AD-A130 668 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR BERGSTROM AIR FORCE BASE TEXAS(U) CH2M HILL GAINESVILLE FL JUL 83 F08637-80-G-0010

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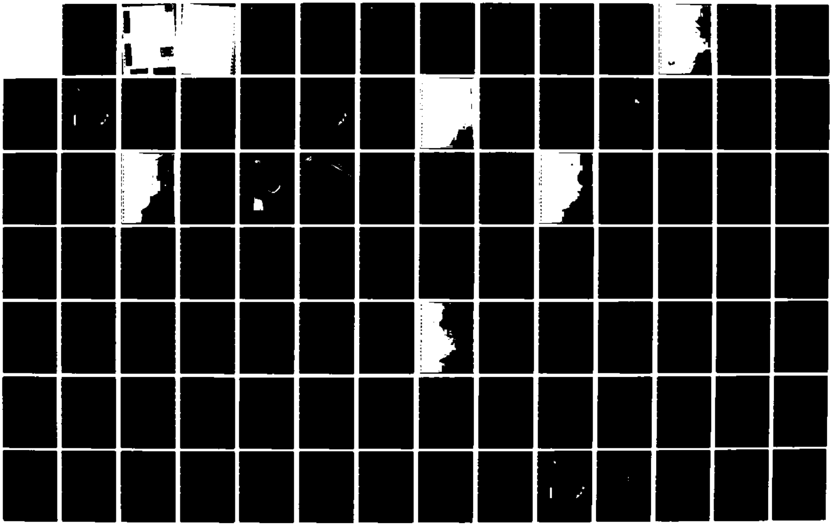

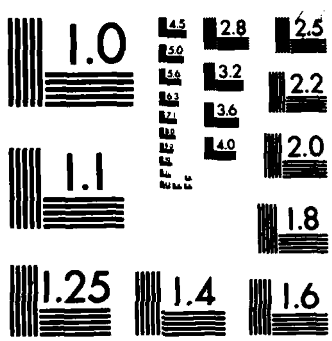

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NATIONAL BUREAU OF STANDARDS-1963-A

INSTALLATION RESTORATION
PROGRAM RECORDS SEARCH

FOR

BERGSTROM AIR FORCE BASE, TEXAS

Prepared for

AIR FORCE ENGINEERING AND SERVICES CENTER
DIRECTORATE OF ENVIRONMENTAL PLANNING
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AND

TACTICAL AIR COMMAND
DIRECTORATE OF ENGINEERING
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Prepared by

CH2M HILL
7201 N.W. 11th Place
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July 1983

Contract No. F08637-80-G0010-~~0016~~

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EXECUTIVE SUMMARY

A. INTRODUCTION

1. CH2M HILL was retained on December 20, 1982, to conduct the Bergstrom Air Force Base (AFB) records search under Contract No. F08637-80-G0010-0016, with funds provided by Tactical Air Command (TAC).

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

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

4. The Bergstrom AFB records search included a detailed review of pertinent installation records, contacts with 12 government organizations for documents

relevant to the records search effort, and an onsite base visit conducted by CH2M HILL during the week of April 4 through April 8, 1983. Activities conducted during the onsite base visit included interviews with 43 past and present base employees, ground tours of base facilities, a detailed search of installation records, and a helicopter overflight to identify past disposal areas. The installations addressed in the records search include Bergstrom AFB, the Lake Travis Recreation Site, the Middle Marker Site, and the Communications Transmitter Site.

B. MAJOR FINDINGS

1. The majority of industrial operations at Bergstrom AFB have been in existence since the early 1950s. The initial construction of the installation began in 1942 and the base was in full operation by the end of 1943. Some industrial activities were conducted during the early years of operation. The major industrial operations have included corrosion control shops, flightline maintenance shops, aerospace ground equipment (AGE) maintenance shops, non-destructive inspection (NDI) labs, photographic processing interpretation facilities (PPIF), and vehicle maintenance shops. These industrial operations generated varying quantities of waste oils, contaminated fuels, and spent solvents and cleaners. The total quantity of waste oils, contaminated fuels, and spent solvents and cleaners generated ranged from 50,000 to 75,000 gallons per year.

2. Standard procedures for past and present industrial waste disposal practices have been as follows: (1) fire department training exercises, sanitary

sewer, road oiling, and base landfills (1943-1972) and (2) sanitary sewer and contractor removal through DPDO (1972 to present).

3. Interviews with past and present base employees resulted in the identification of 26 past disposal or spill sites at Bergstrom AFB and the approximate dates that these sites were active (see Figure 1 for site locations).

C. CONCLUSIONS

1. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Bergstrom AFB boundaries. Indirect evidence of contamination was found at Site No. 17, South Fork Drainage Ditch in the form of two small patches of a red oily material, suspected of being a red dye used in the Fuels Systems Repair Shop, which were observed on the surface of the ditch.

2. No evidence of environmental stress due to past disposal of hazardous wastes was observed at Bergstrom AFB.

3. Information obtained through interviews with 43 past and present base personnel, base records, shop folders, and field observations indicates that hazardous wastes have been disposed of on Bergstrom AFB property in the past.

4. The potential for contaminant migration exists at Bergstrom AFB. A shallow ground-water zone, not used as a potable water source, is located approximately 40 feet below the surface. Assuming the existence of a hydraulic driving force, vertical

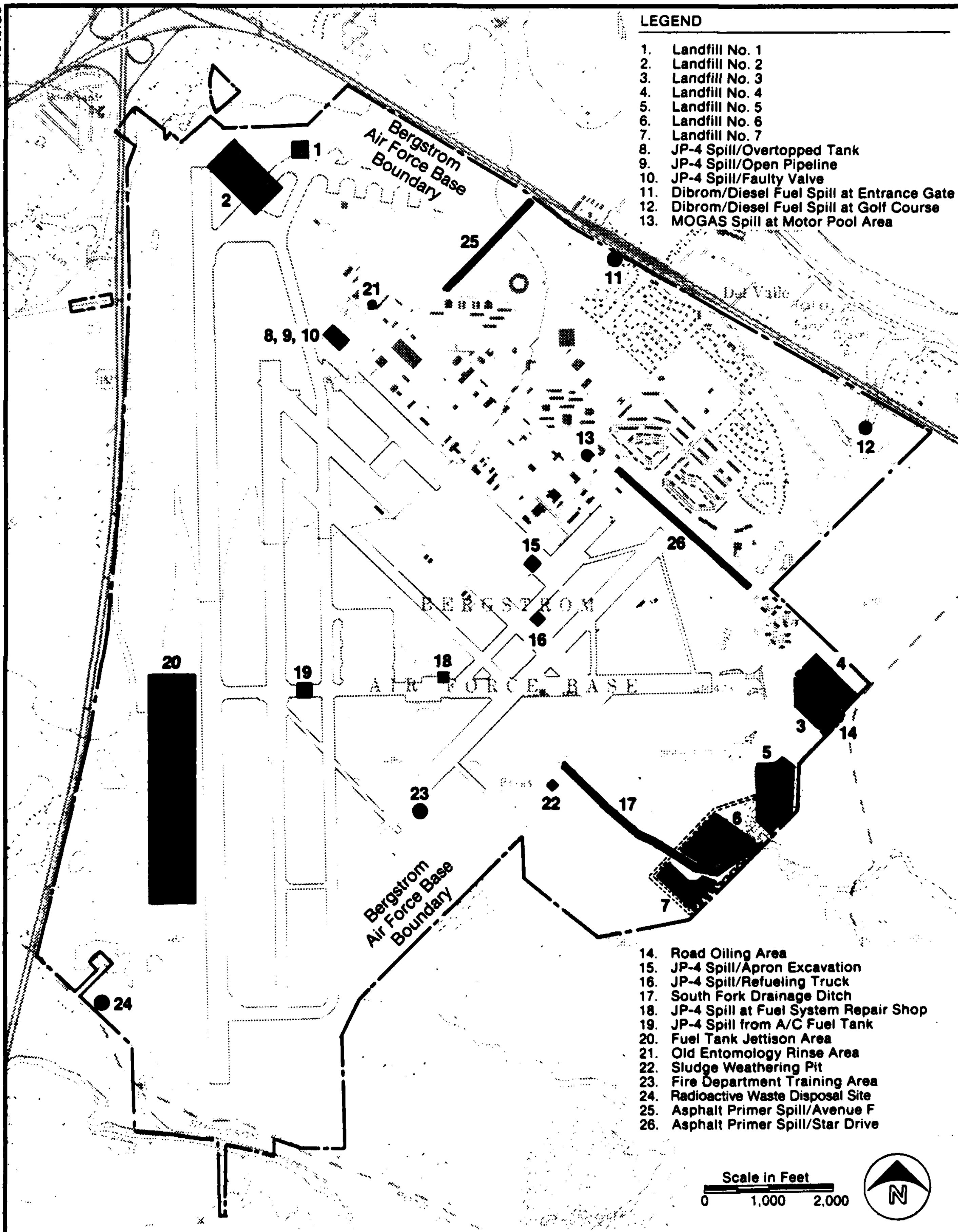

FIGURE 1.
Location Map of Identified Disposal and Spill Sites at Bergstrom AFB.

percolation to this zone would be moderate (1×10^{-3} ft/min) due to a clay-silt soil at the surface; movement of contaminants horizontally through the lenticular river deposits would be slow. The moderate vertical percolation through the clay-silt soils reduces the potential for ground-water migration of contaminants but increases the potential for surface-water runoff and migration of contaminants.

5. Table 1 presents a priority listing of the rated sites and their overall scores. The following sites were designated as those showing the most significant potential (relative to other Bergstrom AFB sites) for environmental impact.

   a. Site No. 17--South Fork Drainage Ditch

   b. Site No. 13--MOGAS Spill at Motor Pool Area

   c. Site No. 23--Fire Department Training Area

   d. Sites No. 6, 14, 3, 4, 5, and 7--The Southeast Landfill Area

   e. Site No. 8--JP-4 Spill/Overtopped Tank

6. The remaining rated sites (No. 1, 2, 9, 10, 12, 15, 16, 18-22, 25, and 26), as well as the sites that were not rated, are not considered to present significant environmental concerns.

7. The records search did not indicate any significant environmental concerns for the Lake Travis Recreation Site, the Middle Marker Site, or

Table 1
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
17	South Fork Drainage Ditch	65
13	MOGAS Spill at Motor Pool Area	58
23	Fire Department Training Area	57
6	Landfill No. 6	56
8	JP-4 Spill/Overtopped Tank	53
14	Road Oiling Area	53
21	Old Entomology Rinse Area	51
3	Landfill No. 3	50
4	Landfill No. 4	50
26	Asphalt Primer Spill/Star Drive	50
5	Landfill No. 5	49
7	Landfill No. 7	49
18	JP-4 Spill at Fuel Systems Repair Shop	49
20	Fuel Tank Jettison Area	49
25	Asphalt Primer Spill/Avenue F	49
16	JP-4 Spill/Refueling Truck	48
22	Sludge Weathering Pit	48
15	JP-4 Spill/Apron Excavation	47
1	Landfill No. 1	46
2	Landfill No. 2	46
12	Dibrom/Diesel Fuel Spill at Golf Course	46
9	JP-4 Spill/Open Pipeline	45
10	JP-4 Spill/Faulty Valve	45
19	JP-4 Spill from A/C Fuel Tank	44

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the Communications Transmitter Site. No Phase II work is recommended for the off-base installations.

