AD-A152 470

INSTALLATION RESTORATION PROGRAM

PHASE I - RECORDS SEARCH

LACKLAND AFB TEXAS

PREPARED FOR

UNITED STATES AIR FORCE
AFESC/DEV

Tyndall AFB, Florida

and

HQ ATC/DEEV

Randolph AFB, Texas

FEBRUARY 1985

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PII Redacted

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FINAL A152 470

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION: Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION: Engineering-Science; 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION: HQ AFESC/DEVP
6c. ADDRESS (City, State and ZIP Code): 57 Executive Park South, Suite 590, Atlanta, GA 30329	7b. ADDRESS (City, State and ZIP Code): Tyndall AFB, FL 32403
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: HQ ATC DEEV; 8b. OFFICE SYMBOL (If applicable): DEEV	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: F08637 83 G0005 5002
8c. ADDRESS (City, State and ZIP Code): Randolph AFB, TX 78150-5300	10. SOURCE OF FUNDING NOS. — PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT NO.
11. TITLE (Include Security Classification) Phase I-Records Search Installation Restoration Program Lackland AFB TX	
12. PERSONAL AUTHOR(S): Thoem, R.L, Absalon, J.R.; Butner, J.R.	
13a. TYPE OF REPORT: Final; 13b. TIME COVERED: FROM 8/84 TO 2/85	14. DATE OF REPORT (Yr., Mo., Day): February 1985; 15. PAGE COUNT: 230
16. SUPPLEMENTARY NOTATION: AFESC Project Officer: Major R. A. Vogel	
17. COSATI CODES: FIELD / GROUP / SUB. GR.	18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number): Installation Restoration Program; Hazardous Waste Management; Past Solid Waste Disposal Sites: Ground Water Contamination

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

This report identified and evaluated several potentially hazardous waste disposal sites at Lackland AFB. Records of past waste handling and disposal practices were reviewed. Interviews with past and present installation employees were conducted to develop a history of waste disposal practices. The environmental setting for effectively receiving the wastes was evaluated including soils, geology, ground water and surface water. One waste leaching area at Lackland AFB and a waste leaching area and landfill at Lackland Training Annex were found to have potential to create environmental contamination and follow-on investigations (Phase II) were recommended and outlined. Key words include:)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT: UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION	
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL

DD FORM 1473, 83 APR — EDITION OF 1 JAN 73 IS OBSOLETE.

SECURITY CLASSIFICATION OF THIS PAGE

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PHASE I - RECORDS SEARCH
LACKLAND AFB
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Prepared For

UNITED STATES AIR FORCE
AFESC/DEV
Tyndall AFB, Florida
and
HQ ATC/DEEV
Randolph AFB, Texas

February 1985

Prepared By

ENGINEERING-SCIENCE
57 Executive Park South, Suite 590
Atlanta, Georgia 30329

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Installation Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Lackland Air Force Base (AFB) under Contract No. F08637 83 G0005 5002.

INSTALLATION DESCRIPTION

Lackland AFB is located within the San Antonio, Texas metropolitan area in Bexar County. the main base has an area of 2,737 acres. Four off-base annexes include Lackland Training Annex (TA), a 3,973-acre site one mile to the west; Hondo Airfield (8 acres) 30 miles to the west; Castroville Airfield (0.5 acre) 15 miles to the west; and Medina Lake Recreation Area 30 miles to the northwest (8.5 acres). Administrative support is provided to Oilton Radar Site (2 acres) 140 miles to the south.

Lackland AFB was activated in 1941 and has served as a training complex since that time. The main training activities have included basic military training and officer training. No flightline has ever existed at the base.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points relevant to Lackland AFB:

- The sole source aquifer, the Edwards, underlies Lackland AFB and Lackland Training Annex at depths of 1,000 feet or deeper.
- Lackland AFB and its Training Annex lie within the reservoir area and not the recharge zone of the Edwards Aquifer.
- The Edwards Aquifer functions under artesian conditions and is sealed from the ground surface by substantial sequences of clay, marl and sandstone.
- A shallow water table (unconfined) aquifer has been shown to exist on base and is probably in communication with base and annex surface waters (Medio Creek, Leon Creek). The full extent of this aquifer is unknown.
- Leon Creek traverses Lackland AFB and Medio Creek passes through Lackland TA in a north to south direction.
- Base surficial soils are predominantly silts or clays that exhibit low permeabilities. More permeable, coarser-grained soils are present at ground surface in zones proximate to Medio and Leon Creeks.
- Annual net precipitation for the area is minus 30 inches. This condition reduces the amount of leachate generation resulting from precipitation at landfills located on Lackland AFB and Lackland Training Annex.
- No wetlands exist at Lackland AFB or at any satellite facilities.
- Natural populations of either threatened or endangered plants or animals do not exist on the base or its satellite facilities.
- A municipal wastewater treatment plant discharges to Leon Creek north of Lackland AFB.
- Two city landfills are located adjacent to Lackland AFB. One landfill is located north of the base and adjacent to Leon Creek. The second landfill is located just south of Lackland Training Annex near Leon Creek.
- The Leon Creek sediment analyses have shown heavy metal, pesticide and herbicide contamination associated with nearby Kelly AFB. These impacts are probably not connected to Lackland AFB or its training mission.

METHODOLOGY

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

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team field inspection, reviews of base records and files, interviews with base personnel, and evaluations using the HARM system.

The areas found to have sufficient potential to create environmental contamination are as follows:

- Leaching Area - 7595 (Lackland AFB)
- Leaching Area - 466 (Lackland TA)
- Landfill No. 4 (Lackland TA)

The areas judged to have minimal potential to create environmental contamination are as follows:

- Five Protection Training Area No. 3 (Lackland TA)
- Five Protection Training Area No. 2 (Lackland AFB)
- Explosive Ordinance Burning Pit (Lackland TA)
- Waste Burning Grounds (Lackland TA)

FIGURE 1

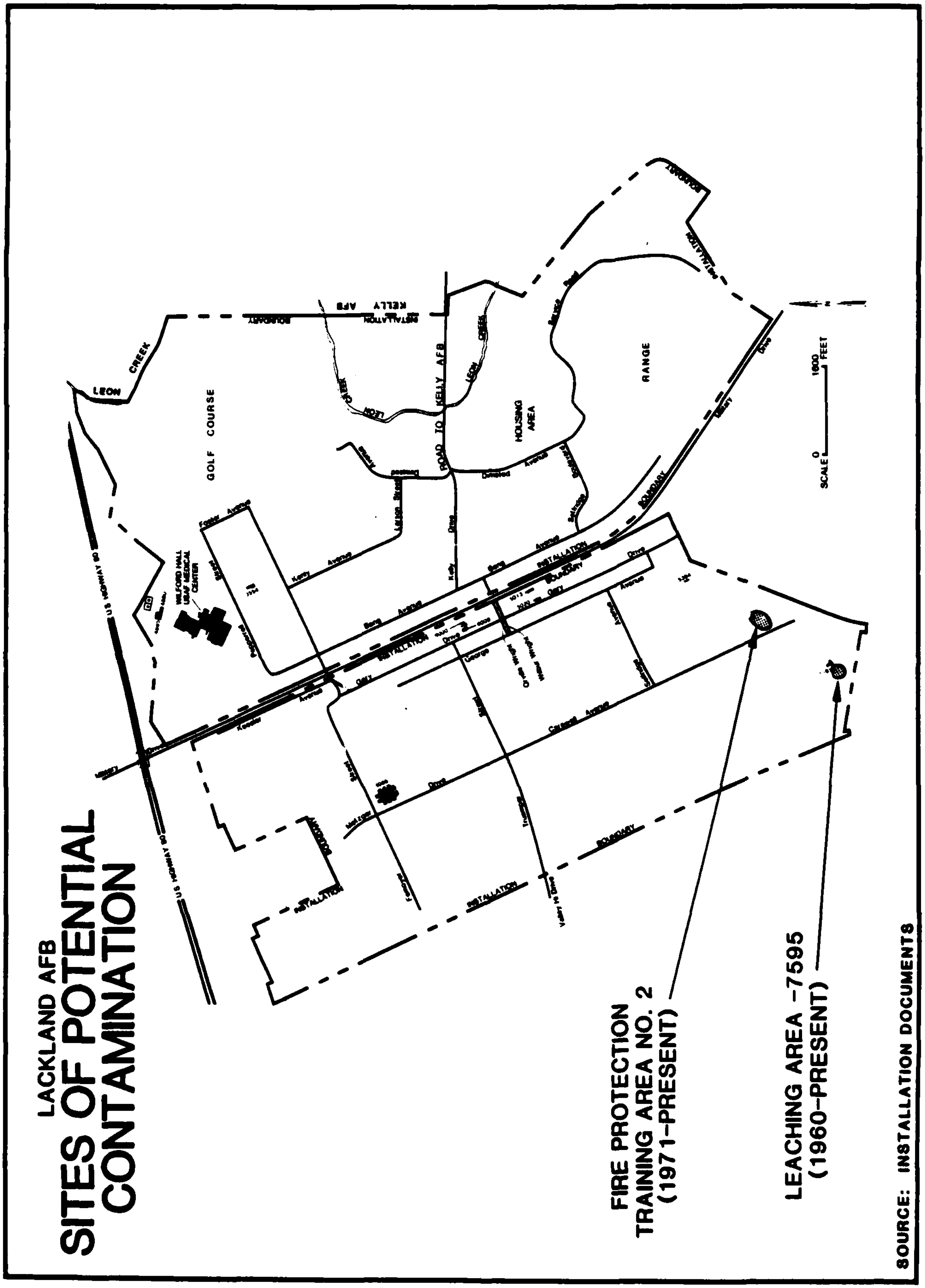

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FIGURE 2

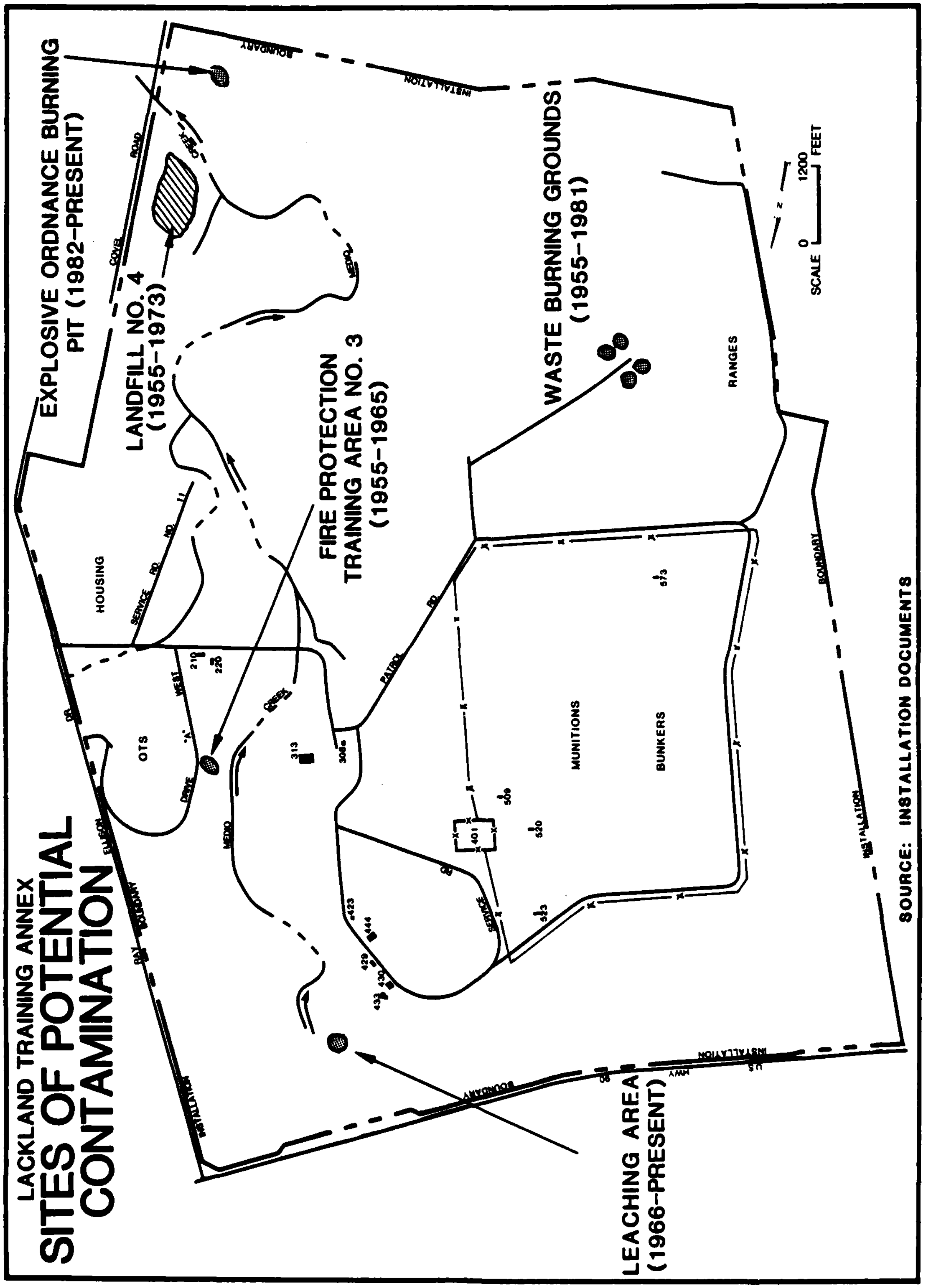

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TABLE 1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
LACKLAND AFB

Rank	Site	Operation Period	HARM Score[1]
1	Leaching Area - 7595	1960 - Present	59
2	Leaching Area - 466	1966 - Present	58
3	Landfill No. 4	1955 - 1973	58
4	Fire Protection Training Area No. 3	1955 - 1965	55
5	Fire Protection Training Area No. 2	1971 - Present	51
6	Explosive Ordnance Burning Pit	1982 - Present	43
7	Waste Burning Grounds	1955 - 1981	42

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

These sites are not recommended for further action due to the small quantities of wastes handled, the extensive combustion which took place to minimize residual materials, and the environmental setting factors.

RECOMMENDATIONS

Recommended guidelines for future land use restrictions at the disposal sites are presented in Section 6. A program for proceeding with Phase II and other IRP activities at Lackland AFB is also presented in Section 6. The recommended actions include a soil boring, monitoring well, sampling and analysis program to determine if contamination exists. This program may be expanded to define the extent and type of contamination if the initial step reveals contamination. The Phase II recommendations are summarized in Table 2.

TABLE 2
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT LACKLAND AFB

Site (Rating Score)	Recommended Monitoring Program
Leaching Area - 7595 (59)	Obtain two borings in the leaching area and one outside as a control. Take borings 10 feet deep and collect soil samples every two feet. Analyze the shallow samples for the parameters in Table 6.2 and then determine the need for testing deeper samples.
Leaching Area - 466 (58)	Obtain two borings in the leaching area and one outside as a control. Take borings 10 feet deep and collect soil samples every two feet. Analyze the shallow samples for the parameters in Table 6.2 and then determine the need for testing deeper samples.
Landfill No. 4 (58)	Perform a geophysical survey to define the boundary of the filled area and to identify subsurface conditions. Use these data to locate one upgradient and three downgradient wells. Sample and analyze the water for the parameters in Table 6.2.

Source: Engineering-Science

SECTION 1
INTRODUCTION

BACKGROUND AND AUTHORITY

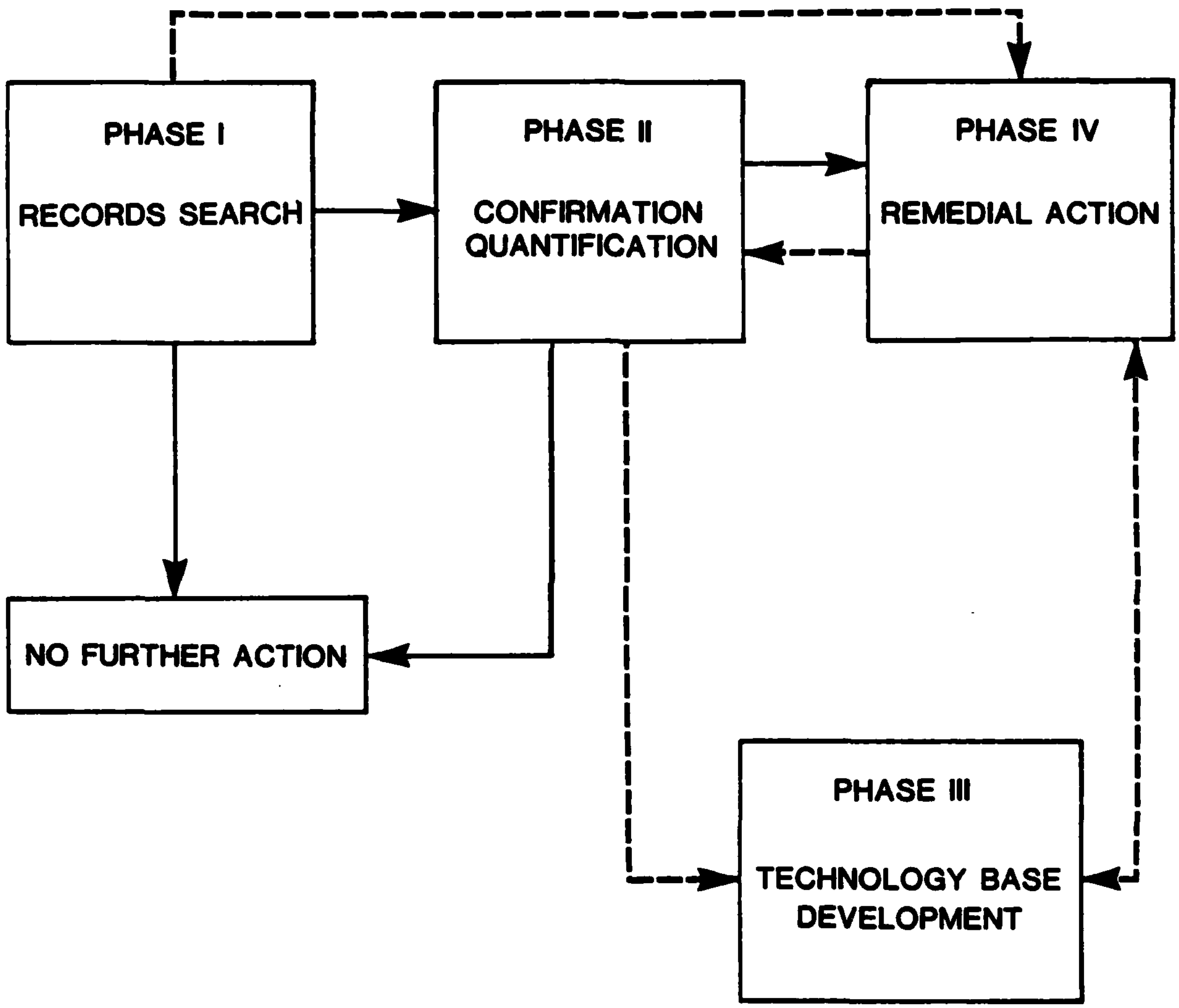
The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations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

PURPOSE AND SCOPE

The Installation Restoration Program is a four-phased program (Figure 1.1) designed to assure that identification, confirmation/quantification, and remedial actions are performed in a timely and cost-effective manner. Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - Phase I is to identify and prioritize those past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or ground waters, or have an adverse effect by its persistence in the environment. In this phase, it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.
- Phase II - Confirmation/Quantification - Phase II is to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination, the extent of contamination, waste characterization (when required by the regulatory agency), and to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be included in the Phase III effort of the program.
- Phase III - Technology Base Development - Phase III is to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.
- Phase IV - Operations/Remedial Actions - Phase IV includes the preparation and implementation of the remedial action plan.

FIGURE 1.1



INSTALLATION RESTORATION PROGRAM

SOURCE: AFESC

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Lackland AFB under Contract No. F08637 83 G0005 5002. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions.

The land area included as part of the Lackland AFB study is as follows:

Lackland AFB	- 2737 acres
Lackland Training Annex	- 3973 acres
Hondo Airfield	- 8 acres
Castroville Airfield	- 0.5 acre
Medina Lake Recreation Area	- 8.5 acres
Oilton Radar Site	- 2 acres

The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of current and past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the base
- Review of past disposal practices and methods
- Reconnaissance of field conditions
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the records search during September, 1984. The following team of professionals were involved:

- R. L. Thoem, Environmental Engineer and Project Manager, MS Sanitary Engineering, 21 years of professional experience.

- J. R. Absalon, Hydrogeologist, BS Geology, 10 years of professional experience.
- J. R. Butner, Environmental Scientist, MS Environmental Engineering Sciences, 5 years of professional experience.

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

METHODOLOGY

The methodology utilized in the Lackland AFB Records Search began with a review of past and present industrial operations conducted at the base. Information was obtained from available records such as shop files and real property files, as well as interviews with 61 past and present base employees from various operating areas. Those interviewed included current and past personnel associated with civil engineering, fuels management, roads and grounds maintenance, fire protection, real property, history, bioenvironmental engineering, recreation, entomology, ordnance disposal, radiation safety, various training activities, and other areas. A listing of interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the employee interviews, the applicable federal, state and local agencies were contacted for pertinent study area related environmental data. The agencies contacted are listed below and in Appendix B.

- U.S. Geological Survey, Water Resources Division (San Antonio, TX)
- U.S. Department of Agriculture, Soil Conservation Service (Hondo, TX)
- Edwards Underground Water District (San Antonio, TX)
- Texas Department of Health, Solid Waste Management Program (San Antonio, TX)
- Texas Department of Water Resources, Water Quality Division (San Antonio, TX)

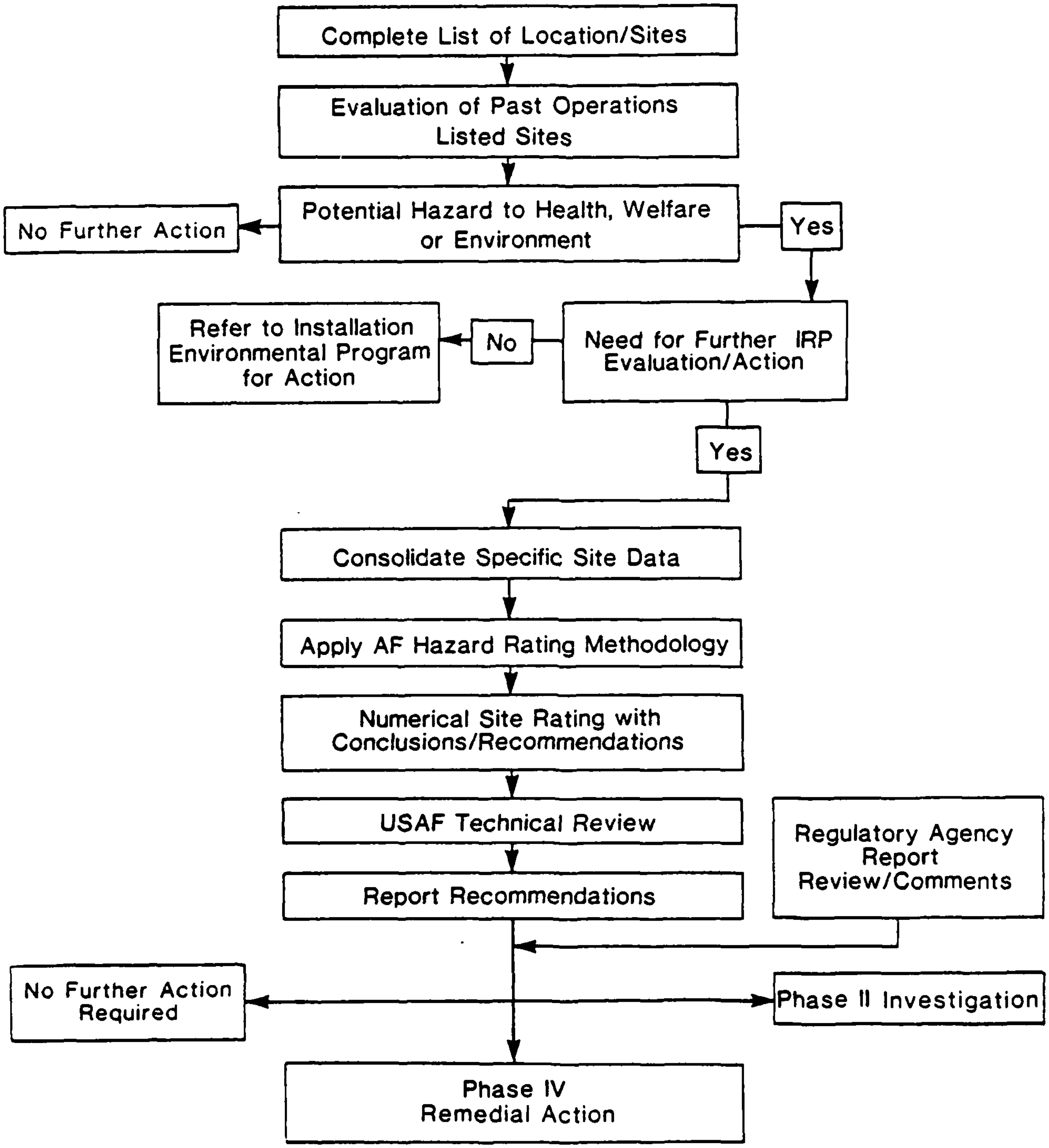
The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources on the base. Included in this part of the activities review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

A general ground tour and an overflight of the identified sites were made by the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches or surface waters; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential hazard to health, welfare or the environment exists at any of the identified sites using the Flow Chart shown in Figure 1.2. If no potential existed, the site was deleted from further consideration. For those sites where a potential hazard was identified, a determination of the need for IRP evaluation/action was made by considering site-specific conditions. If no further IRP evaluation was determined necessary, then the site was referred to the installation environmental program for appropriate action. If a site warranted further investigation, it was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score is a resource management tool which indicates the relative potential for adverse effects on health or the environment at each site evaluated.

PHASE I INSTALLATION RESTORATION PROGRAM

RECORDS SEARCH FLOW CHART



Source: AFESC

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

Lackland AFB is located within the San Antonio, Texas metropolitan area in Bexar County. Commercial and residential developments border the base on the north, west and south sides while Kelly AFB borders the east side. Figures 2.1 and 2.2 show the location of the base both regionally and within the urban area.

The base has a land area of 2,737 acres which is all Air Force-owned. Figure 2.3 shows Lackland AFB. The base has four annexes and has administrative responsibilities for another site (Figures 2.1 and 2.2).

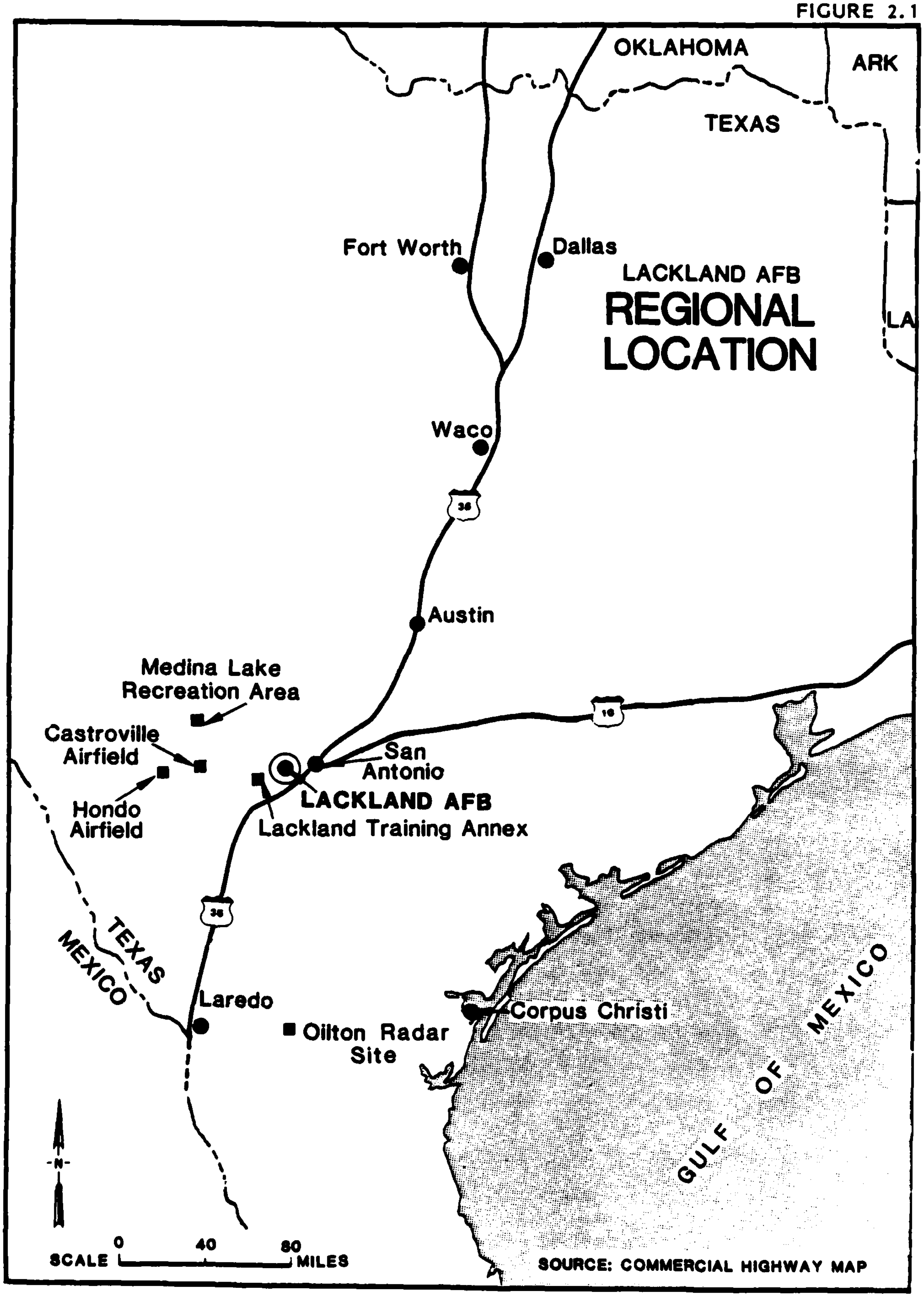
- Lackland Training Annex - this annex comprises 3,973 acres of Air Force-owned land which is located one mile west of the base. Figure 2.4 shows the Lackland Training Annex (TA).

- Hondo Airfield - this annex is located approximately 30 miles west of Lackland AFB (Figure 2.2). It consists of about 8 acres of land leased from the City of Hondo at the Hondo Municipal Airport.

- Castroville Airfield - this annex is located about 15 miles west of the base (Figure 2.2). One-half acre is leased from the City of Castroville at the Castroville Municipal Airport.

- Medina Lake Recreation Area - this annex is located approximately 30 miles northwest of the base (Figure 2.2). It consists of 8.5 acres of leased land.

FIGURE 2.1



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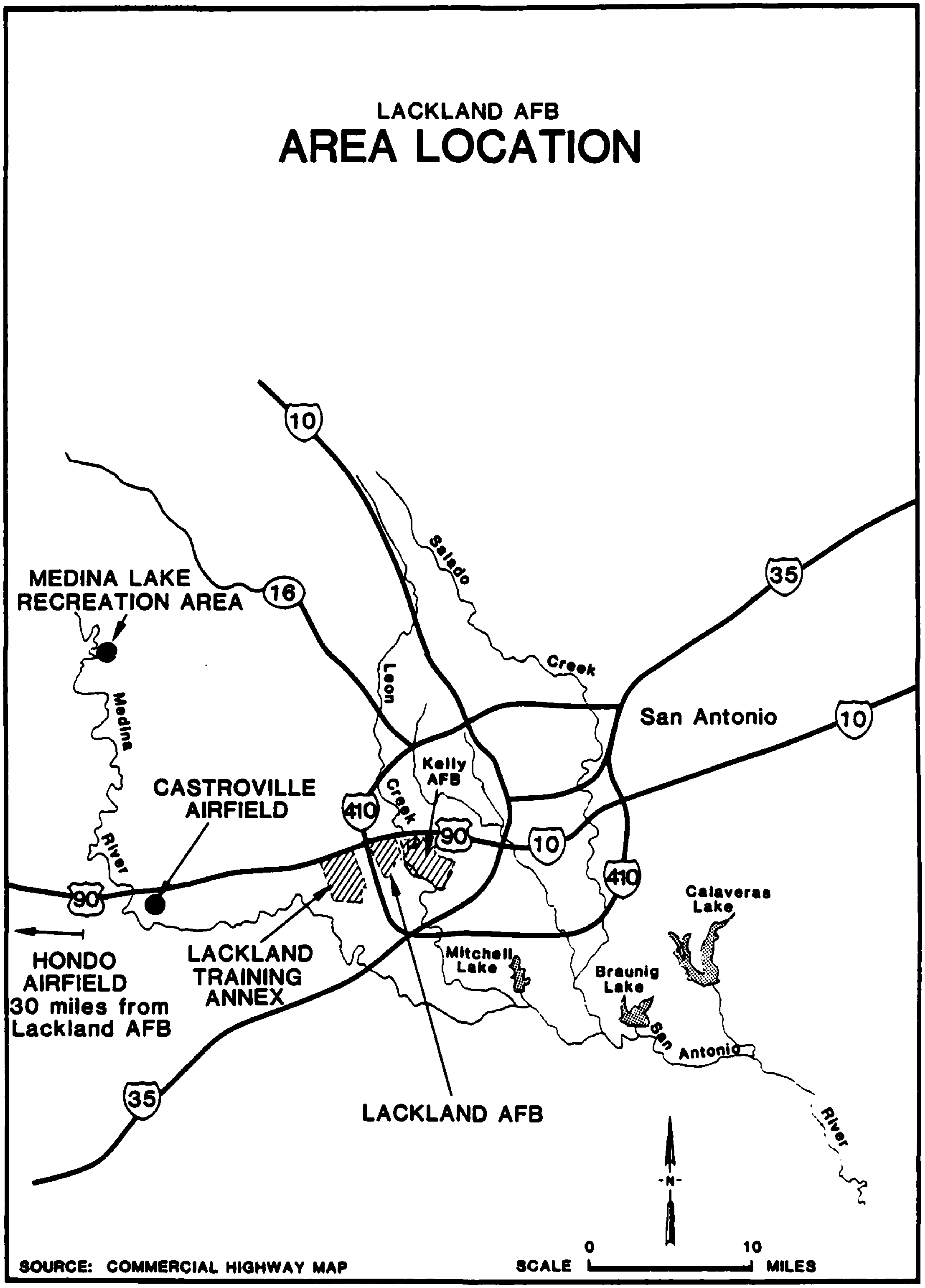

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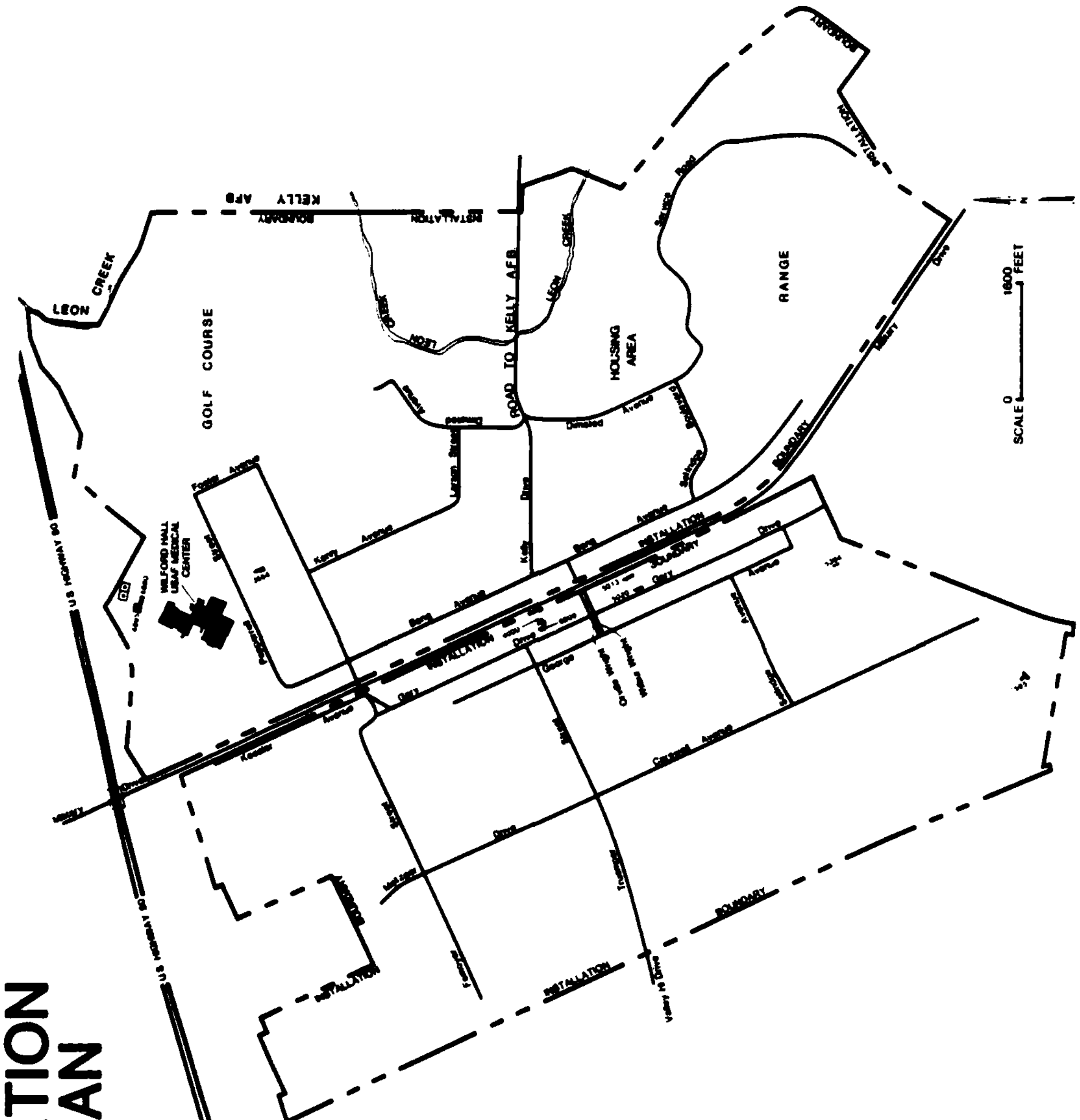
FIGURE 2.3



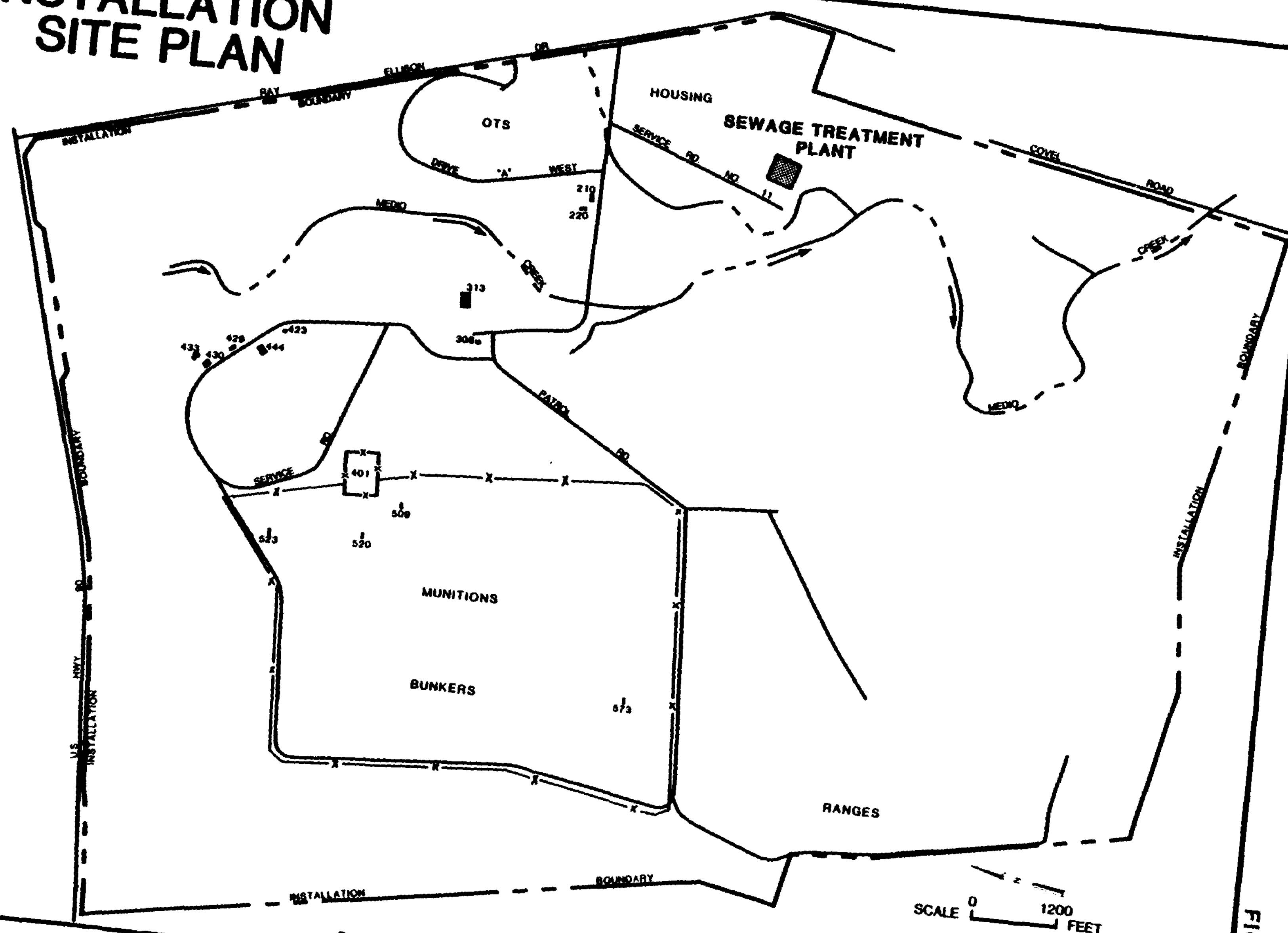
LACKLAND AFB
INSTALLATION
SITE PLAN

SOURCE: INSTALLATION DOCUMENTS

ES ENGINEERING - SCIENCE

FIGURE 2.4

LACKLAND TRAINING ANNEX
INSTALLATION SITE PLAN



SOURCE: INSTALLATION DOCUMENTS

- Oilton Radar Site - Lackland AFB provides only administrative support at this radar facility; the personnel and all other support are under the Tactical Air Command (TAC). The site consists of approximately 2 acres of leased land which is located in Webb County 140 miles south of Lackland AFB (Figure 2.1) and two miles north of Oilton, Texas.

