCE BASE
Address:
Tenant:
Address:

State No. 08N06E13P01M
Other No. HOUSING #5

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin No.

U.S.G.S. Quad. CARMICHAEL Quad. No.

SE ¼ SW ¼ Section 13, Twp. 8N, Rge. 6E, M Base & Meridian

Description: EAST OF McROBERTS WAY & OPPOSITE McCALL DRIVE (SOUTH END) BUILDING 1775

Reference Point description

which is ____ ft. above/below land surface. Ground Elevation 123

Reference Point Elev. ____ ft. Determined from

Well: Use MUNICIPAL Condition Depth 549

Casing, size 12" in., perforations

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.

Type of Material Perm. Rating Thickness

Gravel Packed? Yes ☒ No ☐ Depth to Top Gr. 28 Depth to Bot. Gr. 549

Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.

Driller: EATON DRILLING CO

Date drilled 5.24.1962 Log, filed YES #68715 open (1) confidential (2) X

Equipment: Pump, type make

Serial No. Size of discharge pipe in.

Power, Kind Make

H. P. Motor Serial No.

Elec. Meter No. Transformer No.

Yield G.P.M. Pumping level ft.

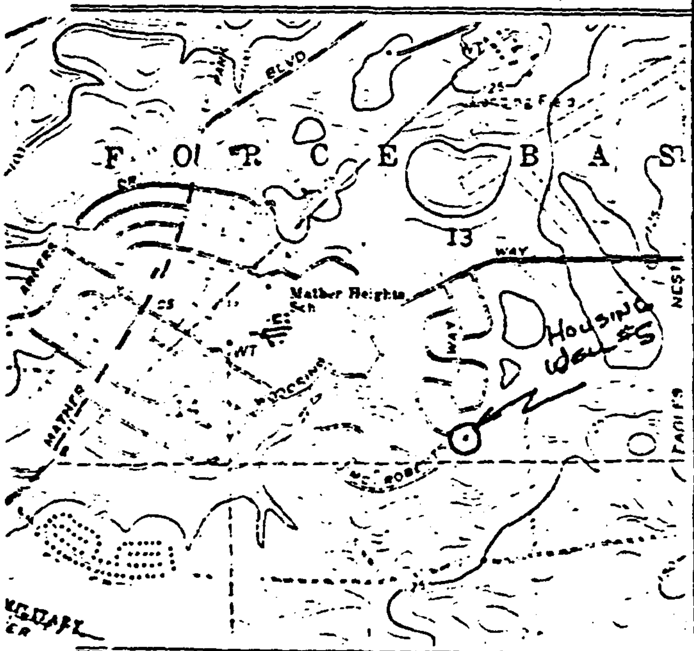
Water Analysis: Min. (1) San. (2) H.M. (3)

Water Levels available: Yes (1) No

Period of Record: Begin End

Collecting Agency:

Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

1963 NUMBERED FOR BULLETIN 133
11/80 " " FOR USGS

Recorded by: ARDELL
Date 11/14/80

DWR 429 (Rev. 4-70)

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No.______
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

No. 65715
State Well No. [illegible]
Other Well No. 13F

OWNER:

Name Mather Air Force Base
Address Sacramento, California

(2) LOCATION OF WELL

County Sacto Owner's number, if any— 2118
R. F. D. or Street No. Mather Air Force Base
Capehart #3
([illegible] Housing Well #5)

(3) TYPE OF WORK (check):

New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☒

(5) EQUIPMENT:

Rotary ☒
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:

SINGLE ☐ DOUBLE ☒

From 0 ft. to 549 ft. 12 Diam. 410 Gage or Wall

If gravel packed: Diameter of bore 28 from ft. 549 to ft.

Type and size of shoe or well ring
Size of gravel: 3/4
Describe joint welded

(7) PERFORATIONS:

Type of perforator used mill
Size of perforations 3/16 in., length, by 1 1/2 in.
From 450 ft. to 547 ft. Perf. per row Rows per ft.

(8) CONSTRUCTION:

Was a surface sanitary seal provided? ☐ Yes ☐ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata
From ft. to ft.
Method of Sealing

(9) WATER LEVELS:

Depth at which water was first found ft.
Standing level before perforating ft.
Standing level after perforating ft.