D. RECOMMENDATIONS

1. A limited Phase II monitoring program is recommended for the South Fork Drainage Ditch (Site No. 17), the MOGAS spill at Motor Pool Area (Site No. 13), the Fire Department Training Area (Site No. 23), the Southeast Landfill Area (Sites 3, 4, 5, 6, 7, and 14), and the JP-4 Spill/Overtopped Tank (Site No. 8). The limited Phase II monitoring program is recommended to confirm or rule out the presence and/or migration of hazardous contaminants. The location map of sites recommended for Phase II monitoring is shown on Figure 2. As can be seen from Figure 2, Sites No. 3, 4, 5, 6, 7, and 14 (the Southeast Landfill Area) are located in close proximity to one another. As part of the limited Phase II monitoring program, it is recommended that these sites be grouped together and monitored under an areawide plan. The limited Phase II program includes soil sampling at Sites No. 17, 13, 23, and 6, along with the installation of upgradient and downgradient monitoring wells for sampling the ground water at the Southeast Landfill Area. The priority for monitoring at Bergstrom AFB is considered low to moderate. Details of the limited Phase II monitoring program are provided in Section VI and in Appendix K of this report.

2. The final details of the monitoring program, including the exact locations of sampling points, should be determined as part of the Phase II program. In the event that contaminants at levels

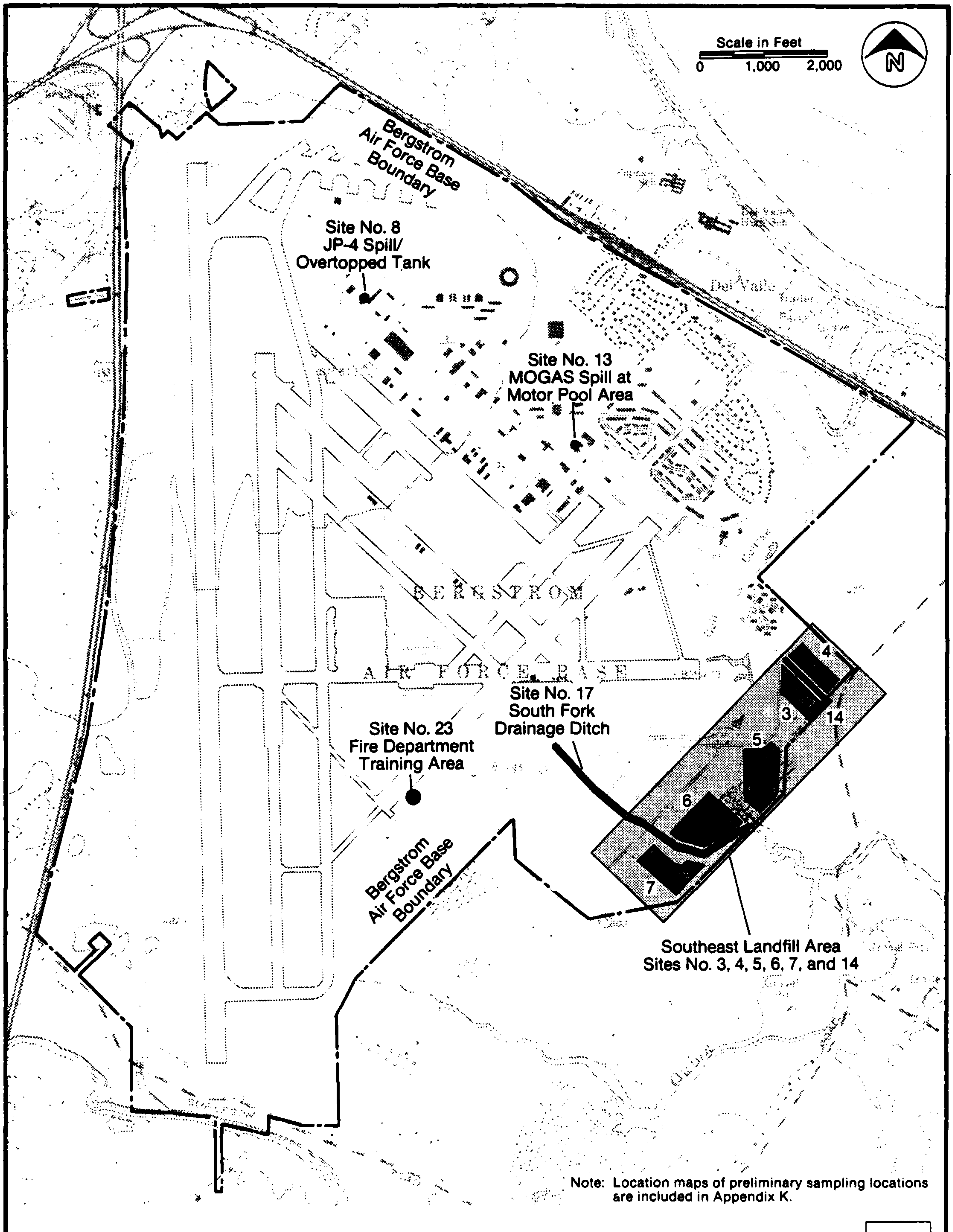

FIGURE 2.
Location Map of Sites Recommended for Limitea Phase II Monitoring.

of serious concern are detected, a more extensive field survey program should be implemented to determine the extent of contaminant migration.

3. Other environmental recommendations in addition to the Phase II monitoring include the following: (1) the golf course well should be sampled and analyzed for primary drinking water parameters, and (2) the oil/water separator located at Facility No. 4533 should be connected to the sanitary sewer.

Recommendations regarding appropriate land use restrictions for identified disposal sites are included in Section VI of this report.

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I. INTRODUCTION

A. BACKGROUND

The United States Air Force (USAF), due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Sections 6003 and 3012 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and state agencies to inventory past disposal sites and make the information available to the requesting agencies.

To ensure 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 IRP. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material contamination, and to control hazards to health and welfare that may have resulted from these past operations. The IRP will be the basis for remedial actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and clarified by Executive Order 12316.

To conduct the IRP Hazardous Materials Disposal Sites Records Search for Bergstrom AFB, Texas, CH2M HILL was retained on December 20, 1982 under Contract No. F08637-80-G0010-0016 with funds provided by Tactical Air Command (TAC). The installations included in the records search include: (1) Bergstrom AFB; (2) Middle Marker Site; (3) Communications Transmitter Site; and (4) Lake Travis Recreation Site. A location map of these sites is shown on Figure 3.

The records search comprises Phase I of the DoD IRP and is intended to review installation records to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration. Phase II (not part of this contract) consists of follow-on field work as determined from Phase I. Phase II consists of a preliminary survey to confirm or rule out the presence and/or migration of contaminants and, if necessary, additional field work to determine the extent and magnitude of the contaminant migration. Phase III (not part of this contract) consists of technology base development (evaluation of alternatives for remedial actions) to support the development of project plans for controlling migration or restoring the installation. Phase IV (not part of this contract) includes those efforts which are required to control identified hazardous environmental conditions.

B. AUTHORITY

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

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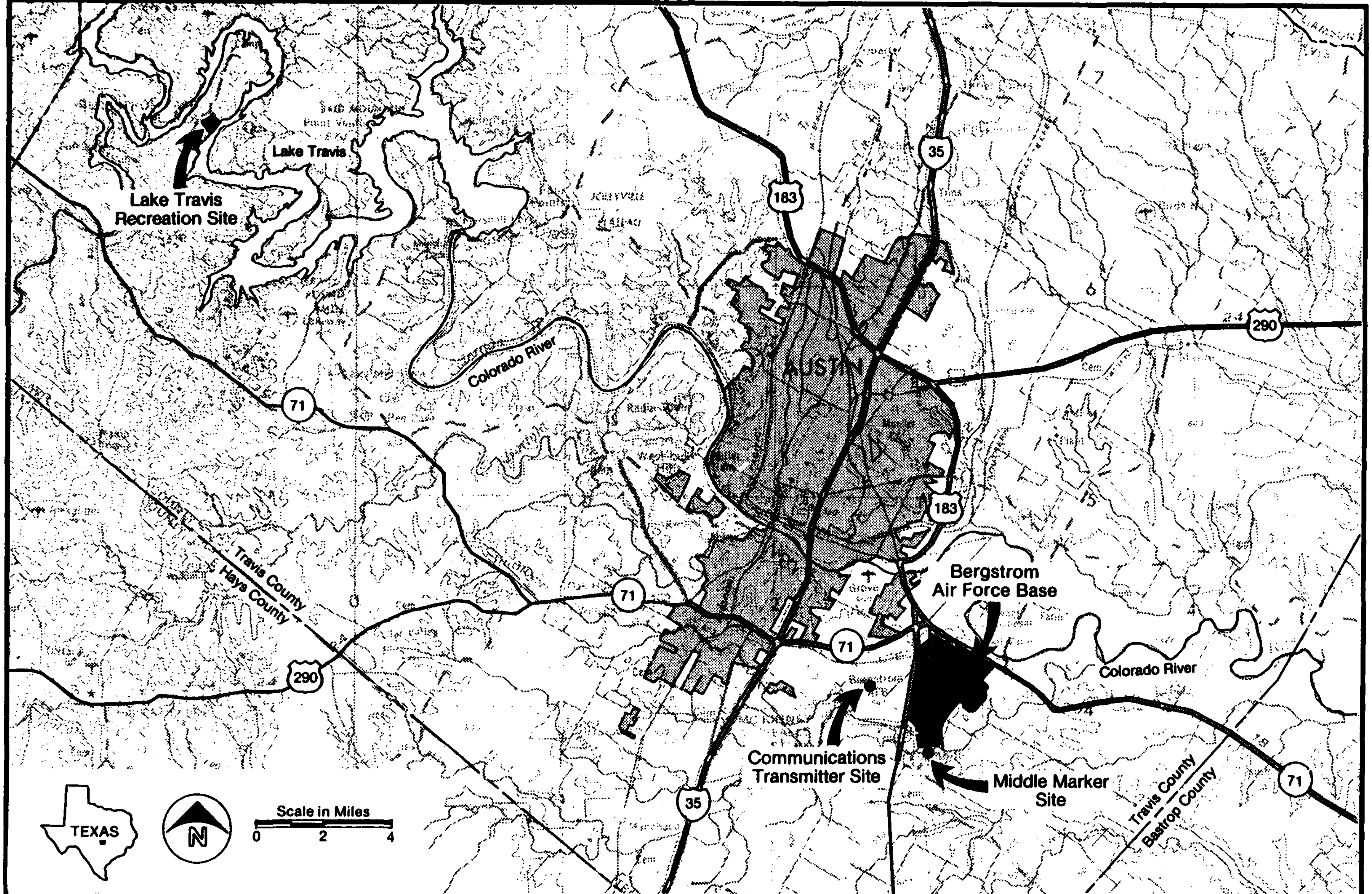

Source: USGS

FIGURE 3.
Location Map of Bergstrom AFB, Middle Marker Site, Communications Transmitter Site, and Lake Travis Recreation Site.

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C. PURPOSE OF THE RECORDS SEARCH

The purpose of the Phase I records search is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities. The existence and potential for migration of hazardous material contaminants were evaluated at Bergstrom AFB by reviewing the existing information and conducting an analysis of installation records. Pertinent information included the history of operations, the geological and hydrogeological conditions which may have contributed to the migration of contaminants, and the ecological settings which indicated environmentally sensitive habitats or evidence of environmental stress.