HISTORY

From 1917 to 1941 the site of Lackland AFB was used as a bombing range by Kelly AFB. Lackland AFB was activated in 1941 and has served as a training complex since that time. No flightline has ever existed at the base. Except for a few years since 1941, Lackland AFB has provided basic military training for all persons entering the Air Force. It has provided pre-flight training and since 1944 has had the USAF Officer Candidate School (now Officer Training School, OTS). Since 1957 Lackland has had a major hospital on base, Wilford Hall USAF Medical Center. Lackland has been involved in several other training functions including recruiters, air and security police, cryptography, marksmanship, social actions, and languages for foreign military personnel.

In 1961 Lackland expanded by acquiring a portion of the Medina Facility (Lackland Training Annex) from the Atomic Energy Commission (AEC). The entire site was taken over by the Air Force in 1966. The Medina facility was started by the AEC in 1955 and was a weapons maintenance and storage facility. The Medina annex, under the Air Force, has included the OTS, security service activities, firing ranges, missile repair training, munitions storage and explosive ordnance disposal (EOD).

The Hondo Annex has served as a training facility for the OTS since about 1964 when land was first leased at the airport. The lease provides for use of a combination hangar/classroom/administration building, parking lot, access roads, runways and a tie-down area for 75 airplanes. Currently T-41 aircraft are used for training.

The lease for the Castroville annex provides for use of the runways and a small area for aircraft storage (emergencies only). Land has been leased at this annex since 1966. No personnel or structures are at the site and it has been used only for emergency aircraft landing situations.

Medina Lake Recreation Area provides the recreational facilities including a main pavilion, picnic shelters and a marina for base personnel. The recreation area has been leased since 1982.

The land at the Oilton radar site has been leased since 1972. The Federal Aviation Administration (FAA) utilizes some of the site and was at the location prior to the Air Force. The Air Force installation includes two antennas and support facilities.

ORGANIZATION AND MISSION

The host unit at Lackland AFB (including Lackland TA) is the Air Force Military Training Center (AFMTC). Major units within the AFMTC include the Basic Military Training School, 3250th Technical Training Wing, Defense Language Institute, 3700th Air Base Group, Resource Management, and the 3700th Personnel Resource Group.

The primary mission of the AFMTC is to provide basic training for persons entering the Air Force. The Basic Military Training School provides this training. The 3250th Technical Training Wing provides a variety of training activities in fields such as cryptographic repair, recruiting, social actions, security police and marksmanship. This wing includes three groups, the 3270th, 3280th and 3290th. The primary mission of the Defense Language Institute is to control all Department of Defense (DOD) English language training programs and courses for American and foreign military programs. The 3700th Air Base Group manages and maintains all base facilities and service functions. Resource Management functions include all supply, transportation, and other logistical support for the base. All military and civilian personnel support is provided by the 3700th Personnel Resource Group.

Descriptions of the major tenants at Lackland AFB and their missions are presented in Appendix C.

SECTION 3

ENVIRONMENTAL SETTING

The environmental setting of Lackland Air Force Base and its satellite facilities is described in this section with the primary emphasis directed toward identifying features that may affect the movement of hazardous waste contaminants off base. Environmental conditions pertinent to this study are presented at the end of the section.

METEOROLOGY

Temperature, precipitation and other relevant climatic data furnished by Detachment 7, 15th Weather Squadron, Kelly AFB are presented in Table 3.1. This information is relevant to a study of environmental conditions at Lackland AFB and its four annexes, due to the close proximity of the installations. The indicated period of record is 43 years. The calculated net annual precipitation is minus 30 inches, based upon National Oceanographic and Atmospheric Administration data (NOAA, 1977). The very low net annual precipitation value suggests there is little potential for water-borne contaminants to infiltrate through surface soils to lower strata. The one-year 24-hour rainfall for the area is about 3.1 inches which indicates rainfall intensity can occur at relatively high levels.

GEOGRAPHY AND TOPOGRAPHY

The San Antonio area lies within two major physiographic divisions, the Edwards Plateau Section of the Great Plains Province and the West Gulf Coastal Plan, as depicted in Figure 3.1. The two regions are separated by the east-west trending Balcones Escarpment. Dissection by stream activity has created distinct relief on the Edwards Plateau; typically, elevations range from 1100 to 1900 feet MSL. The plateau is significant to this project as it serves as the precipitation catchment for surface waters flowing to aquifer recharge zones and streams extending through the study area.

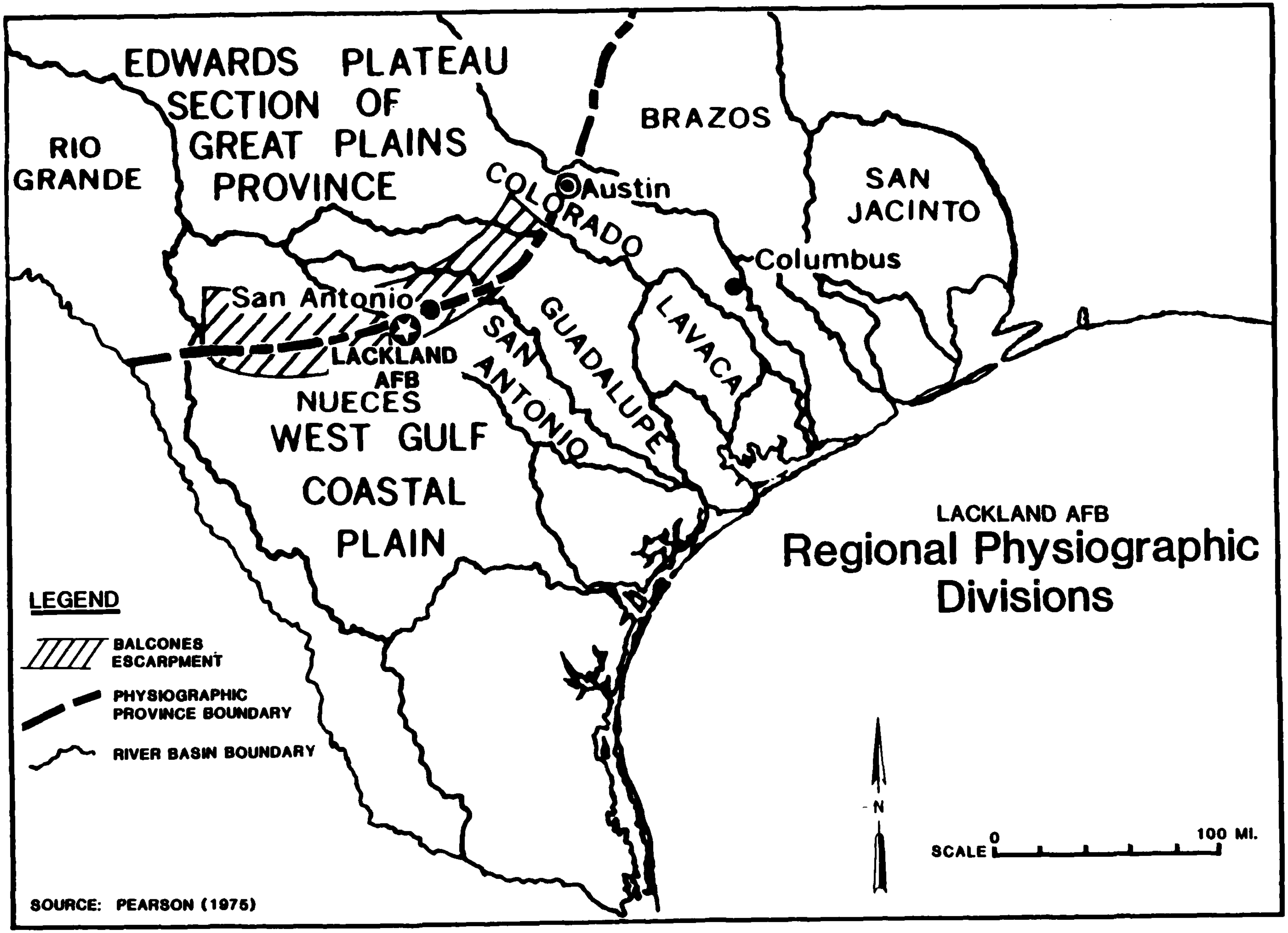
TABLE 3.1
CLIMATIC CONDITIONS AT LACKLAND AFB

Month	Temperature		Rainfall Precipitation		Snowfall Precipitation		Wind	
	Mean Max(°F)	Mean Min(°F)	Mean (in)	Max (in)	Mean (in)	Max (in)	Mean Speed (kts)	Prevailing Direction
Jan.	62	41	1.5	9.5	0	4	6	N
Feb.	66	44	1.8	5.9	0	4	6	N
Mar.	74	61	1.3	3.7	0	4	7	SSE
Apr.	80	60	2.6	10.2	0	0	7	SE
May	86	67	3.6	9.3	0	0	6	SSE
June	92	73	2.5	9.2	0	0	6	SSE
July	95	74	1.7	6.1	0	0	6	SSE
August	95	74	2.8	15.1	0	0	5	SSE
Sept.	90	64	3.9	13.5	0	0	5	S
Oct.	82	60	3.0	9.0	0	0	5	S
Nov.	71	49	1.8	5.1	0	0	6	N
Dec.	65	43	1.3	4.0	0	0	5	N
Annual	-	-	27.8	-	-	-	-	-

Elevation: 690 feet
Period of Record: September 1937-August 1980
Note: Data shown is representative for the four Lackland AFB annexes.

Source: Detachment 7, 15th Weather Squadron, Kelly AFB, TX

FIGURE 3.1



LACKLAND AFB
Regional Physiographic Divisions

The Balcones Escarpment, located northwest of the base, was created by the faulting of underlying geologic units and is significant since this area corresponds to the recharge zone of the major regional aquifer. Relief changes abruptly across the escarpment, with elevations ranging from approximately 1100 feet to 700 feet NGVD (National Geodetic Vertical Datum of 1929). Lackland Air Force Base is located on the West Gulf Coastal Plain, some 15 miles south of the escarpment. The Coastal Plain consists of a gently undulating prairie, where elevations typically range from 450 feet to approximately 700 feet, MSL. The plain slopes to the southeast gradually toward the Gulf of Mexico. Lackland Air Force Base relief varies from 791 feet NGVD in the northwest extent of the base near facility 10702 to approximately 640 feet, NGVD along segments of the cut incised by Leon Creek, at Kelly Drive. Relief is pronounced along the channel of Leon Creek, reaching approximately ninety feet, also in the vicinity of Kelly Drive.

Drainage

The surface drainage of most main installation land areas is accomplished by overland flow to gullies and swales which direct runoff to Leon Creek or its unnamed tributaries. In addition, some drainage originating from the southwest corner of Lackland AFB follows local topography to Indian Creek. Surface drainage originating from most of the Lackland Training Annex is directed to Medio Creek, which flows through the east part of the base. A minor amount of surface drainage originating from the west portion of Lackland TA discharges to unnamed tributaries of the Medina River which either extend through the base or rise in the training ranges of the installation. Leon, Indian, Medio and local unnamed creeks or drainage courses are all tributaries of the Medina River. Lackland AFB and Lackland TA surface drainage is shown in Figures 3.2 and 3.3, respectively.

Surface drainage flowing from the Hondo Airfield is directed generally toward the west of the East Branch of Live Oak Creek, a tributary of Hondo Creek.

Surface drainage originating from the Castroville Airfield is directed to Flat Creek, an ephemeral tributary of the Medina River.

FIGURE 3.2

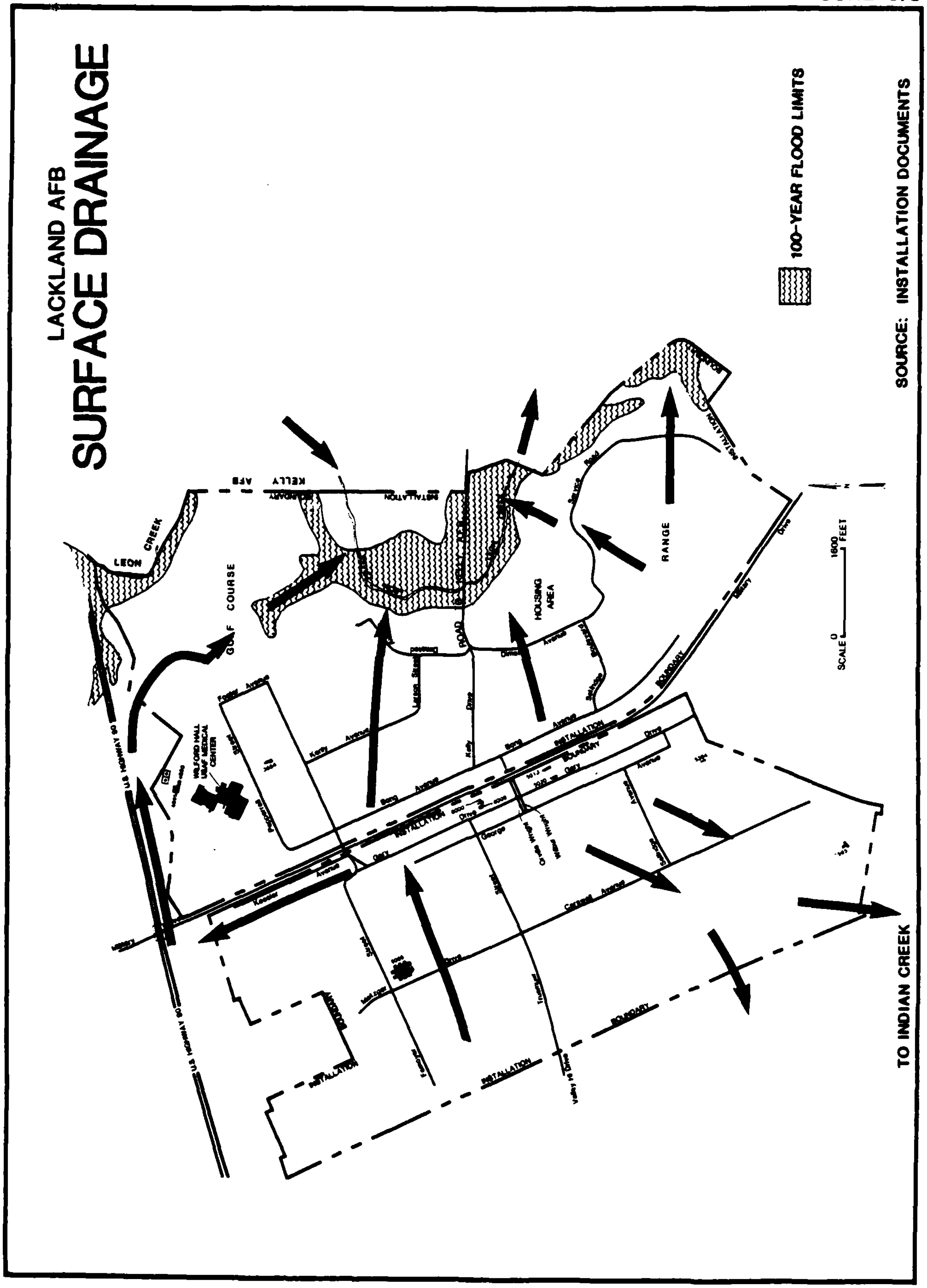
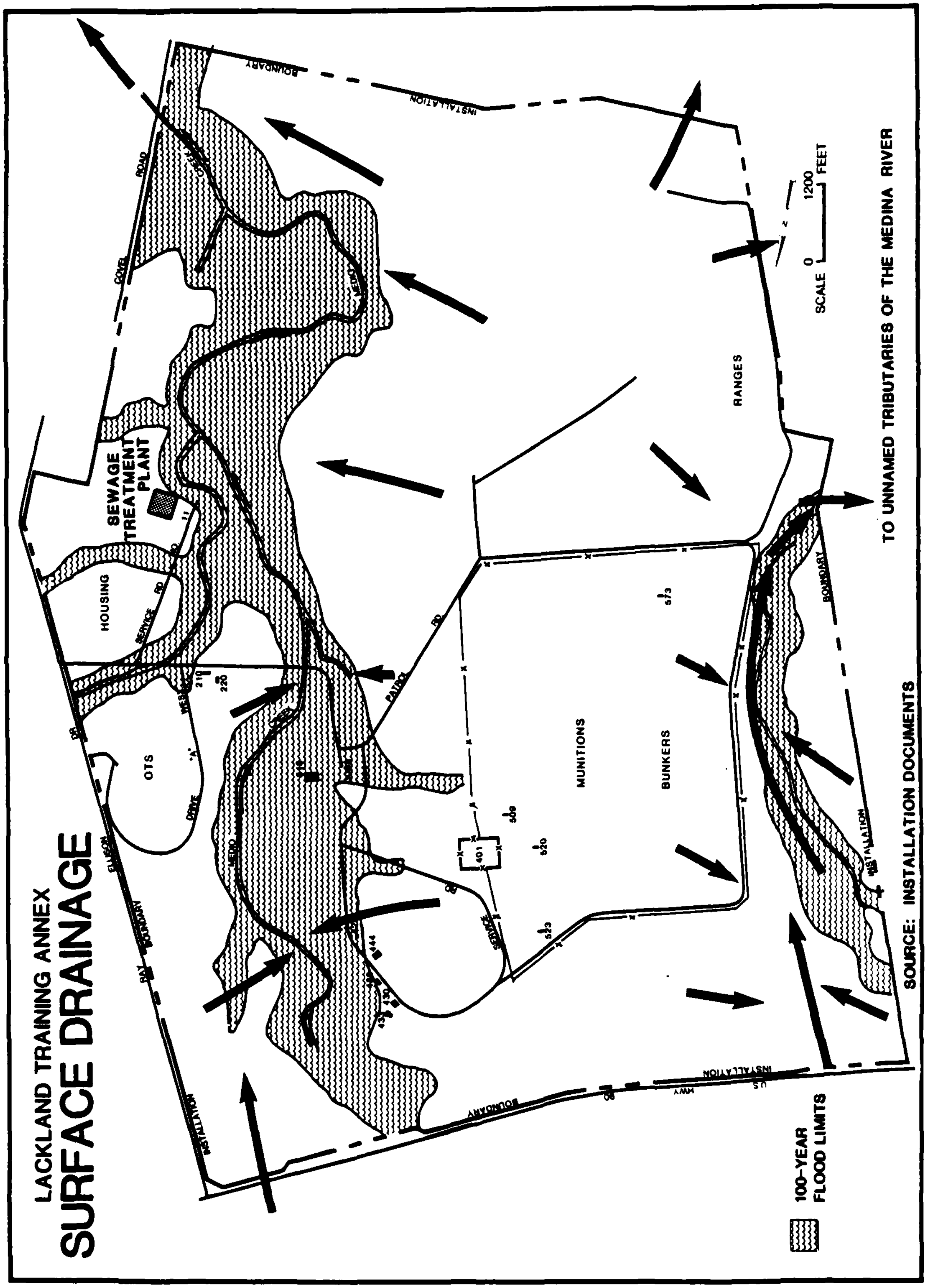

LACKLAND AFB
SURFACE DRAINAGE
100-YEAR FLOOD LIMITS
SOURCE: INSTALLATION DOCUMENTS
KELLY AFB
LEON CREEK
GOLF COURSE
HOUSING AREA
RANGE
WILFORD HALL USAF MEDICAL CENTER
INSTALLATION BOUNDARY
U.S. HIGHWAY 90
SCALE 0 1600 FEET
TO INDIAN CREEK

FIGURE 3.3



ES ENGINEERING-SCIENCE

Drainage from the Medina Lake Recreation Area proceeds in a generally downslope direction, following local topography to the lake.

Surface drainage from the Oilton Radar Site flows generally to the west, following local topography toward the Arroyo de Los Angeles and finally to the Rio Grande River.

No wetlands exist on Lackland AFB or on any of its satellite facilities.

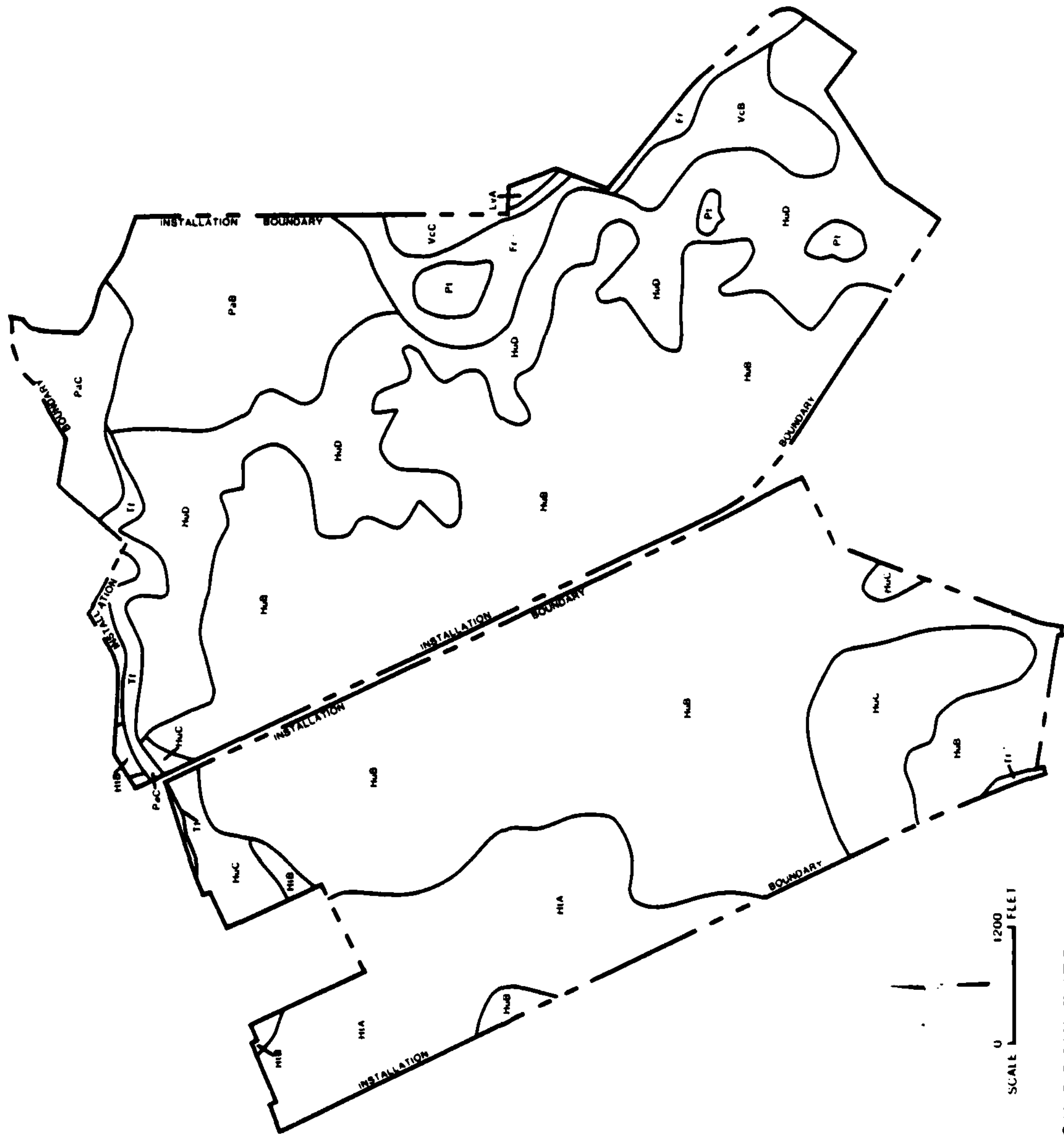
Surface Soils

Surface soils of the installation and training annex areas have been studied by the USDA, Soil Conservation Service (1966) and by McIntosh and Behm (1967). Eighteen soil types have been mapped within installation and annex boundaries, which are depicted in Figure 3.4 and 3.5. The individual soil types are described in Table 3.2. Base soils are typically alluvial, predominantly poorly drained, fine-grained soils possessing generally low permeabilities. Surface soils occurring in the training annex range areas are gravelly materials, in contrast to the predominantly silty or clayey soils of the study area. Fine-grained soils usually promote rapid runoff. Gravelly soils tend to reduce runoff. According to McIntosh and Behm (1967), gravelly clays underlie surficial soils at depths ranging from two feet below ground surface along the golf course hillsides to ten feet along the upland areas. The average thickness of the gravelly clay layer is reported to be five feet with local variations. Installation surface soils are underlain by older alluvium. The alluvium is known to vary in thickness from 23 feet at Kelly AFB Well I-61 to 60 feet at Kelly AFB Well I-97.

The surface soils of Hondo and Castroville Airfields are predominantly the Knippa-Mercedes-Castroville Association. These soils are deep calcareous clays and loams with varying amounts of silt, sand and gravel present. This association has formed on nearly level to gently sloping outwash plains and old stream terraces. Permeabilities and runoff potentials tend to be slow and the erosion hazard is reported to be slight (from USDA, SCS, 1977).

Soils of the Medina Lake Recreation Area are composed of the Tarrant-Real-Brackett Association. These are shallow loamy, gravelly loamy and cobbly clayey calcareous soils occurring on sloping, undulating and steep surfaces. Limestone bedrock may outcrop locally. Soils

LACKLAND AFB
SOILS MAP



SOURCE: INSTALLATION DOCUMENTS

FIGURE 3.5

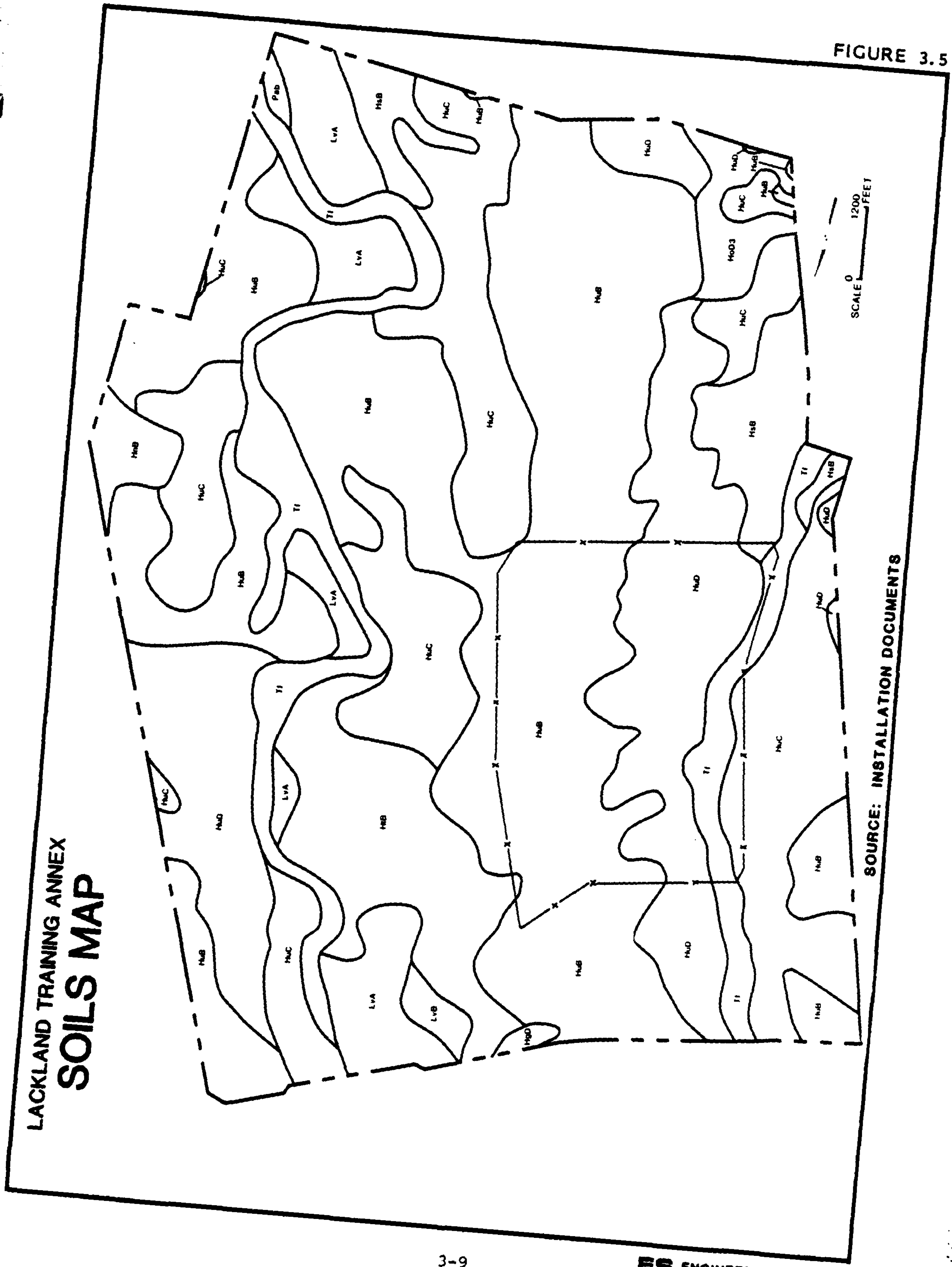

LACKLAND TRAINING ANNEX
SOILS MAP
SCALE 0 1200 FEET
SOURCE: INSTALLATION DOCUMENTS

TABLE 3.2

SOILS CLASSIFICATIONS FOR LACKLAND AIR FORCE BASE AND THE LACKLAND TRAINING ANNEX

Symbol	Description (Major Fraction)	Thickness (in.)	Unified Classification (Major Fraction)	Permeability (in./hr)	Disposal Site Use Constraints
Fr	Frio clay loam, clay and sandy loam over gravel locally.	0-84+	CL, CH over GM, SM or CL	1.0 - 2.5	Severe. Subject to flooding, underlain by gravel.
HgD	Hilly gravelly land. Gravel pits and caliche outcrops.	Unknown	Varies	High *	Severe. Gravel may connect to surface waters locally.
HnB	Houston clay. Clay and marly clay. 1-3 percent slopes.	24-62	CH, CL	<0.1 - 0.5	Slight.
HoD_3	Houston-Sumter clays. Gravelly clay. 5-10 percent slopes, very eroded.	8-30	CH, CL	0.2 - 0.4	Slight.
HsB	Houston black clay. Clay, silty clay, gravel, chalk and marl. 1-3 percent slopes.	38-84	CH, CL	0.1 - 0.6	Slight.
HtA	Houston black clay. Clay gravelly clay, loam. 0-1 percent slopes.	42-120	CH, CL or CG	0.3 - 1.5+	Severe. Underlain by gravel.
HtB	Houston black clay. Clay, gravelly clay, loam. 1-3 percent slopes.	42-120	CH, CL or GC	0.3 - 1.5+	Severe. Underlain by gravel.
HuB	Houston black clay. Gravelly clay over clay. 1-3 percent slopes.	36-60+	GC, CH	0.2 - 0.8	Slight. Contains gravel.
HuC	Houston black gravelly clay. Gravelly clay over clay. 3-5 percent slopes.	36-60+	GC, CH	0.2 - 0.8	Slight. Contains gravel.
HuD	Houston black gravelly clay. Gravelly clay over clay. 0-5 percent slopes.	36-60+	GC, CH	0.2 - 0.8	Slight. Contains gravel.
LvA	Lewisville silty clay. Silty clay, silty clay loam, gravel. 0-1 percent slopes.	0-62	CL	1.0 - 1.2	Moderate due to permeability.

TABLE 3.2
SOILS CLASSIFICATIONS FOR LACKLAND AIR FORCE BASE AND THE LACKLAND TRAINING ANNEX
(Continued)

Symbol	Description (Major Fraction)	Thickness (in.)	Unified Classification (Major Fraction)	Permeability (in./hr)	Disposal Site Use Constraints
LvB	Lewisville silty clay. Silty clay, silty clay loam, gravel. 1-3 percent slopes.	0.62	CL	1.0 - 2.0	Moderate due to permeability.
PaB	Patrick soils. Clay loam, loam, silty clay loam over gravel. 1-3 percent slopes.	0-60+	CL, CH, ML-CL over GM, GC	2.0 - 5.0+	Severe. Underlain by gravel.
PaC	Patrick soils. Clay loam, loam, silty clay loam over gravel. 3-5 percent slopes.	0-60+	CL, CH, ML-CL over GM, GC	2.0 - 5.0+	Severe. Underlain by gravel.
Pt	Pits and Quarries. Sand and/or gravel, locally.	Unknown	Varies	Probably higher than 5.0	Severe. May connect to surface waters locally.
Tf	Trinity and Frio soils. Clay and sandy clay loam over gravel locally.	0-84+	CL, CH over GM, SM or CL	1.0 - 2.5	Severe. Subject to flooding. Underlain by gravel.
VcB	Venus clay loam. Clay loam, loam, gravel. 1-3 percent slopes.	16-72	CL, ML over GM	1.0 - 5.0+	Severe. Underlain by gravel.
VcC	Venus clay loam. Clay loam, loam, gravel. 3-5 percent slopes.	16-72	CL, ML over GM	1.0 - 5.0+	Severe. Underlain by gravel.

Source: USDA, Soil Conservation Service, 1966.

* Estimated by Engineering-Science

tend to be slowly to moderately permeable and runoff is rapid (USDA, SCS, 1977).

Soils present at the Oilton Radar Site consist primarily of the Cuevitas-Randado Association. These materials are typically thin sandy clay loams formed over flat to gently rolling lands with local depressions developing as a result of karst (solution and collapse structures) terrain. They are usually underlain by white indurated caliche. The infiltration rates of these soils ranges from slow in zones where the soil column has developed to maturity to very high where the soil column is thin and overlies local fracture and solution (sink holes, collapse structures) cavities. Runoff tends to be slow due to the generally level nature of the land surface (USDA, SCS, 1984a and Kier, at al., 1977).

GEOLOGY

The geology of the San Antonio area has been reported by Sellards, et al. (1932, reprinted 1981), Arnow (1959 and 1963), McIntosh and Behm (1967) and the Texas Bureau of Economic Geology (1976 and 1983), among others. A brief review of the published information has been summarized in support of this investigation.

Stratigraphy

Geologic units ranging in age from Cretaceous to Quaternary have been described in the San Antonio area and are presented as Table 3.3. The lithologies of these units include unconsolidated materials and sedimentary rocks.

Distribution

The area of significant geologic units relevant to this study are mapped as Figure 3.6, which has been modified from the work of Arnow (1959 and 1963) and McIntosh and Behm (1967). Generally, the upper geology of Lackland Air Force Base and the Lackland Training Annex is dominated by thick sections of marls of the Navarro and Taylor Groups. Geologic section A-A' is presented as Figure 3.7.