(10) WELL TESTS:

Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: gal./min. with ft. draw down after hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No
Was electric log made of well? ☐ Yes ☐ No

(11) WELL LOG:

Total depth 549 ft. Depth of completed well 549 ft.

Formation: *Describe by color, character, size of material, and structure.*

From (ft.)	To (ft.)	Formation
0	8	dry red clay
8	24	gravel cobble stones
24	77	clay
77	88	sand
88	93	clay hard
93	166	hard sandy clay
166	178	sand
178	183	clay soft
183	205	sandy clay
205	227	clay hard
227	235	hard clay blue
235	250	clay blue
250	261	clay soft
261	294	clay blue
294	356	blue shale rough
356	448	blue clay
448	461	blue clay
461	483	fine gravel rough
483	515	clay blue
515	547	fine gravel coarse sand
547	549	clay

Work started 3-23-62 19 . Completed 5-24-62 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Eaton Drilling Co.
(Person, firm, or corporation) (Typed or printed)
Address P. O. Box 975
Woodland, California
[Signed] [illegible]
Well Driller
License No. 133783057 Dated 6-11-62, 19

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

State No. [illegible]

WELL DATA

DISTRICT

Owner MATHER AFB (WHERRY HOUSING)
Address
Tenant
Address

State No. 08N06E13M01M
Other No. HOUSING #6

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin No.

U.S.G.S. Quad. CARMICHAEL Quad. No.

¼ ¼ Section , Twp. , Rge. MD SB H Base & Meridian

Description 275' E/O INTERSECTION OF HAYDEN WAY & CORCORAN DRIVE

Reference Point description

which is ft. above below land surface. Ground Elevation 110 ft.

Reference Point Elev. ft. Determined from

Well: Use MUNICIPAL & DOM. Condition Depth ~~499~~ 500 ft.

Casing, size 16" in., perforations 246-270, 318-366, 390-450-499

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.

Type of Material Perm. Rating Thickness

Gravel Packed? Yes ☒ No ☐ Depth to Top Gr. 30 Depth to Bot. Gr. 500

Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.

Driller BEN BARROW

Date drilled 2/8/77 Log, filed #126584 open (1) confidential (2) X

Equipment: Pump, type make

Serial No. Size of discharge pipe in.

Power, Kind Make

H. P. Motor Serial No.

Elec. Meter No. Transformer No.

Yield G.P.M. Pumping level ft.

Water Analysis: Min. (1) San. (2) H.M. (3)

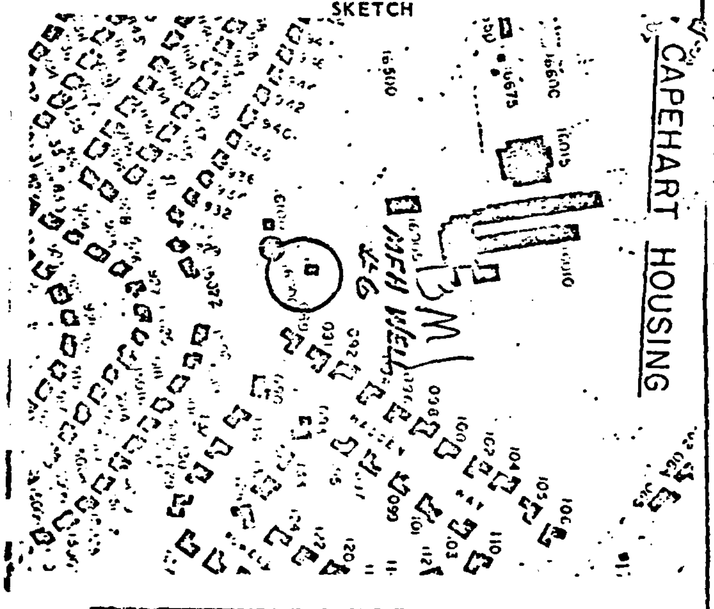
Water Levels available: Yes (1) No

Period of Record: Begin End

Collecting Agency:

Prod. Rec. (1) Pump Test (2) Yield (3)

SKETCH



REMARKS

11/80 NUMBERED FOR USGS

Recorded by: ACOCU
Date 11/1980

DWR 429 (Rev. 4 ..)

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

Nº 126584

State Well No.