D. SCOPE

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

The pre-performance meeting was held at Bergstrom AFB, Texas, on February 15, 1983. Attendees at this meeting included representatives of the Air Force Engineering and Services Center (AFESC), USAF Occupational and Environmental Health Laboratory (OEHL), Tactical Air Command (TAC), Bergstrom AFB, and CH2M HILL. The purpose of the pre-performance meeting was to provide detailed project instructions, to provide clarification and technical guidance by AFESC, and to define the responsibilities of all parties participating in the Bergstrom AFB records search.

The onsite base visit was conducted by CH2M HILL from April 4 through 8, 1983. Activities performed during the onsite visit included a detailed search of installation records, ground and aerial tours of the installation, and interviews with past and present base personnel. At the conclusion of the onsite base visit, the Deputy Combat Support Group Commander was briefed on the preliminary findings. The following individuals comprised the CH2M HILL records search team:

1. Mr. David Moccia, Project Manager (B.S. Chemical Engineering, 1971)

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

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

4. Dr. Robert Knight, Ecologist (M.S. Environmental Chemistry and Biology, 1973; Ph.D. Systems Ecology, 1980)

Resumes of these team members are included in Appendix A.

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

Individuals from the Air Force who assisted in the Bergstrom AFB records search include the following:

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

2. Mr. Gil Burnet, TAC, Command Program Manager, Phase I

3. Mr. James Wueste, Bergstrom AFB, Environmental Coordinator

4. Capt. Patric Nassaux, Bergstrom AFB, Chief of Bioenvironmental Engineering Services

E. METHODOLOGY

The methodology utilized in the Bergstrom AFB records search is shown graphically on Figure 4. First, a review of past and present industrial operations was conducted at the base. Information was obtained from available records such as shop files and real property files, as well as interviews with past and present base employees from the various operating areas of the base. The information obtained from interviewees on past activities was based on their best recollection. A list of 43 interviewees from Bergstrom AFB, with areas of knowledge and years at the installation, is given in Appendix C.

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

An aerial overflight and a general ground tour of identified sites was then made by the records search team to gather site-specific information including evidence of environmental stress and the presence of nearby drainage ditches or surface-water bodies. These water bodies were inspected for any evidence of contamination or leachate migration.

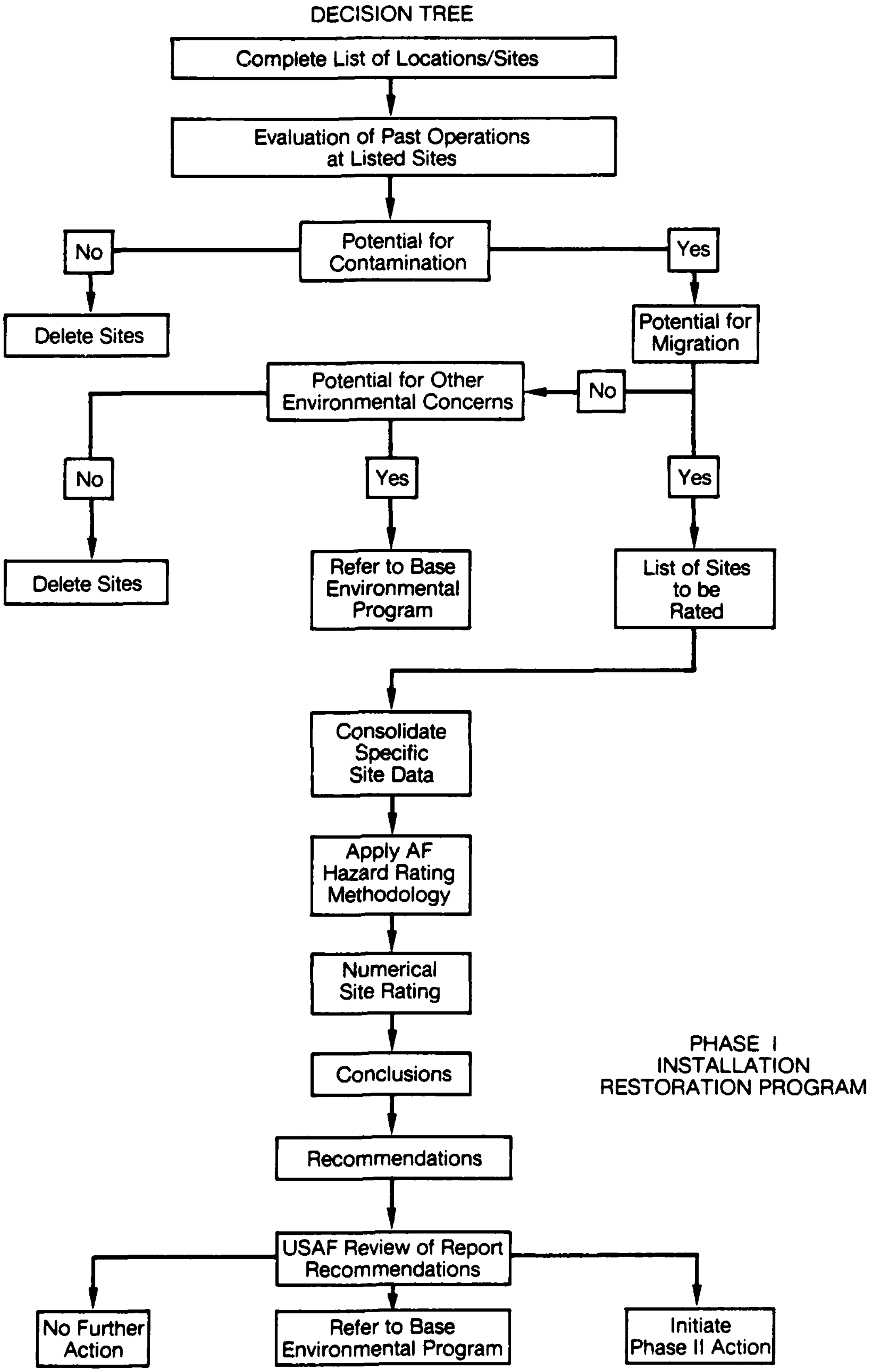

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FIGURE 4.
Records Search Methodology.

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A decision was then made, based on all of the above information, as to whether a potential existed for hazardous material contamination from any of the identified sites. If not, the site was deleted from further consideration. Minor operations and maintenance deficiencies were noted during the investigations and were made known at the outbriefing.

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

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

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The following is a representative soil horizon profile of Lewisville silty clay, 1 to 2 percent slopes, in a cultivated field 50 feet south of a paved county road from a point 1 mile northwest of its junction with U.S. Highway 290 and 3 miles east of its junction with Interstate 35:

- A Horizon--0 to 4 inches, dark grayish-brown silty clay, very dark grayish brown when moist; strong, fine, granular structure; very hard, firm; calcareous; moderately alkaline; abrupt, smooth boundary.

- A Horizon--4 to 13 inches, dark grayish-brown silty clay, very dark grayish brown when moist; moderate, fine and medium, subangular blocky and granular structure; very hard, firm; calcareous;

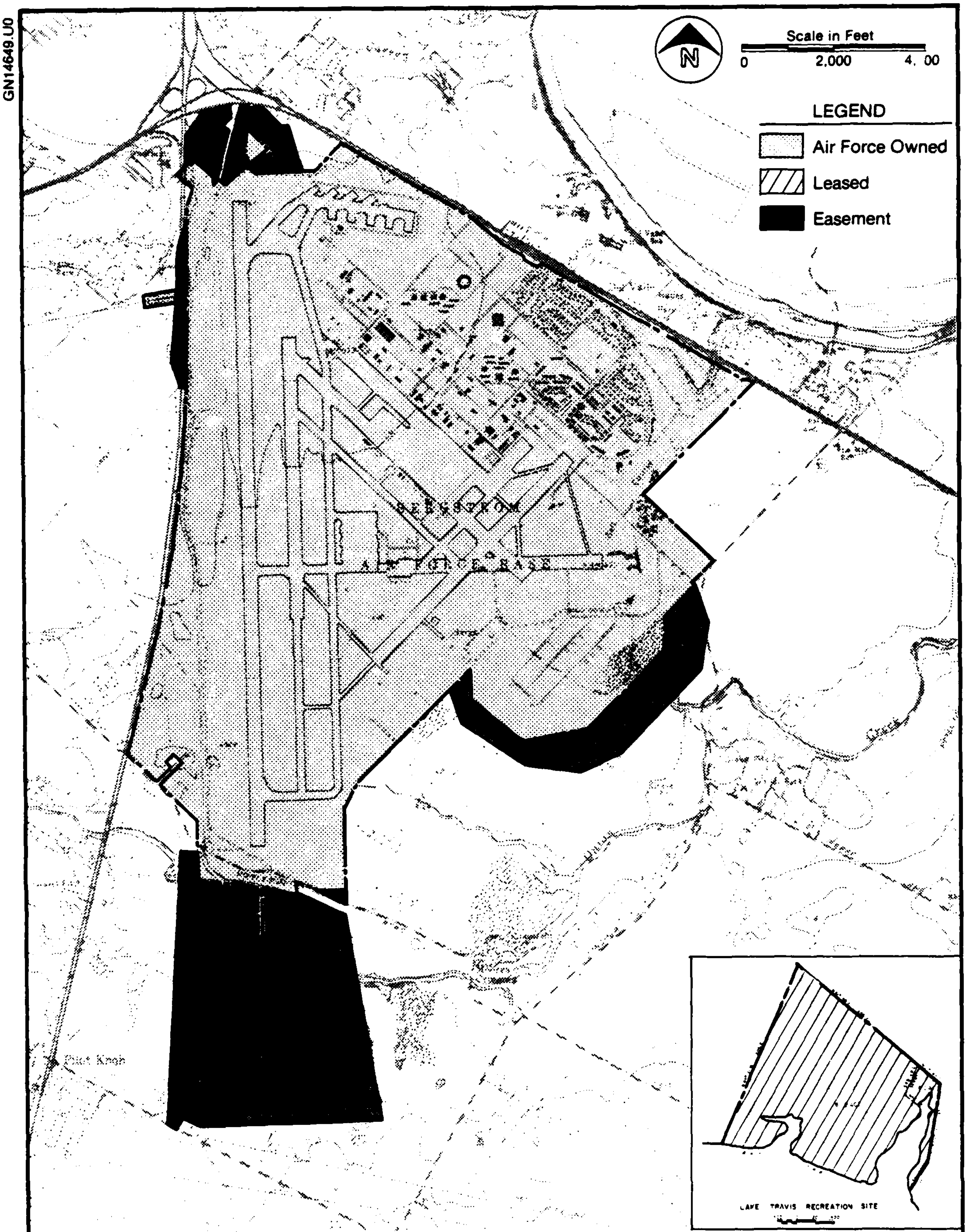
II. INSTALLATION DESCRIPTION

A. LOCATION

Bergstrom AFB is located 7 miles south by southeast from the center of the City of Austin, Travis County, Texas. The base is bordered on the east by State Highway 71 and on the west by U.S. Highway 183, both of which are main arteries leading into Austin. The base is situated on approximately 4,000 acres of land, of which 3,294 acres are Air Force owned, 691 acres are easements, and 65 acres are leased. The real estate map of Bergstrom AFB is shown on Figure 5 and the site map of Bergstrom AFB is shown on Figure 6.