Structure

Lackland Air Force Base occupies a position within the tectonically significant Balcones Fault Zone. Normal faulting in this area has been attributed to the settlement of the Gulf of Mexico geosyncline,

TABLE 3.3
SAN ANTONIO AREA GEOLOGIC UNITS
LACKLAND AIR FORCE BASE AND TRAINING ANNEX

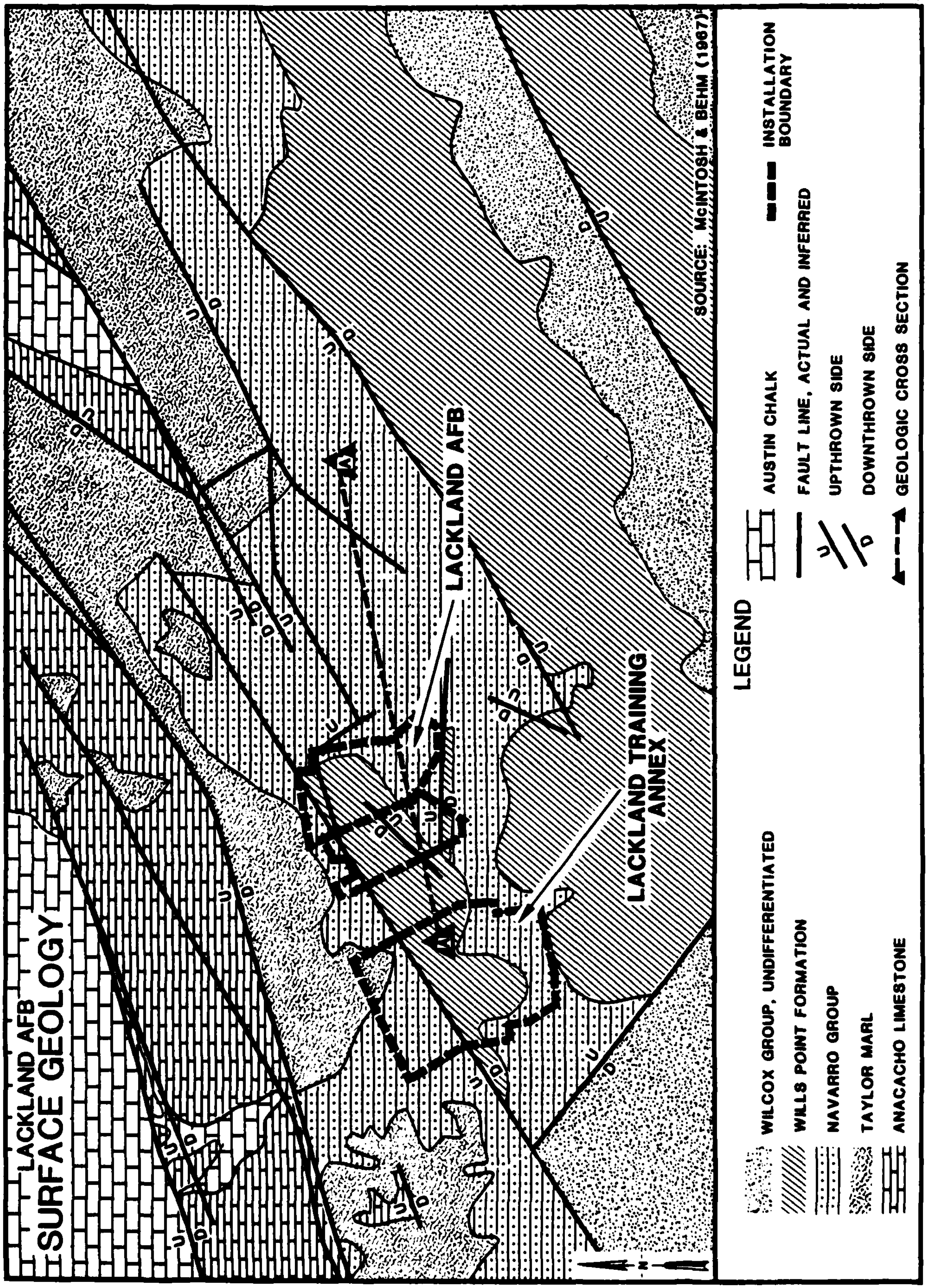
System	Series	Group	Stratigraphic Unit	Approximate Maximum Thickness (feet)	Character of Material	Water-Supply Properties
Quaternary	Recent and Pleistocene		Alluvium	45	Silt, sand, and gravel.	In places yields water for stock and domestic wells.
Tertiary	Pliocene		Uvalde Gravel	30	Coarse flinty gravel in matrix of clay or silt.	Not known to yield water to wells in Bexar County.
Tertiary	Eocene	Claiborne	Mount Selman Formation	200	Sand and clay with iron concretions.	Not known to yield water to wells in Bexar County.
			Carrizo Sand	800	Coarse to medium-grained	Yields moderate supplies of potable water.
		Wilcox	Undifferentiated Deposits	1,070	Thin-bedded sand and sandstone and some clay, lignite and calcareous concretions.	Yields moderate supplies of water of good to poor quality.
	Paleocene	Midway	Wills Point Formation	490	Arenaceous clay containing Numerous arenaceous and calcareous concretions.	Not known to yield water to wells in Bexar County.
Cretaceous	Gulf	Navarro	Kemp Clay, Escondido Formation, and Corsicana Marl	535	Clay and marl.	Not known to yield water to wells in Bexar County.
			Taylor Marl	540	Marl and calcareous clay.	Not known to yield water to wells in bexar county.
			Anacacho Limestone	355	Marly chalk.	Not known to yield water to wells in Bexar county.
			Austin Chalk	210	Limestone and argillaceous chalky limestone.	Yields small to large supplies of water of good to poor quality.
			Eagle Ford Shale	40	Calcareous and sandy shale and some argillaceous limestone.	Not known to yield water to wells in Bexar County.
	Comanche	Washita	Buda Limestone	80	Dense, hard limestone.	Yields sufficient water near the outcrop for stock and domestic use.

TABLE 3.3
SAN ANTONIO AREA GEOLOGIC UNITS
LACKLAND AIR FORCE BASE AND TRAINING ANNEX
(Continued)

System	Series	Group	Stratigraphic Unit	Approximate Maximum Thickness (feet)	Character of Material	Water-Supply Properties
Cretaceous (Continued)	Comanche (Continued)	Washita (Continued)	Grayson Shale (Del Rio Clay)	60	Blue clay, weathering greenish and yellowish brown.	Does not yield water to wells in Bexar County.
			Georgetown Limestone	65	Hard massive limestone and argillaceous limestone.	Yields large supplies of water for municipal, industrial, and irrigation supplies. Forms the principal aquifer in the county. Water is highly mineralized downdip in the southern part of the county.
		Fredericksburg	Edwards Limestone	600+	Hard semicrystalline massive limestone and dolomite and some thin-bedded limsetone and marly limestone.	
			Comanche Peak Limestone	40	Light-gray massive limestone and marl.	
			Walnut Clay	20	Sandy clay or marl.	Not known to yield water to wells in Bexar County.
		Trinity	Glen Rose Limestone	1,200	Massive chalky limestone alternating with beds of less resistent marly limestone.	Generally yields sufficient water in the outcrop for stock and domestic use. Water from deeper wells generally is more highly mineralized than is water from shallow wells.
			Pearsall Formation	190	Shale and limestone.	Not known to yield water to wells in Bexar County.
	Pre-Comanche (Coahuila of Mexico)	(Nuevo Leon of Mexico)	Sligo Formation	1,100	Limestone, dolomite, and shale.	Not known to yield water to wells in Bexar County.
		(Nuevo Leon and Durango of Mexico)	Hosston Formation		Limestone, shale, and sandstone.	Yields small to moderate supplies of water which becomes more highly mineralized downdip toward the southern part of the county.
Pre-Cretaceous			Sedimentary and metamorphic		Slate, black limestone, and schist.	Not known to yield water to wells in Bexar County.

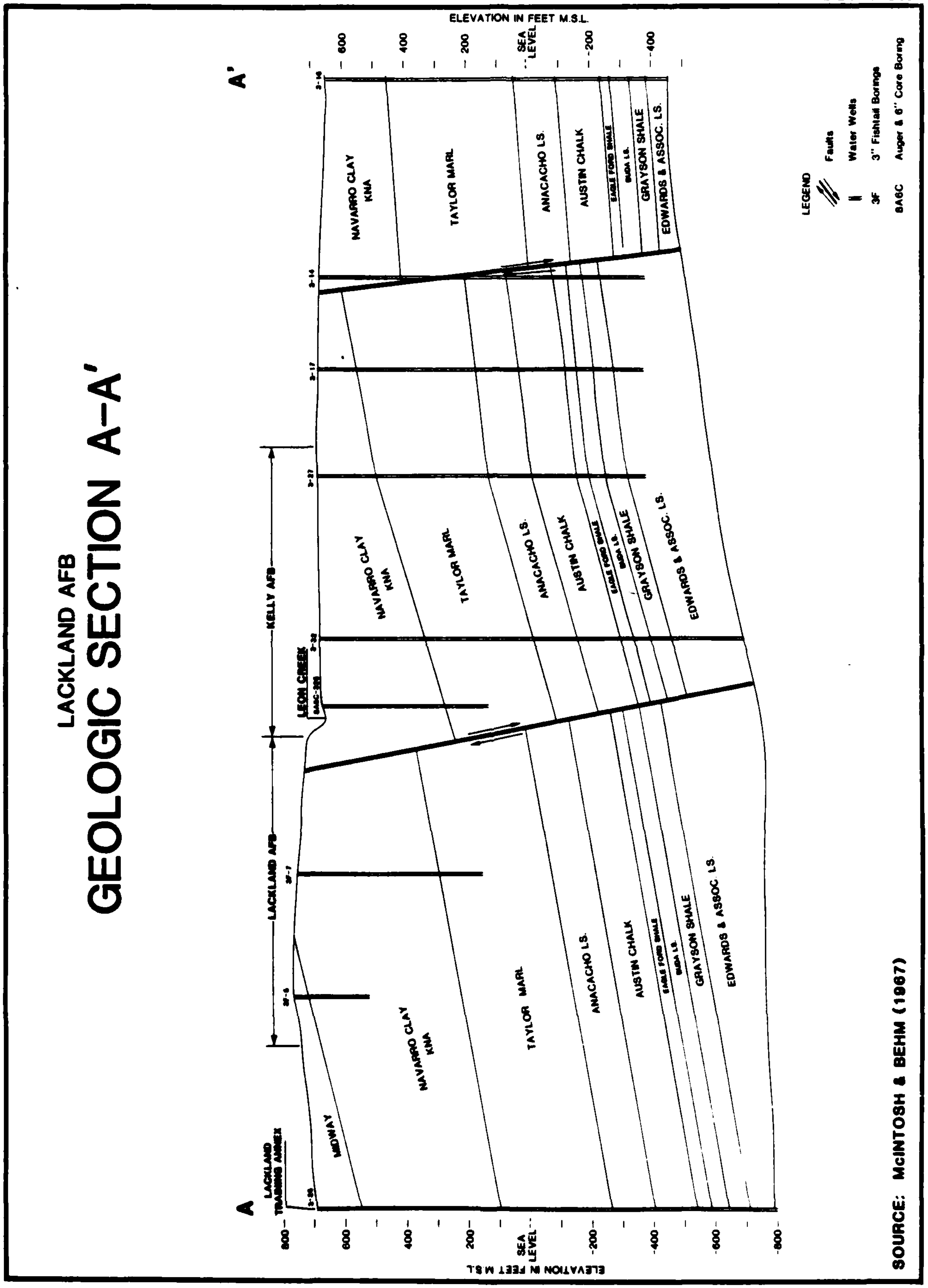
Source: Arnow, 1959

FIGURE 3.6



LACKLAND AFB
SURFACE GEOLOGY
LACKLAND AFB
LACKLAND TRAINING ANNEX
N
SOURCE: McINTOSH & BEHM (1967)
LEGEND
WILCOX GROUP, UNDIFFERENTIATED
WILLS POINT FORMATION
NAVARRO GROUP
TAYLOR MARL
ANACACHO LIMESTONE
AUSTIN CHALK
FAULT LINE, ACTUAL AND INFERRED
UPTHROWN SIDE
DOWNTHROWN SIDE
GEOLOGIC CROSS SECTION
INSTALLATION BOUNDARY

FIGURE 3.7


LACKLAND AFB
GEOLOGIC SECTION A–A'
A
A'
ELEVATION IN FEET M.S.L.
800
600
400
200
SEA LEVEL
-200
-400
-600
-800
LACKLAND TRAINING ANNEX
LACKLAND AFB
KELLY AFB
LEON CREEK
MIDWAY
NAVARRO CLAY KNA
TAYLOR MARL
ANACACHO LS.
AUSTIN CHALK
EAGLE FORD SHALE
BUDA LS.
GRAYSON SHALE
EDWARDS & ASSOC. LS.
LEGEND
Faults
Water Wells
3F 3" Fishtail Borings
8A6C Auger & 6" Core Boring
SOURCE: McINTOSH & BEHM (1967)

which is presently receiving large quantities of terrestrial sediments. Faulting has occurred along parallel lines trending roughly from southwest to northeast across the study area. The faulting is significant because it has modified the gross structure of area geologic units and has permitted the development of secondary porosity in some units. According to Arnow (1959) many of the faults are not traces of discrete separation but are actually shatter zones which have created a series of smaller step faults along parallel lines. Displacement along individual fault lines may vary from twenty feet to several hundred feet, with the greatest amount of movement occurring near the fracture center (Figure 3.7). Total vertical displacement observed in strata extending between the Edwards Plateau and the Coastal Plain is on the order of 3000 feet.

The sedimentary rocks of Bexar County tend to strike east-northeast and dip south-southeast toward the Gulf of Mexico. In the north part of the county, the dip averages ten to fifteen feet per mile (relatively flat). In the southern part of the county the dip increases to 150 feet per mile, which may be due in part to the previously discussed faulting. According to the work of McIntosh and Behm (1967), compartmentalized faulting may have altered local strike and dip relationships from the reported regional trends. This may be seen in the Geologic Section, Figure 3.7, where displacement along major fault lines has modified regional conditions within relatively confined zones beneath Lackland AFB.

The surface geology of the Hondo and Castroville Airfields is dominated by the Quaternary age Leona Formation. This unit occurs on wide terraces above present day stream valleys and consists primarily of fine calcareous silts near the surface and grades downward into coarse gravel. Kier, et al. (1977) report that shallow ground water may be present within this unit and Holt (1956, reprinted 1976) reports that moderate supplies of water can be obtained where the unit is significant, reaching a maximum thickness of 65 feet. The Leona overlies the Escondido and Anacacho Formations, which may be locally significant aquifers. The Austin Chalk underlies the Escondido and Anacacho Formations, separating them from the Edwards Limestone, which is present at great depth.

The geology of the Medina Lake area is dominated by the outcrops of the Edwards Limestone and the Glen Rose Formation limestone and dolomite. In the geologic column, the Glen Rose underlies the Edwards. This portion of the study area is significant as the Edwards Aquifer receives much of its recharge in its outcrop zone.

The geology of the Oilton Radar Site is dominated by the Pliocene Goliad Formation, a 300-foot sequence of clay, marl, caliche, sand, sandstone, limestone and conglomerate. Locally, the unit is well bedded.

HYDROLOGY

Ground-water hydrology of the Lackland Air Force Base-San Antonio area has been reported by Arnow (1959, 1963), Garza (1962), Pearson et al. (1975), Baker and Wall (1976), Maclay and Small (1976), USBR (1978), Metcalf and Eddy, Inc. (1979), Muller and Price (1979), Marquardt and Elder (1979), Maclay et al. (1980), and Maclay et al. (1981). Additional information has been obtained from interviews with officials of the U.S. Geological Survey Water Resources division and the Edwards Underground Water District. Information describing shallow aquifer conditions was obtained from the interviews and from McIntosh and Behm (1967).

Edwards (Balcones Fault Zone) Aquifer

Lackland AFB lies within the limits of the Edwards (Balcones Fault Zone) Aquifer, which is defined as a "sole source" aquifer by the U.S. EPA. In 1959, the Texas Legislature created the Edwards Underground Water District to provide for the systematic planning and protection of subsurface water resources derived from the Edwards Aquifer. Regulatory authority is governed by the Texas Water Code Section II, Chapters 156.20.01.001-.019 and extends into the recharge zone (outcrop area) located north of the reservoir zone.

The area underlain by the Edwards Aquifer sweeps an arc extending from Kinney County to the west, to Hays County on the east aquifer boundary. This area is approximately 175 miles long and varies in width from 5 to 30 miles. The west, north and east aquifer boundaries are defined geologically where hydrogeologic units crop out forming the generally acknowledged recharge zone or where ground-water divides exist. The south aquifer boundary is arbitrarily defined as the "bad water line" where total dissolved solids concentrations exceed 1,000 milligrams per liter (mg/L). The aquifer (reservoir) area and its associated recharge zone are presented in Figure 3.8.

The Edwards Aquifer consists of three hydrogeologic units which are known to be hydraulically continuous: the Georgetown Limestone, the Edwards Limestone and the Comanche Peak Limestone. The Limestone units are described as being thin to massive-bedded, nodules, cherty, gypseous, argillaceous white to gray limestone and dolomite. The rock is characterized by an extensively honeycombed, cavernous structure created by solution channeling over a wide area.

At Lackland AFB, the Edwards Aquifer lies some 1,490 feet below ground surface. The well log depicted in Figure 3.9, illustrates hydrogeologic units encountered at Lackland Well No. 3 which is typical of the study area. Installation well logs indicate a typical aquifer thickness of 540 feet in the study area.

The Edwards Aquifer is confined at its base by the Glen Rose Formation and at its upper surface by the Del Rio clay or correlative units. Water is contained in the Edwards under confined (artesian) conditions.

The Edwards is recharged principally by the downward percolation of surface waters from streams traversing the area of outcrop and by precipitation infiltration in this same zone. Figure 3.10 depicts the recharge area in a generalized cross-section. In areas where streams cross the aquifer area of outcrop, numerous large solution channels have been observed (Arnow, 1959). Similar large solution channels have been noted on driller's well logs in the reservoir zone several miles to the south. Once water has entered the Edwards, it moves rapidly downdip (Maclay, 1981) principally in solution channels such as those shown in the hypothetical flow diagram presented as Figure 3.11. Ground-water flow directions are both to the south (downdip along formation gradients) and to the east - northeast paralleling the fault system and according to prevailing hydraulic gradients (Pearson, et al, 1975). Figure 3.12 depicts water levels within the Edwards as of July, 1974 with approximate ground-water flow directions. It should be noted here that local variations in flow directions may occur.

FIGURE 3.8

LACKLAND AFB

EDWARDS AQUIFER AREA

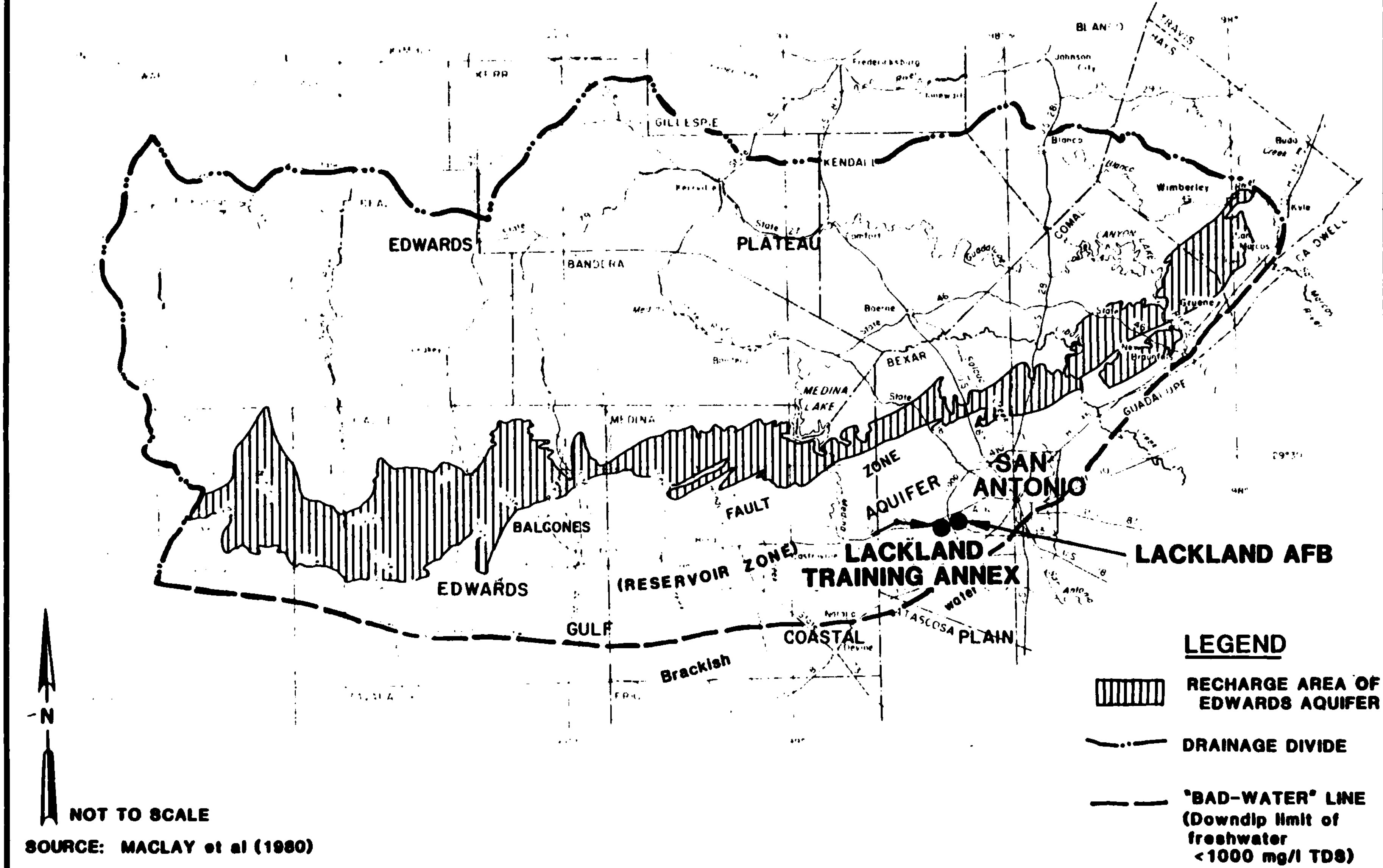
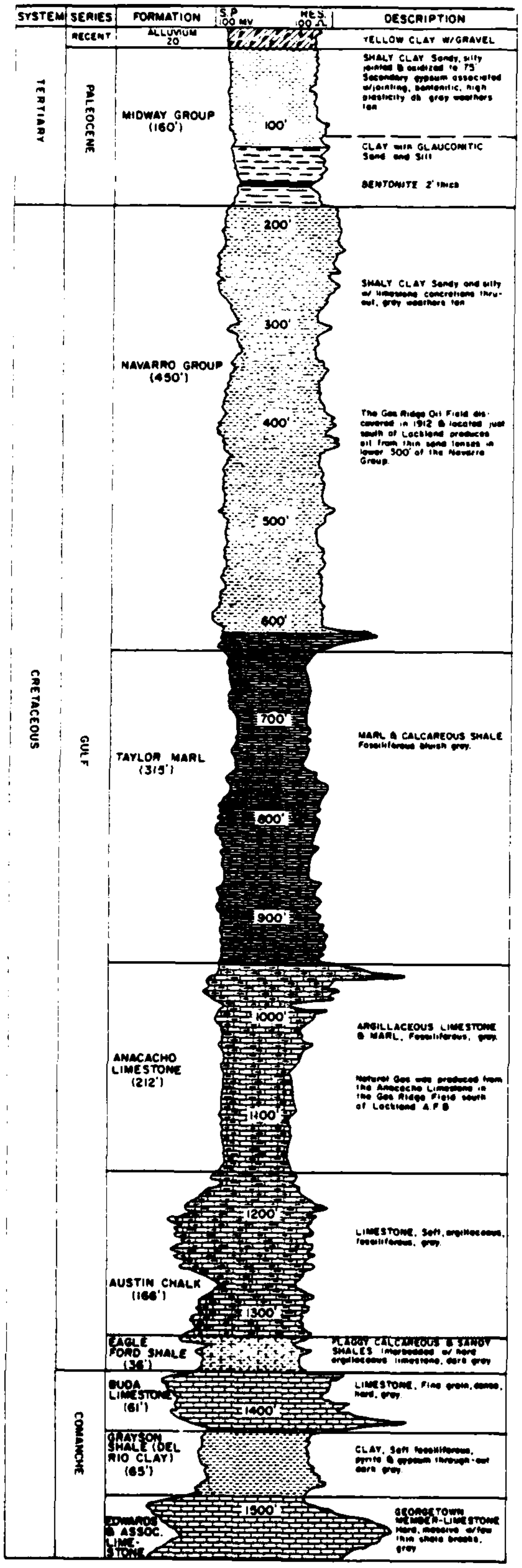


FIGURE 3.9

STUDY AREA WELL LOG

Well located at Luke Drive and Military Highway, Lackland, AFB.



SOURCE: McINTOSH & BEHM (1967)

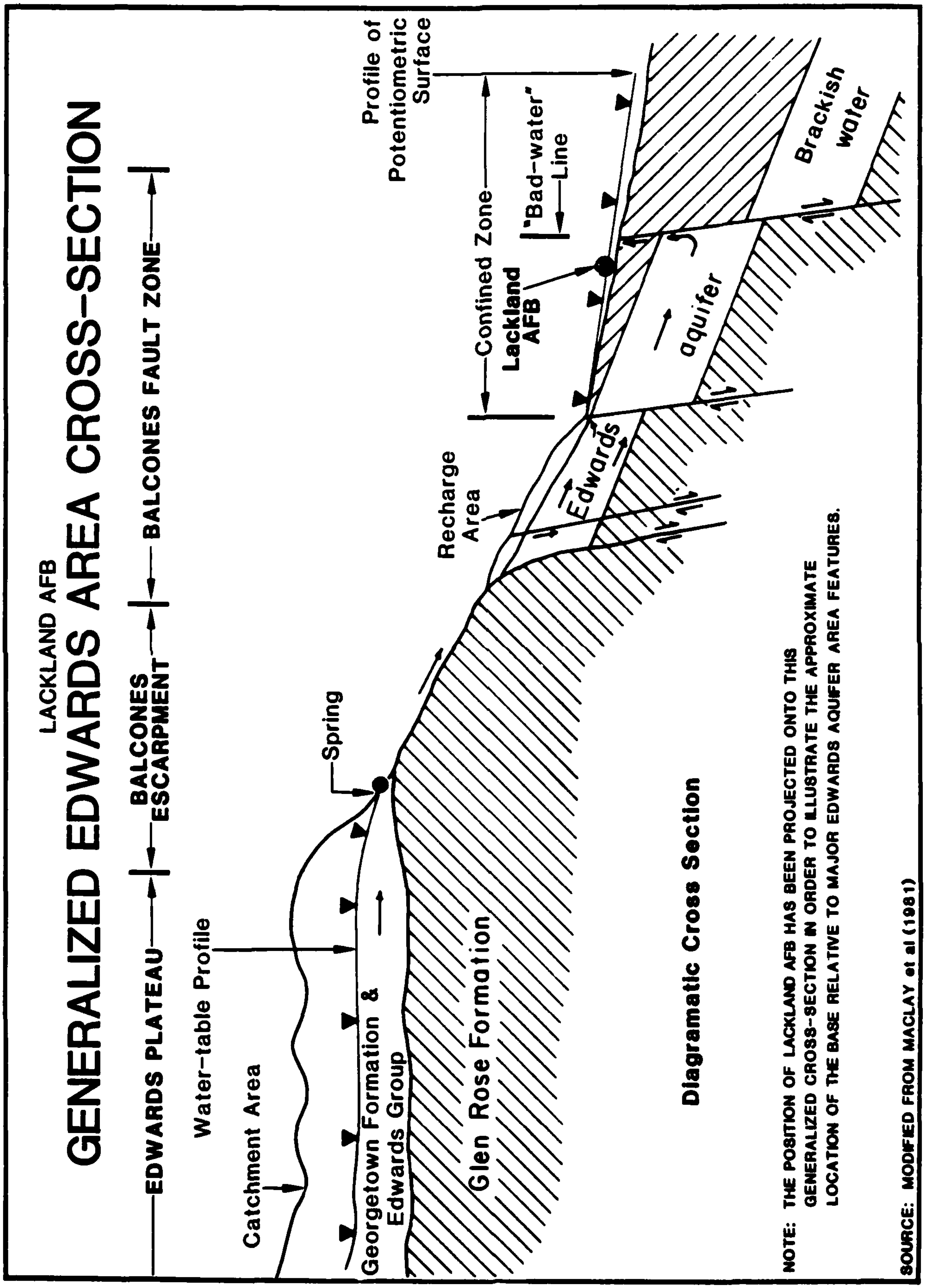

LACKLAND AFB
GENERALIZED EDWARDS AREA CROSS-SECTION
EDWARDS PLATEAU
BALCONES ESCARPMENT
BALCONES FAULT ZONE
Catchment Area
Water-table Profile
Spring
Georgetown Formation & Edwards Group
Glen Rose Formation
Recharge Area
Edwards
Confined Zone
Lackland AFB
"Bad-water" Line
aquifer
Brackish water
Profile of Potentiometric Surface
Diagramatic Cross Section
NOTE: THE POSITION OF LACKLAND AFB HAS BEEN PROJECTED ONTO THIS GENERALIZED CROSS-SECTION IN ORDER TO ILLUSTRATE THE APPROXIMATE LOCATION OF THE BASE RELATIVE TO MAJOR EDWARDS AQUIFER AREA FEATURES.
SOURCE: MODIFIED FROM MACLAY et al (1981)

FIGURE 3.11

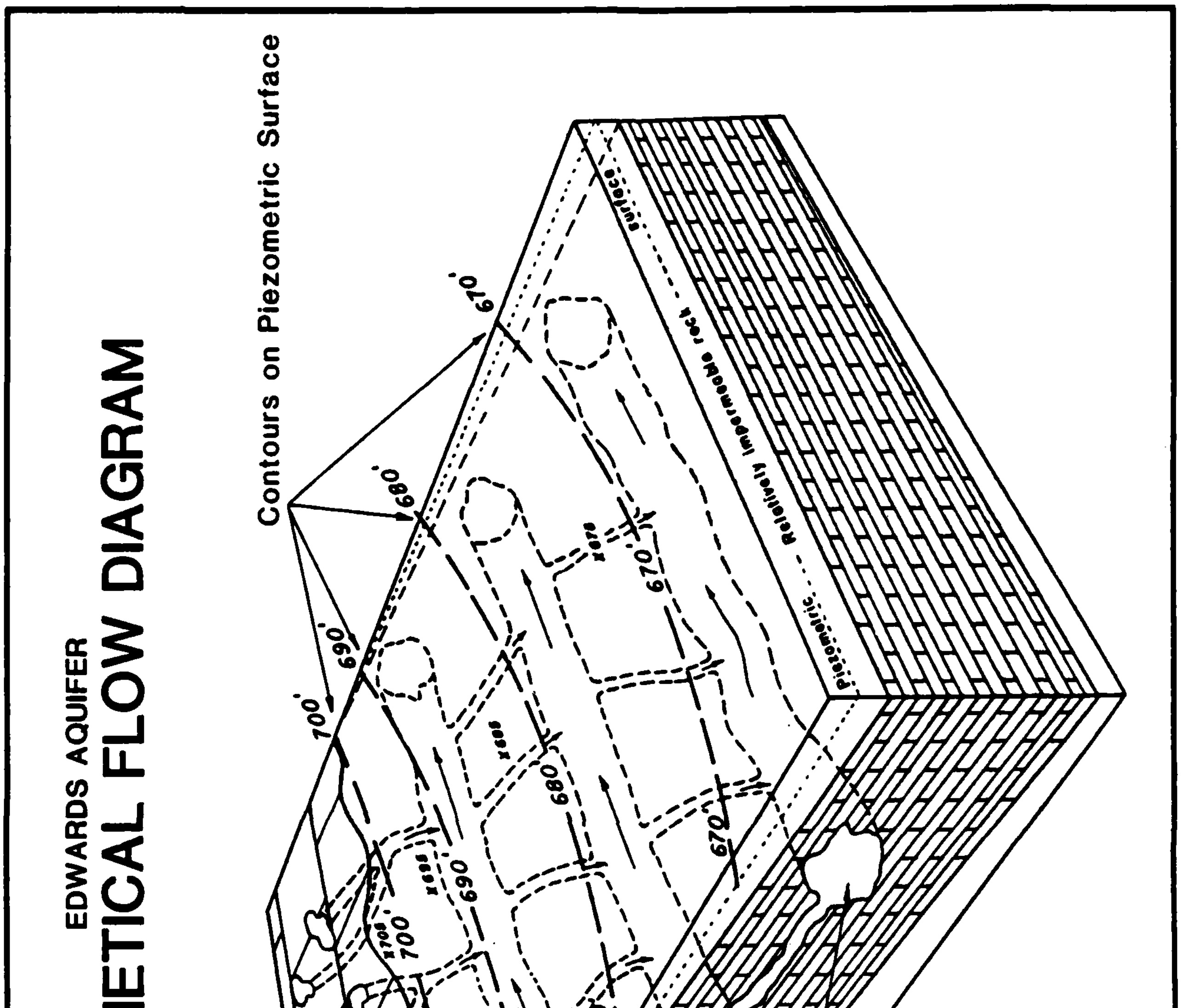
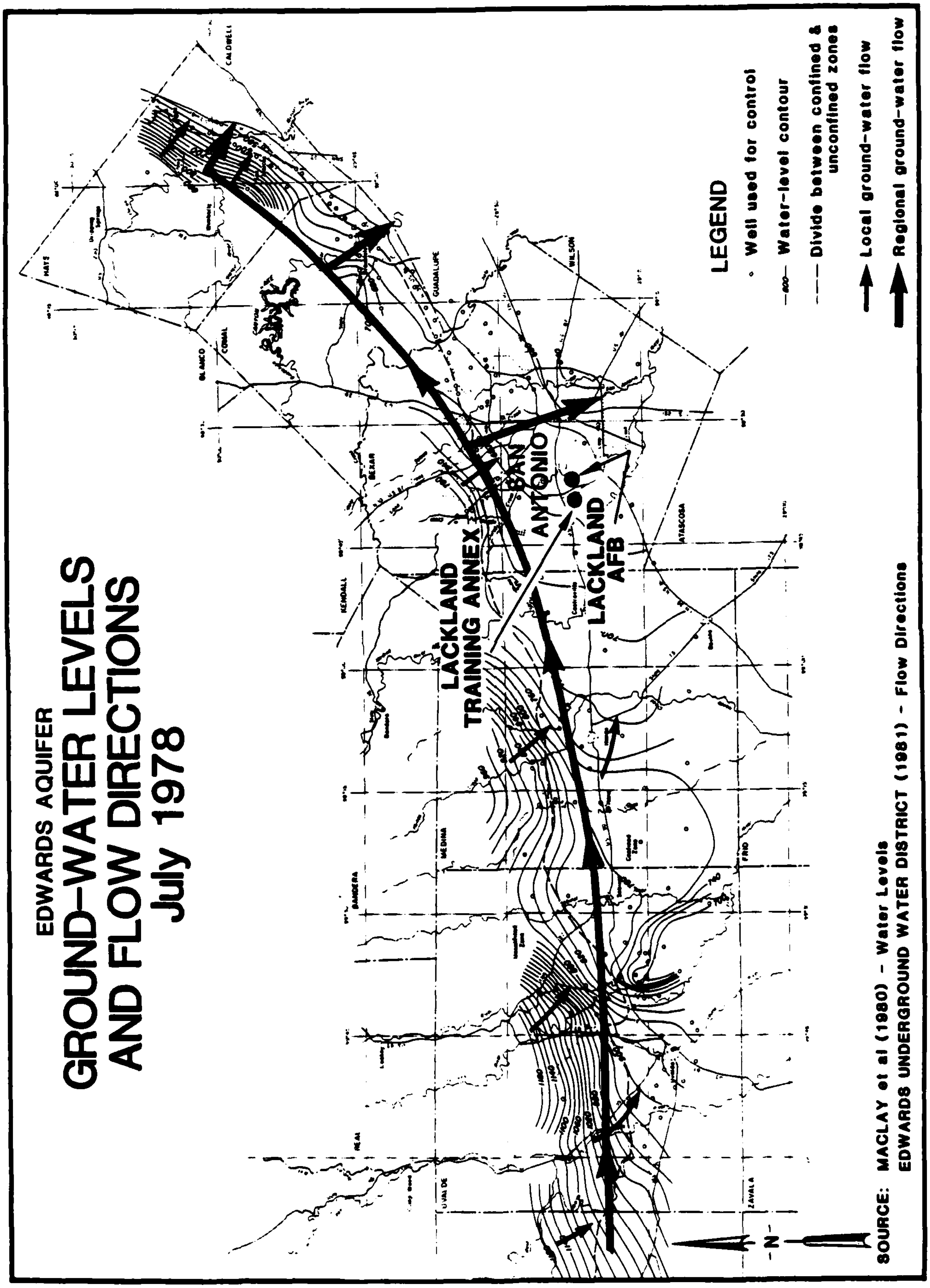

EDWARDS AQUIFER
HYPOTHETICAL FLOW DIAGRAM
Contours on Piezometric Surface
700'
690'
680'
670'
Intake area
Relatively impermeable rock
Piezometric surface
Lower Transmissibility
Higher Transmissibility
SOURCE: ARNOW, 1959

FIGURE 3.12



ES ENGINEERING-SCIENCE

The quality of ground water derived from the Edwards has been studied by Reeves (1976), Maclay, et al. (1980), Reeves, et al. (1980) and Reeves, et al. (1984). Water quality is generally considered to be acceptable in wells sampled north of the "bad water line" shown in Figure 3.8. Because of its highly prolific nature, the Edwards is easily susceptible to contamination in the recharge (outcrop) zone, but not in the reservoir zone where Lackland Air Force Base is located. In the reservoir zone the Edwards Aquifer is tightly confined and under strong artesian pressure.

At present, Lackland Air Force Base derives its water resources from five installation wells. The Training Annex has two active base wells and one abandoned well. All of the wells have been finished in the Edwards Aquifer. Medina Lake Recreation Area and the Oilton Radar site also utilize their own wells to obtain water supplies. The Hondo Airfield facility currently purchases water from the City of Hondo. The wells supplying water to the Hondo installation were originally installed by the government and later turned over to the municipality. The wells furnishing water to the Hondo Airfield are located near the installation leased property. The Castroville Airfield purchases water from the City of Castroville. Table 3.4 summarizes Lackland AFB and satellite facilities water well data. The locations of the Lackland AFB wells are shown in Figure 3.13 and the Training Annex well locations are depicted in Figure 3.14. Information recorded during the period 1934-1981 indicate that historical Edwards Aquifer water levels averaged sixty feet below land surface. A drought that has lasted some eighteen months (up to the date of this report) has caused the lowering of Edwards Aquifer water levels. As of September, 1984, Edwards water elevations averaged 625 feet, NGVD (National Geodetic Vertical Datum of 1929), about 65 feet below land surface at Lackland AFB.