Other Well No. 8N/6E-14

(1) OWNER:

Name: Mather AFB

Address: Sacramento, CA

(2) LOCATION OF WELL:

County: Sacramento Owner's number, if any

Township, Range and Section: Family Housing MatherAFB

Distance from cities, roads, railroads, etc.: 275' E. of intersection Cochran Dr. & Hayden Way

(3) TYPE OF WORK (check):

New Well X Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic X Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary X Cable ☐ Other ☐

(6) CASING INSTALLED:

STEEL: SINGLE X DOUBLE ☐ OTHER:

From ft.	To ft.	Diam.	Gage or Wall	If gravel packed: Diameter of Bore	From ft.	To ft.
+2	499	16"	1/4	30	0	500

Size of shoe or well ring: Size of gravel:

Describe joint: welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen: Louver

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
246	270			1/8x2 full flow
318	366			1/8x2 " "
390	450			1/8x2 " "
450	499			1/8x2 " "

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes X No ☐ To what depth 100 ft.

Were any strata sealed against pollution? Yes X No ☐ If yes, note depth of strata

From 0 ft. to 100 ft.

From ft. to ft.

Method of sealing: Cement grout-pumped

(9) WATER LEVELS:

Depth at which water was first found, if known ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing ft.

(10) WELL TESTS:

Was pump test made? Yes X No ☐ If yes, by whom? Ben Barrow Co., Inc.

Yield: 3400 gal./min. with 187 ft. draw down after 2 hrs.

Temperature of water Was a chemical analysis made? Yes X No ☐

Was electric log made of well? Yes ☐ No X If yes, attach copy

(11) WELL LOG:

Total depth 500 ft. Depth of completed well 499 ft.

Formation: Describe by color, character, size of material, and structure

Formation	ft.	to ft.
Adobe clay & topsoil	0	1
Cobble stone, 2"-5" in adobe	1	22
Same with water	22	25
Large cobbles, 4"-8" in adobe	25	28
Red clay streaksw/sand	28	45
Sand & gravel	45	60
Clay	60	65
Coarse sand	65	75
Fine sand	75	88
Hard packed sand w/some clay	88	95
Gravel & rock/large cobblestones	95	111
Gravel w/ cemented sand	111	113
Brown sandy clay	113	119
Coarse sand w/layers of clay	119	128
Brown sandy clay	128	137
Gravel w/coarse sand	137	142
Clay & gravel mixed	142	151
Brown sandy clay	151	164
Coarse sand	164	181
Gray clay & sand w/layers of cemented sand	181	189
Brown sandy clay w/hard brn clay	189	236
Brown clay w/s gravel mixed	236	238
Brown clay	238	246
Brown clay w/cemented sand	246	260
Coarse sand w/gravel	260	264
Coarse sand/cemented sand	264	270
Brown clay w/s cemented, hard sand	270	303
Blue clay w/ cemented sand	303	335
1/2" gravel & large rocks	335	357
Sandy blue clay w/layers of shale	357	392
Hard volcanic rock	392	393
Hard blue clay	393	403
Blue sandy clayw/layers of volcanic rock	403	421

Work started 2-3 19 77 Completed 2-8 19 77

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Ben Barrow Co., Inc.
(Person, firm, or corporation) (Typed or printed)

Address 220 N. East St.
Woodland, CA 95695

Signed [signature]
(Well Driller)

License No. Dated 3/30 1977

SKETCH LOCATION OF WELL ON REVERSE SIDE

CONFIDENTIAL LOG
Water Code Sec. 13752

DWR 188 (REV. 9-68)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

State No. ______

WELL DATA

DISTRICT ______

Owner MATHER A.F.B.
Address ______
Tenant ______
Address ______

State No. 8N/6E-13B1
Other No. AC & W WELL

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐

Location: County SACRAMENTO Basin ______ No. A0500

U.S.G.S. Quad. CARMICHAEL Quad. No. 229d

NW ¼ NE ¼ Section 13, Twp. 8N, Rge. 6E, MD Base & Meridian

Description ______

Reference Point description ______

which is ______ ft. above/below land surface. Ground Elevation 133 ft.

Reference Point Elev. ______ ft. Determined from ______

Well: Use FIRE PROTECTION ONLY Condition ______ Depth 250 ft.