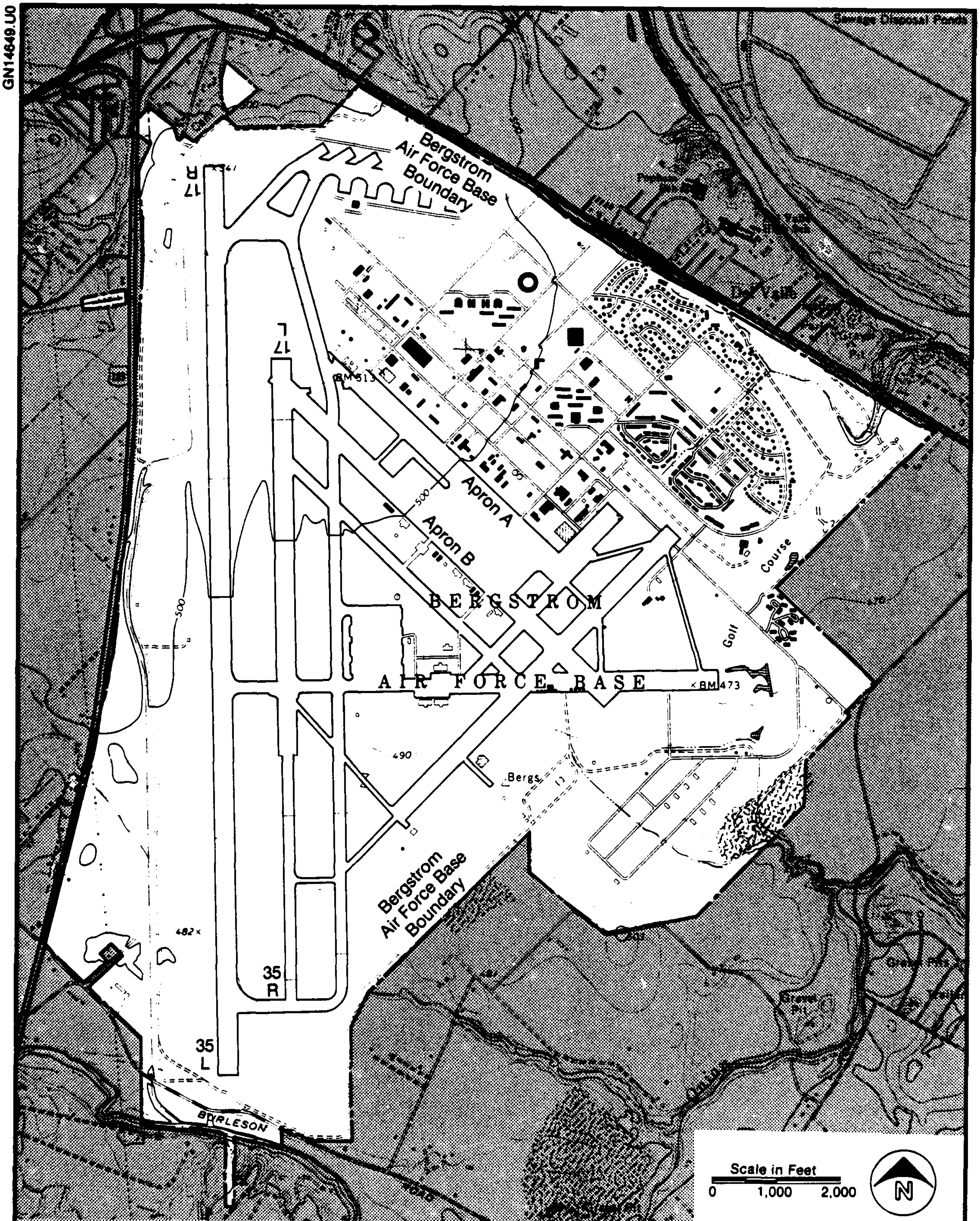
B. ORGANIZATION AND MISSION

Bergstrom AFB was given the name Del Valle Army Air Base in the official activation of the station on September 19, 1942. The name was changed to Bergstrom Army Air Field on March 3, 1943; to Bergstrom Field on November 11, 1943; and finally to Bergstrom AFB in December 1948. In the fall of 1942, the base was operating and by the end of 1943, it was in full operation. After activation, Bergstrom became the home of troop carrier units, some of which took part in the historic Berlin airlift of 1948-1949. The transfer of the base to the Strategic Air Command (SAC) in 1949 was followed by the arrival of the 27th Fighter Wing in March 1949. The 12th Fighter Wing moved to the base in December 1950. With the arrival of the 42nd Air Division in 1951, Bergstrom became a very important station of SAC. These two wings and the air division were active at Bergstrom through July 1957. On July 1, 1957, Bergstrom was transferred from SAC to Tactical Air Command, and in January 1958, the base was assigned to the Twelfth Air Force, then headquartered at Waco, Texas. The base was once again transferred to SAC on October 1, 1958.



Source: Bergstrom AFB.

FIGURE 5.
Real Estate Map of Bergstrom AFB.



Source: Bergstrom AFB

FIGURE 6.
Site Map of Bergstrom AFB.

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On July 1, 1966, Bergstrom once again came under the jurisdiction of TAC. With the transfer, the base became a unit of Twelfth Air Force and home of the 75th Tactical Reconnaissance Wing. The 602nd Tactical Control Group moved to Bergstrom on April 15, 1966. On August 31, 1968, the parent command to Bergstrom's tactical activities, Headquarters Twelfth Air Force, moved to the base. The Twelfth Air Force is generally responsible for all TAC reconnaissance and fighter operations west of the Mississippi River. On July 15, 1971, the host 75th Tactical Reconnaissance Wing was deactivated and replaced by the 67th Tactical Reconnaissance Wing, making Bergstrom the only tactical reconnaissance base.

The primary mission of Bergstrom AFB has remained relatively unchanged since 1966. The primary mission of the 67th Tactical Reconnaissance Wing is twofold; to maintain a combat-ready force capable of conducting tactical air reconnaissance missions worldwide, and secondly to conduct basic and advanced reconnaissance training for all student inputs to the reconnaissance force.

The major aircraft which have been assigned to Bergstrom AFB during its history include the following:

Aircraft	Dates
C-47	1942 to 1945
C-46, C-82, C-54, AT-6, and T-24	1945 to 1979
F-84F	1949 to 1957
F-101 and CB-29	1957 to 1958
F-101	1958 to 1959
B-52 and CK-135	1959-1966
RF-4C, T-39, O-2, OV-10, C-130, and F-4D	1966 to present

Presently there are 91 RF-4C, 4 CT-39A, and 20 F-4D aircraft assigned to Bergstrom AFB. The total work force on

Bergstrom AFB numbers approximately 6,150, which includes 5,050 military, 910 civilian, and 190 non-appropriated fund employees.

The major organizations at Bergstrom AFB are as follows:

HOST

67th Tactical Reconnaissance Wing
- 67th Component Repair Squadron
- 67th Aircraft Generation Squadron
- 67th Equipment Maintenance Squadron
- 67th Tactical Training Squadron
- 67th Supply Squadron
- 67th Transportation Squadron
- 12th Tactical Reconnaissance Squadron
- 91st Tactical Reconnaissance Squadron
- 45th Tactical Reconnaissance Training Squadron
- 62nd Tactical Reconnaissance Training Squadron
- 67th Combat Support Group Headquarters Squadron Section
- USAF Hospital, Bergstrom
- 67th Combat Support Group
  - 67th Civil Engineering Squadron
  - 67th Security Police Squadron
  - 67th Transportation Squadron

TENANTS

Headquarters 12th Air Force
Headquarters 10th Air Force (Reserve)
12th Air Force Headquarters Squadron Section
602 Tactical Air Control Center
712th Air Support Operations Center Squadron

12th Tactical Intelligence Squadron
924th Tactical Fighter Group (Reserve)
1882 Communications Squadron
25th Weather Squadron
Detachment 1, 1702 Mobility Support Squadron
Detachment 1, 4400 Management Engineering Squadron (TACMET-1)
Detachment 2, 4500 School Squadron
Detachment 3, 1400 Military Airlift Squadron (MAC)
Detachment 10, 25th Weather Squadron
Detachment 12, Tactical Communications Area
Detachment 423, 3751 Field Training Squadron (ATC)
Detachment 502, Air Force Audit Agency
Detachment 1001, AF Office of Special Investigations

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

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nued

...er[a]	General Description
	Gray to tan, thin- to thick-bedded, fine- to medium-grained limestone and marly limestone; many beds with fossils
	Gray-brown to tan, thin interbeds of dolomite, dolomitic limestone, limestone, and marly limestone
	Gray to tan, thin to thick interbeds of fine- to medium-grained limestone, marly limestone, and marl; many beds with fossils
	Gray to tan, thin- to thick-bedded limestone, marly limestone, and marl; orange-brown limestone ledge at top with abundant small fossil clams (Corbula harveyi) underlain by a fossiliferous marly limestone; lower contact not exposed

d either by name or number.

III. ENVIRONMENTAL SETTING

A. METEOROLOGY

The climate of Bergstrom AFB is humid subtropical, with hot summers and mild winters. These characteristics result from the location of the base near 30° north latitude and the dominance of winds from south Texas and the Gulf of Mexico.

The average annual temperature for Bergstrom AFB is 68°F (Table 2), and monthly mean temperatures range from 50°F in January to 84°F in July and August. The average daily maximum temperature in August is 96°F, while the highest recorded temperature at the base is 107°F. Daily minimum temperatures range from 40°F in January to 74°F during the summer months. The lowest recorded temperature was -5°F during the month of January. The average number of days with maximum temperatures above 90°F is 111 per year, and the average number of days with freezing temperatures is 21 per year.

Mean annual precipitation recorded at Bergstrom AFB is 30.1 inches. This precipitation is fairly well distributed throughout the year, with peak amounts occurring in late spring and in late summer. Rainfall from April until September usually results from thundershowers with a maximum recorded 24-hour amount of 9.9 inches. On the average, there are 41 days per year with thundershower activity. Winter precipitation is usually associated with frontal air masses and is generally light. On the average, there is less than 1 day with snowfall occurring per year at Bergstrom AFB. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, in the vicinity of Bergstrom AFB is estimated to be about 55 inches per year, and evapotranspiration over land areas may be greater or less than this depending on vegetative cover type.

Table 2
METEOROLOGICAL DATA SUMMARY FOR BERGSTROM AFB, TEXAS AND VICINITY

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Temperature (°F)													
Mean	50	53	61	68	75	82	84	84	79	69	59	52	68
Average Daily Maximum	60	64	71	79	85	92	95	96	89	81	70	63	79
Average Daily Minimum	40	43	49	59	66	72	74	74	69	59	49	42	58
Highest Recorded	89	92	98	99	99	104	106	107	107	97	90	91	107
Lowest Recorded	-5	8	19	34	45	53	62	60	41	34	20	17	-5
Precipitation (in)													
Mean	1.9	2.4	1.7	2.9	3.8	3.0	1.2	2.2	3.9	2.9	2.0	2.2	30.1
Maximum Monthly	7.9	6.4	5.0	9.9	10.0	11.4	10.5	8.9	8.1	12.3	7.9	5.9	12.3
Minimum Monthly	0.0	0.3	0.0	0.1	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Relative Humidity (%)													
Mean	71	69	65	68	70	68	64	62	67	66	67	69	67
Surface Winds (mph)													
Mean	10	10	11	11	10	9	8	8	8	8	9	9	9
Maximum	47	57	44	44	49	49	43	53	45	47	48	49	57
Prevailing Direction	S	S	S	SSE	SSE	S	S	S	S	S	S	S	S

Source: United States Air Force, Bergstrom AFB, Texas; NOAA 1980, Local Climatological Data, Austin, Texas.