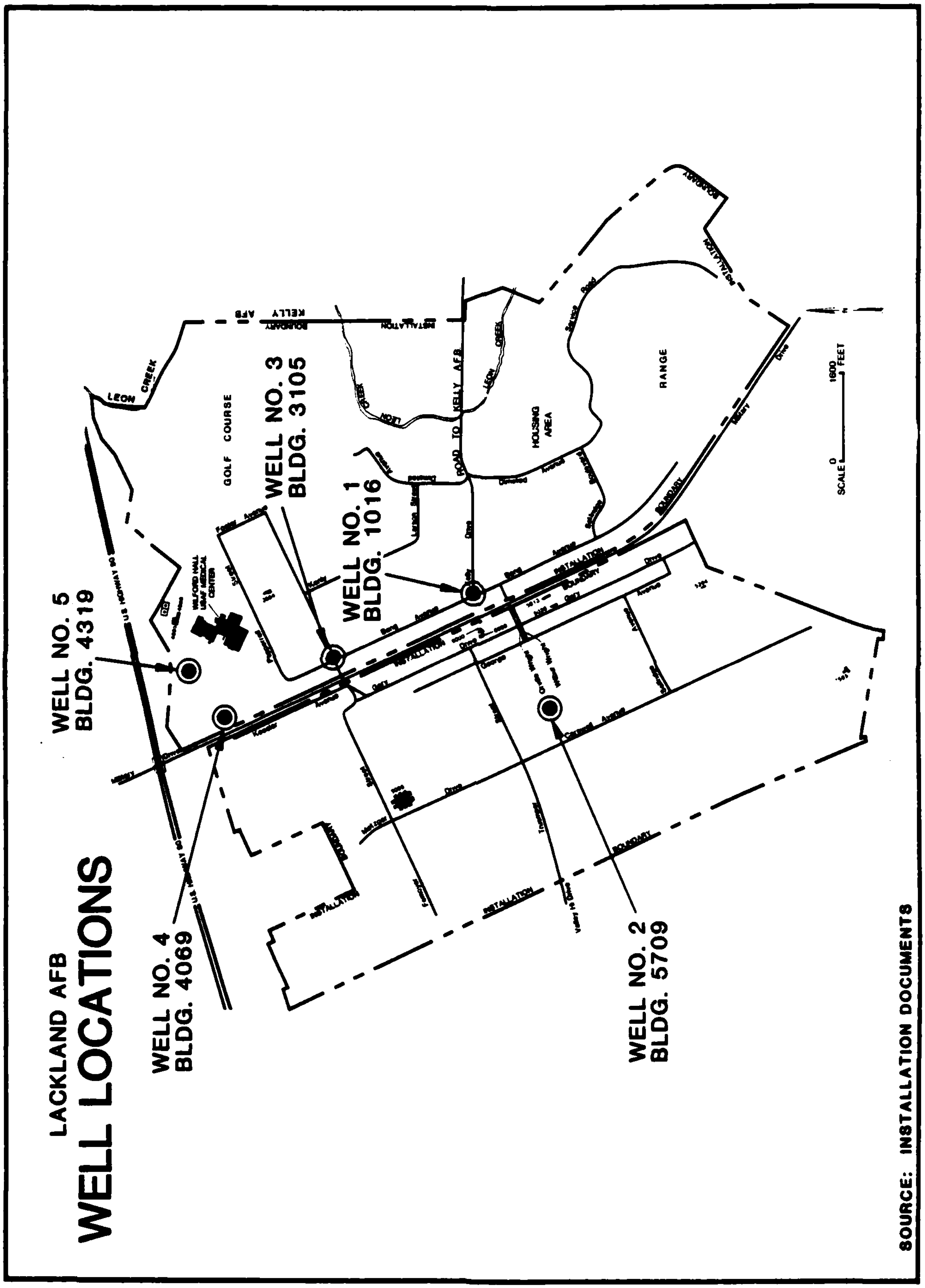
A review of installation ground-water quality sampling data indicates that water supplies are of generally good quality, with hardness being the only problem constituent. Because Lackland AFB and the Training Annex are located in the Edwards Aquifer reservoir zone where a substantial thickness of clay and marl isolate the aquifer from potential waste-related impacts at ground surface, no hazard is likely to be

TABLE 3.4
LACKLAND AFB WELL DATA

Location	Identification	Facility (Bldg. No)	Total Depth (Feet)	Pumping Capacity (gpm)	Year Drilled	Aquifer
Main Base	Well #1	1016	1,609	1,130	1942	Edwards
	Well #2	5709	1,911	750	1943	Edwards
	Well #3	3106	1,755	1,780	1951	Edwards
	Well #4	4070	1,545	1,400	1952	Edwards
	Well #5	4380	1,500	1,665	1960	Edwards
	Geothermal Well #1	--	4,000	450	1983	Hosston
Training Annex	Well #1**	--	NI	NI	NI	Edwards*
	Well #2	104	1,544	600	NI	Edwards
	Well #3	246	1,804	1,100	1977	Edwards
Hondo Airfield	Hondo #1	-	1,510	1,000	1942	Edwards
	Hondo #2	-	1,418	1,200	1942	Edwards
Medina Lake	Medina Lake #1	-	380	100	1983	Igneous Rocks*
Oilton Radar Site	Not Numbered	-	NI	50	NI	NI

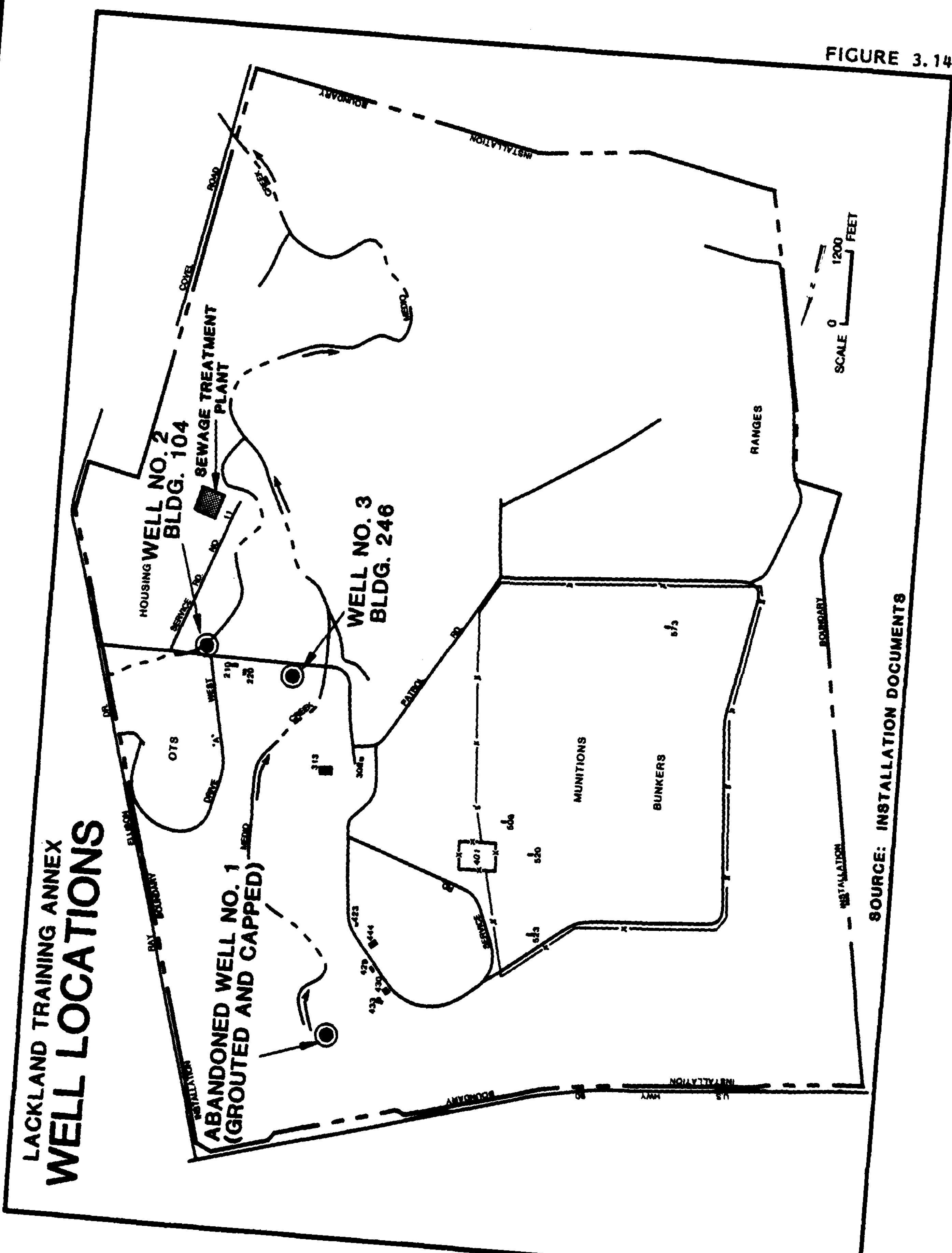
The Hondo wells were transferred to the City of Hondo, date unknown.
NI indicates no information is available.
* Assumed.
** Abandoned.
Source: Installation Documents and Holt, 1956 reprinted 1976.

FIGURE 3.13



ES ENGINEERING-SCIENCE

FIGURE 3.14



LACKLAND TRAINING ANNEX
WELL LOCATIONS
ABANDONED WELL NO. 1
(GROUTED AND CAPPED)
WELL NO. 2
BLDG. 104
WELL NO. 3
BLDG. 246
SEWAGE TREATMENT
PLANT
HOUSING
OTS
MUNITIONS
BUNKERS
RANGES
SCALE
0
1200
FEET
SOURCE: INSTALLATION DOCUMENTS

posed to the primary regional aquifer. A potential threat does exist, however, due to the corrosion of existing well casings or the improper abandonment of inactive water wells. When a well is constructed, shallow geologic units are penetrated and sealed off from the lower zones (such as the Edwards) where the well is designed to obtain water. Decomposition of the cement grout used to backfill the annular space between the casing and the borehole or corrosion of the metal casing will eventually penetrate these layers of protection and permit the interchange of flow between shallow and deep water-bearing zones. This effect may allow contaminants to enter the regional aquifer. Such a situation was documented in November, 1983 when it was determined that gasoline from a leaking underground storage tank entered the Edwards Aquifer via the corroded casing of an inactive well located about twenty miles from Lackland AFB in northeast San Antonio. The leaking well casing was subjected to television inspection which confirmed the gasoline migration (Bader, 1984). In order to avoid this problem, active wells should be inspected periodically to insure that casing integrity is being maintained and water levels should be monitored frequently. A sudden change in well water levels may indicate that the casing has been breached. Well No. 1 at Lackland TA was abandoned due to a leaky casing. The well was grouted and capped.

Shallow Aquifer Zones

Coarse-grained alluvium deposited by existing or now abandoned stream channels exists at shallow depths throughout much of the study area. The granular alluvium typically begins at depths in the range of two to ten feet below present land surface and varies in thickness, averaging five feet. Ground water contained in the alluvium may be present at depths below ground surface in the range of five to fifteen feet, and is usually absent below 25 feet. This condition has been interpreted by McIntosh and Behm (1967) to indicate that a perched water table exists in the general study area. The perched water table system is probably recharged directly by precipitation and/or where the granular materials are intersected by the courses of surface streams. Flow directions, persistence and lateral limits of this perched system are uncertain. It is suggested that shallow aquifer zones adjacent to local streams are recharged during high flow periods and discharge to the streams during dry periods, providing base flow to the nearby surface waters.

A ground-water quality monitoring program conducted at the Kelly AFB sludge lagoon adjacent to Leon Creek, apparently encountered a shallow aquifer at depths below present ground surface ranging from 13.25 feet to 14.16 feet, as measured in four of seven monitoring wells. Presumably, coarse-grained alluvium deposited along the breadth of Leon Creek's floodway is the water-bearing stratum, and is, therefore, probably in periodic communication with base surface waters.

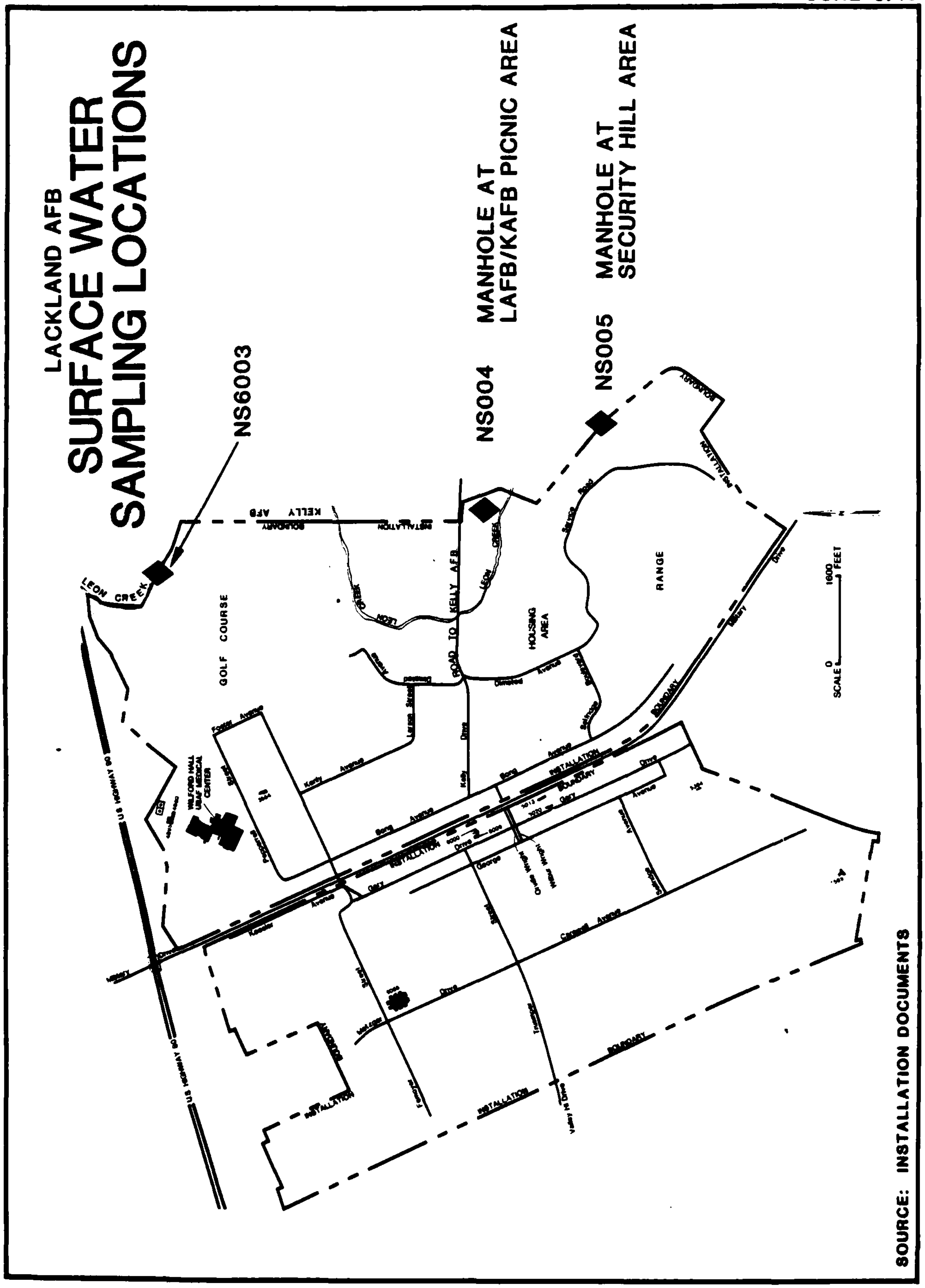
Surface Water Quality

The Texas Department of Water Resources has regulatory responsibility for the maintenance of water quality in the San Antonio area. The applicable Surface Water Quality Standards for general surface waters and Leon Creek are contained in Appendix D. Leon Creek and Medio Creek within Lackland AFB and Lackland TA are classified for contact recreation, non-contact recreation, propagation of fish and wildlife, and domestic raw water supply by the Texas Department of Water Resources.

Lackland AFB conducts routine surface water monitoring activities at locations where Leon and Medio Creeks cross the installations. The three surface water monitoring locations are shown in Figure 3.15 for Lackland AFB. Figure 3.16 depicts Lackland Training Annex sampling locations where Medio Creek is routinely sampled at two points. A review of surface water quality data indicates that water quality is generally acceptable with the notable exception of Leon Creek. Several surface water and sediment monitoring studies have been conducted on Leon Creek at Lackland and Kelly Air Force Bases by the Texas Water Quality Board (now Texas Department of Water Resources). These studies have utilized the monitoring points illustrated in Figure 3.17. The materials found in Leon Creek water and sediment samples from these special studies appear to be related to Kelly AFB industrial activities and are not associated with the Lackland AFB training mission.

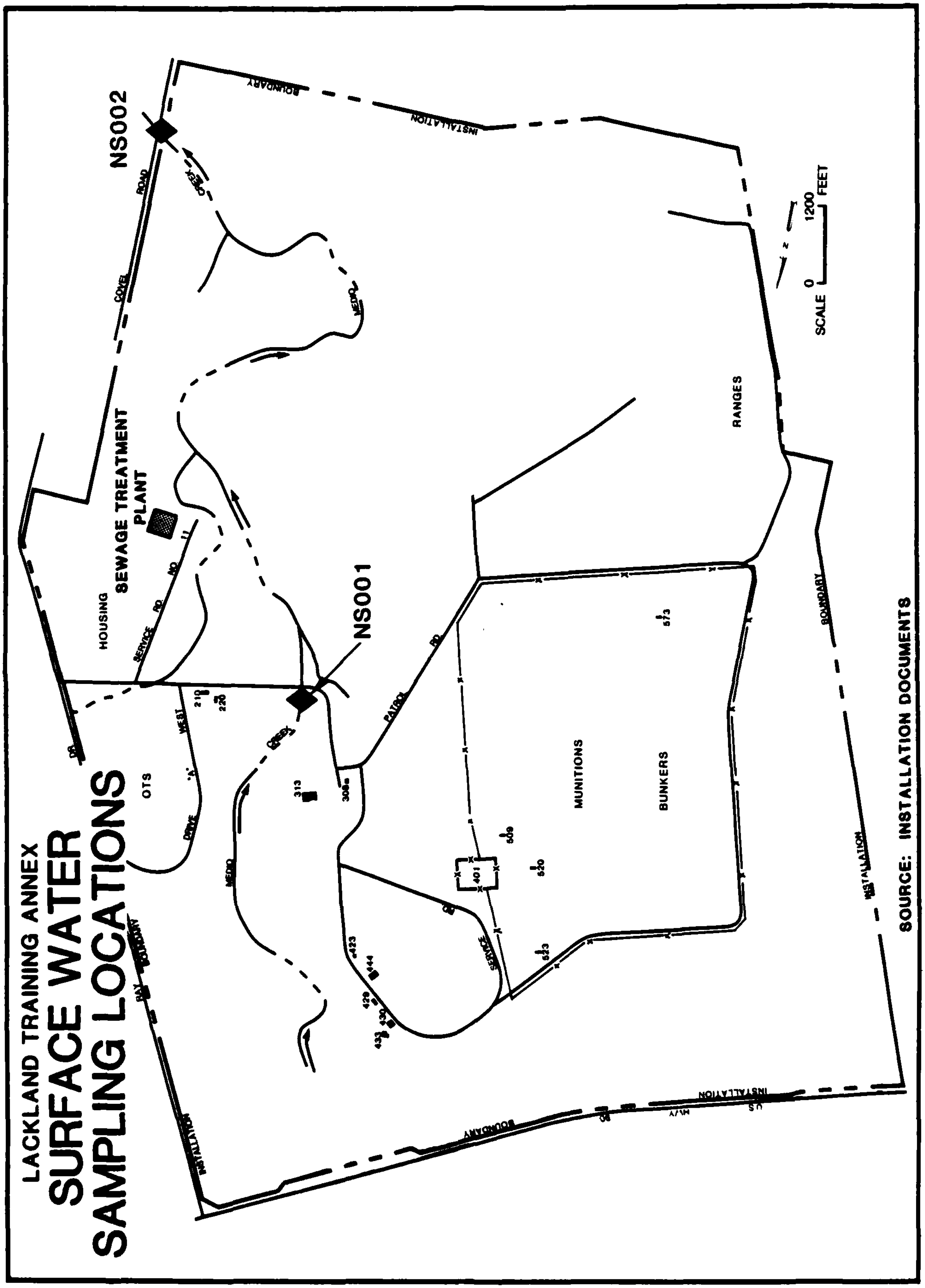
The state monitoring studies which were conducted in July 1974, March 12, 1976, November 15-18, 1976, May 10-11, 1979 and January 21, 1980 confirmed the presence of DDT and its degradation products, DDD and DDE, as well as PCB's, in Leon Creek sediment samples. The presence of

FIGURE 3.15



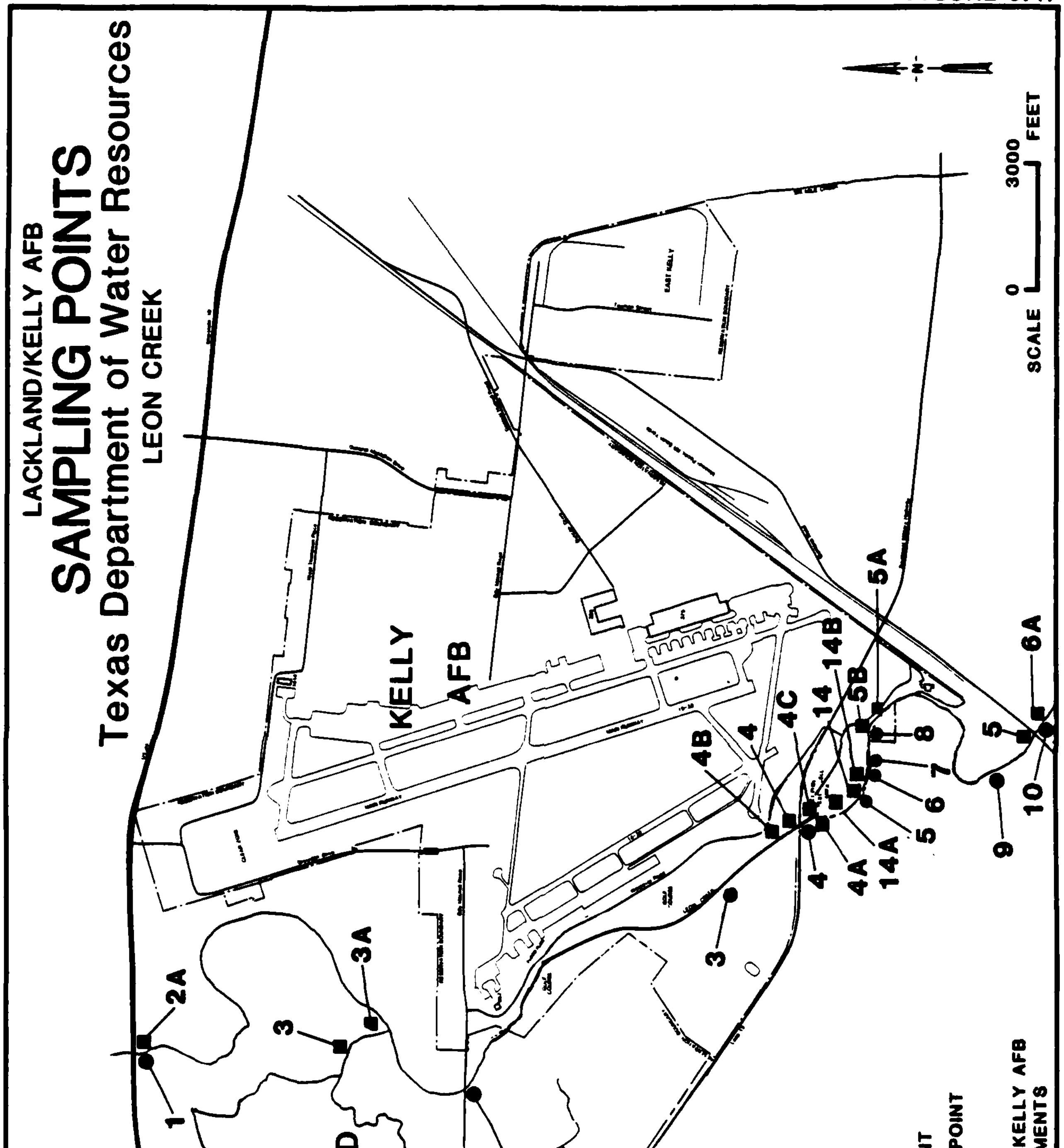
SOURCE: INSTALLATION DOCUMENTS

FIGURE 3.16



ES ENGINEERING-SCIENCE

FIGURE 3.17



LACKLAND/KELLY AFB
SAMPLING POINTS
Texas Department of Water Resources
LEON CREEK
KELLY AFB
LACKLAND AFB
1
2
2A
3
3A
4
4A
4B
4C
5
5A
5B
6
6A
7
8
9
10
14
14A
14B
N
SCALE
0
3000
FEET
LEGEND
■ TDWR SAMPLING POINT
● SEDIMENT SAMPLING POINT
SOURCE: LACKLAND AFB AND KELLY AFB INSTALLATION DOCUMENTS

diethylhe /l phthalate was found in sediment samples taken from Station 14 (discharge point 001). However, this compound was detected at only one sample point. In addition, heavy metal concentrations were noted at various sediment sampling locations along Kelly AFB, particularly at Station 14. Sediment pesticide analyses for sampling stations at Kelly AFB on May 10, 1979, are illustrated in Appendix D (Table D.3). Sediment heavy metals analyses at the same stations are illustrated in Appendix D (Table D.3).

In addition to Lackland and Kelly Air Force Bases, several other facilities may impact the quality of local surface waters, especially Leon Creek. A municipal wastewater treatment plant discharges to Leon Creek north (upstream) of Lackland AFB. Two municipal landfills are located adjacent to Lackland AFB. One landfill is situated north of the installation and is adjacent to Leon Creek. The second landfill is located south of Lackland Training Annex, also near Leon Creek.

THREATENED OR ENDANGERED SPECIES

No threatened or endangered species of plants or animals are known to exist on Lackland Air Force Base or on any of its satellite facilities.

ENVIRONMENTAL SUMMARY

Geographic, geologic and hydrologic data evaluated for this study indicate the following:

- The sole source aquifer, the Edwards, underlies Lackland AFB and Lackland Training Annex at depths of 1,000 feet or deeper.
- Lackland AFB and its Training Annex lie within the reservoir area and not the recharge zone of the Edwards Aquifer.
- The Edwards Aquifer functions under artesian conditions and is sealed from the ground surface by substantial sequences of clay, marl and sandstone.
- A shallow water table (unconfined) aquifer has been shown to exist on base and is probably in communication with base and annex surface waters (Medio Creek, Leon Creek). The full extent of this aquifer is unknown.

- Leon Creek traverses Lackland AFB and Medio Creek passes through Lackland TA in a north to south direction.
- Base surficial soils are predominantly silts or clays that exhibit low permeabilities. More permeable, coarser-grained soils are present at ground surface in zones proximate to Medio and Leon Creeks.
- Annual net precipitation for the area is minus 30 inches. This condition reduces the amount of leachate generation resulting from precipitation at landfills located on Lackland AFB and Lackland Training Annex.
- No wetlands exist at Lackland AFB or at any satellite facilities.
- Natural populations of either threatened or endangered plants or animals do not exist on the base or its satellite facilities.
- A municipal wastewater treatment plant discharges to Leon Creek north of Lackland AFB.
- Two city landfills are located adjacent to Lackland AFB. One landfill is located north of the base and adjacent to Leon Creek. The second landfill is located just south of Lackland Training Annex near Leon Creek.
- The Leon Creek sediment analyses have shown heavy metal, pesticide and herbicide contamination associated with nearby Kelly AFB. These impacts are probably not connected to Lackland AFB or its training mission.

A potential does exist for the generation and migration of waste contaminants into and through the shallow aquifer zone. Wastes disposed in areas adjacent to Leon Creek or Medio Creek have been placed in the unsaturated portion of this aquifer. The aquifer is present at shallow depths and is recharged directly by precipitation and/or by communication with the streams. Waste migration would reasonably be expected to move through the shallow aquifer and enter Medio or Leon Creeks as part of the base flow during dry periods.

From these major points it may be concluded that the potential for the generation and subsequent migration of contaminants originating from past waste disposal sites to the deep (Edwards) aquifer is not likely unless migrating wastes encounter an improperly abandoned well and follow deteriorating casing materials downward into the potable water zone. The actual movement of contaminants into an artesian aquifer would be governed by the hydrochemical properties of the individual material.

SECTION 4

FINDINGS

This section summarizes hazardous waste generated by installation activities, identifies disposal sites located on base, and evaluates the potential for environmental contamination. Past waste generation and disposal methods were reviewed to assess hazardous waste management at Lackland Air force Base and associated facilities.

SATELLITE ANNEXES REVIEW

Lackland Training Annex is a major part of the Lackland AFB mission. Waste generation and disposal activities at this annex are discussed later in this section with the base.

The Hondo Annex lease includes a combination hangar/classroom/administrative building, parking lot, apron parking area for 75 airplanes, and use of runways and access roads. This facility is operated by the OTS for flight screening. T-41 aircraft are used at Hondo. All major maintenance and painting of aircraft are done off-site by contract. Touch-up painting is done at Hondo as is minor aircraft maintenance such as motor oil changes and small parts cleaning. The annual liquid waste quantities generated presently are approximately 520 gallons of oil and 430 gallons of solvent. All waste oils and solvent (Varsol) are stored on site for subsequent hauling off of the installation site by contract. Minor quantities of paint and thinner are either poured down the sanitary sewer drains or placed in dumpsters. All solid wastes including oily rags, paint residuals in rags and cans, etc. are placed in dumpsters and landfilled off-site.

The Hondo Airfield Annex is supplied water by the City of Hondo; similarly all wastewater is discharged to the city sanitary sewer system. Two oil-water separators are provided for aircraft washracks. The waste-water is discharged to the sanitary sewer system and the oil is hauled off of the installation by a contractor.

Three above-ground tanks exist at Hondo for diesel fuel, Mogas and solvent. One mobile Avgas tank trailer is also used. There are no known leaks or spills from these facilities.

In summary, the leased Hondo Annex has waste generation activities but wastes have historically been hauled or transported for disposal off of the installation.

The USAF has had only indirect involvement with wastes generated by Gary Aircraft Corporation (also a tenant at Hondo Airfield). At one time Gary Aircraft Corporation was under contract to strip and paint USAF T-38 Aircraft. Hazardous paint stripper and cleaning residues were stored in drums. Deterioration of drums prior to disposal caused leakage of wastes onto Gary Aircraft ground and subsequent enforcement action by State officials. The USAF was involved in the general agreement on disposal of those wastes.

The Castroville Airfield Annex has been leased for emergency landings only. It has primarily been designed for use by aircraft from Randolph AFB, however, the number of times Castroville has been used is reported to be minimal. No facilities are provided for the Air Force; only the runways and a small plot of land to roll a plane onto in case of an emergency are the present uses of this site. This facility has had no history of waste generation or disposal.

Medina Lake Recreation Area has been leased for only a few years. Facilities include a main pavilion, two dwellings, picnic shelters, and a marina. Water is supplied by a well. Wastes are removed from the site by a contractor. Two above ground fuel tanks exist for gasoline and gas/oil mixture. No spills, leaks, or waste disposal have occurred on the site.

The Oilton facility is a radar site used by TAC. Facilities include two antennas, a well, septic tank and tile field, below ground diesel fuel tank and buildings shared with the FAA. All solid and other wastes are hauled off the site by contract. There are no reported spills, leaks or waste disposal on the installation.

BASE HAZARDOUS WASTE ACTIVITY REVIEW

A review was made of past and present main base and training annex activities that resulted in the generation and disposal of hazardous wastes. Information to support this review was obtained from files, records, facility inspections and interviews with past and present base employees.

It is noted that file data and interviews did not enable determination of waste handling activities prior to about 1945 at Lackland AFB. From the historical descriptions of training activities at Lackland AFB prior to 1945, it is believed that the generation of hazardous materials was small. In addition, many of the currently known hazardous chemicals were developed during and after World War II. At the Lackland Training Annex, Air Force operations did not begin until 1966 and waste handling activities are traced back to that time. Prior to USAF operations at this site, AEC operated a weapons maintenance and storage facility.

Hazardous waste sources at Lackland AFB and the Lackland Training Annex are grouped into the following:

- Industrial Operations (Shops)
- Waste Accumulation and Storage Areas
- Fuels Management
- Spills and Leaks
- Pesticide Utilization
- Fire Protection Training

The following discussion addresses only those wastes generated (or stored) on Lackland AFB or Lackland Training Annex which are either hazardous or potentially hazardous. In this discussion a hazardous substance is defined by the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA). Waste oils and liquid fuels are also included as a hazardous substance because they are of concern to Air Force operations. A potentially hazardous waste is one which is suspected of being hazardous, although insufficient data are available to fully characterize the material.

Industrial Operations (Shops)

The industrial operations at Lackland AFB and Lackland Training Annex can be divided into five main operating units as follows:

- 3700th Air Base Group
- DOD Dog Center
- Resource Management
- Wilford Hall Medical Center
- Lackland Training Annex (Medina)

Various branches and offices exist within each operating unit, many of which use hazardous materials and/or generate hazardous wastes. A review was made of the Bioenvironmental Engineering Services (BES) shop files to identify those shops which handle hazardous wastes. The results of this file review are presented in Appendix E - Master List of Shops.

For those shops that were identified as handling hazardous material or generating hazardous waste, personnel were interviewed to obtain required information. The information obtained from base interviews, base records and facilities inspection were used to establish a time line of disposal methods for major wastes generated at each shop. The information presented in Table 4.1 shows shop and building number, shop wastes or materials used, current quantities of wastes or materials used, and disposal methods.

Most wastes are generated by support functions (vehicle maintenance, weapons maintenance, etc.) and disposal is generally managed through the Defense Property Disposal Office (DPDO). The sanitary sewer is used to dispose of a number of minor waste liquid streams. In two instances, disposal of liquids by leaching of wastes onto ground was reported. Two burn areas have existed for disposing of waste explosives. Solid wastes and mixtures of solid and liquid wastes were disposed of at on-site and off-site landfills.

<u>Waste Accumulation and Storage Areas</u>

There are nine major waste accumulation and storage areas currently operating at Lackland AFB and Training Annex, as indicated in Figures 4.1 and 4.2, respectively. All storage points are above ground except two underground waste oil storage tanks by the auto hobby shop (No. 4).