Casing, size 10 in., perforations 198-227, 234-244

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐

Chief Aquifer: Name ______ Depth to Top Aq. ______ Depth to Bot. Aq. ______

Type of Material ______ Perm. Rating ______ Thickness ______

Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. ______ Depth to Bot. Gr. ______

Supp. Aquifer ______ Depth to Top Aq. ______ Depth to Bot. Aq. ______

Driller WESTERN WELL DRILLING

Date drilled 10/6/50 Log, filed TES-DWR-#442 open (1) ______ confidential (2) X

Equipment: Pump, type ______ make ______

Serial No. ______ Size of discharge pipe ______ in.

Power, Kind ______ Make ______

H. P. ______ Motor Serial No. ______

Elec. Meter No. ______ Transformer No. ______

Yield 450 G.P.M. Pumping level DD. 26' ft.

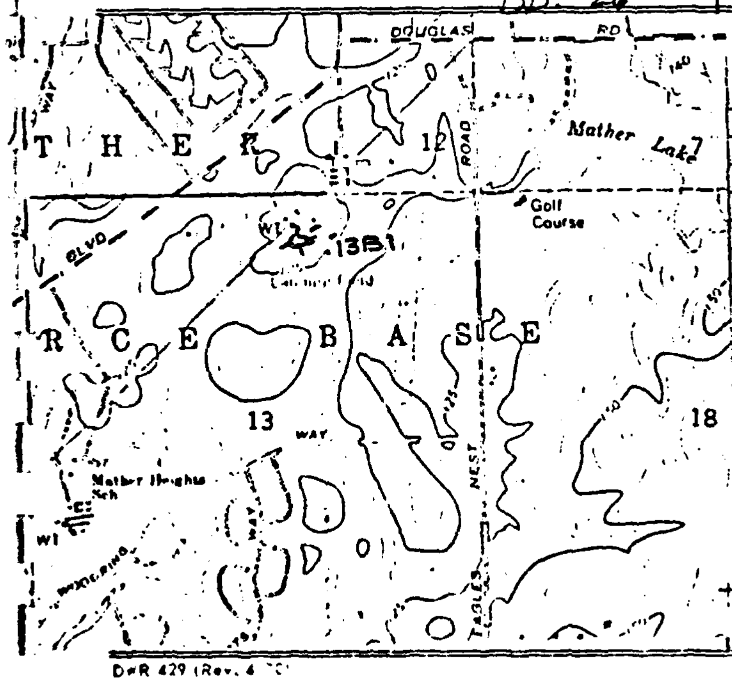
Water Analysis: Min. (1) ______ San. (2) ______ H.M. (3) ______

Water Levels available: Yes (1) ______ No ______

Period of Record: Begin ______ End ______

Collecting Agency: ______

Prod. Rec. (1) ______ Pump Test (2) ______ Yield (3) ______



REMARKS

Recorded by: G. USKAO
Date 2.2.81

DWR 429 (Rev. 4 '70)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

State No. 8N/6E-15N:

WELL DATA

DISTRICT

Owner MATHER AIR FORCE BASE
Address
Tenant
Address

State No. 08N06E15N01M
Other No. JET TEST WELL

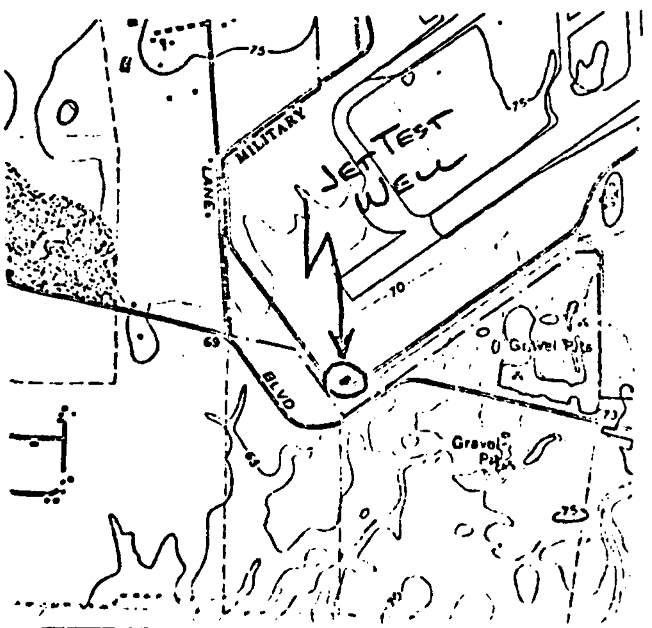
Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐
Location: County SACRAMENTO Basin No.
U.S.G.S. Quad. CARMICHAEL Quad. No.
SW ¼ SW ¼ Section 15, Twp. 8N, Rge. 6E, M Base & Meridian
Description ENGINE TEST AREA AT SW END OF RUNWAY, WELL AT NE CORNER OF BUILDING SOUTH OF WATER TANK # 7098