Period of Record: Approximately 1942-1979.

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Therefore, the annual net precipitation rate (mean annual precipitation minus mean annual evapotranspiration) for the Bergstrom AFB area is approximately -25 inches per year.

Relative humidity at Bergstrom AFB averages 67 percent throughout the year, with highest values recorded in the morning hours and lowest values during the early evening. In the Austin area, mean cloud cover is lowest during late summer, averaging about 47 percent, and highest during the spring, when it averages over 60 percent. On the average, there are approximately 24 days per year when heavy fog reduces visibility to 1/4 mile or less.

Wind speeds in the Austin area average 9 miles per hour, with an annual recorded maximum speed of 57 miles per hour. The prevailing wind direction is from the south at Bergstrom AFB, but winds from the south-southeast and from the north are important during limited time periods.

B. PHYSICAL GEOGRAPHY

Bergstrom AFB is located in the Colorado River Terraces physiographic province, southeast of Austin, Texas. The other major physiographic regions in the vicinity of the base include the Edwards Plateau, Rolling Prairie, and Blackland Prairie (see Figure 7). The physiographic regions in this part of Texas are delineated on the basis of topographic expression.

The Edwards Plateau region, in which Lake Travis occurs, is bounded on the east by the Balcones Fault zone. This region is highly dissected by the meandering Colorado River and its tributaries.

The Rolling Prairie province is a slightly to moderately dissected area located east of the Balcones Fault zone. The Colorado River Terraces in the vicinity of the

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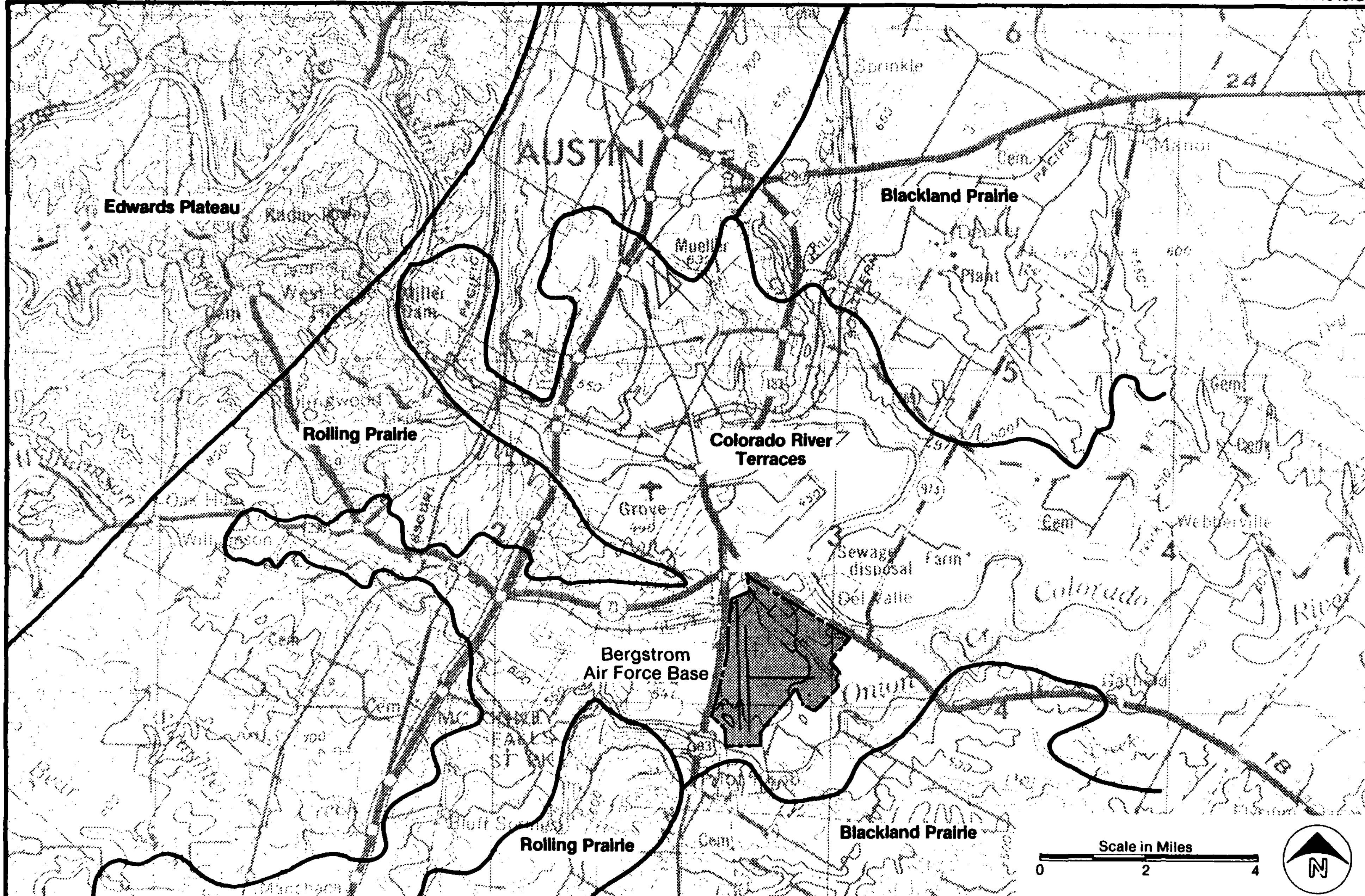

Source: University of Texas, Bureau of Economic Geology

FIGURE 7. Physiographic Map.

base form a subsection within the Rolling Prairie province. The area consists of flat lowlands modified by river erosional processes.

Topography at the base is flat with little relief. Elevations range from 540 feet above mean sea level (msl) at the northwest corner to 420 feet above msl at the southeast corner.

Soils occurring at Bergstrom AFB are alluvial, generally consisting of brown to red-brown, calcareous sandy loams, silty clay loams, and gravelly sands (see Figure 8). The U.S. Department of Agriculture, Soil Conservation Service (SCS) classifies most of the soils on base as the Lewisville series. The SCS description of Lewisville series soils is given below.

The Lewisville series consists of deep, nearly level to gently sloping, well-drained silty clays. These soils occupy terraces along the major streams. Areas range from broad to long and narrow in shape. Slopes are smooth and as great as 2 percent. These soils developed under a cover of mid to tall grasses.

In a representative profile, the surface layer, which is about 13 inches thick, is dark grayish-brown silty clay. The next layer, which extends to a depth of about 29 inches, is brown silty clay. The underlying material, to a depth of 72 inches, is very pale brown silt loam. The soil is calcareous and moderately alkaline throughout.

These soils are moderately permeable, and the available water capacity is high. These soils are easily tilled.

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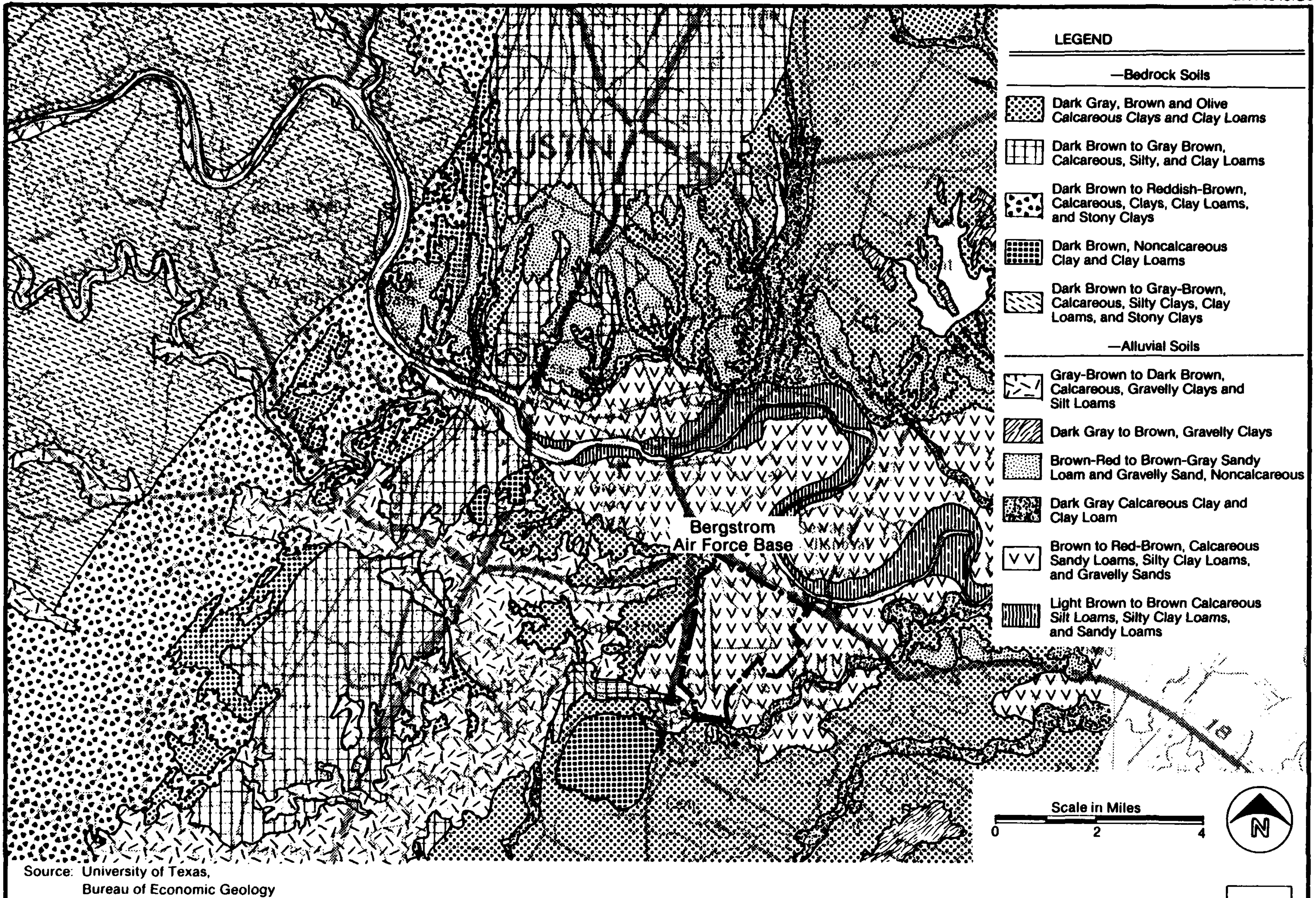

FIGURE 8.
Soils Map.

The following is a representative soil horizon profile of Lewisville silty clay, 1 to 2 percent slopes, in a cultivated field 50 feet south of a paved county road from a point 1 mile northwest of its junction with U.S. Highway 290 and 3 miles east of its junction with Interstate 35:

- A Horizon--0 to 4 inches, dark grayish-brown silty clay, very dark grayish brown when moist; strong, fine, granular structure; very hard, firm; calcareous; moderately alkaline; abrupt, smooth boundary.