The waste storage area at Building 433 (Site No. 7) is a secure central accumulation point for temporary storage of hazardous wastes. This site is located at the Lackland Training Annex and is used to store

TABLE 4.1
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE/MATERIAL	CURRENT QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
3700TH AIR BASE GROUP (ABG) CIVIL ENGINEERING DIVISION/SARPMA				
LAWNMOWER REPAIR	6011	MOTOR OIL	2000 GALS./YR.	DPDO
		PD-680 (STODDARD SOLVENT)	520 GALS./YR.	DPDO
		SULFURIC ACID	36 GALS./YR.	NEUTRALIZATION AND SANITARY SEWER
PAINT SHOP	6026	THINNER AND RESIDUE	200 GALS./YR.	SANITARY SEWER, DPDO
MORALE, WELFARE AND RECREATION DIVISION				
AUTO HOBBY	7245	WASTE OIL, GREASES, GEAR OILS	2225 GALS./YR.	UNDERGROUND TANK/DPDO
PHOTO HOBBY	7041	PHOTO DEVELOPERS AND FIXER	75 GALS./YR.	SILVER RECOVERY & WASTE LIQUIDS TO SANITARY SEWER

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

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

TABLE 4.1 (Cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE/MATERIAL	CURRENT QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
ADMINISTRATIVE DIVISION				
BASE REPRODUCTION	3295	PERCHLORETHYLENE	72 GALS./YR.	SANITARY SEWER → DPDO
		ELECTROSTATIC SOLUTION (FERROCYANIDE)	240 GALS./YR.	SANITARY SEWER → DPDO
		PETROLEUM DISPERSANT	36 GALS./YR.	SANITARY SEWER → DPDO
		TONER	24 GALS./YR.	SANITARY SEWER → DPDO
SERVICES DIVISION				
BILLETING VEHICLE MAINTENANCE	4902	PD-680 (STODDARD SOLVENT)	144 GALS./YR.	SANITARY SEWER
		WASTE OIL	200 GALS./YR.	DISCHARGE TO GROUND/ SANITARY SEWER
		ANTIFREEZE	300 GALS./YR.	SANITARY SEWER
DOD DOG CENTER				
MILITARY DOG VET SERVICES	7595	FORMALDEHYDE	4 GALS./YR.	SANITARY SEWER
		X-RAY FIXER AND DEVELOPER	200 GALS./YR.	SANITARY SEWER/DPDO
		DERMATON (OR EQUIVALENT FLEA AND TICK REMOVER)	2000 GALS./YR.	PIPE DISCHARGE TO GROUND

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

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

TABLE 4.1 (Cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE/MATERIAL	CURRENT QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
RESOURCE MANAGEMENT/ TRANSPORTATION DIVISION				
MINOR/HEAVY EQUIPMENT REPAIR	5015	PD-680 (STODDARD SOLVENT)	55 GALS./YR.	SANITARY SEWER → DPDO
		WASTE OILS	1000 GALS./YR.	DPDO
		SULFURIC ACID	600 GALS./YR.	NEUTRALIZATION AND SANITARY SEWER
		HYDRAULIC FLUID	300 GALS./YR.	SANITARY SEWER → DPDO
PAINT AND BODY	5015/5007	THINNER, RESIDUAL PAINT, RAGS, ETC.	50 GALS./YR.	EVAPORATION/LANDFILL → OFF-BASE LANDFILL
VEHICLE MAINTENANCE	5020	HYDRAULIC FLUID	120 GALS./YR.	SANITARY SEWER → DPDO
		GREASE (BEARING)	300 LBS./YR.	LANDFILL → OFF-BASE LANDFILL
		PD-680 (STODDARD SOLVENT)	480 GALS./YR.	SANITARY SEWER → DPDO
		TRANSMISSION FLUID	150 GALS./YR.	SANITARY SEWER → DPDO
		BRAKE FLUID	300 GALS./YR.	SANITARY SEWER → DPDO
		WASTE OILS	1200 GALS./YR.	OIL/WATER SEPARATOR/DPDO
TRAINING SERVICES - PAINT	6408	WASTE THINNER AND PAINT RESIDUE	240 GALS./YR.	DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

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

TABLE 4.1 (Cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE/MATERIAL	CURRENT QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
WILFORD HALL MEDICAL CENTER				
INCINERATOR	NEAR 3558	ASHES FROM INCINERATION OF BIOLOGICAL CONTAMINANTS, TISSUES, SOLVENTS, ETC.	430 CU. FT./YR.	LANDFILL (estimated from ~1950, confirmed from ~1965 →)
TOTAL ENERGY PLANT	4880	BOILER FEEDWATER TREATMENT	660 GALS./YR.	SANITARY SEWER (confirmed, from ~1980 →)
		ALGAE AND SLIME CONTROL	2000 GALS./YR.	SANITARY SEWER (confirmed, from ~1980 →)
		COOLING WATER AND COOLING TOWER TREATMENT	12000 GALS./YR.	SANITARY SEWER (confirmed, from ~1980 →)
		WASTE OIL - BULK	45000 GALS./YR.	DPDO (confirmed, from ~1980 →)
		WASTE OIL - SMALL JOBS	NOT AVAILABLE	OIL/WATER SEPARATOR/SANITARY SEWER (confirmed, from ~1980 →)
		MISCELLANEOUS FLUIDS-WASH DOWN	NOT AVAILABLE	OIL/WATER SEPARATOR/SANITARY SEWER (confirmed, from ~1980 →)
LABORATORIES	WHMC	XYLENE	390 GALS./YR.	SANITARY SEWER (estimated, ~1960 to ~1975); DPDO (confirmed, ~1975 →)
		MISCELLANEOUS SOLVENTS, STAINS AND PRESERVATIVES	NOT AVAILABLE	SANITARY SEWER (estimated, ~1960 →)
		TOLUENE	55 GALS./YR.	DPDO (estimated from ~1960, confirmed ~1980 to ~1982)
		PHOTO FIXERS AND REPLENISHERS	8000 GALS./YR.	SILVER RECOVERY & WASTE LIQUIDS TO SANITARY SEWER (estimated, ~1960 →)

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

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

TABLE 4.1 (Cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE/MATERIAL	CURRENT QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
LABORATORIES (CONT'D)	WHMC	LOW-LEVEL RADIOACTIVE WASTES (CONTAMINATED PAPER PRODUCTS AND TEST TUBES)	6-55 GAL. BARRELS/YR.	CONTRACT DISPOSAL TO OFF-BASE LANDFILL; DECAY/BLDG. 433 THEN LANDFILL; DECAY/BLDG. 340, 341 THEN LANDFILL
McKOWN DENTAL LAB	4602	AMALGAMATED MERCURY	24 LBS./YR.	DPDO
LACKLAND TRAINING ANNEX				
3280th TECHNICAL TRAINING GROUP/ MILITARY WORKING DOGS	466	DERMATON FLEA AND TICK	2000 GALS./YR.	DISCHARGE ON GROUND
DET. 40 MUNITIONS STORAGE AND MAINTENANCE	444, 427	AEROSOL PAINT CANS	1000(12OZ) CANS/YR.	LANDFILL
		THINNER	36 GALS./YR.	LANDFILL
WEAPONS MAINTENANCE	431	BLUING SALTS	160 LBS./YR.	LANDFILL; DPDO
		RIFLE BORE CLEANER	5 GALS/YR.	SANITARY SEWER
		DRY CLEANING SOLVENT	110 GALS./YR.	SANITARY SEWER; DPDO
		WASTE PAINT, THINNERS AND LACQUER RESIDUALS	180 CANS/YR.	LANDFILL
VEHICLE MAINTENANCE	220	WASTE OIL	360 GALS./YR.	DPDO
		HYDRAULIC FLUID	60 GALS./YR.	DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

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

TABLE 4.1 (Cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE/MATERIAL	CURRENT QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950–1980)
VEHICLE MAINTENANCE	210	PAINT THINNER AND RESIDUE	55 GALS./YR.	DPDO (confirmed, c. 1970 → present)
		DEGREASER	1000 GALS./YR.	OIL/WATER SEPARATOR/ SANITARY SEWER (confirmed, c. 1970 → present)
		WASTE OIL	1000 GALS./YR.	DPDO (confirmed, c. 1970 → present)
OTS DENTAL CLINIC	114	PHOTO FIXER AND DEVELOPER	60 GALS./YR.	MEDICAL SUPPLY (estimated, c. 1970 → present)
6948th FSS MOBILITY	230	WASTE OILS	2400 GALS./YR.	DPDO (estimated, c. 1970 → present)
FIRING RANGE	919	RIFLE BORE CLEANER	200 GALS./YR.	DPDO (confirmed, c. 1970 → present)
		PD-680 (STODDARD SOLVENT)	60 GALS./YR.	DPDO (confirmed, c. 1970 → present)

KEY

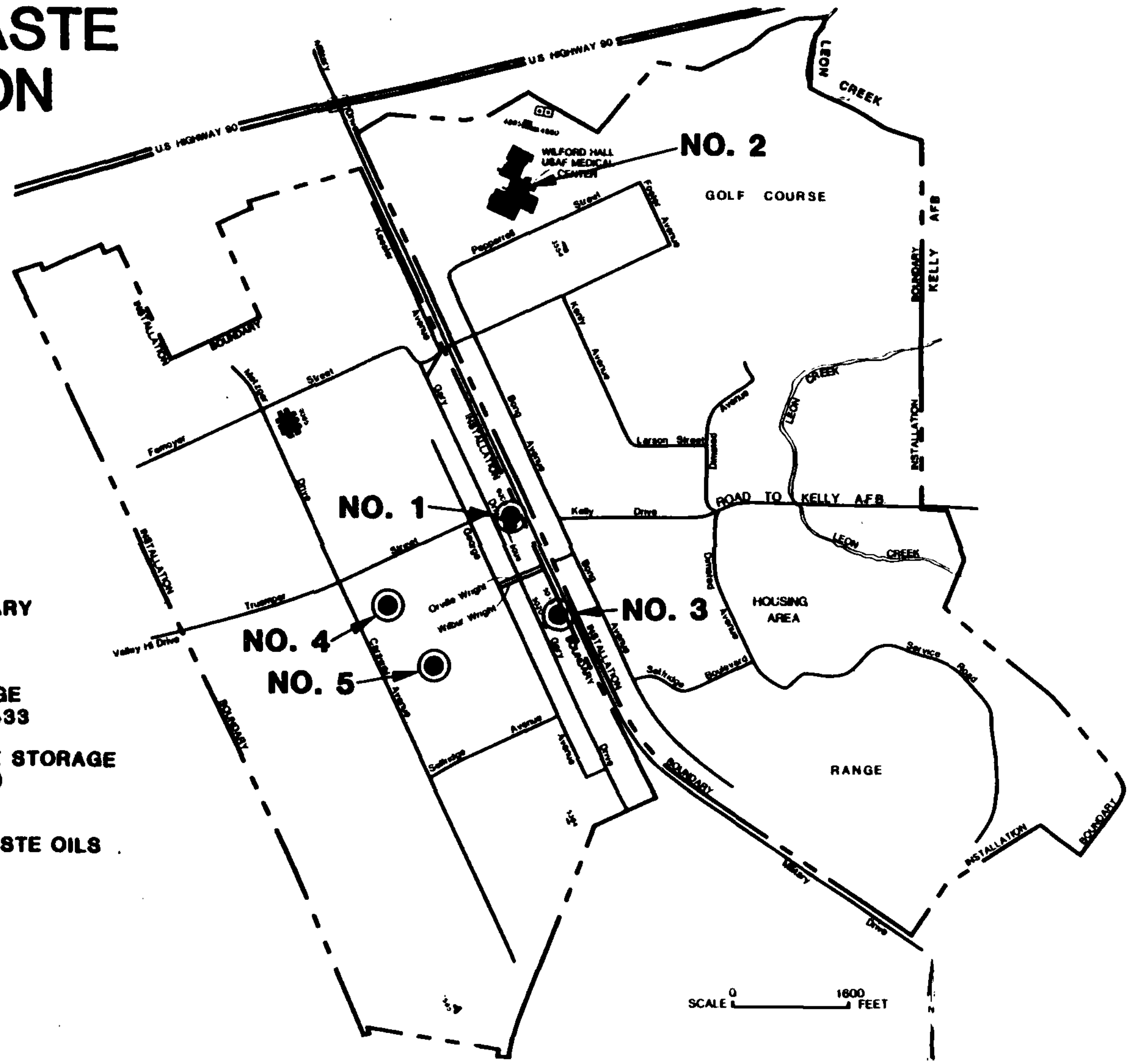
——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

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

FIGURE 4.1

LACKLAND AFB

HAZARDOUS WASTE ACCUMULATION POINTS



LEGEND

NO. 1 – CIVIL ENGINEERING YARD, TEMPORARY STORAGE OF BATTERIES, DRUMMED FLUIDS, AND TRANSFORMERS

NO. 2 – WILFORD HALL, TEMPORARY STORAGE PREVIOUS TO TRANSFER TO BLDG. 433

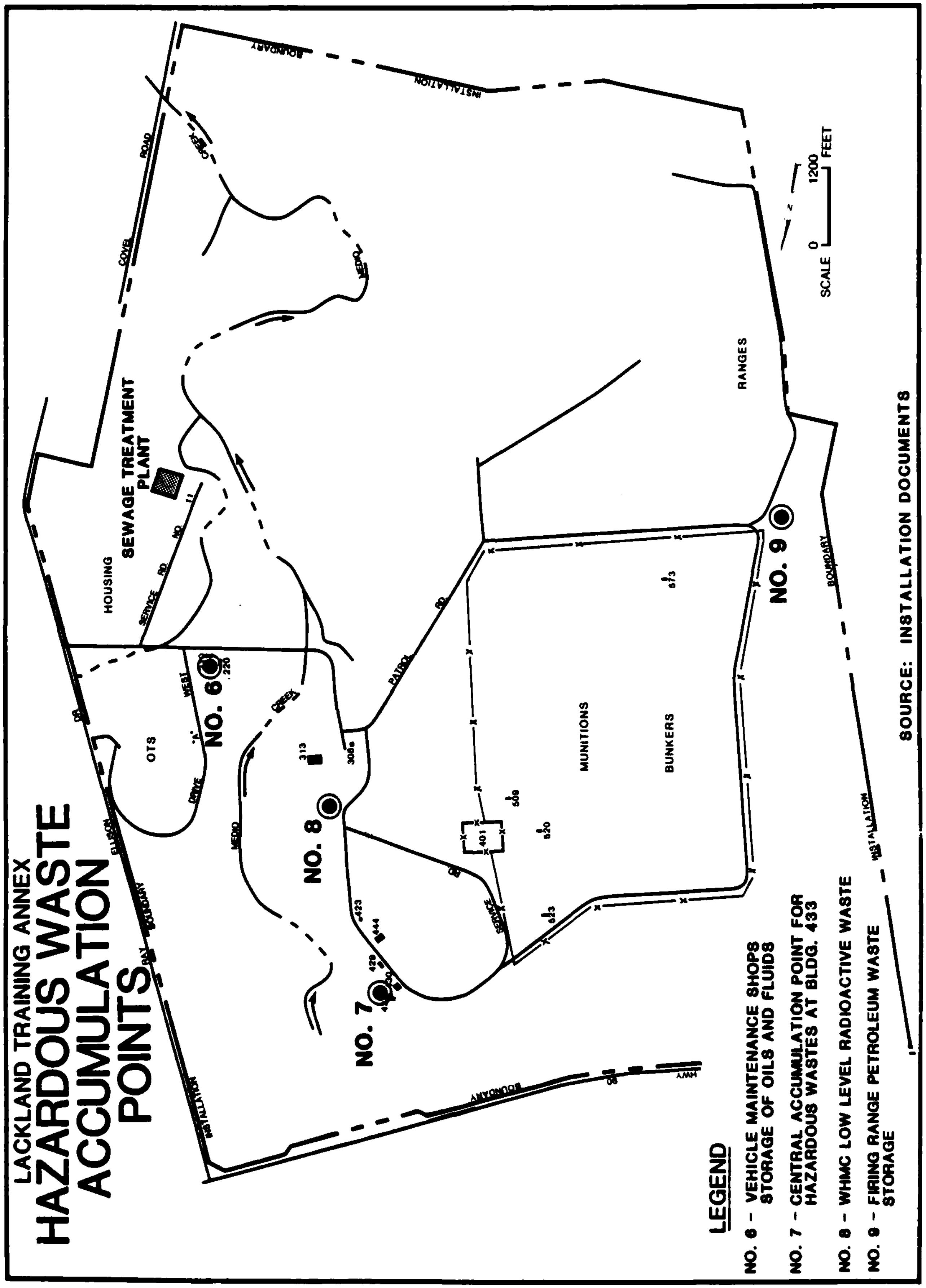
NO. 3 – TEMPORARY VEHICLE MAINTENANCE STORAGE OF DRUMMED WASTE (OILS, FLUIDS) AND BATTERIES

NO. 4 – UNDERGROUND STORAGE TANK, WASTE OILS

NO. 5 – DRUM STORAGE AREA

SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.2



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hazardous wastes including known PCB transformers, solvents and thinners (toluene, xylene, petroleum naptha, perchlorethylene) before DPDO pick-up. Battery cases are stored at sites No. 1 and No. 3 before DPDO pickup. Waste oils are generally stored and picked up at these and other accumulation points on base.

Currently low-level radiological wastes generated by hospital activities are stored at Buildings 341 and 340, an old AEC radioactive secure facility (Site No. 8). The low-level radioactive wastes have short half-lives (less than 65 days). They are allowed to decay in this facility for ten half-lives or until only background levels of radiation are detected. At that point, these wastes are disposed of in ordinary landfills. Prior to 1981, these wastes were managed by an off-site contractor and taken to a landfill approved for low-level radioactive waste disposal.

No large spills or other similar problems were reported with current waste storage and accumulation areas. Sites No. 6 and No. 9 at the Lackland Training Annex are petroleum and rifle bore cleaner waste storage sites that do not have sufficient containment to prevent run off or to contain minor spills and residue from reaching nearby soils. Minor contamination of soils next to these sites was evident from the oily discoloration noted on these soils.

Fuels Management

Unlike many Air Force installations, Lackland AFB and Lackland TA do not have airplanes to fuel, service and maintain. Therefore, an extensive fuels management, distribution and delivery program is not in place. Most fuel related activities support fuel supply activities for the auxiliary diesel generators and gasoline supply tanks located at over 40 locations throughout Lackland AFB and over 30 sites at the Lackland TA. Three tanks previously used for radioactive waste-waters were left in place at Lackland TA from previous AEC operations. A listing of tanks located at Lackland AFB and Lackland TA, their contents and status is presented in Table 4.2 and 4.3, respectively.

Spills and Leaks

Since 1981, only one spill of major consequence has occurred. In April of 1983, a spill of PCB transformer oil occured near Building 5100, by the corner of Kirkland Street and Gary Avenue. Approximately 1

TABLE 4.2
LACKLAND AFB
INVENTORY OF TANK STORAGE FACILITIES

Location By Bldg. No.	Tank Location Above Ground	Tank Location Under Ground	Contents	Size of Tank (Gallons)	Remarks
1016	X		#2 Diesel	400	--
1017	X		Gasoline	25	--
1030		X	Gasoline	110	--
1050		X	#2 Diesel	3,000	Est. Age 10 yrs.
1415A,B	X		Fuel Oil	8,000	Est. Age 3 yrs.
1525A		X	Gasoline	11,754	BX Serv. Stn. (regular); Est. Age 25 yrs.
1525B		X	Gasoline	11,754	BX Serv. Stn. (unleaded); Est. Age 12yrs.
1525C		X	Gasoline	6,000	BX Serv. Stn. (premium); Est. Age 25 yrs.
2213		X	Diesel	250	--
2840	X		#2 Diesel	400	--
2886		X	Gasoline	500	--
2900	X		Gasoline	400	Golf Course
2960		X	Gasoline	500	--
3106	X		#2 Diesel	400	--
3410	X		Gasoline	50	WHMC
3603	X		#2 Diesel	60	--
3726		X	Diesel	285	--
4070	X		#2 Diesel	400	--
4550	X		#2 Diesel	60	Temporary tank
4880A1	X		#2 Diesel	420,000	WHMC Total Energy Plant; Est. Age 4 yrs.
4880A2	X		#2 Diesel	420,000	WHMC Total Energy Plant; Est. Age 4 yrs.
4880B		X	Lube Oil	3,000	WHMC
4880C		X	Waste Oil	970	WHMC
4902A	X		Gasoline	550	--
4902B	X		Gasoline	550	--
5005A		X	Gasoline	10,000	BX Service Station; Est. Age 30 yrs.
5005B		X	Gasoline	11,775	BX Service Station; Est. Age 12 yrs.
5005C		X	Gasoline	11,775	BX Service Station; Est. Age 30 yrs.
5023A		X	Gasoline	18,000	Base Motor Pool; Est. Age 30 yrs.
5023B		X	Gasoline	12,000	Base Motor Pool; Est. Age 12 yrs.
5023C	X		Diesel	550	Base Motor Pool
5023D	X		Diesel	550	Base Motor Pool
5023E		X	Diesel	3,000	Base Motor Pool
5023F	X		Diesel	1,000	Base Motor Pool
5072	X		Diesel	1,000	No longer in use, empty
5218A	X		Diesel	2,000	--
5218B	X		Gasoline	2,000	--
6000		X	Diesel	200	Generator

TABLE 4.2
(Continued)
LACKLAND AFB
INVENTORY OF TANK STORAGE FACILITIES

Located By Bldg. No.	Tank Location Above Ground	Under Ground	Contents	Size of Tank (Gallons)	Remarks
6020A	X		Asphalt	3,000	--
6020B	X		Asphalt	3,000	--
7012A	X		Gasoline	25	--
7012B	X		Gasoline	110	--
7012C		X	#2 Diesel	200	--
7380		X	#2 Diesel	285	--
9278A		X	Diesel	8,500	Est. Age 30 yrs.
9278B		X	Diesel	8,500	Est. Age 30 yrs.
9278C		X	Gasoline	275	--

Source: Installation Documents

TABLE 4.3
LACKLAND TRAINING ANNEX
INVENTORY OF TANK STORAGE FACILITIES

Nearest Bldg. No. To Tank	Tank Location Above Ground	Under Ground	Contents	Size of Tank (Gallons)	Remarks
104		X	#2 Diesel	400	--
130A		X	Gasoline	275	Abandoned in place
130B		X	#2 Diesel	1,000	Abandoned in place
210A		X	Gasoline	6,000	Annex Service Station
210B		X	Gasoline	3,000	Annex Service Station
210C		X	Gasoline	3,000	Annex Service Station
231A	X		#2 Diesel	2,000	--
231B	X		#2 Diesel	2,000	--
303		X	Fuel Oil	2,000	Not in use, empty
307		X	Fuel Oil	2,000	Not in use, empty
313	X		#2 Diesel	44	--
321		X	Fuel Oil	2,000	Not in use, empty
326A		X	Waste Oil	10,000	Not in use, some water
326B		X	Waste Oil	10,000	Not in use, some water
400A		X	Fuel Oil	2,000	--
400B	X		Fuel Oil	1,000	Occasional use only
421A		X	Fuel Oil	2,000	--
421B		X	Fuel Oil	2,000	--
426		X	Fuel Oil	2,000	--
427		X	Fuel Oil	2,000	--
431A		X	Fuel Oil	2,000	--
431B		X	Fuel Oil	2,000	--
433		X	Fuel Oil	500	Not in use, empty
436		X	Fuel Oil	2,000	Not in use, empty
437		X	Fuel Oil	2,000	--
439		X	Fuel Oil	500	Not in use, empty
443		X	Fuel Oil	8,000	--
444		X	Gasoline	50	--
447		X	Fuel Oil	2,000	Not in use, empty
468		X	Fuel Oil	500	--
559	X		Gasoline	500	--
720A		X	Diesel	275	Not in use, empty
720B		X	Diesel	1,000	Not in use, empty

TABLE 4.3
(Continued)
LACKLAND AFB
INVENTORY OF TANK STORAGE FACILITIES

Nearest Bldg. No. to Tank	Tank Location: Above Ground	Tank Location: Under Ground	Contents	Size of Tank (Gallons)	Remarks
Special AEC Waste Tanks					
308		X	*	5,000	Capped 4'below ground; wastewater holding tank
423		X	*	1,000	Capped 4' below ground; wastewater holding tank
430		X	*	1,000	Capped above ground wastewater holding tank

* Previously Held Low-Level Radioactive Wastewater
Source: Installation Documents

gallon of this oil spilled onto the soil penetrating less than 1 foot into the soil profile. Rapid response by base personnel prevented further migration. Contaminated soils were collected, placed in drums and manifested to a hazardous waste landfill. The remaining soil was tested to assure decontamination was complete. Previous to 1981, no other major spills or leaks were reported by personnel or in records reviewed.

Evidence of two uncontrolled releases were observed. These sites occurred at the discharge to the oil-water separators located at WHMC and Building 5020 (discussed later). It is not possible to estimate the quantities of spillover oil that has been released at these sites. The soil was found to be oil stained at both spill sites which are located in open drainage ditches.

In about 1972, a fuel tank truck explosion occurred at facility 1525 during a fuel delivery. About 4000 gallons of gasoline was lost and all of it combusted at the site.

Pesticide Utilization

Several pesticides have been used for controlling weeds, insects, rodents and fungus at Lackland AFB and Lackland TA. These are used by entomology and the golf course.

Pesticides used at the golf course have been mixed outside and west of the Golf Course Maintenance Building 2960. Empty pesticide containers and bags have routinely been put in dumpsters and taken to landfill disposal. Cans received multiple rinses and were punched with holes starting in the early 1970's. Rinsewater from the can washing was discharged to the ground in the mixing area. No major vegetation stress was observed at this site. All residual solutions in spray equipment has been randomly sprayed on the golf course. Sprayers are rinsed at various locations and sprayed on the golf course grounds.

The pesticides used at areas other than the golf course have been mixed at the Entomology Building 5394 since the 1950's. Prior to that time the chemicals were mixed in the 6000 area. Mixing of pesticides for the large exterior spray equipment is done outside at the north end of Building 5394 and mixing for the small sprayers is done inside the building.

Entomology pesticide containers have been triple rinsed since about 1974. The rinsewater from the containers is put back into the sprayers for dilution water. Both the large and small sprayers are rinsed after use. Rinsewater from the large sprayers is currently sprayed at various locations on the base. In the 1960's the rinsewater was discharged in the drainage ditch just west of Building 5394. The rinsewater from the small sprayers is discharged on the ground at the north end of Building 5394. When the pesticide operations were in the 6000 area rinsewater went to the sanitary sewer. One former employee indicated that in the 1960's vegetation damage occurred at the north side of Building 5394 and in the two adjoining drainage ditches from drainage of pesticide residuals.

It was reported by one employee that in about 1968 a large quantity of chlordane was delivered to Entomology. The bags of pesticide were stored for some time while attempts were made to turn the material back into supply. However, the stored bags began deteriorating and the excess (estimated at about one ton) was placed in plastic bags and taken to the Medina facility landfill.

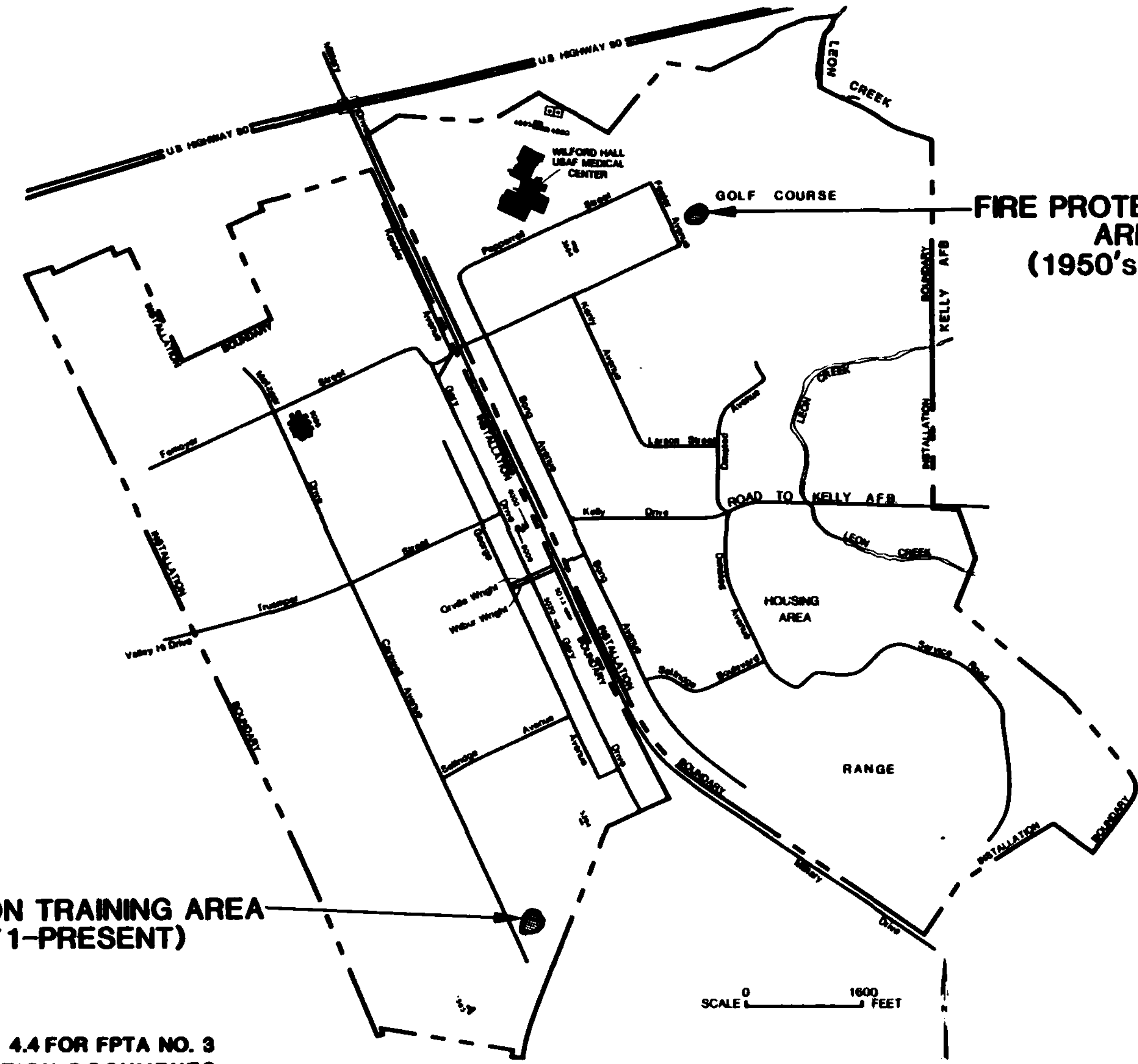
Fire Protection Training

Fire training activities have been conducted at two locations at Lackland AFB (Figure 4.3). The earliest one known to have operated was located about where Building 2850 now exists. Fire Protection Training Area (FPTA) No.1 was utilized sporadically in the 1950's and 1960's. The site consisted of an old building and a fire pit. Wooden pallets and other solid materials were used to fuel training fires conducted in the building. Waste oils and other liquid industrial wastes (such as solvents) were used for fueling fires in the pit. The frequency of training activities typically consisted of about two fires at the pit per year. For each fire approximately three to four drums of waste liquid were poured on the ground; no water was applied to the ground before the waste liquid.

In the early 1970's (approximately 1971) Fire Protection Training Area No. 2 started to be used and it continues in operation at this time. The site used a fire pit constructed on the ground until 1977 when the existing concrete burning area was constructed. Waste liquids such as oils and solvents were used for the fires at FPTA No. 2 until

LACKLAND AFB

FIRE PROTECTION TRAINING AREAS



NOTE: SEE FIGURE 4.4 FOR FPTA NO. 3
SOURCE: INSTALLATION DOCUMENTS

1978. The quantity of waste used per fire and the number of fires per year were comparable to FPTA No. 1 until 1978. Wastes were put on the ground without application of water before combustion. According to fire protection employees, the waste liquids used for fire training at Lackland AFB until 1978 were generally brought in from off-base industrial sources or Kelly AFB.

Quarterly fire training activities started in 1978, resulting in approximately eight to ten fire events per year. Each fire event consisted of three to four "burns". That is, each fire was initially started with about 100 gallons of fuel and then quenched. This was immediately followed with another burn which required only 30 to 50 gallons of fuel. Thus, a total of 200-250 gallons of fuel is typically used per fire. Clean fuels have been used on the concrete burning pad since 1978.

Extinguishing agents used for fire training activities at Lackland AFB consisted of protein foam until the mid 1970's when aqueous film forming foam (AFFF) started to be used. Dry chemicals and halon have been used with AFFF since 1982.

Fire training activities at the Lackland TA were conducted at one site, FPTA No. 3 in Figure 4.4. The fire training occurred only during the AEC operations (1955-1965) and ceased when the Air Force took over the Medina facility. The training fires were conducted twice a year in a shallow trench about 100 feet long. Two fires were utilized per training exercise or a total of four per year. The fuel was normally supplied by a petroleum company and did not consist of waste liquids from either the AEC operations or Lackland AFB. The fuel used was usually fuel oil. To produce each fire, about 300 to 500 gallons were poured into the trench and ignited without prior soaking of the ground with water. Water was the only extinguishing agent used.

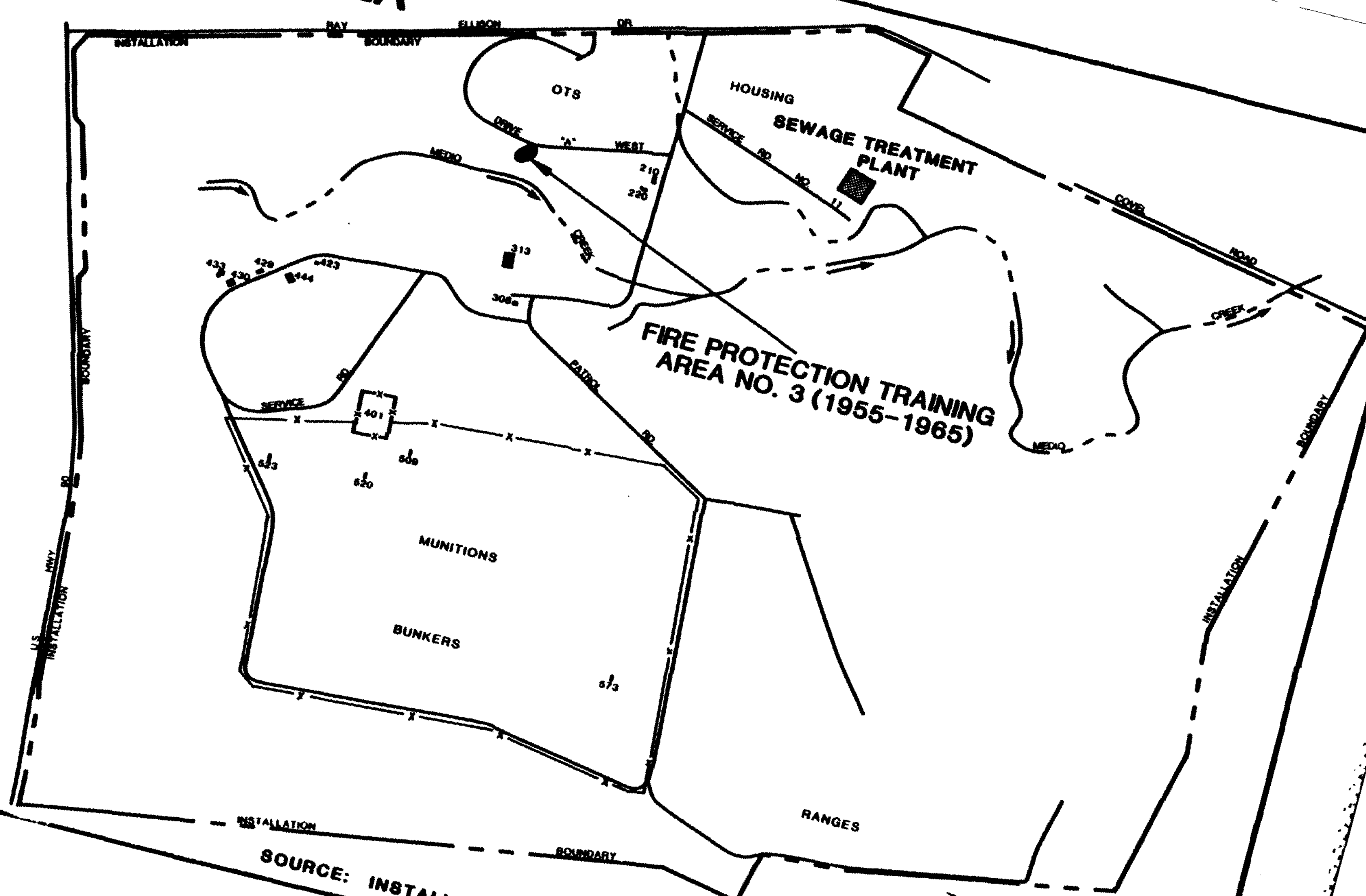
BASE WASTE DISPOSAL METHODS

The facilities at Lackland AFB and Lackland TA which have been used for management and disposal of waste are as follows:

- Landfills
- Hardfills

FIGURE 4.4

LACKLAND TRAINING ANNEX
FIRE PROTECTION TRAINING AREA



SOURCE: INSTALLATION DOCUMENTS

NOTE: SEE FIGURE 4.3 FOR FPTA NOS. 1 AND 2

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- Low-Level Radioactive Waste Disposal Sites
- Waste Burning Sites
- Leaching Areas
- Sanitary Sewerage System
- Oil-Water Separators
- Surface Drainage System
- Incinerator

Landfills

The oldest portion of the present Lackland AFB is the central area east of Military Drive. No present or past employees could specifically confirm the existence of a landfill adjacent to Leon Creek but several believed one was used in the area. Figure 4.5 shows the general vicinity of Landfill No. 1 which probably served the base in the early 1940's. An aerial photograph of Lackland AFB in 1945 shows a disturbed land area in this vicinity which may have been the landfill operation. An area fill about 6 to 8 feet deep appears likely for the site. Since the mission of the base did not include flying activities and the associated industrial shops, it is presumed this landfill received only minor quantities of hazardous wastes.

The second landfill serving the base was located on the site area under and between Facility Nos. 9085, 6590, 6690 and 6691. Landfill No. 2, shown in Figure 4.5, operated from the mid 1940's until the late 1950's. Aerial photographs confirm this general operating period. Wastes received were primarily garbage and refuse. Some empty five-gallon containers were noted by an interviewee but the hazardous materials are believed to be minimal at this site. It was indicated that some refuse from Kelly AFB may have been brought to this site during the 1950's in addition to wastes from Lackland AFB. The filling at this site was to a depth of about 15 feet. An area fill method was apparently used. Table 4.4 summarizes the landfill operations for both Lackland AFB and Lackland TA.

Landfill No. 3 (Figure 4.5) was a small single trench operation at Lackland AFB reported by an employee. This site was operated about two to three years in the late 1950's (concurrently with Landfill No. 2) and

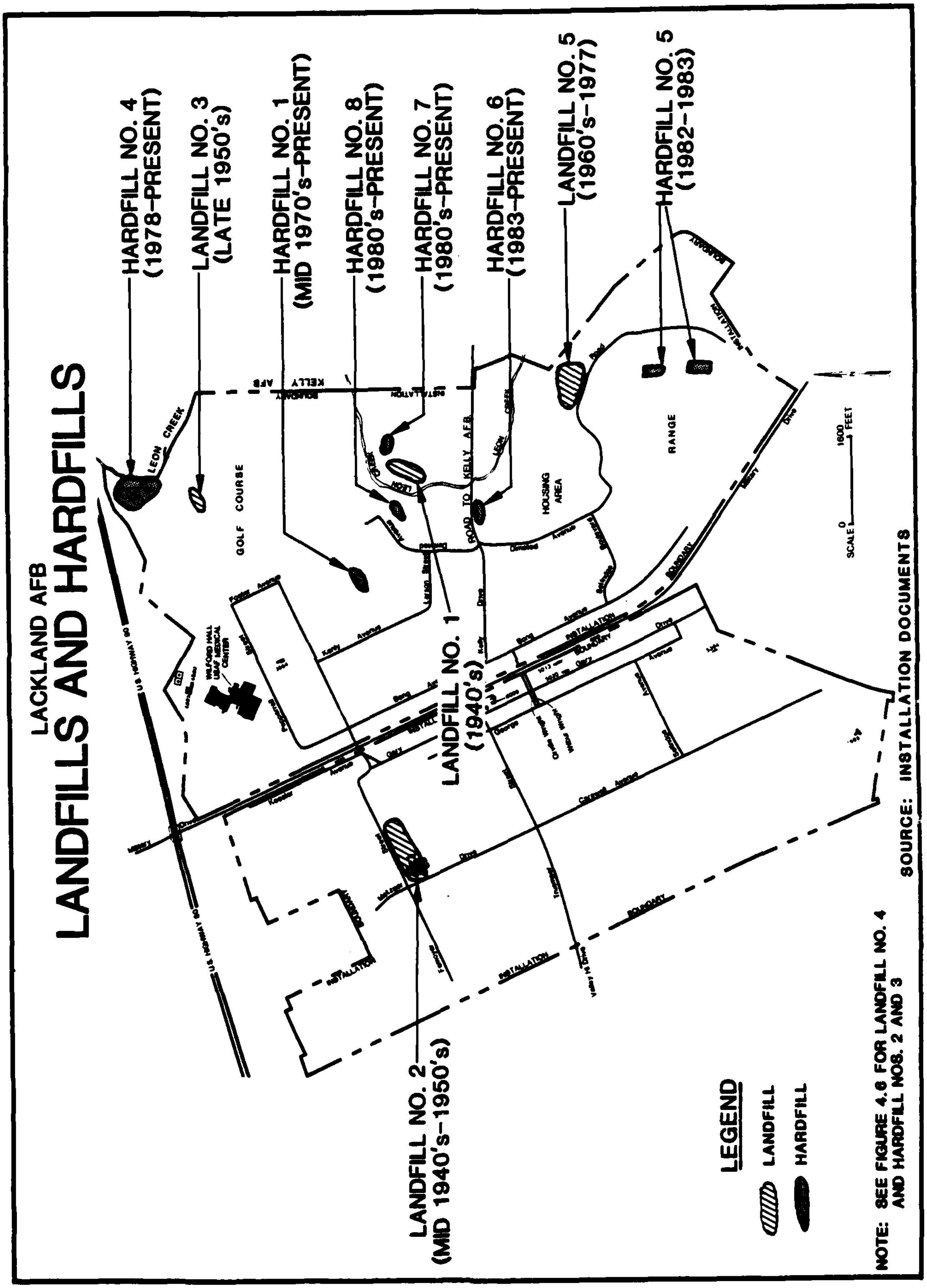
LACKLAND AFB
LANDFILLS AND HARDFILLS
HARDFILL NO. 4 (1978-PRESENT)
LANDFILL NO. 3 (LATE 1950's)
HARDFILL NO. 1 (MID 1970's-PRESENT)
HARDFILL NO. 8 (1980's-PRESENT)
HARDFILL NO. 7 (1980's-PRESENT)
HARDFILL NO. 6 (1983-PRESENT)
LANDFILL NO. 5 (1960's-1977)
HARDFILL NO. 5 (1982-1983)
LANDFILL NO. 1 (1940's)
LANDFILL NO. 2 (MID 1940's-1950's)
LEON CREEK
GOLF COURSE
HOUSING AREA
RANGE
KELLY AFB
ROAD TO KELLY AFB
INSTALLATION BOUNDARY
U.S. HIGHWAY 90
WILFORD HALL USAF MEDICAL CENTER
SCALE 0 1600 FEET
LEGEND
LANDFILL
HARDFILL
NOTE: SEE FIGURE 4.6 FOR LANDFILL NO. 4 AND HARDFILL NOS. 2 AND 3
SOURCE: INSTALLATION DOCUMENTS

TABLE 4.4
SUMMARY OF LANDFILLS

Site (Installation)	Period of Operation	Approximate Area (ac)	Method of Operation	Type of Wastes
Landfill No. 1 (Lackland AFB)	1940's	2	Area fill about 6-8 ft. deep	Refuse and garbage.
Landfill No. 2 (Lackland AFB)	Mid 1940's - 1950's	8	Area fill to a depth of about 15 ft. below present grade	Primarily refuse and garbage.
Landfill No. 3 (Lackland AFB)	Late 1950's	<0.1	Trench fill about 15 ft. deep	Refuse and garbage.
Landfill No. 4 (Lackland TA)	1955 - 1973	16	Trench fill 10 to 15 ft. deep; burning	Refuse, garbage, wood, tires, paints, thinners pesticides, scrap metal, pathological wastes, construction and demolition debris and yard wastes.
Landfill No. 5 (Lackland AFB)	Early 1960's - 1977	7	Area fill 10 to 15 ft. deep	Refuse, garbage, wood, construction and demolition debris and yard wastes.