Reference Point description TOP OF CASING

which is 69.8 ft. above/below land surface. Ground Elevation ft.
Reference Point Elev. 69.87 ft. Determined from DWR LEVELS 75 ?
Well: Use INDUSTRIAL Condition Depth 200 ft.
Casing, size 12" & 6 5/8" in., perforations

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐
Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.
Type of Material Perm. Rating Thickness
Gravel Packed? Yes ☒ No ☐ Depth to Top Gr. Depth to Bot. Gr.
Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.
Driller WAYNE DRILLING 11/5/61 EE LUNDORFF Co 12/10/76 (DEEPENED)
Date drilled 1961 & 1976 Log, filed YES # 52349 & # 123428 open (1) confidential (2) X
Equipment: Pump, type SUBMERSIBLE make
Serial No. Size of discharge pipe in.
Power, Kind ELECTRIC Make
H. P. Motor Serial No.
Elec. Meter No. Transformer No.
Yield G.P.M. Pumping level ft.

Water Analysis: Min. (1) San. (2) H.M. (3)
Water Levels available: Yes (1) No
Period of Record: Begin End
Collecting Agency:
Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

1963 NUMBERED FOR BULLETIN 133
11/80 " " FOR USGS

Recorded by: ARDELL
Date 11/14/80

FE 8N/6E-~~16P~~15N1

QUADRUPLICATE
RETAIN THIS COPY

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

Do Not Fill In
No. 52349
State Well No.
Other Well No.

(1) OWNER:
Name MATHER AIR FORCE BASE
Address Sacramento, California

(2) LOCATION OF WELL:
County Sacto. Owner's number, if any—
R. F. D. or Street No.
Test Stand Jet

(3) TYPE OF WORK (check):
New well ☐ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable ☒
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☒ DOUBLE ☐

From ft.	to ft.	Diam.	Gage or Wall
0	93	12"	10 ga

If gravel packed

Diameter of bore	from ft.	to ft.

Type and size of shoe or well ring 5/[illegible] x 1
Size of gravel:
Describe joint [illegible]

(7) PERFORATIONS:
Type of perforator used 1/2" Milling Saw
Size of perforations 3 in., length, by 1/8 in.

From ft.	to ft.	Perf. per row	Rows per ft.
39	79		

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☐ No To what depth 15 ft.
Were any strata sealed against pollution? ☐ Yes ☐ No If yes, note depth of strata
From ft. to ft.
Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found 51 ft ft.
Standing level before perforating ft.
Standing level after perforating ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☐ No If yes, by whom? Wayne Drilling
Yield: gal./min. with ft. draw down after hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:
Total depth 93 ft. Depth of completed well ft.
Formation: *Describe by color, character, size of material, and structure.*

From ft.	to ft.	Formation
0	3	Fill
3	7	Brown Sandy Clay
7	25	Gravel up to 10" dia
25	27	Reddish Brown Clay
27	39	Light brn Clay
39	53	Brown Sandy clay
53	61	Brown clay
61	63	Fine sand W.B.
63	73	Brown clay
73	80	Sand W.B.
80	93	Clay

Work started Oct. 16, 1961 Completed Nov 6 1961

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME WAYNE DRILLING CO
(Person, firm, or corporation) (Typed or printed)
Address 7316 Power Inn Rd.
Sacramento, California
[SIGNED] Well Driller
License No. 127538 Dated Dec. 3, 1961

DWR 188 (REV. 5-58)