- A Horizon--4 to 13 inches, dark grayish-brown silty clay, very dark grayish brown when moist; moderate, fine and medium, subangular blocky and granular structure; very hard, firm; calcareous; moderately alkaline; clear, smooth boundary.

- B Horizon--13 to 29 inches, brown silty clay, dark brown when moist; common splotches of very pale brown; moderate, fine granular and subangular blocky structure; hard, friable; scattered hard calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

- C-Horizon--29 to 72 inches, very pale brown silt loam, very pale brown when moist; massive, breaking to weak, fine, granular structure; many fine vesicles; hard, friable; splotches of soft calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum ranges from 25 to 46 inches. The A horizon is 10 to 19 inches thick. Texture is clay loam or silty clay. Color is very dark grayish brown, dark grayish brown, or grayish brown.

The B horizon ranges from 10 to 32 inches in thickness. Color is brown, light brown, reddish yellow, very pale brown, pale brown, light yellowish brown, brownish yellow, or yellowish brown.

The C horizon is light brown, reddish yellow, pale brown, very pale brown, or light yellowish brown. In many areas it rests on a bed of gravel at a depth of 10 to 20 feet. Permeability of this soil type ranges from 1×10^{-3} to 3×10^{-3} ft/min (moderate permeability).

Bergstrom AFB is underlain by several thousand feet of sedimentary rock. Figure 9 illustrates the geologic formations which would be exposed in the vicinity of the base if the soil cover were removed. Most of the base is immediately underlain by the lower Colorado River Terraces deposits composed of yellow to orange sand, silt clay, and gravel. The Taylor group underlies the Terraces' deposits at Bergstrom AFB. This unit consists of approximately 700 feet of greenish-gray to brown, calcareous, montmorillonitic clay and marly clay. Formations recognized in this group include, from bottom to top, the Sprinkle, Pecan Gap, and Bergstrom.

Occurring below the Taylor group is the Austin group, consisting of several formations having a total thickness of approximately 350 feet. This group includes, from base to top, the Atco, Vinson, Jonah, Dessau, Burditt, Pflugerville, McKown, Pilot Knob Tuff, and Pilot Knob Basalt formations. The Atco, Vinson, Jonah, Dessau, Pflugerville, and McKown formations consist of limestone, marly limestone, fossiliferous limestone, or chalk. The Burditt formation consists of marly chalk with 10 to 20 percent clay.

Underlying the Austin group is the Eagle Ford formation (approximately 25 feet thick) consisting of dark gray calcareous clay with thin beds of limestone. Below this

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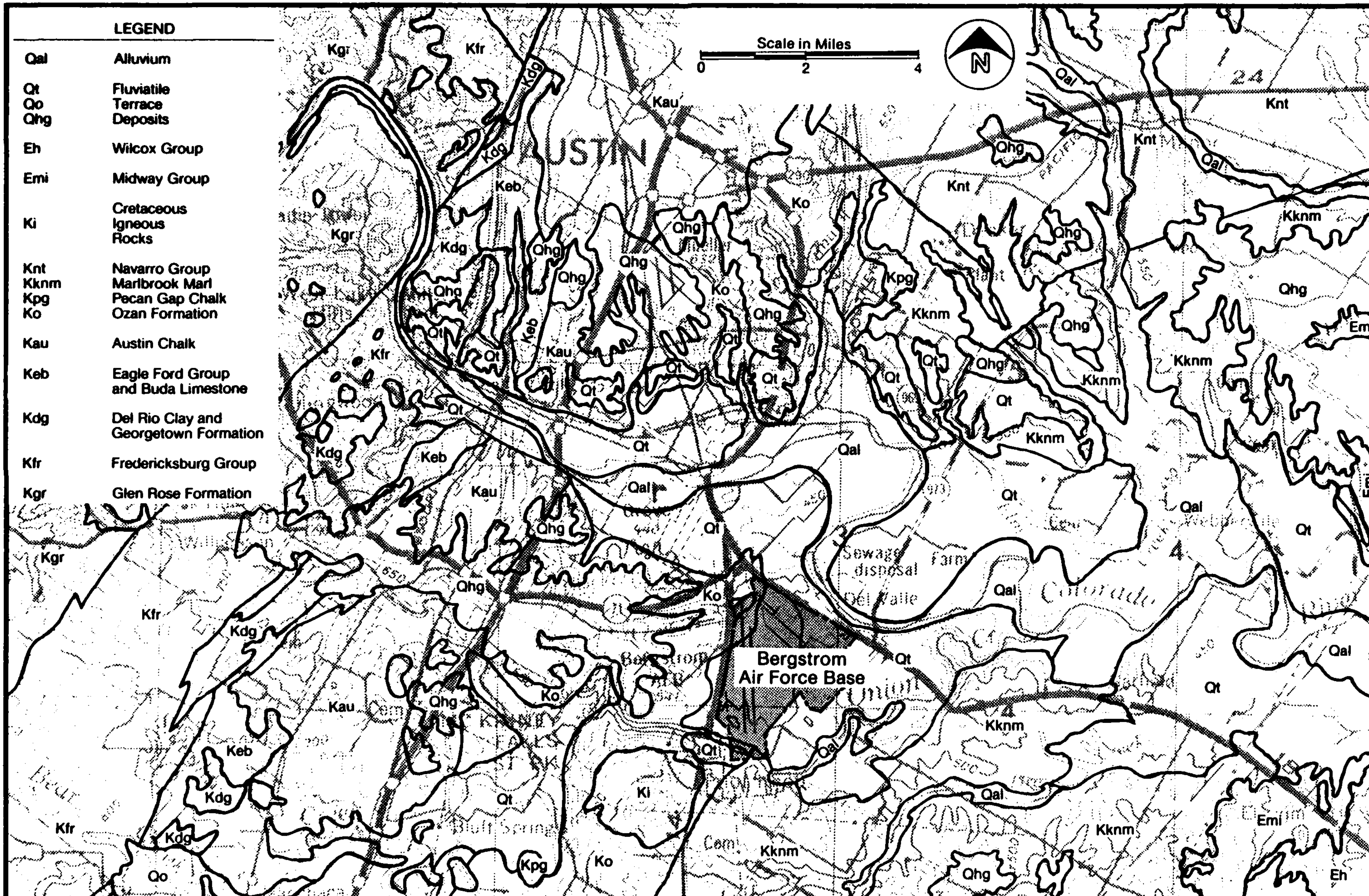

Source: University of Texas, Bureau of Economic Geology

FIGURE 9.
Geologic Map.

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formation is the Buda formation, which consists of approximately 35 feet of glauconitic limestone, and the Del Rio formation, which consists of 25 to 35 feet of clay.

Below these strata, the Georgetown formation (approximately 40 to 60 feet thick) caps the underlying Edwards formation. This section (the Edwards), a regionally important aquifer, consists of approximately 300 feet of limestone, dolomitic limestone, and chert nodules.

Approximately 20 feet of Comanche Peak limestone separate the Edwards formation from the underlying Walnut formation, which also consists primarily of limestone.

Below the Walnut formation, another regionally significant aquifer occurs within the Glen Rose Formation (approximately 1,000 feet thick), which consists of limestone, dolomite, and marl.

Unconsolidated sands form the base of the Cretaceous Age (70 to 135 million years ago) formations in the vicinity of Bergstrom AFB. Table 3 lists geologic formations discussed above and Figure 10 illustrates a general geologic cross section taken in a northwest-southeast direction.

Structurally, the geologic formations underlying Bergstrom AFB dip to the southeast at approximately 100 feet per mile. The Balcones Fault zone, which is a Miocene Age (10 to 15 million years ago) geologic feature, consists of a series of normal faults. The zone trends or strikes northeast- southwest in the vicinity of Austin and is located just west of Bergstrom.

Another interesting geologic feature in the vicinity of the base is a basalt intrusion occurring in the Austin group. This very hard, crystalline rock, known as the Pilot

Table 3
GEOLOGIC FORMATIONS

System	Group	Formation	Member[a]	General Description
Quaternary	--	Alluvium	--	Unconsolidated gravel, sand, silt, and clay deposits of the Colorado River and tributary streams
Quaternary	--	Lower Colorado River Terrace Deposits	Sand Beach, Riverview, First Street, and Sixth Street Terraces	Yellow- to red-brown, unconsolidated gravel, sand, silt, and clay; gravel more abundant near base
Quaternary	--	Upper Colorado River Terraces Deposits	Capitol and Asylum Terraces	Orange-brown, unconsolidated gravel, sand, silt, and clay; gravel more common than in lower units
Quaternary	--	Tributary	Terrace Deposits	Light gray to tan, mostly unconsolidated, calcareous gravel, sand, silt, and clay
Quaternary	--	High Terrace Deposits	--	Gray to tan, unconsolidated gravel, sand, silt, and clay; topographically high, not related to modern drainage
Tertiary	Midway	Kincaid	--	Dark gray to brown-gray, sandy, micaceous, and glauconitic clays with large concretions
Cretaceous	Navarro	Kemp	--	Brown to drak gray, silty montmorillonitic clay; prominent calcareous and quartz siltstone layers; calcareous concretions occur at irregular intervals
Cretaceous	Navarro	Corsicana	--	Dark gray to blue-gray, calcareous, montmorillonitic clay; sandy phosphatic zone near base
Cretaceous	Navarro	Bergstrom	--	Green-gray to brown-gray, unctuous, calcareous, montmorillonitic clay; calcareous content increases toward base
Cretaceous	Taylor	Pecan Gap	--	Brown to dark gray, highly calcareous montmorillonitic clay and marl
Cretaceous	Taylor	Sprinkle		Green-gray, calcareous, montmorillonitic clay; calcium carbonate content increases toward base

Source: University of Texas, Bureau of Economic Geology.

[a]Some formations are further subdivided into members which are identified either by name or number.

Table 3--Continued

System	Group	Formation	Member[a]	General Description
Cretaceous	Austin	Pilot Knob Basalt	--	Black to drak green-gray, hard, fine-grained basalt
Cretaceous	Austin	Pilot Knob Tuff	--	Green-brown to tan, nontronitic, altered tuff, lenticular
Cretaceous	Austin	McKown	--	Light gray to white, coarse-grained, porous, shell-fragment limestone
Cretaceous	Austin	Pflugerville	--	Light gray, chalky, and clayey limestone with hard limestone beds at top and base
Cretaceous	Austin	Burditt	--	Light gray, marly chalk containing 10 to 20 percent montmorillonitic clay
Cretaceous	Austin	Dessau	--	Light gray, slightly clayey chalk and soft limestone bounded by an upper hard fossiliferous limestone and a basal hard limestone
Cretaceous	Austin	Jonah	--	Light gray, medium- to thin-bedded, hard fossil-iferous limestone
Cretaceous	Austin	Vinson	--	Gray to white, thin- to thick-bedded massive chalk
Cretaceous	Austin	Atco	--	Gray to white, thin- to thick-bedded, massive to slightly nodular, fine-grained limestone, marly limestone, and chalk
Cretaceous	--	Eagle Ford	--	Dark gray, calcareous montmorillonitic clay; mid portion consists of thin interbeds of sandy and flaggy limestone, chalk, clay, and bentonite
Cretaceous	--	Buda	--	Gray to tan, hard, fine-grained, glauconitic, shell-fragment limestone; lower part slightly nodular weathering
Cretaceous	--	Del Rio	--	Dark gray to olive-brown, pyritic, gypsiferous, calcareous clay containing abundant Exogyra arietina

Source: University of Texas, Bureau of Economic Geology.