Source: Interviews and file data.

received refuse and garbage but no industrial/hazardous wastes. The fill was a trench 15 feet deep approximately 100 to 200 feet long.

In 1955 when the AEC began operations at the Medina facility (now Lackland Training Annex), Landfill No. 4, shown in Figure 4.6, was started. This landfill served AEC until it ceased operations in 1966 and then continued to be used by the Air Force until 1973. Wastes from both Lackland TA and Lackland AFB were sent to this site. This landfill used the trench method for filling with most trenches about 10 to 15 feet deep. Wastes which reportedly were routinely disposed included garbage, refuse, wood, tires, paints, thinners, solvents, construction and demolition debris, and yard wastes. As discussed previously, a one-time disposal of unused chlordane pesticide is also believed to have occurred at Landfill No. 4. In 1965-1966 bulky unusable items such as used hand tools, canvas and other materials resulting from the AEC closedown were put in this landfill. Periodically, when the Wilford Hall incinerator was out of service, pathological wastes were also taken to this landfill. Kelly AFB reportedly brought garbage, refuse and demolition material to the site at times. Burning of wastes reportedly occurred at this landfill site.

Landfill No. 5 (Figure 4.5) was used from the early 1960's to about 1969 or 1970 as a landfill for garbage, refuse, wood, construction and demolition debris, and yard wastes. In the 1970's, it served mainly as a disposal site for brush, yard wastes and construction/demolition debris. Industrial/shop wastes were not reported as going to this landfill. The operation used an area fill method with the depth estimated from 10 to 15 feet.

In 1974 Lackland AFB and Lackland TA began a contract operation for refuse collection and disposal. From 1974 on, all non-bulky wastes have been taken to off-base disposal sites.

Hardfills

There have been several sites on Lackland AFB and Lackland TA used as hardfills (disposal of non-putrescible material such as construction and demolition debris, wood, scrap metal, brush and yard wastes). These sites are shown in Figures 4.5 and 4.6 and summarized in Table 4.5. Some hardfills have been used in an attempt to reduce erosion and stabilize steep slopes.

FIGURE 4.6

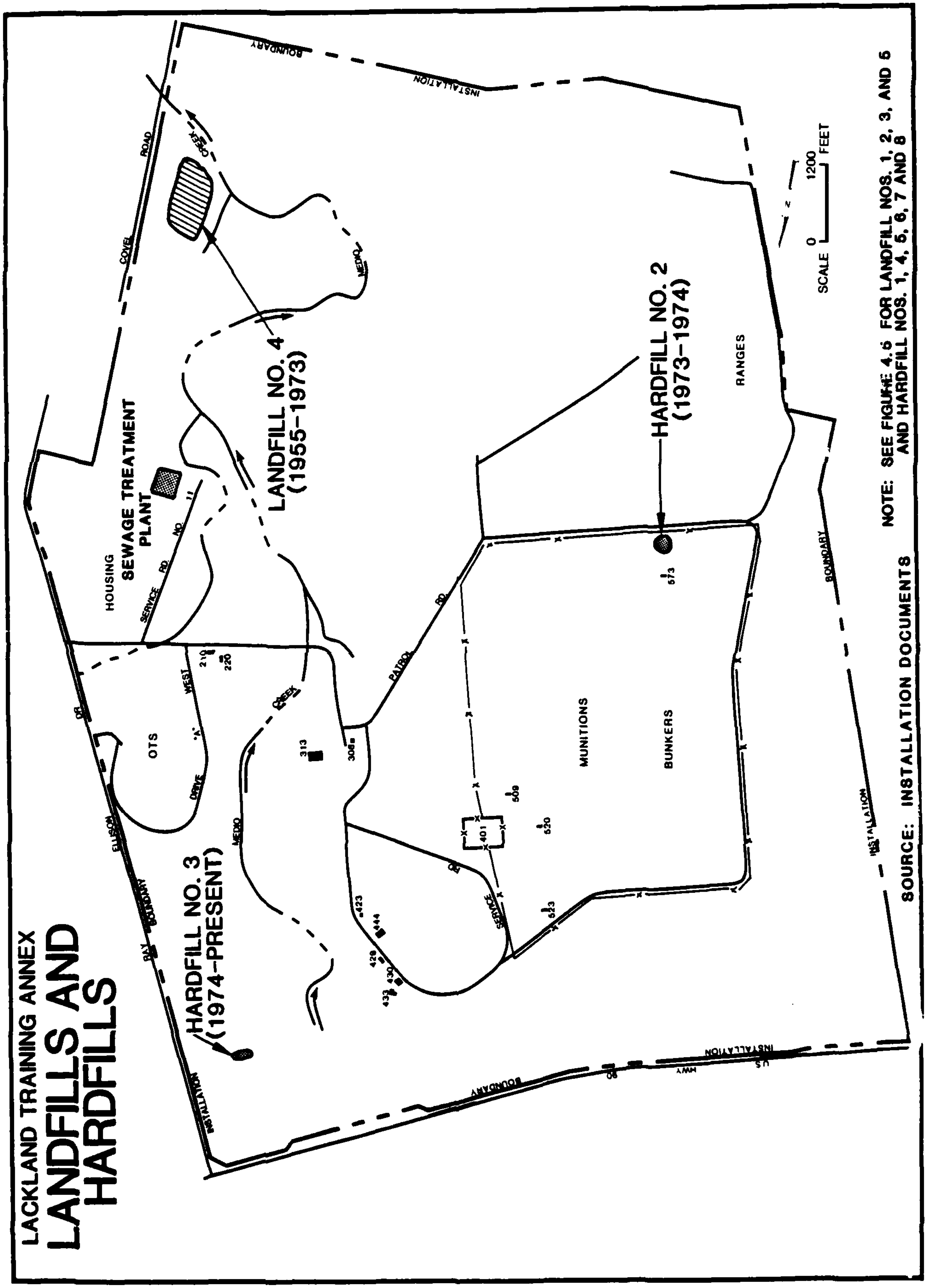

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TABLE 4.5
SUMMARY OF HARDFILLS

Site (Installation)	Period of Operation	Approximate Area (ac)	Method of Operation	Type of Wastes
Hardfill No. 1 (Lackland AFB)	mid 1970's - present	0.5	Placed on side slope about 20 ft. deep	Construction and demolition debris, wood, scrap metal and brush.
Hardfill No. 2 (Lackland TA)	1973 - 1974	0.4	Placed in explosion hole about 70 ft. deep	Construction and demolition debris, wood, scrap metal and brush.
Hardfill No. 3 (Lackland TA)	1974 - present	0.4	Filling a ravine about 15 ft. deep	Construction and demolition debris, wood, scrap metal and brush.
Hardfill No. 4 (Lackland AFB)	1978 - present	7	Area fill 8 to 12 ft. deep	Construction and demolition debris, wood, scrap metal and brush.
Hardfill No. 5 (Lackland AFB)	1982 - 1983	<0.1	Trench fill 6 to 8 ft. deep	Wood and other range demolition material.
Hardfill No. 6 (Lackland AFB)	1983 - present	<0.1	Placed on side slope about 30 40 ft. deep	Concrete rubble.
Hardfill No. 7 (Lackland AFB)	1980's - present	<0.1	Area fill about 5 ft. deep	Wood, concrete, soil.
Hardfill No. 8 (Lackland AFB)	1980's - present	<0.1	Placed at grade about 8 ft. deep	Wood and concrete.

Source: Interviews and file data.

Hardfill No. 1 (Figure 4.5) was started in the 1970's and has been used periodically to the present time. The fill depth is estimated at 20 feet.

Hardfill No. 2, located at the Lackland TA as shown in Figure 4.6, was operated for only a year or two (1973 - 1974). This site was the location of a munitions bunker explosion which occurred when AEC was operating the site in the early 1960's. Concrete rubble, brush and yard wastes were placed in the explosion hole (about 70 feet deep).

Another hardfill (Hardfill No. 3) located at the Lackland TA (Figure 4.6) was started in approximately 1974 and appears to still be receiving wastes. The site is in a ravine and the wastes are uncovered. Materials discarded at the site include concrete, wood, brush, major appliances, and other bulky items. The fill depth is approximately 15 feet.

Hardfill No. 4 located at Lackland AFB (Figure 4.5) began operations in 1978 and continues at the present time. Depth of fill on the site is variable and is estimated at 8 to 12 feet. During the on-site visit for this study there was considerable solid waste observed dumped on top of the ground between the Lackland AFB boundary and U.S. Highway 90 near Hardfill No. 4. This unauthorized disposal site is off base property.

Hardfill No. 5 operated 1982 to 1983 (Figure 4 5). It consisted of two trenches, 6 to 8 feet deep, which received wood and other demolition material from the firing range.

From 1983 to the present time, concrete rubble has been dumped and not covered adjacent to Kelly Drive in an effort to minimize erosion (Hardfill No. 6, Figure 4.5). The area being filled is approximately 30 to 40 feet deep.

Two other small hardfill areas are currently being used at Lackland AFB (Figure 4.5). Hardfill No. 7 near the golf course is receiving bulky items and Hardfill No. 8 consists of building demolition materials.

Low-Level Radioactive Waste Disposal Sites

At the time the Air Force took over the AEC Medina facility and converted it to the Lackland Training Annex, five sites were identified to Real Property as radioactive disposal areas. These sites were cleared by federal safety personnel as being decontaminated when AEC closed operations. A sixth site was described during the IRP site visit by an employee who worked at the Medina facility since 1955. The burial sites are referenced in Figure 4.7.

Facility 308 is a 5,000-gallon steel wastewater storage tank buried with slightly over 12 feet of cover. The tank has a 7.5 foot diameter. Two 6-inch vertical access lines are capped 4 feet below grade.

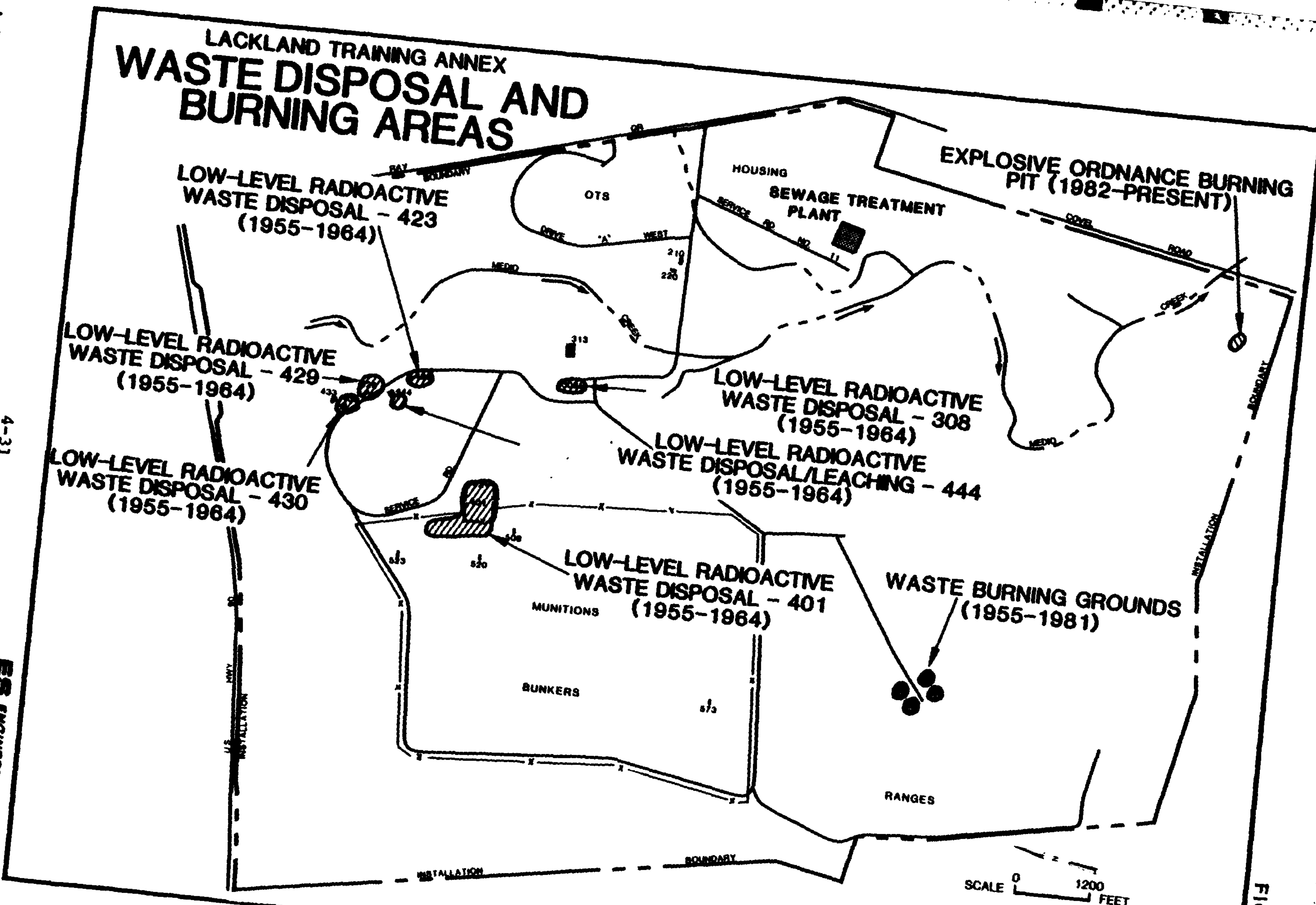
Both Facility 423 and 430 are 1,000-gallon steel wastewater storage tanks buried with slightly over 7 feet of cover. Two 6-inch vertical access lines connect to the 4-foot diameter tank. These lines are capped 4 feet below grade at Facility 423.

The disposal area at Facility 429 was an unlined pit 4 feet by 10 feet by 6 feet deep which is now filled in to grade with soil.

The wastewater storage tanks (308, 423 and 430) are connected to adjacent buildings by floor drains. There are no outlets for these tanks and in practice, they function as holding vessels. The 429 pit was designed to receive dry wastes. A former employee indicated the wastewater discharged to the tanks was very infrequent but the quantities discharged or the number of times they were pumped out are not known. The composition of wastes going to these four facilities is not available. They reportedly received low-level radioactive wastes generated as a part of the weapons maintenance by AEC. The results of analyses conducted in 1971 on two one-gallon samples of the 430 tank contents are presented in Table 4.6. Based upon these analyses, the USAF Radioisotope Committee recommended the tanks be drained to the sanitary sewer system; however, no data is available to indicate whether the tanks were drained or whether any subsequent sampling ever occurred. The tanks have not been tested for leakage since the access pipes are below ground.

In addition to the four facilities described above, Facility 401 was identified on a Real Property map as a low-level radioactive disposal area. However, other correspondence notes that the 401 site was rumored to be the location of a munitions bunker which burned, but no documentation is available to substantiate this. Early correspondence

FIGURE 4.7



SOURCE: INSTALLATION DOCUMENTS

TABLE 4.6

WASTEWATER ANALYSES OF FACILITY 430 IN 1971

Sample No. 1 - Facility 430		
Gross beta	- suspended:	5 picocuries/liter
	- dissolved:	12 picocuries/liter
Gross alpha	- suspended:	0 picocuries/liter
	- dissolved:	5 picocuries/liter
Sample No. 2 - Facility 430		
Gross beta	- suspended:	0 picocuries/liter
	- dissolved:	17 picocuries/liter
Gross alpha	- suspended:	0 picocuries/liter
	- dissolved:	12 picocuries/liter

Source: Installation Files

apparently did not mention the 401 site and it is possible the rectangular-shaped 401 area was created after the AEC activities were terminated. A field inspection of the 401 site in 1981 revealed a hole about 30 feet in diameter and 15 feet deep, but no other unusual features. A former employee at the AEC site indicated that low-level radioactive waste from Medina and other AEC facilities was buried in the vicinity of the 401 area (either in the now-designated 401 area or west of it in line with the 509 bunker as shown in Figure 4.7) in the time period 1961 to 1965. The waste was in wooden crates (about 4 feet by 4 feet by 8 feet) with radioactive signs on the exterior. The crates were excavated in 1965 and removed from the area when the AEC ceased operations. The volume of material buried or the extent of the contamination is not known but reportedly it took several weeks to remove the crates.

The sixth area identified as having been used for low-level radioactive waste was Facility 444. A former employee indicated a small gravel leaching type area (about 20 feet by 20 feet) existed behind the building. This apparently received intermittent wastewater discharges. It was noted that the gravel and soil from this area was excavated and removed from the Lackland TA when AEC left.

Waste Burning Sites

Two areas have served as waste burning sites and both are located at the Lackland TA. A waste burning ground (Facility 815) operated from 1955 to 1981 and an explosive ordnance burning pit (Facility 805) has been operating since 1982. These sites are shown in Figure 4.7.

The waste burning grounds is an area originally used by AEC and later by the Air Force. During the AEC operations, outdated explosives were burned at Facility 815. This area consisted of four circular at-grade gravel sites on which materials were ignited. Some of the materials reportedly burned included Composition B, Composition C4, TNT, and detonators. Other unidentified materials were also burned during the AEC operations including items brought to the Medina facility from other AEC installations. The frequency of burning and quantity of wastes disposed at the site were apparently quite variable. At times material was accumulated and then burned once or twice per day for a couple of weeks; on other occasions burning occurred one or two days per week on a more regular weekly routine. Detonators were often ignited on

Friday and burned all weekend with copper residual being recovered at the site after combustion. Typical quantities per burn on each circular area of Facility 815 was several thousand pounds of explosives prior to 1966 and a lesser amount after that time.

Following the departure of AEC in 1966, the Facility 815 burning grounds continued to be used until 1981 by Lackland Explosive Ordnance Detachment personnel. In 1982 the EOD group abandoned the Facility 815 grounds and began using a new area at Facility 805. Burning at the latter site takes place in a pit about 6 feet by 20 feet by 5 feet deep. Explosives from other bases have been brought to the Lackland TA burning sites for disposal. A wide variety of munitions and explosives have been burned at these two sites by EOD including black powder; smokeless powder; fulminate of mercury; PETN; Composition B; Composition C1, C2, C3, and C4; dynamite, gelatin dynamite and TNT. Other items which are burned include flares, small arms ammunition and blasting caps, and aircraft starter cans containing propellants (from Kelly AFB). The materials to be burned are placed on wooden pallets and ignited with about 10 gallons of diesel fuel. The frequency of fires by the EOD teams has typically been slightly less than once per month. The quantity of material per burn has been variable depending upon the type of items being disposed.

Leaching Areas

As noted in Table 4.1 and Figures 4.8 and 4.9, respectively, one leaching area is located near Building 7595 at Lackland AFB and another near Building 466 at the Lackland Training Annex. Both of these facilities discharge the contents of the dip tanks used for military dogs onto nearby soils on a monthly basis. These discharges are comprised of about 200 gallons of flea and tick dip solution (pesticides in solution with a solvent carrier). Although the type of dip solution has changed periodically (every few years) current use includes Dermaton II, 10% xylene (as a carrier) and 12% Supono (a dichlorophenyl diethyl phosphate derived insecticide). The leaching area at Lackland AFB has been used since about 1960 and at Lackland TA since about 1966.

Sanitary Sewerage System

Lackland AFB since its beginning has discharged its wastewater off

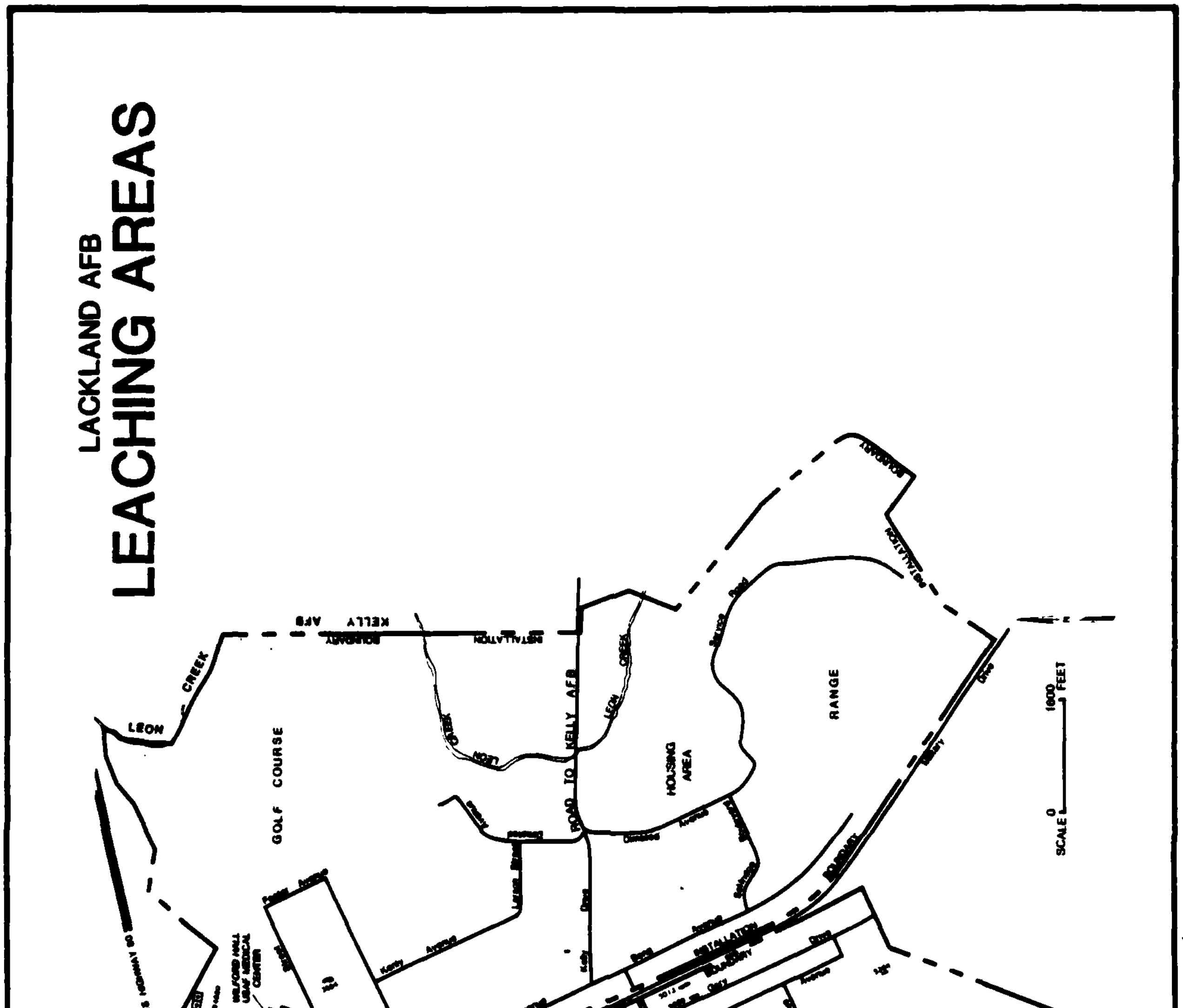
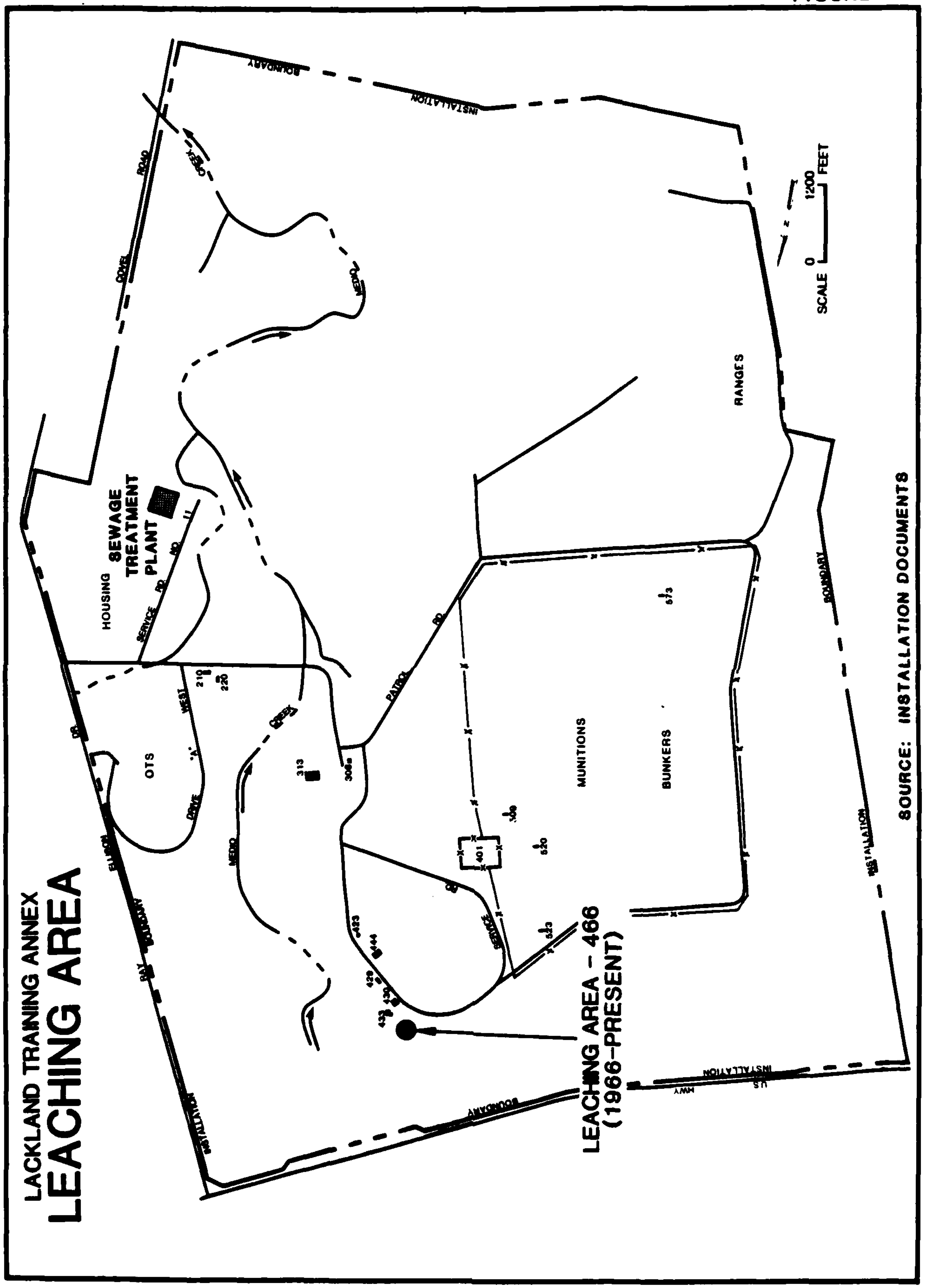

LACKLAND AFB
LEACHING AREAS
GOLF COURSE
HOUSING AREA
RANGE
ROAD TO KELLY AFB
LEON CREEK
KELLY AFB
INSTALLATION BOUNDARY
WILFORD HALL USAF MEDICAL CENTER
U.S. HIGHWAY 90
SCALE 0 1600 FEET
LEACHING AREA-7595
(1960-PRESENT)
SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.9



ES ENGINEERING-SCIENCE

base to a cityment plant. Flows are measured but the characteristics of the water have not been regularly determined.

The Lackla has a sewage treatment plant which has served the facility since :iginal construction for AEC in 1955. The plant is located at the f Service Road No. 11, south of the housing area. Treated effluem the facility discharges into Medio Creek. An Imhoff tank prc treatment from 1955 until 1973 when the plant was upgraded with .ended aeration activated sludge process. Sludge from the treatmant was dried and placed on the ground around the plant until abo6. Since 1976 the dried sludge has been placed in dumpsters for h. to off-base disposal locations.

The ranges:kland TA are not served by a sewer system but have two holding tan wastes. The tank contents have been pumped and hauled off base their original construction.

Some smallities of potentially hazardous materials have been discharged to titary sewerage system (Table 4.1). The sanitary sewerage systemot considered a potential for contamination or migration of haz materials based upon present or past operations.

Oil-Water Separa

There are l-water separators at Lackland AFB. The first, serving the totrgy plant, is located at WHMC. The unit was installed in 1978 an approximate capacity of 1500 gallons. The second separatorcated behind Building 5013, and was also recently installed with city of approximately 1000 gallons. Both separators dischargejacent drainage ditches.

A small suves the floor drain system for Building 5020, receiving cleanuspilled oils and wash water. Due to its small size and irregulntenance this sump does not function in practice as an oil-water tor. This was evidenced by the oil found at the discharge site (acent drainage ditch).

Surface Drainage

The surfaceage system consists chiefly of trench and lot drains, short lastorm sewers, overland flow discharging to open drainage ditches oil-water separators drain to this storm ditch system, not to ttment plant. Minor spills often wash into this storm drainage s About 25 percent of the Lackland AFB buildings drain to a storm sewer that discharges to Leon Creek. The rest of the base drains into open drainage ditches which also discharge into Leon Creek (see Figure 3.2). A portion of the base also drains westward in an overland flow. Most areas of concern at the Lackland Training Annex drain to Medio Creek (Figure 3.3). A portion of the range areas drain to unnamed tributaries of the Medina River.

Considering the types and quantities of materials discharged to the surface drainage systems, the greatest potential for contamination and migration is from the discharge of the oil-water separators and spill materials going to the drainage system.

Incinerators

The Wilford Hall Medical Center (WHMC) utilizes an incinerator to dispose of pathological wastes. This practice dates back at least to the mid-1950's. The old incinerator operated from the roof of WHMC, but its capacity was insufficient. The new incinerator (1980 to present) is located close to WHMC (Building 3558) and operates five days a week, year-round. Ashes are disposed of at the landfill adjacent to Leon Creek (see Table 4.1).

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at Lackland AFB has resulted in identification of 31 sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants.

Sites Eliminated from Further Evaluation

The sites of initial concern were evaluated using the Flow Chart presented in Figure 1.2. Sites not considered to have a potential for contamination were deleted from further evaluation. The sites which have potential for contamination and migration of contaminants were evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.7 summarizes the results of the flow chart logic for each of the areas of initial concern.

Twenty-four of the 31 sites assessed did not warrant further evaluation. The rationale for omitting these sites from HARM evaluation is discussed below.

TABLE 4.7
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN AT LACKLAND AFB

Site	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Fire Protection Training Area No. 2	Yes	Yes	Yes
Fire Protection Training Area No. 3	Yes	Yes	Yes
Landfill No. 4	Yes	Yes	Yes
Explosive Ordnance Burning Pit	Yes	Yes	Yes
Waste Burning Grounds	Yes	Yes	Yes
Leaching Area (Bldg. 7595)	Yes	Yes	Yes
Leaching Area (Bldg. 466)	Yes	Yes	Yes
Landfill No. 1	No	No	No
Landfill No. 2	No	No	No
Landfill No. 3	No	No	No
Landfill No. 5	No	No	No
Hardfill No. 1	No	No	No
Hardfill No. 2	No	No	No
Hardfill No. 3	No	No	No
Hardfill No. 4	No	No	No
Hardfill No. 5	No	No	No
Hardfill No. 6	No	No	No
Hardfill No. 7	No	No	No
Hardfill No. 8	No	No	No
Fire Protection Training Area No. 1	No	No	No
Low-Level Radioactive Waste Disposal Site 308	No	No	No
Low-Level Radioactive Waste Disposal Site 401	No	No	No
Low-Level Radioactive Waste Disposal Site 423	No	No	No
Low-Level Radioactive Waste Disposal Site 429	No	No	No
Low-Level Radioactive Waste Disposal Site 430	No	No	No
Low-Level Radioactive Waste Disposal Site 444	No	No	No
Pesticide Handling	No	No	No
Sanitary Sewerage System	No	No	No
Surface Drainage System	No	No	No
Incinerator	No	No	No
Spill Areas	No	No	No

Source: Engineering-Science

Landfill Nos. 1, 2, 3 and 5 have received little if any industrial/ shop wastes. Nearly all materials disposed have been normal base solid waste such as garbage, refuse, etc. Similarly, all hardfill areas (Nos. 1-8) have received only construction and demolition materials, such as wood, scrap metal and other bulky wastes. There is no evidence that any of these landfills and hardfills have the potential to create environmental contamination.

FPTA No. 1 was used periodically in the 1950's and 1960's. However, when the facility was discontinued major construction occurred on the site including significant regrading and possibly the removal of some soils from the site. Due to the small quantities of material burned and the disturbed nature of the site, it is concluded that minimal potential for contamination exists.

The low-level radioactive waste disposal sites which existed during the AEC operations were all inspected and provided environmental clearances when the Air Force took over the site. One site not included (near Facility 444) in the listing to Air Force Real Property had all the soil removed from it and taken off the installation according to a former AEC employee. There is no indication from records or employee interviews that radioactive wastewater tanks (Facility 308, 429 and 430) were suspected to leak. A sample from one tank indicated low level radioactive wastewater. All material buried in the 401 area was removed from the area. The AEC testing and clearances on the Lackland TA included both 401 and 444 disposal sites. Based upon the available information, it is concluded the low-level radioactive waste disposal sites do not pose a potential for contamination.

Review of the pesticide handling operations and the rinsing and mixing sites does not indicate a potential source of contamination or migration. The suspected disposal of pesticides to Landfill No. 4 is considered as a part of the evaluation of that disposal site.

Wastewaters sent to the sanitary sewerage system at Lackland AFB have been transported in closed conduits off-base for its entire history. Wastewater has been treated at the Lackland TA plant and discharged to Medio Creek since the original AEC operations. The sanitary sewerage system is not considered a potential source of contamination.

The surface drainage system receives some minor spillage of waste materials from building operations and from oil-water separators. Discharge of waste to the surface drainage system is believed to be infrequent and minimal potential for contamination exist.

Ash from the Wilford Hall incinerator has been disposed in the base landfills or hardfills. The incinerator operation and ash disposal is not a potential source of contamination.

Oil releases to the ground and drainage areas near Buildings 4902 and 5020 do not represent good practice but the potential for environmental contamination is considered minimal. The reported one gallon spill of PCB capacitor oil and subsequent removal of soil does not represent a potential for contamination. The fuel tank truck explosion and fuel loss do not represent a potential contamination site.

Sites Evaluated Using HARM

The remaining seven sites identified in Table 4.7 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the sites are summarized in Table 4.8.

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the seven sites at Lackland AFB are presented in Appendix H. The HARM system is designed to indicate the relative need for follow-on action.

TABLE 4.8
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT LACKLAND AFB

Rank	Site	Receptor Subscore	Waste Charac-teristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
1	Leaching Area - 7595	69	72	35	1.0	59
2	Leaching Area - 466 - 466	46	72	56	1.0	58
3	Landfill No. 4	46	72	57	1.0	58
4	Fire Protection Training Area No. 3	61	48	57	1.0	55
5	Fire Protection Training Area No. 2	69	48	35	1.0	51
6	Explosive Ordnance Burnir.g Pit	54	24	50	1.0	43
7	Waste Burning Grounds	52	32	43	1.0	42

Source: Engineering-Science

SECTION 5
CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contamination migration from these sites. The conclusions given below are based on field inspections; review of records and files; review of the environmental setting; interviews with base personnel, past employees and local, state and federal government employees; and assessments using the HARM system. Table 5.1 contains a list of the potential contamination sources identified at Lackland AFB and a summary of the HARM scores for those sites.

LEACHING AREA - 7595

This site at Lackland AFB has sufficient potential to create environmental contamination and follow-on investigation is warranted. This leaching area has routinely received discharges of spent pesticide solutions from the dog training facilities at Lackland AFB since about 1960. The solutions have varied through the years. The receptor and waste characteristics subscores have contributed to the total HARM score of 59.

LEACHING AREA - 466

This leaching area at Lackland TA has sufficient potential to create environmental contamination and follow-on investigation is justified. The site has regularly had spent pesticide solutions from dog training activities discharged to it. This operation has been active since the Air Force took over the Medina facility from AEC in 1966. The waste characteristic and pathway subscores primarily contributed to the HARM score of 58.

TABLE 5.1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
LACKLAND AFB

Rank	Site	Operation Period	HARM Score(1)
1	Leaching Area - 7595	1960 - Present	59
2	Leaching Area - 466	1966 - Present	58
3	Landfill No. 4	1955 - 1973	58
4	Fire Protection Training Area No. 3	1955 - 1965	55
5	Fire Protection Training Area No. 2	1971 - Present	51
6	Explosive Ordnance Burning Pit	1982 - Present	43
7	Waste Burning Grounds	1955 - 1981	42

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

LANDFILL NO. 4

The site previously used for a landfill at Lackland TA has sufficient potential to create environmental contamination and follow-on study is warranted. This landfill operated from 1955 to 1973 and has received paints, thinners, pesticides and pathological wastes at times. The pathways and waste characteristic subscores contributed to the HARM score of 58.

FIRE PROTECTION TRAINING AREA NO. 3

The fire protection training area which operated at the Lackland TA when AEC occupied the facility is concluded to have minimal potential to create environmental contamination. The burning of fuel oil at this site was relatively infrequent and the quantity was small. Combustion of the oil will have eliminated most residual materials. There is no surface evidence of the training area. The total HARM score of 55 is influented by the receptor and pathway subscores, primarily due to the close proximity of populated areas, well locations and surface water.

FIRE PROTECTION TRAINING AREA NO. 2

FPTA No. 2, located at Lackland AFB, which has been operating at its present location since 1971 has minimal potential for environmental contamination. This facility burned waste fluids on the ground on an infrequent basis for about seven years and then had concrete burning facilities constructed. The quantity of waste fluids burned was small. Combustion will have eliminated most residual materials. No evidence of vegetation stress exists. The receptor subscore influences the total HARM score of 51 primarily due to the proximity of the installation boundary, populated areas and land use.

EXPLOSIVE ORDNANCE BURNING PIT

The explosive ordnance burning pit at Lackland TA has been operating for only a few years and is judged to create minimal environmental contamination. A variety of munitions and explosives has been combusted in a small pit. Burning at the site minimizes residual materials. The solid nature of the residuals and the environmental setting minimizes any contamination potential. The receptors and pathways subscores contribute to the HARM score of 43, mainly due to the deep ground water supply and surface water quality.

WASTE BURNING GROUNDS

The burning grounds at the Lackland TA, which functioned for both Air Force and AEC waste explosive combustion, has minimal potential to create environmental contamination. The burning procedures have minimized residual materials. The remaining solid residuals, when coupled with the environmental setting, minimizes any contamination potential. The receptors subscore primarily influences the total HARM score of 42 due to the deep ground water supply and surface water quality.

SECTION 6
RECOMMENDATIONS

Seven sites were identified at Lackland AFB as having the potential for environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional Phase II IRP investigations. Three of the seven sites have sufficient potential to create environmental contamination and warrant Phase II investigations. The remaining four sites have minimal potential to create environmental contamination. The sites evaluated have been reviewed concerning land use restrictions which may be applicable.

RECOMMENDED PHASE II MONITORING

The subsequent recommendations are made to further assess the potential for environmental contamination from the three waste disposal areas at of concern Lackland AFB. The recommended actions are sampling and monitoring programs to determine if contamination does exist at the site. If contamination is identified in this first-step investigation, the Phase II sampling program will probably need to be expanded to define the extent and type of contamination. The recommended monitoring program is summarized in Table 6.1 and discussed below for each site.