ꞮGINAL
ɘ with DWR

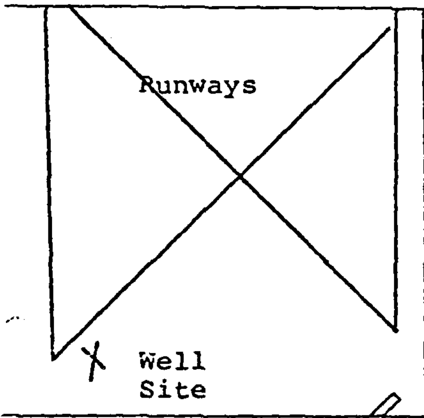
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fi
No. 123428
State Well No. 8N/6E-15N
Other Well No. 8N/6E-15

Intent No. ______
mit No. or Date ______

(1) OWNER: Name Mather A.F.B.
Address Procurement Division
Mather A.F.B. Zip 95655

(2) LOCATION OF WELL (See instructions):
County Sacramento Owner's Well Number W 1253
Well address if different from above ______
Township 8 N Range 6E Section SW¼ 15
Distance from cities, roads, railroads, fences, etc. SW corner of Air Base next to jet engine test block



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☐ Deepening ☒
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other Military ☒

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size Pea
Diameter of bore 10-5/8
Packed from ______ ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
		6-5/8	

(8) PERFORATIONS: Mill slot
Type of perforation or size of screen

From ft.	To ft.	Slot size
		1/8

(9) WELL SEAL: Provided in previous well
Was surface sanitary seal provided? Yes ☐ No ☒ If yes, to depth ______ ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ______ ft.
Method of sealing ______

(10) WATER LEVELS:
Depth of first water, if known ______ ft.
Standing level after well completion ______ ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? EELCO
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 83 ft. At end of test ______ ft
Discharge 40 gal/min after ______ hours Water temperature ______
Chemical analysis made? Yes ☐ No ☒☒ If yes, by whom? ______
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 201 ft. Depth of completed well 20_ ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
80	97	Sandy brittle brown clay
97	106	Sandy brittle blue clay
106	118	Sandy brittle brownclay
118	121	Soft sticky gray clay
121	144	Sandy brittle brown clay
144	153	Small gravel
153	157	Sand and big gravel
157	176	Large gravel and large sand
176	185	Sandy brown clay
185	201	Sticky brown clay

Work started 12-2- 1976 Completed 12-10 1976

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
SIGNED ______ (Well Driller)
NAME E.E. Luhdorff Co/Division of Layne Western
(Person, firm, or corporation) (Typed or printed)
Address P.O. Box 1326
City Woodland Zip 95695
License No. 334205 Date of this report 12-12-7_

SAC MUNITIONS STORAGE AREA WATER SUPPLY SYSTEM
BLDG. 18005

Water is supplied to the munition storage area from a deep well located approximately 30 feet North of Ordnance Way in building 18005 and approximately 100 feet East of building 18002. The well is 250 feet deep. The 12 inch diameter casing extends from 6 inches above ground level to a depth of 250 feet and seats in a stratum of impervious tight blue clay.

The well was drilled under contract and completed in December of 1957. The well is equiped with a Johnston Deep Well, Multi-stage Turbine Pump that is water lubricated.

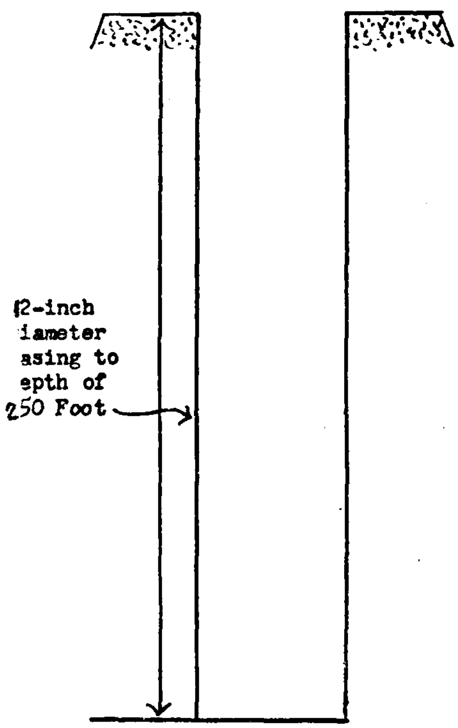
Water is pumped directly from the well to the pressure tank then flows into the distribution system. The treatment of the water is accomplished at the well discharge head and consists of chlorination only. Pump is automatically controlled and pressure is maintained at 45 psi on the system.