[a]Some formations are further subdivided into members which are identified either by name or number.

Table 3--Continued

System	Group	Formation	Member[a]	General Description
Cretaceous	--	Georgetown	--	Gray to tan, interbedded, nodular-weathering, hard, fine-grained limestone, marly limestone, and marl containing abundant fossil shells
Cretaceous	--	Edwards	4	Gray to tan, hard, dense, thick- to thin-bedded, fine-grained limestone with soft dolomitic limestone zone near middle
Cretaceous	--	Edwards	3	Gray to tan, soft, nodular-weathering marly limestone
Cretaceous	--	Edwards	2	Light gray to tan, fine-to medium-grained, hard, thin- to thick-bedded limestone; chert nodules in lower third
Cretaceous	--	Edwards	1	Gray-brown, thin- to medium-bedded, porous dolomitic limestone, and limestone; chert common; solution collapse zone at top
Cretaceous	--	Comanche Peak	--	Gray to tan, fine-grained, nodular limestone, marly limestone, and marl
Cretaceous	--	Walnut	Keys Valley	Gray to tan, soft marl and nodular limestone with abundant fossils
Cretaceous	--	Walnut	Whitestone	Gray to tan, hard, fine- to medium-grained, thin- to thick-bedded fossiliferous limestone
Cretaceous	--	Walnut	Cedar Park	Gray to tan, thin- to thick-bedded, fine- to medium-grained, hard limestone
Cretaceous	--	Walnut	Bee Cave	Gray to tan, soft, nodular-weathering, fine-grained limestone, marly limestone, and marl with abundant fossil shells
Cretaceous	--	Walnut	Bull Creek	Gray to tan, hard, fine- to medium-grained, thin- to thick-bedded limestone; shell fragments common
Cretaceous	--	Glen Rose	5	Gray-brown, thin-bedded, fine-grained, porous dolomite; upper 10 to 20 feet pulverulent

Source: University of Texas, Bureau of Economic Geology.

[a]Some formations are further subdivided into members which are identified either by name or number.

Table 3--Continued

System	Group	Formation	Member[a]	General Description
Cretaceous	--	Glen Rose	4	Gray to tan, thin- to thick-bedded, fine- to medium-grained limestone and marly limestone; many beds with fossils
Cretaceous	--	Glen Rose	3	Gray-brown to tan, thin interbeds of dolomite, dolomitic limestone, limestone, and marly limestone
Cretaceous	--	Glen Rose	2	Gray to tan, thin to thick interbeds of fine- to medium-grained limestone, marly limestone, and marl; many beds with fossils
Cretaceous	--	Glen Rose	1	Gray to tan, thin- to thick-bedded limestone, marly limestone, and marl; orange-brown limestone ledge at top with abundant small fossil clams (Corbula harveyi) underlain by a fossiliferous marly limestone; lower contact not exposed

Source: University of Texas, Bureau of Economic Geology.

[a]Some formations are further subdivided into members which are identified either by name or number.

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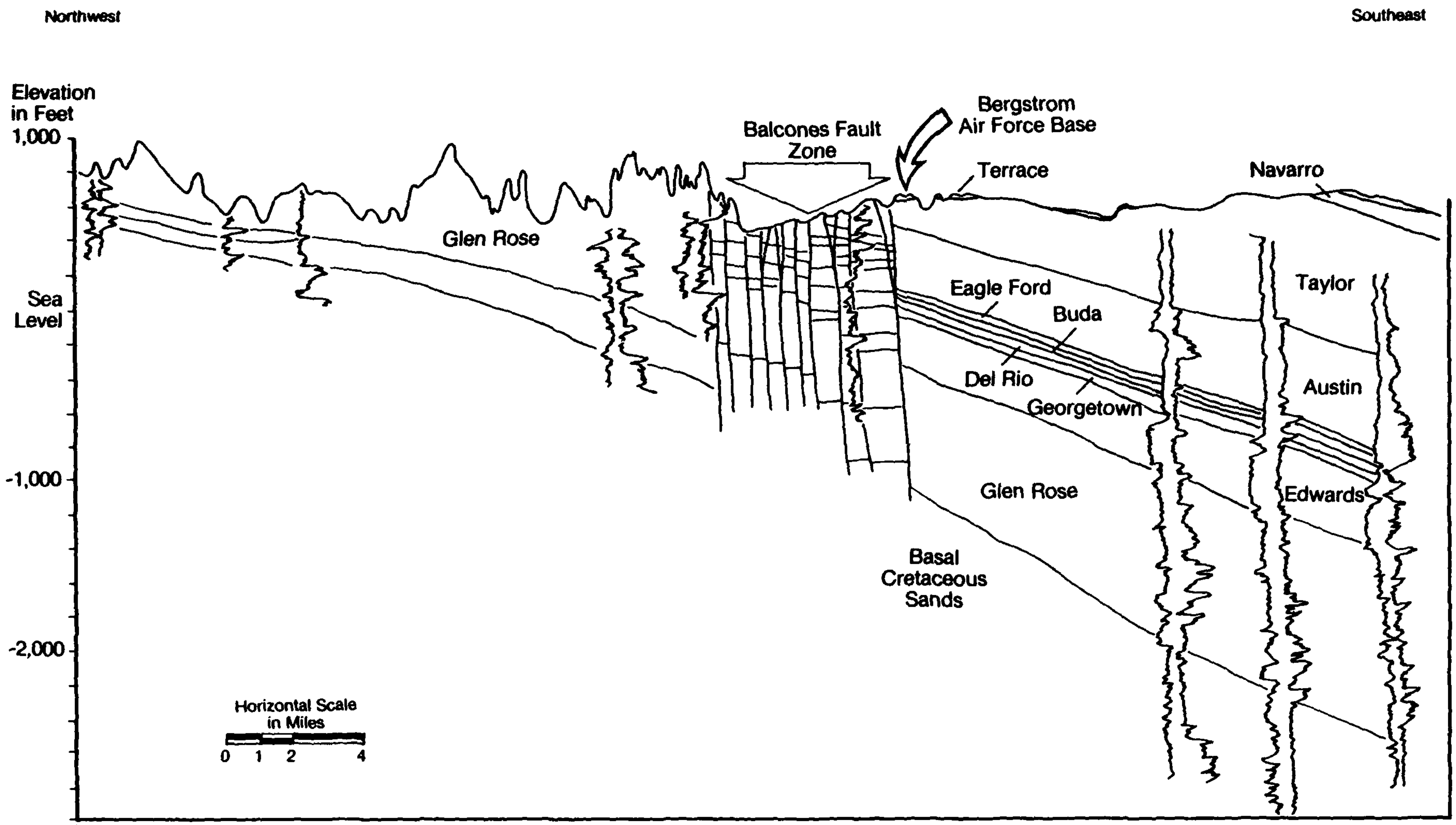

Source: University of Texas,
Bureau of Economic Geology

FIGURE 10.
Dip-Oriented (Northwest to Southeast) Cross Section of Geologic Units,
Austin Area, Texas

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Knob Basalt, intruded into the soft, sedimentary limestone units of the Austin group in late Cretaceous time (100 to 135 million years ago).

C. HYDROLOGY

The study area is located within the terrace deposits of the Colorado River and one of its tributaries, Onion Creek. The Colorado River flows toward the southeast and is located approximately 1 mile north of the base boundary. Austin develops most of its water supply from impoundments along the river and provides potable water to the base. Potable water is developed from the Colorado River upstream of the base. Immediately adjacent to Bergstrom AFB, the regional wastewater treatment plant discharges Austin's (and the base's) treated effluent to the Colorado River.

Onion Creek flows just southeast of the base boundary and discharges to the Colorado River. Adjacent to the base, one of Onion Creek's tributaries receives the majority of the runoff and collected storm drainage from the base (see Figure 11). A small municipal sewage treatment plant discharges wastewater to Williamson Creek just upstream of the confluence of Onion and Williamson Creeks (approximately 4 miles west of the base). A small portion of the base is affected by flooding of Onion Creek at times. Figure 12 illustrates the floodprone areas in the vicinity of the base.

Water quality within Onion Creek is excellent, and the creek is classified by the Texas Department of Water Resources as a potable water source upstream of the base. Water quality analyses from a recent (1982) intensive study of the creek are provided in Appendix E, Table E-1.

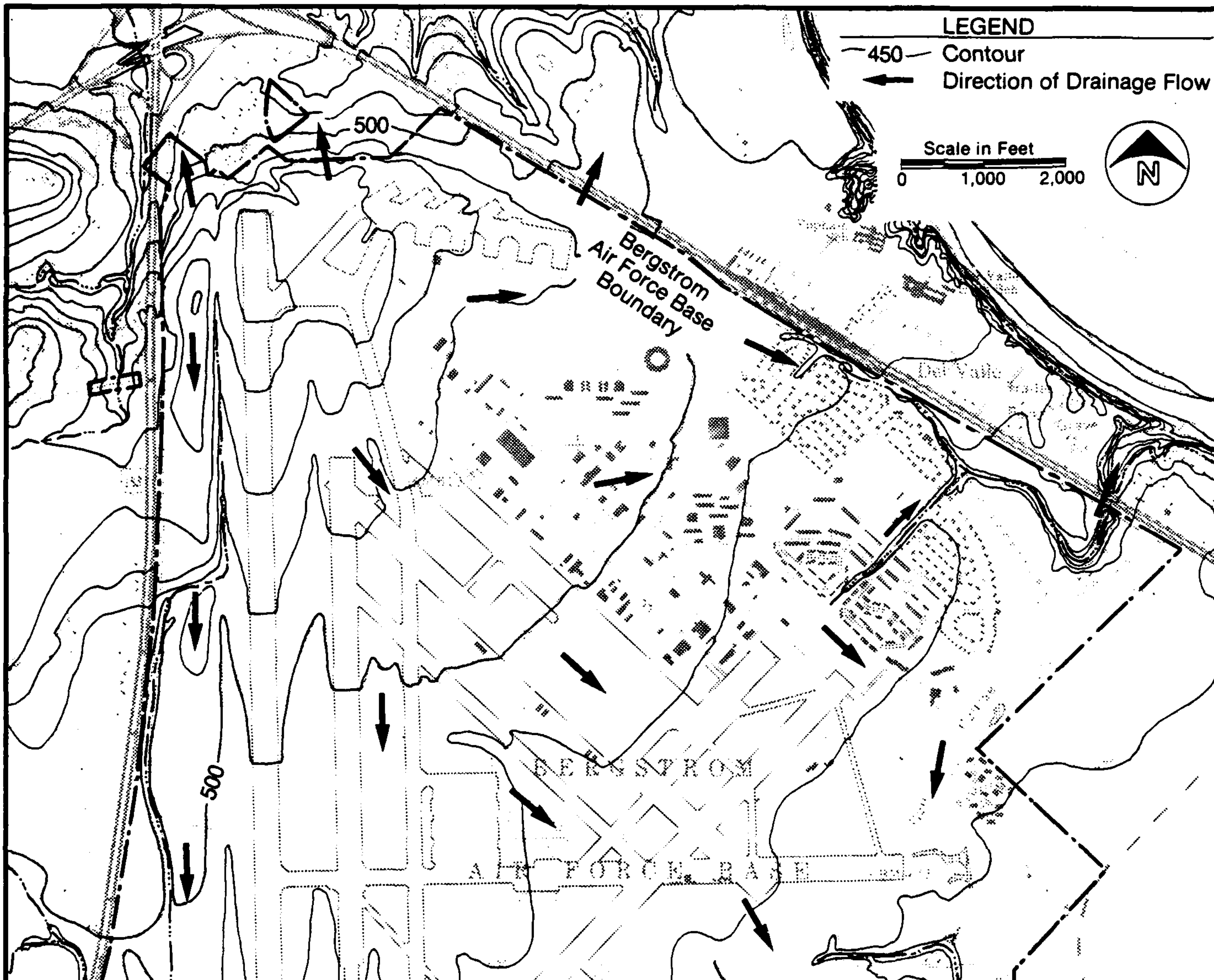

FIGURE 11.
Topography and Surface Drainage Map of Bergstrom AFB.