Leaching Area - 7595

It is recommended that three ten-feet deep soil borings be obtained at Lackland AFB to assess the potential contamination at this leaching area. One boring would serve as a control located away from the site and two would be taken within the leaching area. Samples of soil would be collected every two feet of depth and analyzed for the parameters in Table 6.2. The analytical parameters are intended as a screening to determine potential contamination. More extensive analyses may be necessary if positive results are obtained in this initial sampling.

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT LACKLAND AFB

Site (Rating Score)	Recommended Monitoring Program
Leaching Area - 7595 (59)	Obtain two borings in the leaching area and one outside as a control. Take borings 10 feet deep and collect soil samples every two feet. Analyze the shallow samples for the parameters in Table 6.2 and then determine the need for testing the deeper samples.
Leaching Area - 466 (58)	Obtain two borings in the leaching area and one outside as a control. Take borings 10 feet deep and collect soil samples every two feet. Analyze the shallow samples for the parameters in Table 6.2 and then determine the need for testing the deeper samples.
Landfill No. 4 (58)	Perform a geophysical survey to define the boundary of the filled area and to identify subsurface conditions. Use these data to locate one upgradient and three downgradient wells. Sample and analyze the water for the parameters in Table 6.2.

Source: Engineering-Science

TABLE 6.2
RECOMMENDED LIST OF ANALYTICAL PARAMETERS FOR PHASE II IRP
AT LACKLAND AFB AND LACKLAND TA

Leaching Area - 7595 (Soil Samples)

Total Organic Halogens
Organo-phosphate Pesticides

Leaching Area - 466 (Soil Samples)

Total Organic Halogens
Organo-phosphate Pesticides

Landfill No. 4 (58) (Water Samples)

pH
Total Organic Carbon
Total Organic Halogens
Chlordane

Source: Engineering-Science

Leaching Area - 466

Three ten-foot deep borings are recommended for this Lackland TA site to assess potential contamination. One boring would serve as a control and the other two would be taken in the leaching area. Samples of soil taken every two feet of depth would be analyzed (Table 6.2). More extensive tests may be needed depending on the initial results.

Landfill No. 4

Four monitoring wells are recommended for installation at this landfill site at Lackland TA. A geophysical survey of the site will define the boundaries and assist in locating the monitoring wells. One upgradient well would be used as a control point for the three downgradient units. Table 6.2 outlines parameters proposed to screen the potential contamination from the site. Additional analyses may be needed if the initial testing shows positive results.

RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

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

The recommended guidelines for land use restrictions at each identified disposal site at Lackland AFB are presented in Table 6.3. A description of the land use restriction guidelines is included in Table 6.4. Land use restrictions at sites recommended for on-site monitoring should be re-evaluated upon completion of the Phase II program and appropriate changes made.

TABLE 6.3
RECOMMENDED GUIDELINES FOR FUTURE LAND USE RESTRICTIONS
LACKLAND AFB

Site Name	Construction	Excavation	Wells	Agriculture	Silviculture	Water Infiltration	Recreation	Burning	Disposal Operations	Vehicular Traffic	Material Storage	Housing
Leaching Area - 7595	NR	NR	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Leaching Area - 466	NR	NR	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Landfill No. 4	R	R	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Fire Protection Training - Area No. 3	NR	NR	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Fire Protection Training - Area No. 2	NR	NR	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Explosive Ordnance Burning Pit	NR	NR	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Waste Burning Grounds	NR	NR	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Landfill Nos. 1, 3, and 5	R	R	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R
Landfill No. 2 and FPTA No. 1	NA	NA	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	NA
Hardfill Nos. 1 through 8	NR	R	R	NR	NR	NR	NR	NR	NR	NR	NR	NR
Radioactive Waste Disposal Sites	R	R	R	NR	R	R	NR	NR	R(2)	NR	NR(3)	R

(1) See Table 6.4 for description of guidelines.

Note the following symbols in this table:
R = Restrict the use of the site for this purpose.
NR = No restriction of the site for this purpose.
NA = Not applicable.

(2) Restrict for all wastes except for construction/demolition debris.
(3) No restriction on solid materials but liquids undesirable.

Source: Engineering-Science

TABLE 6.4
DESCRIPTION OF GUIDELINES FOR LAND USE RESTRICTIONS

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

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APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

ROBERT L. THOEM
Civil/Environmental Engineer

PII Redacted

[redacted]

Education

B.S. Civil Engineering, 1962, Iowa State University, Ames, IA
M.S. Sanitary Engineering, 1967, Rutgers University, New Brunswick, NJ

Professional Affiliations

Registered Professional Engineer in six states
American Academy of Environmental Engineering (Diplomate)
American Society of Civil Engineers (Fellow)
National Society of Professional Engineers (Member)
Water Pollution Control Federation (Member)

Honorary Affiliations

Who's Who in Engineering
Who's Who in the Midwest
USPHS Traineeship

Experience Record

1962-1965 U.S. Public Health Service, New York, NY. Staff Engineer, Construction Grants Section (1962-1964). Technical and administrative management of grants for municipal wastewater facilities.

Water Resources Section Chief (1964-1965). Supervised preparation of regional water supply and pollution control reports.

1966-1983 Stanley Consultants, Muscatine, IA and Atlanta, GA. Project Manager and Project Engineer (1966-1973). Responsible for managing studies and preparing reports for a variety of industrial and governmental environmental projects.

Environmental Engineering Department Head (1973-1976). Supervised staff involved in auditing environmental practices, conducting studies and preparing reports concerning water and wastewater systems, solid waste and resource recovery and water resources projects (industrial and governmental).

Resource Management Department Head (1976-1982). Responsible for multidiscipline staff engaged in planning and design of water and wastewater systems, solid waste and resource recovery, water resources, bridge, site development and recreational projects (industrial, domestic and foreign governments).

Associate Chief Environmental Engineer (1980-1983). Corporate-wide quality assurance responsibilities on environmental engineering planning projects.

Operations Group Head and Branch Office Manager (1982-1983). Directed multidiscipline staff responsible for planning and design of steam generation, utilities, bridge, water and wastewater systems, solid waste and resource recovery, water resources, site development and recreational projects (industrial, domestic and foreign governments). Administered branch office support activities.

Project Manager/Engineer for over 25 industrial projects, 25 city and county projects ranging in present study area population from 1,400 to 1,700,000, 10 regional (multi-county) planning or operating agency projects, five state agency projects, 10 projects for federal agencies, and several projects for Middle East governments.

1983-Date Engineering-Science. Senior Project Manager. Responsible for managing a variety of environmental projects. Conducted hazardous waste investigations at seven U.S. Air Force installations to identify the potential migration of contaminants resulting from past disposal practices under the Phase I Installation Restoration Program. Evaluated solid waste collection, disposal and potential for resource recovery at a U. S. Army post.

Publications and Presentations

Thirteen presentations and/or papers in technical publications dealing with solid waste, sludge, water, wastewater and project cost evaluations.

Biographical Data

JOHN R. ABSALON
Hydrogeologist

PII Redacted

[redacted]

Education

B.S. in Geology, 1973, Upsala College, East Orange, New Jersey

Professional Affiliations

Certified Professional Geologist (Indiana No. 46) (Virginia No. 241)
Association of Engineering Geologists
Geological Society of America
National Water Well Association

Experience Record

1973-1974 Soil Testing Incorporated-Drilling Contractors, Seymour, Connecticut. Geologist. Responsible for the planning and supervision of subsurface investigations supporting geotechnical, ground-water contamination, and mineral exploitation studies in the New England area. Also managed the office staff, drillers, and the maintenance shop.

1974-1975 William F. Loftus and Associates, Englewood Cliffs, New Jersey. Engineering Geologist. Responsible for planning and management of geotechnical investigations in the northeastern U.S. and Illinois. Other duties included formal report preparation.

1975-1978 U.S. Army Environmental Hygiene Agency, Fort McPherson, Georgia. Geologist. Responsible for performance of solid waste disposal facility siting studies, non-complying waste disposal site assessments, and ground-water monitoring programs at military installations in the southeastern U.S., Texas, and Oklahoma. Also responsible for operation and management of the soil mechanics laboratory.

1978-1980 Law Engineering Testing Company, Atlanta, Georgia. Engineering Geologist/Hydrogeologist. Responsible for the project supervision of waste management, water quality assessment, geotechnical, and hydrogeologic studies at commercial, industrial, and government facilities. General experience included planning and management of several ground-water monitoring programs, John R. Absalon (Continued)

development of remedial action programs, and formulation of waste disposal facility liner system design recommendations. Performed detailed ground-water quality investigations at an Air Force installation in Georgia, a paper mill in southwestern Georgia, and industrial facilities in Tennessee.

1980-Date Engineering-Science. Hydrogeologist. Responsible for supervising efforts in waste management, solid waste disposal, ground-water contamination assessment, leachate generation, and geotechnical and hydrogeologic investigations for clients in the industrial and governmental sectors. Performed geologic investigations at twelve Air Force bases and otherindustrial sites to evaluate the potential for migration of hazardous materials from past waste disposal practices. Conducted RCRA ground-water monitoring studies for industrial clients and evaluated remedial action alternatives for a county landfill in Florida. Conducted quality management, hydrogeologic and ground-water quality programs for the pulp and paper industry at several mills located in the Southeast United States.

Publications and Presentations

Eleven presentations and/or papers in technical publications or conferences dealing with geology, ground water, and waste disposal/-ground water interaction.

Biographical Data

JAMES R. BUTNER

Environmental Scientist

PII Redacted

[redacted]

Education

B.S. Tulane University, Biological Sciences, 1976
M.S. University of Florida, Environmental Engineering Sciences, 1983

Professional Affiliations

Water Pollution Control Federation
Society of Wetlands Scientists

Experience Record

1977-1979 Horticulturalist in the Horticultural industry in Gainesville, Florida. Primary areas of experience were in botany, evaluation of the uses of native plant species, and business management.

1979-1981 Center for Wetlands, University of Florida. His involvement focused on evaluating the public health aspects of wastewater recycling through wetlands, the subject of his Master's thesis. Mr. Butner's other activities included modeling the survivorship of pathogens in surface and ground waters, vegetation analysis, and application of computer statistical software (SAS) to large data sets generated from revegetation studies of phosphate mined lands in central Florida. Mr. Butner's coursework included graduate level courses in Environmental Chemistry, Nutrients and Eutrophication, Water Resources Planning, Fortran Programming, Toxicology, Ecological Modeling and Statistics.

1982-1984 Claude Terry & Associates, Inc. (CTA). As an Environmental Scientist, his primary responsibilities were involved the collection, review and analysis of technical data and institutional issues associated with effluent discharge into wetlands. These duties were in conjunction with the production of a generic eight-state Environmental Impact Statement for Region IV EPA entitled "Freshwater Wetlands for Wastewater

Management". Other projects have involved conducting environmental inventories and recommending mitigation to preserve and protect natural resources for other EIS work. He was involved in the design of various sampling programs, the collection, analysis, and interpretation of chlorophyll and periphyton data as part of the Georgia Statewide Nonpoint Source Study, and training laboratory personnel in wet chemistry techniques.

1984-Present Engineering-Science, Inc. Environmental Scientist responsible for the conduct of water and wastewater sampling programs and analyses, quality control, laboratory process evaluations, and evaluation of other environmental assessment data. Involved in the development of environmental studies, inventories, and evaluations for municipal, industrial, and Federal government projects.

Publications

Coauthor of the publication (1983), "Survival of Virus and Enteric Bacteria in Groundwater", Journal of Groundwater.

Paper entitled, "Freshwater Wetlands for Wastewater Management: An integrated framework for decision-making and wetlands protection", presented at the 1984 Research Triangle Conference on Environmental Technology, Raleigh, N.C., March 1984.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

TABLE B.1
LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

Most Recent Position	Years of Service
1. Mechanical Superintendent, SARPMA	30
2. Structural Superintendent, SARPMA	18
3. Pavement and Grounds Superintendent, SARPMA	15
4. NCOIC, Bioenvironmental Engineering	3
5. Fire Chief	2
6. Assistant Fire Chief (Acting)	20
7. Pest Controller, Entomology (Retired)	22
8. Foreman, Pavements and Grounds Equipment	13
9. EOD Specialist, Ordance Disposal	5
10. NCOIC, Equipment Supply, Ordnance Disposal	1
11. Assistant Fire Chief	24
12. Foreman, Entomology	17
13. Assistant to Supervisor, Golf Course	4
14. Radiation Safety Officer	1
15. Foreman, Grounds	19
16. Foreman, Water Plant	15
17. NCOIC, Oilton	1
18. Site Chief, Oilton	4
19. Assistant Fire Chief, Randolph AFB	20
20. Industrial Engineering Tech., SARPMA Control	21
21. Superintendent, EOD	2
22. Real Property Officer	24
23. Quality Assurance Evaluator, Hondo	7
24. Maintenance Supervisor, Hondo	12
25. Radiation Safety Officer (Retired)	15
26. Tractor Operator, Golf Course	31
27. Chief, Recreation Services	4
28. Director, Outdoor Recreation	7
29. Chief, Radiation Services, OEHL	NA
30. Secretary, Radioisotope Committee, OEHL	NA

TABLE B.1
(Continued)
LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

Most Recent Position	Years of Service
31. Foremen, Mower and Equipment Repair	28
32. Foreman, Plumbing	17
33. NCOIC, Vehicle Maintenance	2
34. Vehicle Maintenance Foreman	12
35. Auto Mechanic Leader	25
36. Heavy Equipment Leader	33
37. Paint and Body Work Leader	33
38. Assistant/Base Reproductions	20
39. Waste Material Monitor/Training Services	14
40. Acting NCOIC, Veterinary Services	1
41. Director, Veterinary Services	1
42. Past Director, Veterinary Services	15
43. Superintendent, Billeting Maint. Services	8
44. NCOIC, Clinical Investigations	2
45. Surgery Technician	29
46. Incinerator Technician Supervisor	6
47. Incinerator Technician	25
48. Total Energy Plant Supervisor	1
49. Total Energy Plant Maintenance Foreman	5
50. McKown Dental Lab Acting, NCOIC	1
51. Det. 40 Maint. Chief	2
52. Weapons Maintenance, NCOIC	5
53. Weapons Maintenance Technician	16
54. DOD Dog Training Director	9
55. NCOIC, Vehicle Maintenance Medina	1
56. Vehicle Maintenance Medina Mechanic	25
57. NCOIC, 6948th Mobility Vehicle Maint.	2

TABLE B.1
(Continued)
LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

Most Recent Position	Years of Service
58. NCOIC, Scheduling Section Medina Firing Range	8
59. NCOIC, Range Maintenance Section, Medina Firing Range	1
60. Supervisor Power Production	9
61. Foreman Exterior Electric	17
62. Bioenvironmental Engineer	3
63. Environmental Coordinator	3

TABLE B.2

OUTSIDE AGENCY CONTACTS

Richard D. Reeves, Hydrologist
Robert W. Maclay, Hydrologist
Paul M. Buszka, Hydrologist
U.S. Geological Survey-Water Resources Division
North Plaza Suite 234
435 Isom Road
San Antonio, Texas 78213
512/344-9731

Robert W. Bader, Geologist
Edwards Underground Water District
1615 N. St. Mary's Street
San Antonio, Texas 78212
512/222-2204

Donald D. Higgins, Engineering Assistant
Texas Department of Health - Solid Waste Management Program
212 Stumberg Street
San Antonio, Texas 78204
512/225-4343

Henry Karnei, Jr., Field Representative
Texas Department of Water Resources-Water Quality Division
321 Center Street
San Antonio, Texas 78222
512/226-3297

H. Harold Bryant, District Conservationist
U.S. Department of Agriculture, Soil Conservation Service
1705 Avenue K/P.O. Box 399
Hondo, Texas 78861
512/426-2521

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

Following is a listing of the tenant organizations at Lackland AFB, along with the missions for some of the major units.

Wilford Hall USAF Medical Center

Wilford Hall conducts a comprehensive program of clinical medicine including medical care, professional education, technical training and clinical research. It operates a 1,000-bed hospital and provides base medical services.

6993rd Electronic Security Squadron

The 6993rd Security Squadron supports the operation of the Consolidated Security Operations Center which includes the recovery of selected HF transmissions collected at overseas sites and USAF transmission security and research.

6948th Electronic Security Squadron (Mobile)

The mission of this unit is to maintain personnel and equipment in a state of operational readiness and to maintain an emergency reaction force to support military combat operations and emergency requirements during contingency situations.

Detachment 2, 1923rd Communications Group

This detachment provides approved commmunications-electronics service to the Air Force Military Training Center and supported mission units at Lackland AFB.

Detachment 40, San Antonio Air Logistics Center

The mission of this unit is to store, maintain, and conduct deployment of Standard Air Munitions Packages (STAMP) and Standard Tanks, Racks, Adapters, and Pylon Packages (STRAPP), in support of USAF mobility plans, contingencies, or situations.

Detachment 37, San Antonio Air Logistics Center (DOD Dog Center)

The DOD Dog Center provides military working dogs in support of AFMTC dog training programs and provides trained military working dogs to meet DOD-wide requirements. The mission involves worldwide logistic responsibilities related to the recruitment, procurement, processing, accountability, kenneling, distribution, redistribution, and disposal of military working dogs.

3304th School Squadron (ATC NCO Academy)

The NCO Academy prepares selected noncommissioned officers for positions of greater responsibility by broadening their leadership and managerial capabilities and by expanding their perspectives of the military profession.

3507th Airman Classification Squadron

This squadron provides counseling orientation and knowledge about the Air Force to basic trainees. It also performs interviews/-counseling for basics who have emotional problems and drug related problems.

Officer Training School (OTS)

The OTS provides Air Force precommissioning training, conducts centralized flight screening, develops pre-UPT screening procedures, and conducts Security Assistance Training Program.

Lackland Field Engineer, San Antonio Real Property Management Agency (SARPMA)

SARPMA provides base maintenance and operations services related primarily to the civil engineering area.

Other Lackland Tenant Organizations

- Air Force Area Defense Counsel
- Air Force Physical Evaluation Board
- Air Force Recruiting Service Liaison Office
- American Red Cross, Station Director
- Army Police School Detachment, US Army Training Center
- Detachment 6, 3314th Management Engineering Squadron
- Detachment 1012, Air Force Office of Special Investigation
- Detachment 3, San Antonio Contracting Center

- Headquarters, 3541st Recruiting Squadron
- Headquarters, 3504th Recruiting Group
- Lackland AFB Branch, San Antonio Post Office
- Lackland AFB Exchange
- Lackland AFB Office, Federal Aviation Administration
- Lackland AFB Operation Detachment, Defense Language Institute, Foreign Language Center
- Marine Corps Administrative Detachment
- Navy and Marine Corps Reserve Center
- OL-A, Headquarters, Air Training Command (Assistant for NCO Professional Military Education)
- OL-AF, Air Force Commissary Service
- USAF Regional Civil Engineer--Central Region
- OL-C, 3480th Technical Training Group
- OL-C, 3785th Field Training Group
- OL-J, 1550th Aircrew Test and Training Wing
- Test Support Section, Personnel Research Division, AF Human Resources Laboratory
- 1365th Audiovisual Squadron
- Training Detachment, US Navy Technical Training Center

APPENDIX D

SUPPLEMENTAL BASE FINDINGS INFORMATION

APPENDIX D
SUPPLEMENTAL BASE FINDINGS INFORMATION

TABLE D.1
PESTICIDES CURRENTLY USED AT
LACKLAND AFB AND LACKLAND TA

Insecticides	Rodenticide	Herbicides
Diazinon	Diphacinane (Warfin)	Roundup
Diazinon EC	Styrchnine	Mesamate - 600
Baygon		Dacthol
Pyrethrum		Pramitol
Diazinon 14G		Fenicil
Malathion EC		Buno
Dipel		Riverside
Amdro		Baylon
Malathion	**Fungicide**	Dalpon
Chlordane		
Dursban	Fore	
Supono	Kromad	

Source: Rest Management Plan and Interviewees

TABLE D.2

TEXAS SURFACE WATER QUALITY STANDARDS

FRESH AND TIDAL WATERS

SAN ANTONIO RIVER BASIN		WATER USES DEEMED DESIRABLE				CRITERIA						
SEGMENT											COLIFORM	
NUMBER	DESCRIPTION	CONTACT RECREATION	NONCONTACT RECREATION	PROPAGATION OF FISH & WILDLIFE	DOMESTIC RAW WATER SUPPLY	CHLORIDE (mg/l) avg. not to exceed	SULFATE (mg/l) avg. not to exceed	TOTAL DISSOLVED SOLIDS (mg/l) avg. not to exceed	DISSOLVED OXYGEN (mg/l) not less than	pH RANGE	FECAL/ (100 ml)— log. avg. not more than (see Gen. Statement)	TEMPERATURE °F (see Gen. Statement)
1901	San Antonio River—Guadalupe River confluence to headwater	*	X	X	X	200	150	700	5.0	6.5–9.0	2,000	90
1902	Cibolo Creek—San Antonio River confluence to MoPac R. R. Bridge West of Bracken		X	X	X	200	300	900	5.0	6.5–9.0	2,000	90
1908**	Cibolo Creek—MoPac R. R. Bridge West of Bracken to headwaters	X	X	X	X	40	75	400	5.0	6.5–9.0	200	90
1903	Medina River—San Antonio River confluence to USGS-TDWR Station 08180500	X	X	X	X	120	120	700	5.0	6.5–9.0	200	90
1909**	Medina River—USGS-TDWR Station 08180500 to Medina Lake Dam	X	X	X	X	50	75	400	5.0	6.5–9.0	200	90
1904	Medina Lake	X	X	X	X	50	75	400	5.0	6.5–9.0	200	88
1905	Medina River—Medina Lake headwater to Medina River headwater	X	X	X	X	40	100	400	5.0	6.5–9.0	200	88
1906	Leon Creek—Medina River confluence to SH 16 northwest of Leon Valley	X	X	X	X	120	120	700	5.0	6.5–9.0	200	95

*Not presently suitable, however, upon completion of proposed facilities, the quality will be improved.

**"This segment has been established in its geographical extent as that portion of the stream which is capable of recharging the Edwards Aquifer, and the Water Quality Standards for it have as a principal purpose the protection of the quality of the water infiltrating into, and therefore recharging, the aquifer."

Source: Texas Surface Water Quality Standards, 1984. Texas Administrative Code Section 333.21.

Printed 3/84

TABLE D.2 (CONT.)

TEXAS SURFACE WATER QUALITY STANDARDS

FRESH AND TIDAL WATERS

SAN ANTONIO RIVER BASIN		WATER USES DEEMED DESIRABLE				CRITERIA						
SEGMENT											COLIFORM	
NUMBER	DESCRIPTION	CONTACT RECREATION	NONCONTACT RECREATION	PROPAGATION OF FISH & WILDLIFE	DOMESTIC RAW WATER SUPPLY	CHLORIDE (mg/l) avg. not to exceed	SULFATE (mg/l) avg. not to exceed	TOTAL DISSOLVED SOLIDS (mg/l) avg. not to exceed	DISSOLVED OXYGEN (mg/l) not less than	pH RANGE	FECAL/ (100 ml)— log. avg. not more than (see Gen. Statement)	TEMPERATURE °F (see Gen. Statement)
1907*	Leon Creek—SH 16 northwest of Leon Valley to headwaters	X	X	X	X	40	75	400	5.0	6.5–9.0	200	95
1910	Salado Creek—San Antonio River confluence to headwaters		X	X	X	50	200	550	5.0	6.5–9.0	2,000	90

*"This segment has been established in its geographical extent as that portion of the stream which is capable of recharging the Edwards Aquifer, and the Water Quality Standards for it have as a principal purpose the protection of the quality of the water infiltrating into, and therefore recharging, the aquifer."

Source: Texas Surface Water Quality Standards, 1984. Texas Administrative Code Section 333.21.

TABLE D.3

LEON CREEK SEDIMENT SAMPLING SITES

HEAVY METALS (uG/Kg)

		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
CADMIUM	A	0.6	0.6	0.3	-	-	2.1	42.8	17.7	-	13.0
(CD)	B	0.3	0.2	0.4	7.2	3.1	1.1	91.2	6.4	5.0	5.4
	C	< 0.5	-	0.58	-	1.7	1.7	57.0	39.0	18.0 18.0	
	D	4.7	-	6.8	-	-	-	46.5	10.4	10.3	14.2
	E	-	-	-	-	-	-	-	-	15.4	19.8
	F	0.4	0.3	0.9	14.9	3.5	3.9	89.0	16.0	11.0	3.5
	G										
	H										
CHROME	A	7.5	7.1	3.0	-	30.0	36.2	438.0	169.0	-	127.0
(CR)	B	7.7	9.8	11.7	177	68.8	18.5	1600.0	39.9	26.2	89.5
	C	30.0	-	36.0	-	84.0	53.0	970.0	420.0	120.0 130.0	-
	D	< 2.3	-	7.5	-	-	-	562.0	46.3	42.6	64.9
	E	-	-	-	-	-	-	-	-	175.0	400.5
	F	5.6	8.0	1.2	89.0	116.0	118.0	1100	118.0	96.0	86.0
	G										
	H										

FOOTNOTES

A-USAF OEHL SURVEY 1971 D-STATE OF TX SURVEY JAN 1980 G-

B-USAF OEHL SURVEY FEB 1980 E-STATE OF TX SURVEY FEB 1980 H-

C STATE OF TX SURVEY MAY 1979 F-SGB-OEHL SURVEY JUN 1980 I-

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

(1) Sampling points are not in the same exact location for the TWQB and Kelly AFB sample points. However, the sampling points are within reasonable proximity to each other and tables were developed for comparison only.

TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING SITES

HEAVY METALS (uG/Kg)

		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
COPPER	A	6.1	2.8	4.0	-	5.0	8.5	107.0	117.0	-	40
(cu)	B	12.6	14.3	18.5	584.0	43.1	24.0	195.0	21.8	20.6	26.9
	C	14.0	-	12.0	-	39.0	23.0	140.0	170.0	46.10 99.8	-
	D	21.3	-	16.4	-	-	-	105.0	18.4	17.0	48.4
	E	-	-	-	-	-	-	-	-	53.0	31.8
	F	8.0	12.0	12.0	14.9	64.0	37.0	200.0	61.0	191.0	23.0
	G										
	H										
NICKEL	A	7.1	5.9	3.0	-	-	6.9	75.0	48.0	-	53.0
	B	4.6	9.9	7.6	16.3	130.0	6.8	400.0	31.3	227.0	27.3
	C	20.0	-	12.0	-	17.0	14.0	710.0	41.0	29.00 100.0	-
	D	12.6	-	12.7	-	-	-	945.0	55.6	30.0	51.8
	E	-	-	-	-	-	-	-	-	54.8	54.8
	F	40.0	9.0	7.0	11.0	17.0	14.0	4900.0	15.0	59.0	23.0
	G										
	H										

FOOTNOTES

A-USAF OEHL SURVEY 1971
B-USAF OEHL SURVEY FEB 1980
C-STATE OF TX SURVEY MAY 1979
D-STATE OF TX SURVEY JAN 1980
E-STATE OF TX SURVEY FEB 1980
F-SGB-OEHL SURVEY JUN 1980
G-
H-
I-

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

(1) Sampling points are not in the same exact location for the TWQB and Kelly AFB sample points. However, the sampling points are within reasonable proximity to each other

TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING SITES
HEAVY METALS (uG/Kg)

		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
LEAD	A	26.7	9.8	17.8	-	267.0	6.7	141.0	99.6	-	83.6
(Pb)	B	113.0	39.4	45.8	321.0	171.0	87.2	506.0	197.0	731.0	77.0
	C	17.0	-	34.0	-	200.0	77.0	250.0	310.0	140.0 170.0	-
	D	161.5	-	96.1	-	-	-	214.0	132.0	85.0	207.0
	E	-	-	-	-	-	-	-	-	210.0	167.0
	F	37.0	45.0	97.0	343.0	221.0	151.0	412.0	149.0	243.0	59.0
	G										
	H										
MANGANESE	A	153.0	166.0	173.0	-	220.	236.0	160.0	235.0	-	192.0
(Mn)	B	292.0	180.0	293.0	113.0	310.0	263.0	2700.0	213.0	182.0	312.0
	C	-	-	360.0	-	250.0	510.0	3120.0	240.0	410.0	-
	F	286.0	260.0	273.0	139.0	284.0	290.0	3700.0	500.0	217.0	263.0
	G										
	H										

FOOTNOTES
A-USAF OEHL SURVEY 1971 D-STATE OF TX SURVEY JAN 1980 G-
B-USAF OEHL SURVEY FEB 1980 E-STATE OF TX SURVEY FEB 1980 H-
C-STATE OF TX SURVEY MAY 1979 F-SGB-OEHL SURVEY JUN 1980 I-

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING SITES

HEAVY METALS (uG/Kg)

		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
SILVER											
(Ag)	B	4.8	10.0	3.7	12.3	4.4	4.4	11.3	6.4	6.5	5.4
	C	4.2	-	3.4	-	6.0	5.8	38.0	22.0	6.8 20.0	-
	D	<2.3	-	-	-	-	-	79.6	5.6	6.6	16.0
	E	-	-	-	-	-	-	-	-	35.9	19.1
	F										
	G										
MERCURY	A	0.13	0.1	0.17	-	0.5	0.12	0.74	1.79	-	0.64
(Hg)	B	0.1	0.2	0.2	0.1	0.3	0.3	0.2	0.1	0.1	0.1
	C	0.05	-	0.04	-	0.8	0.12	0.44	0.16	0.1 0.5	-
	D										
	E										
	F										
	G										

FOOTNOTES

A-USAF OEHL SURVEY 1971   D-STATE OF TX SURVEY JAN 1980   G-

B-USAF OEHL SURVEY FEB 1980   E-STATE OF TX SURVEY FEB 1980   H-

C STATE OF TX SURVEY MAY 1979   F-SGB-OEHL SURVEY JUN 1980   I-

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING SITES
HEAVY METALS (uG/Kg)

		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
ZINC	A	155.0	28.1	193.0	-	53.3	62.2	89.2	637.0	-	116
(Zn)	B	30.9	33.6	34.8	158.0	131.0	55.7	247.0	366.0	31.1	58.1
	C	57.0	-	83.0	-	100.0	110.0	250.0	190.0	150.0 730.0	-
	D	70.7	-	6.3	-	-	-	168.0	70.2	43.0	116
	E	40.0	36.0	2300.00	145.0	148.0	160.0	268.0	128.0	116.0	69.0
	F										
	G										
	H										
IRON	A	2700.00	6400.0	6200.0	2500.0	11000.0	6200.0	3200.0	3000.0	2400.0	8900.0
(Fe)	F	39.0	4800.0	6300.0	4400.0	6900.0	7500.0	21000.0	9000.0	4200.0	5700.0
	G										
	H										

FOOTNOTES
A-USAF OEHL SURVEY 1971
B-USAF OEHL SURVEY FEB 1980
C-STATE OF TX SURVEY MAY 1979
D-STATE OF TX SURVEY JAN 1980
E-STATE OF TX SURVEY FEB 1980
F-SGB-OEHL SURVEY JUN 1980
G-
H-
I-

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
ALDRIN	A	0.0				0.0				0.0	
	D									5	
LDL	E			<0.5		<5.0	<0.5	<0.5	<5.0	<0.5	
5.0	G	1353	31	686	ND	290	3491	288	T	2426	1322
	H	<5.0	<5.0	<5.0	B	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
CHLORODANE											
	A	0.0				0.0				0.0	
LDL	D									<100	
50.0	E			<10		<100	<10	<10	<100	67	
	F	74	60.5	23				110	34	ND	38.5
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H	<20.0	<20.0	<20.0	B	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

(1) Sampling points are not in the same exact location for the TWQB and Kelly AFB sample points. However, the sampling points are within reasonable proximity to each other and tables were developed for comparison only.

TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
DDE	A	1.0				7.0				37.0	
	B	1.0				3.2				4.2	
LDL	C	< 2.0					82		28	18.0	
5.0	D									33.0	
	E			42.0		<15.0	43.0	<1.5	<15.0	29.0	
	F	13.0	45.0	8.8				ND	480.0	110.0	112.0
	G	ND	36.0	ND	392.0	ND	ND	44.0	52.0	23.0	T
	H	<10.0	<5.0	<10.0	B	<10.0	<10.0	<10.0	<10.0	< 10.0	< 10.0
SILVEX	A	0.0				0.0				0.0	
	D									20.0	
LDL	G H	T	T	ND	ND B	T	ND	ND	T	ND	ND

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80
B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

(1) Sampling points are not in the same exact location for the TWQB and Kelly AFB sample points. However, the sampling points are within reasonable proximity to each other and tables were developed for comparison only.

TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
METHOXYCHLOR											
	A					0.0				0.0	
LDL	D									20.0	
50.0	F			10.0		<100.0	<10.0	<10.0	<10.0	<10.0	
	G	ND	ND	ND	1297	T	ND	ND	61	ND	T
	H	<20.0	<10.0	<20.0	B	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
DDD	A	0.0				17.0				165.0	
	B	0.0				2.9				13.0	
LDL	C	<3.0					210.0		50	10.0	
5.0	D									86.0	
	E			34.0		<30.0	150.0	<3.0	<30	74.0	
	F	ND	19.0	ND				ND	48.0	13.5	16.0
	G	ND	ND	ND	ND	ND	ND	31	ND	18.0	ND
	H	<10.0	2.4	<10.0	B	<10.0	70	<10.0	<10.0	<10.0	<10.0

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80
B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
DDT											
	A	0.0				77.0				725	
LDL	B	0.0				5.1				243	
5.0	C	<5.0					690.0		180.0	<5.0	
	D									<25.0	
	E			16.0		<30.0	380.0	<3.0	<30.0	1060.0	
	F	ND	11.0	ND				258.0	353.0	40.0	14.0
	G	ND	23.0	ND	120.0	194.0	168.0	35.0	610.0	24.0	ND
	H	<10.0	<5.0	<10.0	B	<10.0	10.0	<10.0	<10.0	<10.0	<10.0

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

(1) Sampling points are not in the same exact location for the TWQB and Kelly AFB sample points. However, the sampling points are within reasonable proximity to each other and tables were developed for comparison only.

TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
METHYL PARATHION											
	A	0.0				0.0				0.0	
LDL	D									5.0	
5.0	E			<3.0		<3.0	<3.0	<3.0	<3.0	<3.0	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H				B						
PARATHION											
	A	0.0				0.0				0.0	
LDL	D									5.0	
5.0	E			<50.0		<3.0	<3.0	<3.0	<3.0	<3.0	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	H				B						

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
B - BROKEN
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
DIELDRIN											
	A	0.0				0.0				1.9	
~~LDL~~	B	0.0				0.0				0.0	
5.0	D									3.0	
	E			2.0		2.0	2.0	2.0	2.0	2.0	
	G	N	ND	ND	ND	19.0	ND	ND	T	ND	ND
	H	<1.0	<1.0	2.1	B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
ENDRIN											
	A	0.0				0.0				0.0	
LDL	E			<3.0		<3.0	<3.0	<3.0	<3.0	<3.0	
5.0	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H	<1.0	<1.0	<1.0	B	1.0	1.0	<10.0	<1.0	<1.0	<1.0

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

(1) Sampling points are not in the same exact location for the TWQB and Kelly AFB sample points. However, the sampling points are within reasonable proximity to each other and tables were developed for comparison only.

TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
LINDANE											
	A	0.0				0.0				0.0	
LDL	D									≤5.0	
5.0	E		<1.0			<10.0	≤1.0	≤1.0	<1.0	<1.0	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H	<5.0	<5.0	<5.0	B	<5.0	<5.0	<5.0	<5.0	< 5.0	< 5.0
DIAZINON											
	A	0.0				0.0				0.0	
LDL	D									5.0	
5.0	E			<5.0		<50.0	<5.0	≤5.0	<5.0	<5.0	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H				B						

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
HEPTACHLOR											
	A	0.0				0.0				0.0	
LDL	D									≤5.0	
5.0	F			≤0.5		≤5.0	<0.5	<0.5	<0.5	<0.5	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H	<5.0	45.0	<5.0	B	<5.0	<5.0	<5.0	<5.0	<5.0	< 5.0
HEPTACHLOR-EPOXIDE											
	A	0.0				0.0				0.0	
LDL	D									<5.0	
5.0	F			<1.0		<10.0	<1.0	<1.0	<1.0	<1.0	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H	<5.0	<1.0	73.0	<B	<5.0	20.0	5.0	5.0	<5.0	<5.0

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

B - BROKEN

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

LEON CREEK SEDIMENT SAMPLING

PESTICIDES ANALYSIS (uG/Kg)

PESTICIDES		NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
PARAPHENE											
	A	0.0				0.0				0.0	
LDL	D									250.0	
250	F			< 50.0		<500.0	<50.0	<50.0	< 50.0	<50.0	
	G	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	H	-	-	-	-	-	-	-	-	-	-

FOOTNOTES

A - TX, 9 JUL 74
B - TX, 12 MAR 76
C - TX, 1 AUG 77
D - TX, 7 DEC 78
E - TX, 10 MAY 79
F - TX, 17 JAN 80
G - OEHL, 27 FEB 80
H - SGB-OEHL, 6 JUN 80

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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TABLE D.3 (CONT.)

POLYCHLORINATED BIPHENYLS
(PCB'S)

*MILLIGRAMS PER KILOGRAM (PPM)

SAMPLE POINTS	NO 1	NO 2	NO 3	NO 4	NO 5	NO 6	NO 7	NO 8	NO 9	NO 10
TEXAS 79 SURVEY	-	-	20	-	1500	20	230	2300	20	-
OEHL 80 SURVEY	<1000	<1000	<1000	TR @ <1000	<1000	TR @ <1000	<1000	TR @ <1000	<1000	<1000
SGB JUN 80 SURVEY	ND < 0.5	ND <.05	TR <0.5	TR < 0.5	TR <0.5	0.5	TR <0.5	TR < 0.5	TR < 0.5	TR < 0.5

*DRY WEIGHT

ND: NONE DETECTED. LESS THAN THE QUANTITATIVE DETECTION LIMIT (0.5)

Source: IRP, Phase I, Kelly AFB, TX, February 1982.