Well Data:

Diameter of Well - 12 inches
Well Capasity - 50 gpm
Pump Capasity - 50 gpm
Static Water Levle -
Pumping Water Level -
Drawdown -

8"x3/4"x12" Forged steel shoe.
Type and size of shoe or well ring ...... Welded joints—X Yes ☐ No

D W R FORM NO 246 REGIONAL WATER POLLUTION CONTROL BOARD COPY



FORMATIONS ENCOUNTERED DURING DRILLING OF WELL # 1 , SAC Munitions Storage Area SAC ORD.

0 Ft.	to	2 FT.	-	Top Soil
2 '	to	12 '	-	Cobble Stones
12 '	to	46 '	-	Brown Clay
46 '	to	70 '	-	Dark Brown Clay
70 '	to	85 '	-	Gravel
85 '	to	132 '	-	Brown Clay
132 '	to	143 '	-	Gray Clay
143 '	to	148 '	-	Course Sand
148 '	to	163 '	-	Brown Clay
163 '	to	178 '	-	Tight Sand
178 '	to	204 '	-	Tight Gray Clay
204 '	to	248 '	-	Cemented Gravel
248 '	to	250 '	-	Tight Blue Clay

AD-A123 927 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR MATHER AIR FORCE BASE CALIFORNIA(U) CH2M HILL GAINESVILLE FL JUN 82 F08637-80-G-0010

4/4

UNCLASSIFIED F/G 13/2 NL

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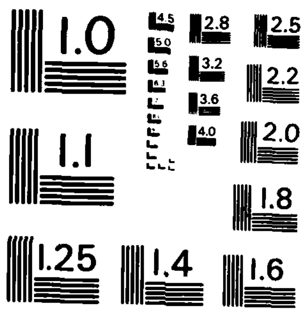

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

[illegible] # 1 and [illegible], [illegible]

[illegible] is supplied to the Mather Air Force Base, [illegible] ([illegible]) [illegible] with [illegible] the Golf Course Area. The wells are [illegible] [illegible]. The casing is 1[illegible]-inch diameter [illegible] and [illegible] in an 18-inch high concrete block [illegible] ground [illegible]. The [illegible] head, motor, and lines are above ground.

[illegible] from [illegible] # 1 is pumped directly from well [illegible] 5,00[illegible] [illegible] pressure [illegible] then flows into distribution system [illegible] ([illegible]) [illegible] # [illegible] pumps directly into [illegible] back [illegible] ([illegible]) course sprinklers. The two systems are connected, [illegible] to main [illegible] flow is restricted between systems.

[illegible] distribution system is asbestos cement pipe ([illegible]) with [illegible] from 1[illegible] [illegible] are automatically controlled and maintain [illegible] of [illegible]0 psi.

No treatment is given water used in sprinkler system.

POOR QUALITY PRINT

[illegible] Elev. 19[illegible] [illegible]

FORMATIONS [illegible] OF [illegible] # 1 - [illegible] COUR[illegible]

0 Ft.	to	4 Ft.	-	[illegible]
4 '	to	1[illegible] '	-	[illegible]
16 '	to	[illegible] '	-	[illegible]
50 '	to	70 '	-	[illegible]
70 '	to	[illegible] '	-	[illegible]
89'	to	1[illegible] '	-	[illegible]
1[illegible]2 '	to	1[illegible] '	-	[illegible]
13[illegible] '	to	1[illegible] '	-	[illegible]
179'	to	2[illegible] '	-	[illegible]
202 '	to	2[illegible] '	-	[illegible]
205 '	to	2[illegible] '	-	[illegible]
2[illegible]9 '	to	2[illegible] '	-	[illegible]
2[illegible] '	to	[illegible] '	-	[illegible]
2[illegible]4 '	to	2[illegible] '	-	[illegible]
[illegible]0 '	to	2[illegible] '	-	[illegible]
2[illegible]3 '	to	2[illegible] '	-	[illegible]
2[illegible]7 '	to	3[illegible] '	-	[illegible]
312 '	to	3[illegible] '	-	[illegible]
3[illegible]6 '	to	3[illegible] '	-	[illegible]
[illegible]8 '	to	3[illegible] '	-	[illegible]
3[illegible]2 '	to	3[illegible] '	-	[illegible]

POOR QUALITY PRINT

DATE
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-83