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APPENDIX E

MASTER LIST OF SHOPS

APPENDIX E
MASTER LIST - INDUSTRIAL SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Typical TSD Methods
3700th Air Base Group Civil Engineering/SARPMA				
CE Carpentry Shop	6008	Yes	No	Consumed in Process
CE Heating Shop	6006	Yes	No	Consumed in Process
CE Lawnmower Repair	6011	Yes	Yes	DPDO, Sanitary Sewer
CE Machine Shop	6026	Yes	No	Consumed in Process
CE Paint Shop	6026	Yes	Yes	DPDO
CE Pavement and Grounds	6020	Yes	No	Consumed in Process
CE Plumbing Shop	6008	Yes	No	Consumed in Process
CE Refrigeration/Air-Conditioning Repair	6006	Yes	No	Consumed in Process
CE Sheetmetal	6008	Yes	No	Consumed in Process
Sewage Treatment Plant	700/720	Yes	No	Consumed in Process
Water Treatment Plant	6008	Yes	No	Consumed in Process
CE Electric Shop	6003	Yes	Yes	DPPO, Consumed in Process
CE Entomology Shop	5394	Yes	Yes	Sprayer Rinsewater to Ground, Consumed in Process
CE Golf Course Maint.	2960	Yes	Yes	Rinsewater to Ground, Consumed in Process
CE Welding Shop	6026	Yes	No	Consumed in Process

APPENDIX E (Continued)
MASTER LIST - INDUSTRIAL SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Typical TSD Methods
3700th Air Base Group/Resource Management-Transportation Maintenance				
Minor/Heavy Equipment Repair	5015	Yes	Yes	DPDO, Sanitary Sewer
Paint and Body Shop	5015/5007	Yes	Yes	Evaporation, Landfill
Vehicle Maintenance	5020	Yes	Yes	DPDO, Landfill, Storm Drain, Sanitary Sewer
3700th Air Base Group/Morale, Welfare, and Recreation Division				
Auto Hobby	7245	Yes	Yes	Underground tank storage/DPDO
Photo Hobby Shop	7245	Yes	Yes	Sanitary Sewer, Silver Recovery at Wilford Hall
Wood Hobby Shop	7041	Yes	No	Consumed in Process
Ceramic Hobby Shop	7041	Yes	No	Consumed in Process
3700th Air Base Group/Administrative Division				
Base Reproductions	3295	Yes	Yes	DPDO
3700th Air Base Group/Services Division				
Billeting Services	4902	Yes	Yes	Sanitary Sewer, onto ground, Landfill
Training Services - Paint	5401	Yes	Yes	DPDO

APPENDIX E (Continued)
MASTER LIST - INDUSTRIAL SHOPS

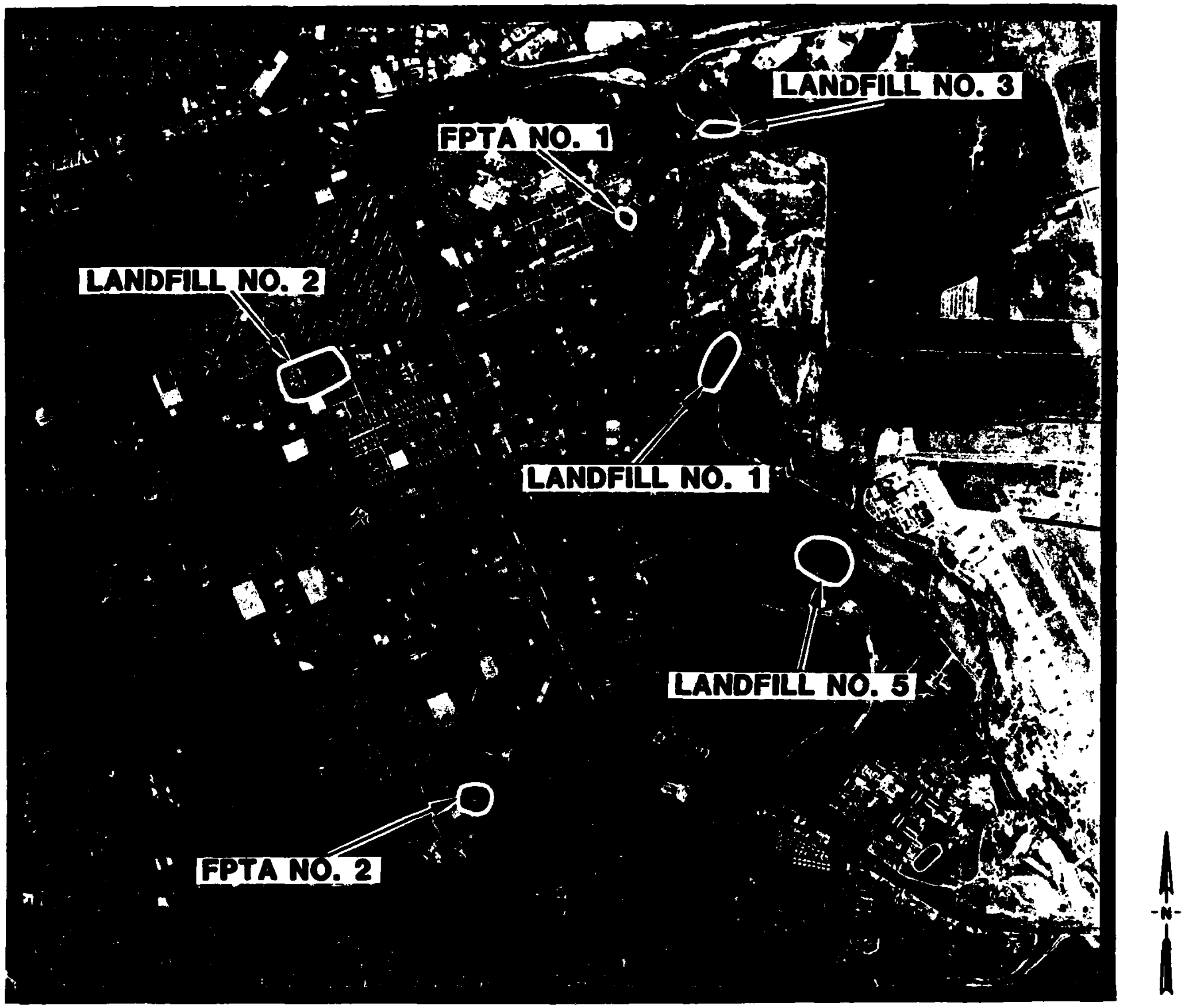
Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Typical TSD Methods
3700th Air Base Group/Services Division (Continued)				
Training Services - Metal Works	5401	Yes	No	Consumed in Process
Training Services - Carpentry	5401	Yes	No	Consumed in Process
DOD Dog Center				
Military Dog Veterinary Services	7595	Yes	Yes	On ground, Sanitary Sewer
Wilford Hall Medical Center				
Laboratories, Blood Donor Center	4550, 9282	Yes	Yes	DPDO, Sanitary Sewer
Incinerator	Near 3558	Yes	Yes	Landfill
Total Energy Plant	4880	Yes	Yes	Sanitary Sewer, DPDO, Storm Drain
Dental Labs	4602, 6418	Yes	Yes	DPDO, Sanitary Sewer
Lackland Training Annex (Medina)				
Det. 40 Munitions Storage and Maintenance	444 Complex	Yes	Yes	Landfill
Weapons Maintenance	431	Yes	Yes	DPDO, Landfill

APPENDIX E (Continued)
MASTER LIST - INDUSTRIAL SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Material	Generates Hazardous Wastes	Typical TSD Methods
Lackland Training Annex (Medina) (Continued)				
DOD Dog Training	466	Yes	Yes	Onground Disposal
3700th Vehicle Maintenance	220	Yes	Yes	DPDO, Sanitary Sewer
6948th FSS Mobility Vehicle Maintenance	210	Yes	Yes	DPDO, Sanitary Sewer
OTS Dental Clinic	114	Yes	Yes	Medical Supply
CE SMART Team	230	Yes	No	Consumed in Process
Firing Range	919	Yes	Yes	DPDO, Landfill

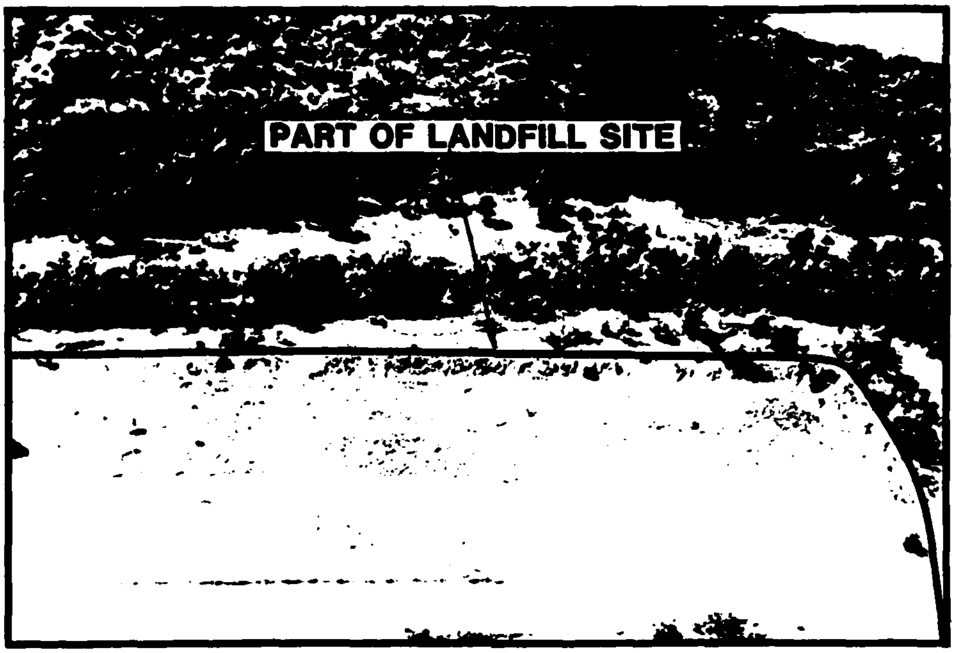
APPENDIX F

PHOTOGRAPHS

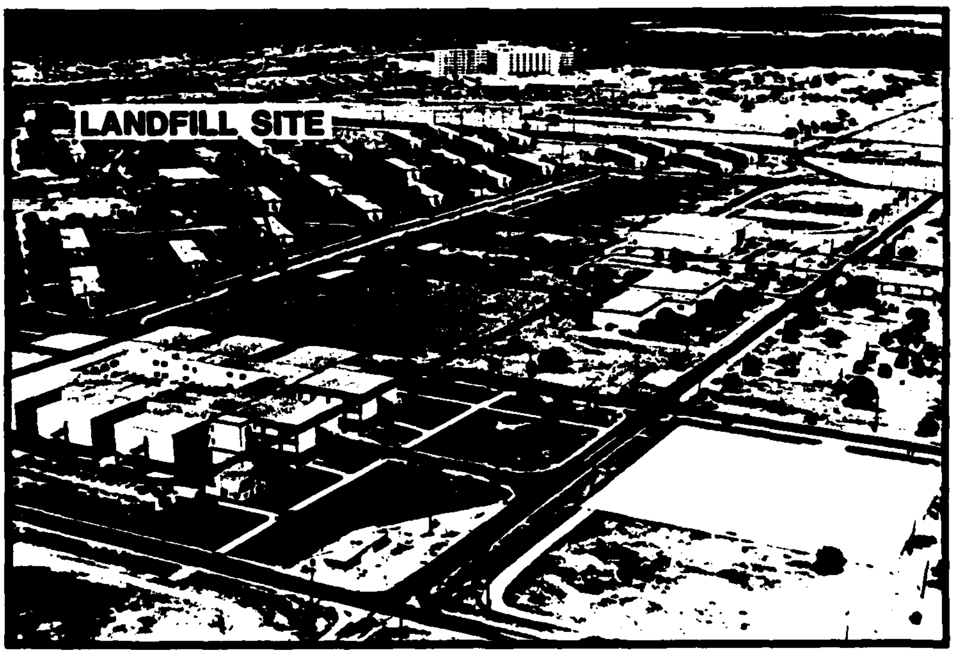


LACKLAND AFB 1984

LACKLAND TRAINING ANNEX **1984**

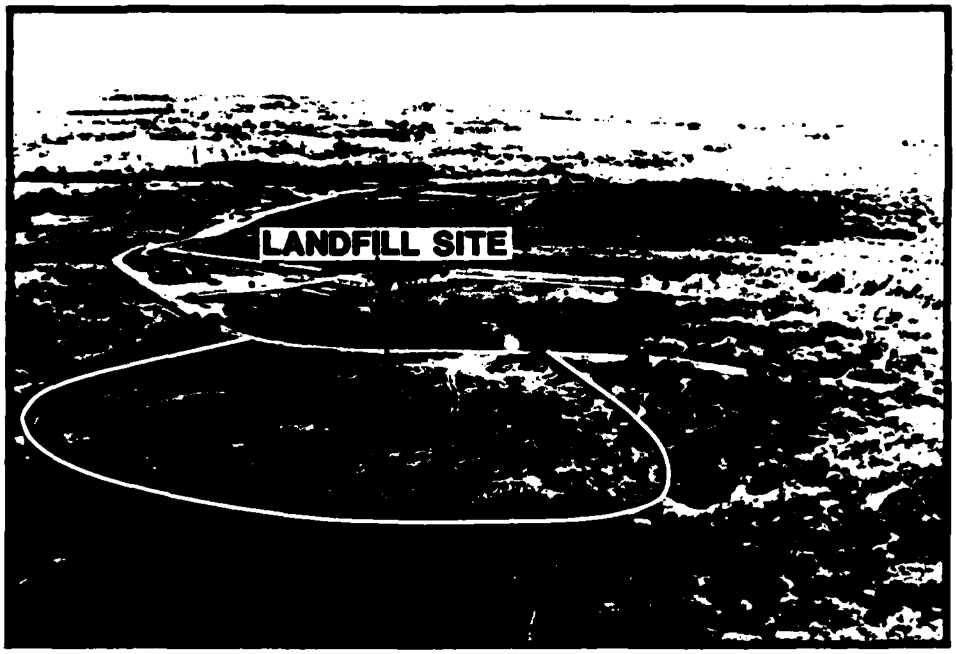


Landfill No. 1



Landfill No. 2

LACKLAND AFB



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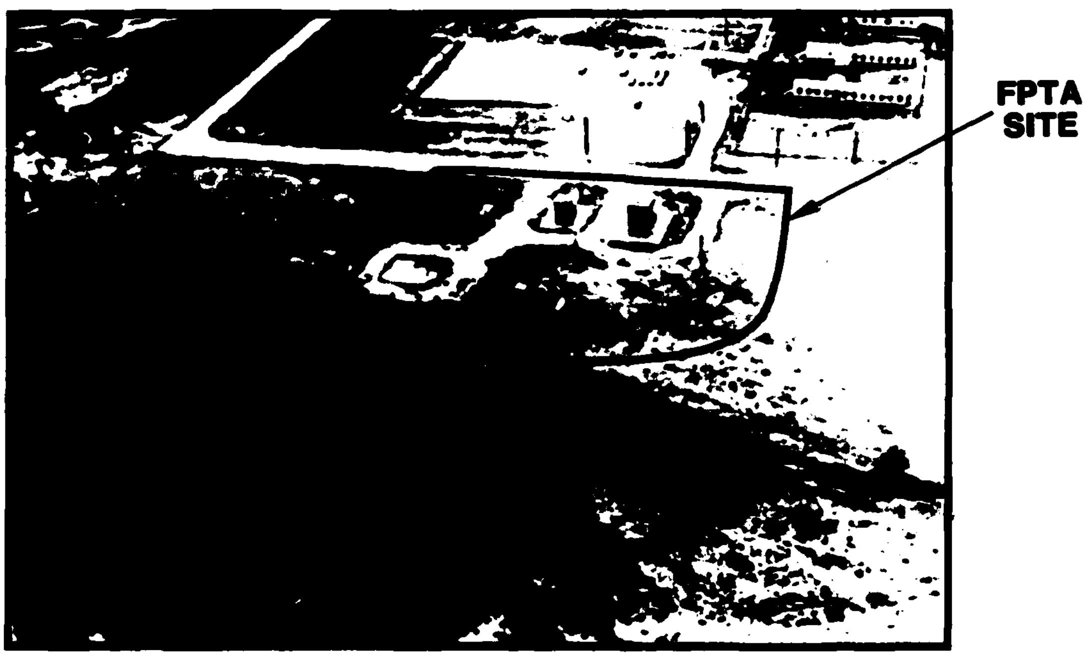
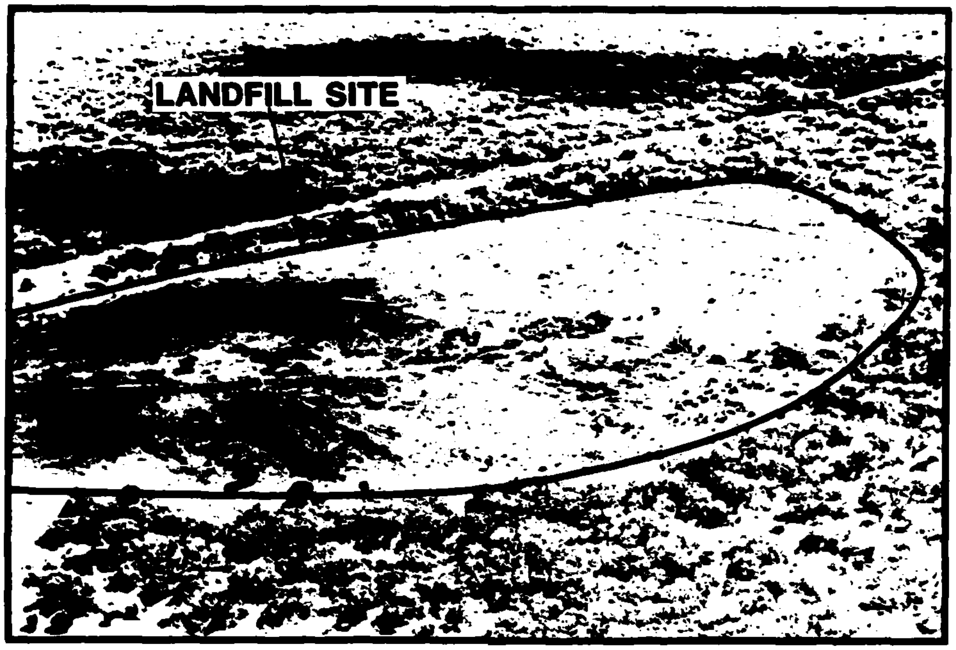


Fire Protection Training Area No. 2

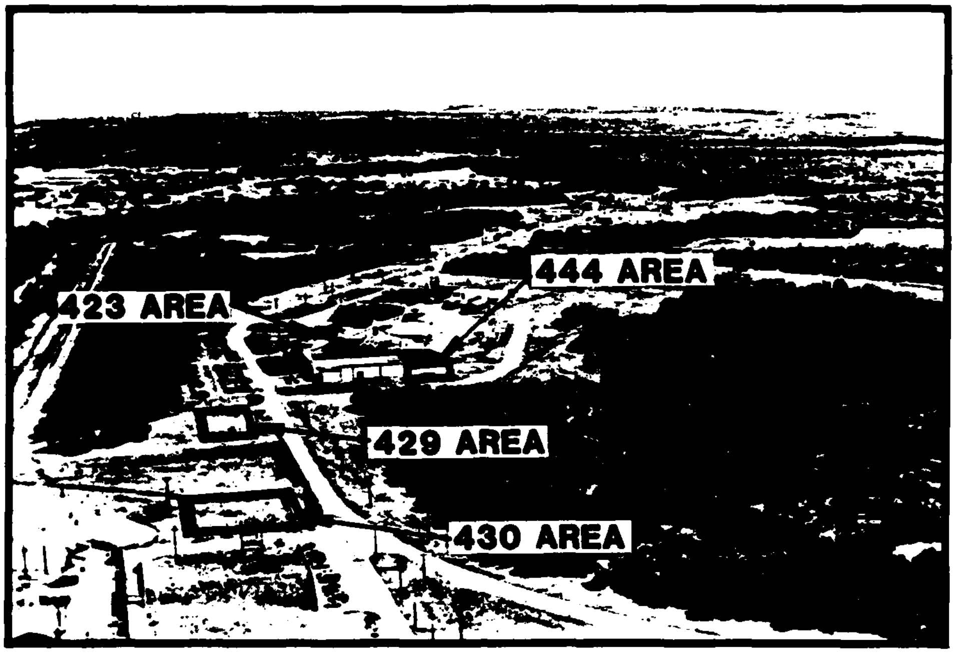
LACKLAND TRAINING ANNEX



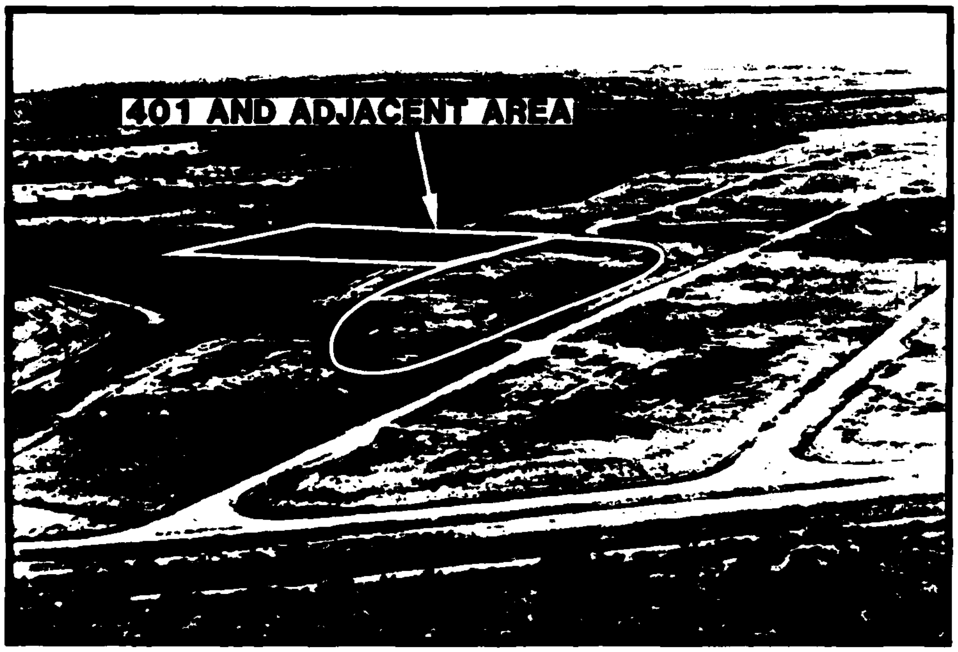
Landfill No. 4

Waste Burning Grounds

LACKLAND TRAINING ANNEX



Radioactive Waste Burial Areas



Radioactive Waste Burial Areas

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM HAZARD

ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

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

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

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

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed tc 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 the 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 Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

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

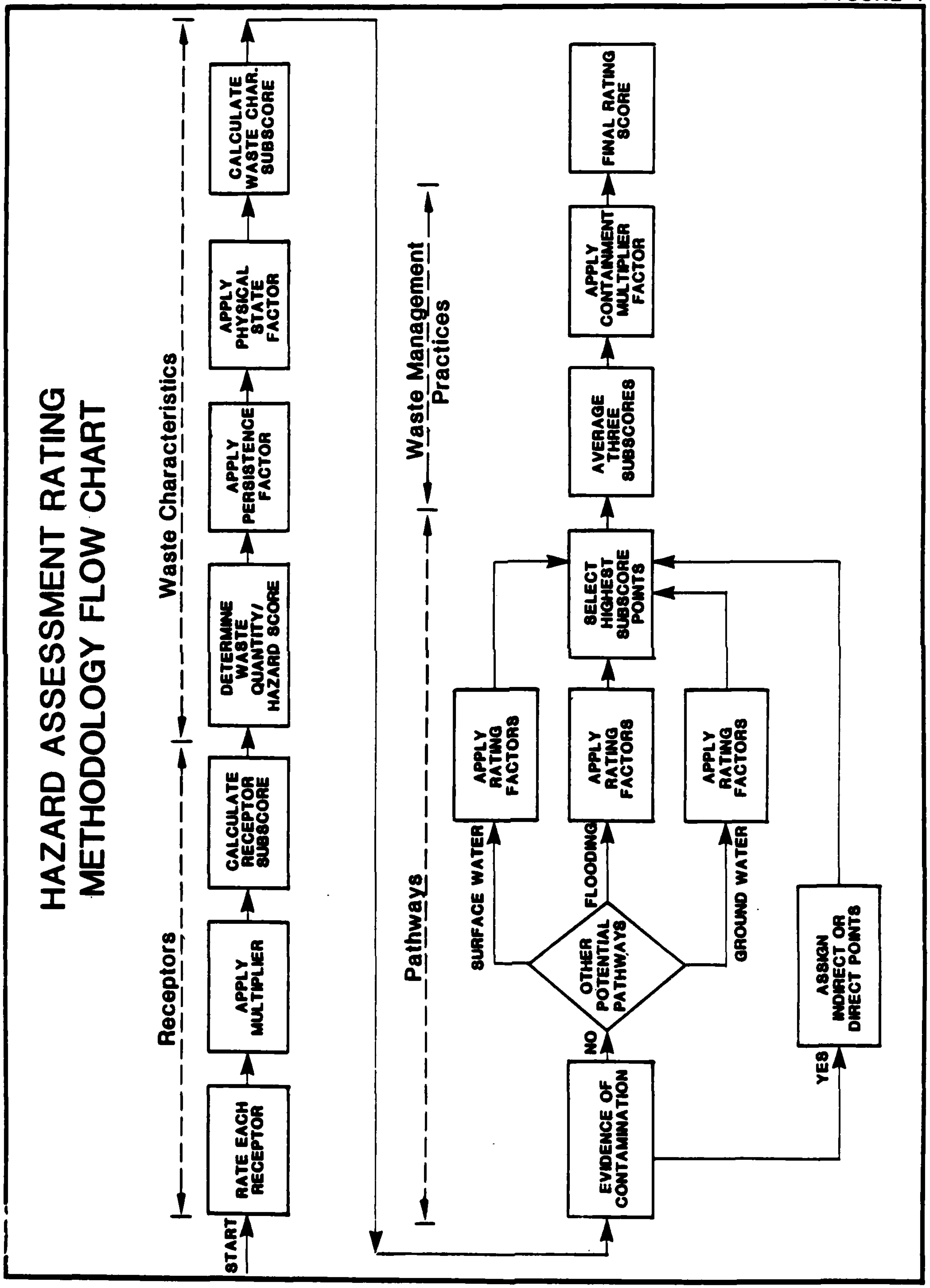
The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

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

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

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

FIGURE 1



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

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______________________

LOCATION ______________________

DATE OF OPERATION OR OCCURRENCE ______________________

OWNER/OPERATOR ______________________

COMMENTS/DESCRIPTION ______________________

SITE RATED BY ______________________

I. RECEPTORS

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

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

II. WASTE CHARACTERISTICS

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

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

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

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

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

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

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

Subscore ______

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

1. Surface water migration

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

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

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

Subscore (100 x factor score/3) ______

3. Ground-water migration

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

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

C. Highest pathway subscore.

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

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

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

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

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

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

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

S = Suspected confidence level

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

A-3 Hazard Rating

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)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

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

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

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

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

B. Persistence Multiplier for Point Rating

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

C. Physical State Multiplier

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

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

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

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

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 flood-plain	In 10-year flood-plain	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 casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

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

B. WASTE MANAGEMENT PRACTICES FACTOR

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

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

Guidelines for fully contained:

Landfills:

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

Spills:

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

Surface Impoundments:

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

Fire Proection Training Areas:

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

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

APPENDIX H

SITE HAZARD ASSESSMENT RATING FORMS

APPENDIX H

INDEX FOR HAZARD ASSESSMENT

METHODOLOGY FORMS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site:Leaching Area (Near Building 7595)
Location:Lackland AFB
Date of Operation or Occurrence: 1960 to present
Owner/Operator: Lackland AFB
Comments/Description:Disposal of pesticide solutions used for dipping military dogs

Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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			125	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

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 (1=small, 2=medium, 3=large) 2
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

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 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	0	8	0	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

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

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	69	
Waste Characteristics	72	
Pathways	35	
Total 176 divided by 3 =		59 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

59 x 1.00 = 59

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Leaching Area (Near Building 466)
Location:Lackland Training Annex
Date of Operation or Occurrence: 1966 to present
Owner/Operator: Lackland AFB
Comments/Description:Disposal of pesticide solutions used for dipping military dogs

Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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			82	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 46

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 (1=small, 2=medium, 3=large) 2
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

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 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding	1	1	1	3
Subscore (100 x factor score/3)				33.33333
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	1	8	8	24
Subtotals			64	114
Subscore (100 x factor score subtotal/maximum score subtotal)				56.14035

C. Highest pathway subscore.

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	46		
Waste Characteristics	72		
Pathways	56		
Total 174 divided by 3 =		58	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

58 x 1.00 = \ 58 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site:Landfill No. 4
Location:Lackland Training Annex
Date of Operation or Occurrence: 1955 to 1973
Owner/Operator: AEC 1955-1965;USAF Lackland AFB 1966-1973
Comments/Description:Disposal of paints,thinners,pesticides,and some pathological wastes
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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			83	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 46

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 (1=small, 2=medium, 3=large) 2
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

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 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding	1	1	1	3
Subscore (100 x factor score/3)				33
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	0	8	0	24
Subtotals			56	114
Subscore (100 x factor score subtotal/maximum score subtotal)				49

C. Highest pathway subscore.

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

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	46	
Waste Characteristics	72	
Pathways	57	
Total	175 divided by 3 =	58 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

58 x 1.00 = 58

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fire Protection Training Area No. 3
Location:Lackland Training Annex
Date of Operation or Occurrence: 1955 to 1965
Owner/Operator: AEC
Comments/Description: Burned fuel oil

Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	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	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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			109	180

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

II. WASTE CHARACTERISTICS

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

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

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 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			62	108
Subscore (100 x factor score subtotal/maximum score subtotal)				57
2. Flooding	1	1	1	3
Subscore (100 x factor score/3)				33
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	0	8	0	24
Subtotals			56	114
Subscore (100 x factor score subtotal/maximum score subtotal)				49

C. Highest pathway subscore.

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

Pathways Subscore 57

IV. WASTE MANAGEMENT PRACTICES

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

Receptors		61	
Waste Characteristics		48	
Pathways		57	
Total	166 divided by 3 =		55 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

55 x 1.00 = 55

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fire Protection Training Area No. 2
Location:Lackland AFB
Date of Operation or Occurrence: 1971 - present
Owner/Operator: Lackland AFB
Comments/Description: Burned waste oils,solvents and fuels and clean fuels
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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			125	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

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 (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

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 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	0	8	0	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

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

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	69
Waste Characteristics	48
Pathways	35
Total	152 divided by 3 = 51 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

51 x 1.00 = 51

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Explosive Ordnance Burning Pit
Location:Lackland Training Annex
Date of Operation or Occurrence: 1982 - present
Owner/Operator: Lackland AFB
Comments/Description: Burned munitions,explosives,blasting caps,etc.
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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 (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

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 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 0.50 = 24

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding	1	1	1	3
Subscore (100 x factor score/3)				33
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

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

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

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

Receptors		54
Waste Characteristics		24
Pathways		50
Total	128	divided by 3 = 43 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

43 x 1.00 = \ 43 \
FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Waste Burning Grounds
Location:Lackland Training Annex
Date of Operation or Occurrence: 1951- 1981
Owner/Operator: AEC 1955-1965; USAF Lackland AFB 1966-1981
Comments/Description: Burned explosives,munitions,detonators, etc.
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	3	6	18	18
G. Ground water use of uppermost aquifer	0	9	0	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			94	180

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

II. WASTE CHARACTERISTICS

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

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

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 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 0.50 = 32

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	1	8	8	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

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

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

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

Receptors		52
Waste Characteristics		32
Pathways		43
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 1.00 = 42

FINAL SCORE

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I
GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

ABG: Air Base Group

ACFT MAINT: Aircraft Maintenance.

AEC: Atomic Energy Commission

AF: Air Force.

AFB: Air Force Base.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent. AFFF concentrates includes fluorinated surfactants plus foam stabilizers diluted with water to a 3 to 6% solution.

AFR: Air Force Regulation.

Ag: Chemical symbol for silver.

AGE: Aerospace Ground Equipment.

Al: Chemical symbol for aluminum.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

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

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

AQUITARD: A geologic unit which impedes ground-water flow.

ARENACEOUS: Sand-bearing or sandy; containing sand-sized particles.

ARGILLACEOUS: Composed of clay minerals or clay-sized particles.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

ATC: Air Training Command.

ARTESIAN: Ground water contained under hydrostatic pressure.

AUTOCLAVE: A method of sterilization by superheated steam under pressure.

AVGAS: Aviation Gasoline.

Ba: Chemical symbol for barium.

BALCONES ESCARPMENT: The long, relatively continuous steeply sloping geomorphological feature formed by faulting that separates the Edwards Plateau (north) from the West Gulf Coastal Plain (south). The Edwards Plateau forms the upper escarpment surface, while the Coastal Plain defines the lower escarpment limits.

BEE: Bioenvironmental Engineer.

BES: Bioenvironmental Engineering Services.

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

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.

BOWSER: A portable tank, usually under 200 gallons in capacity.

BX: Base Exchange.

$CaCO_3$: Chemical symbol for calcium carbonate.

CALICHE: Gravel, sand, silt or clay cemented by soluble calcium salts to form a crust or hard layer. A term used to describe a broad variety of "hard pan" conditions in the southwest U.S.

CAMS: Consolidated Aircraft Maintenance Squadron.

CARBON 14: A radionuclide with a 5730 year half-life.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CERIUM 144: A radionuclide with a 284 day half-life.

CES: Civil Engineering Squadron.

CESIUM 137: A radionuclide with a 30 year half-life.

CHERTY: A precipitated cryptocrystalline silicate rock material. Occurs chiefly as nodules or concretions within a host rock.

CHLORDANE: An insecticide.

CIRCA: About; used to indicate an approximate date.

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

CN: Chemical symbol for cyanide.

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

COE: Corps of Engineers.

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

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

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

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

CURIE: Unit for measuring radioactivity. One curie is the quantity of any radioactive isotope undergoing 3.7×10^{10} disintegrations per second.

DDD: 2,2-bis (para-chlorophenyl) - 1,1-dichloroethane. An insecticide. Insoluble in water.

DDT: Dichlorodiphenyltrichloroethane. An insecticide. Insoluble in water.

DET: Detachment.

2,4-D: Abbreviation for 2,4-dichlorophenoxyacetic acid, a common weed killer and defoliant.

DIP: The angle at which a stratum is inclined from the horizontal.

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

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

DO: Dissolved oxygen.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office.

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

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

EOD: Explosive Ordnance Disposal.

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

EPA: U.S. Environmental Protection Agency.

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

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

ES: Engineering-Science, Inc.

FAA: Federal Aviation Administration.

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

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

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

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

FMS: Field Maintenance Squadron.

FPTA: Fire Protection Training Area.

FTW: Flying Training Wing.

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

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

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

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

HALF-LIFE: The time required for half the atoms present in radioactive substance to disintegrate.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

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

HARM: Hazard Assessment Rating Methodology.

*HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

*HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HQ: Headquarters.

HWAP: Hazardous Waste Accumulation Point.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

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* For purposes of this Phase I IRP report hazardous substances and hazardous wastes are considered synonymous.

ISOTOPE: Two or more species of atoms of the same chemical element, with the same atomic number and place in the periodic table, and nearly identical chemical properties, but with different atomic mass numbers and different physical properties; an example may be the radioactive isotope - Carbon (12) and Carbon-14.

JP-4: Jet Propulsion Fuel Number Four, military jet fuel.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

LOX: Liquid oxygen.

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone.

m: Milli (10^{-3})

MARL: An earthy substance consisting of 35-65% clay and 65-35% carbonate, formed as a result of calcium carbonate precipitation and clay particle sedimentation.

MEK: Methyl ethyl ketone.

METALS: See "Heavy Metals".

ug/l: Micrograms per liter.

mg/l: Milligrams per liter.

MGD: Million gallons per day.

MIBK: Methyl isobutyl ketone.

MICRO: u (10^{-6}).

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MONITORING WELL: A well used to measure ground-water levels and to obtain samples.

MSL: Mean Sea Level.

MWR: Morale, Welfare and Recreation.

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929. A national datum system, tied to Mean Sea Level, but referenced primarily to land-based benchmarks.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration.

NPDES: National Pollutant Discharge Elimination System.

NRC: Nuclear Regulatory Commission

OEHL: Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OMS: Organizational Maintenance Squadron.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

OSI: Office of Special Investigations.

OTS: Officer Training School.

O&G: Symbols for oil and grease.

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PD-680: Cleaning solvent, petroleum distillate, Stoddard solvent.

PERCHED WATER TABLE: A water table above a relatively impermeable zone underlain by unsaturated rocks of sufficient permeability to allow ground-water movement.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

PESTICIDE: An agent used to destroy pests. Pesticides include such specialty groups as herbicides, fungicides, insecticides, etc.

PETN: Pentaerythritol tetranitrate. An explosive which is soluble in water.

pH: Negative logarithm of hydrogen ion concentration.

pico: 10^{-12}

PL: Public Law.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.

POTENTIOMETRIC SURFACE: The imaginery surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

ppb: Parts per billion by weight.

ppm: Parts per million by weight.

PRECIPITATION: Rainfall.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RDX: Cyclonite. An explosive consisting of hexahydro-trinitro-triazine.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RECON: Reconnaissance.

RIPARIAN: Living or located on a riverbank.

RM: Resource Management.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SARPMA: San Antonio Real Property Maintenance Agency

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream.

SMART: Structural maintenance and repair team.

SOLE SOURCE: As in aquifer. The only source of potable water supplies of acceptable water quality available in adequate quantities for a significant population. Sole source is a legal term which permits use control of the aquifer by designated regulatory authorities.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

STRIKE: The compass direction or trend taken by a structural feature, such as bedding, folds, faults, etc. Strike is measured at a point when the specific feature intersects the topographic surface.

SUPONO: Trade name for the pesticide 2-chloro-1-2, 4-dichlorophenyl vinyl diethyl phosphate.

TA: Training Annex

TAC: Tactical Air Command

TCE: Trichloroethylene, a solvent and suspected carcinogen.

TDS: Total Dissolved Solids, a water quality parameter.

TECTONIC (ally): Said of or pertaining to the forces and resulting structural or deformational features evident in the earth's crust. Tectonics usually deals with the broad architecture of the earth's outer crust.

TOC: Total Organic Carbon.

TNT: 2,4,6-trinitrotolene. An explosive which is insoluble in water.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal.

TWQB: Texas Water Quality Board (now Texas Department of Water Resources).

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of groundwater.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USEPA: United States Environmental Protection Agency.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WHMC: Wilford Hall Medical Center.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX J

REFERENCES

APPENDIX J
REFERENCES

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APPENDIX K

INDEX OF REFERENCES TO POTENTIAL CONTAMINATION SITES AT LACKLAND AFB

APPENDIX K
INDEX OF REFERENCE TO POTENTIAL
CONTAMINATION SITES AT LACKLAND AFB

Site	References (Page Numbers)
Leaching Area - 7595	3, 6, 8, 4-34, 4-39, 4-42, 5-1, 5-2, 6-1, 6-2, 6-3, 6-5, H-1.
Leaching Area - 466	3, 6, 8, 4-34, 4-39, 4-42, 5-1, 5-2, 6-2, 6-3, 6-4, 6-5, H-3.
Landfill No. 4	3, 6, 8, 4-26, 4-39, 4-42, 5-2, 5-4, 6-2, 6-3, 6-4, 6-5, F-2, H-5.
Fire Protection Training Area No. 3	3, 6, 4-21, 4-39, 4-42, 5-2, 5-4, 6-5, F-2, H-7.
Fire Protection Training Area No. 2	3, 6, 4-19, 4-21, 4-39, 4-42, 5-2, 5-4, 6-5, F-4, H-9.
Explosive Ordnance Burning Pit	3, 6, 4-33, 4-39, 4-42, 5-2, 5-4, 6-5, H-11.
Waste Burning Grounds	3, 6, 4-33, 4-39, 4-42, 5-2, 5-6, 6-5, F-2, F-5, H-13.