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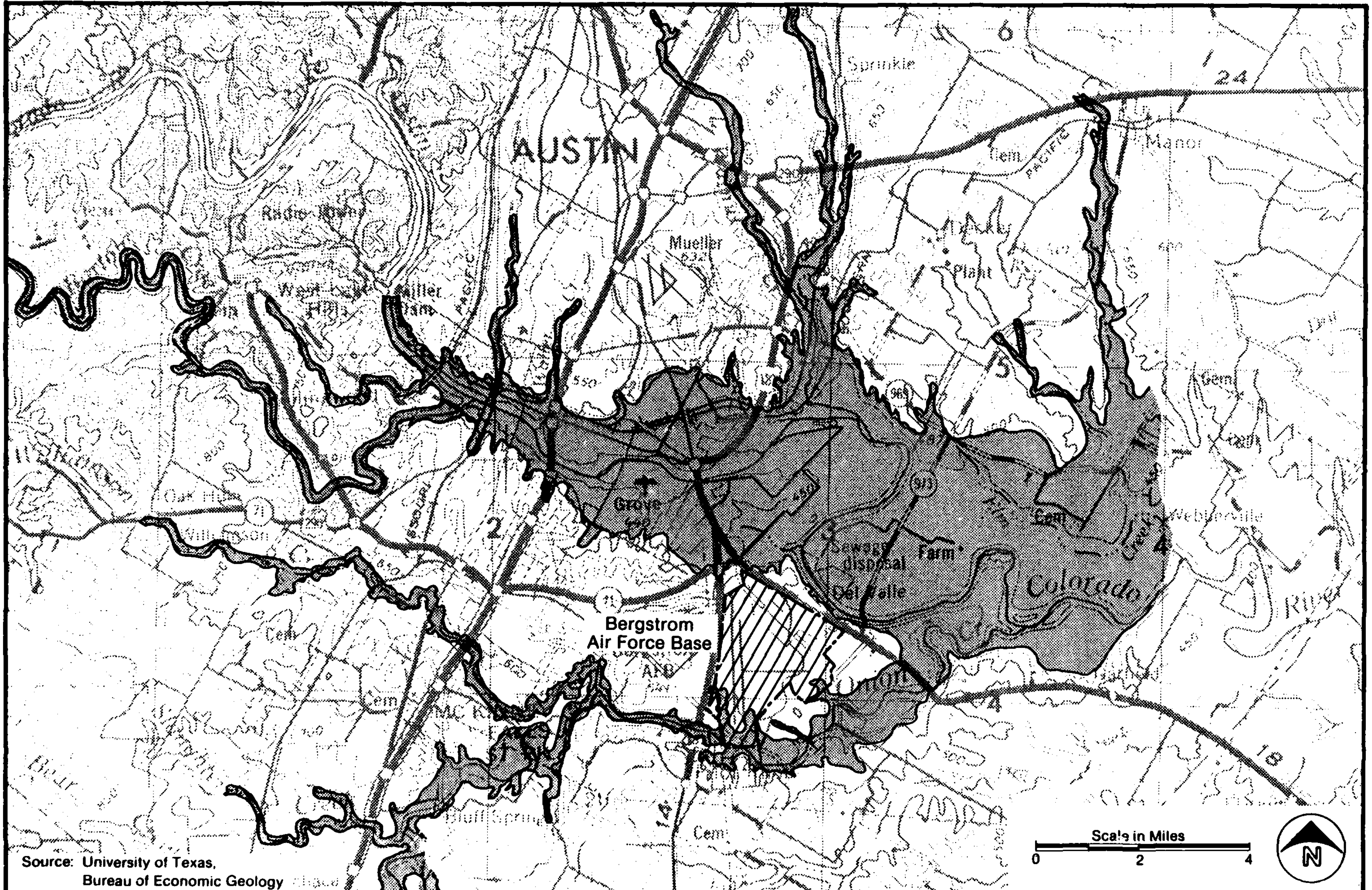

Source: University of Texas,
Bureau of Economic Geology

Note: Map depicts area most likely to have recurrent flood problems.

FIGURE 12.
Location Map of Flood Prone Areas.

Most of the surface drainage from Bergstrom AFB is collected in a series of ditches and storm sewers which eventually discharge to the Colorado River. Most of the surface drainage from the flightline and industrial areas of the base is routed through various storm sewers and drainage ditches to the South Fork Drainage Ditch, which discharges via Onion Creek to the Colorado River. Storm drainage from the south end of the runway is discharged to Onion and Burleson Creeks, eventually reaching the Colorado River. Storm drainage from the housing area and parts of the cantonment area discharges directly to the Colorado River. All of the base storm drainage which reaches the Colorado River enters the river downstream of the City of Austin's wastewater discharge point.

Two regionally significant aquifers underlie Bergstrom AFB; however, both aquifers contain poor quality water beneath the base.

The Edwards aquifer, consisting of limestone, dolomitic limestone, and chert nodules, occurs at an elevation of 1,000 feet below sea level (bsl) or 1,500 feet below land surface (bls). Figure 13 illustrates structural contours indicating the top of the Edwards aquifer in the vicinity of the base. Also illustrated on this figure is the location and orientation of the Balcones Fault zone. From this figure, it can be seen that the top of the Edwards aquifer occurs at approximately 500 feet bsl northwest of the fault and 1,000 feet bsl southeast of the fault. It is this structural control which is responsible for water quality differences in the Edwards aquifer on either side of the fault zone.

The Balcones Fault zone represents the approximate boundary between good and poor quality water. Ground water is not developed from the Edwards aquifer immediately

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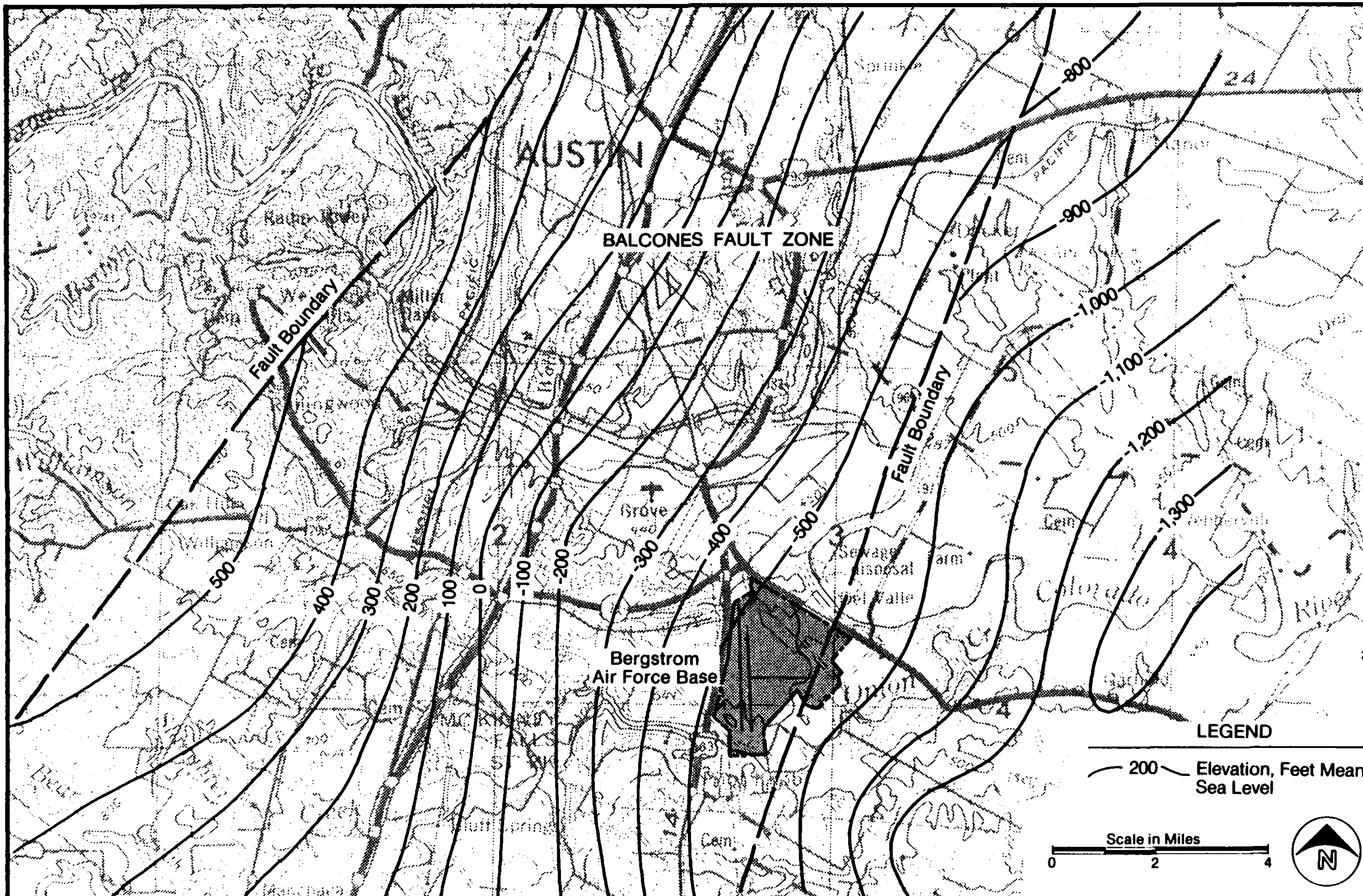

Source: University of Texas,
Bureau of Economic Geology

FIGURE 13.
Structural Contour Map of the Top of the Edwards Aquifer, Austin Area, Texas.

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southeast of the fault zone below Bergstrom because the water is too high in total dissolved solids for most uses. Northwest of the fault, the Edwards aquifer is used extensively for potable water supply.

The Trinity aquifer, another regionally significant source of ground water, is also non-potable in the vicinity of the base. Figure 14 illustrates the structural configuration of the top of this aquifer. This map is very similar to Figure 11 except that the top of the formation is deeper (2,100 feet bls at the base). The Trinity aquifer is developed in the Basal Cretaceous sands identified above.

Both of the aquifers discussed above occur under artesian conditions, and flow is generally to the southeast. Thick strata of clay and marl overlying the aquifers isolate the permeable strata from the surface at the base.

Major aquifers, though non-potable, are isolated from the surface in the vicinity of the base. There is, however, limited occurrence of shallow ground water within the surficial terrace deposits at the base. This ground water occurs in sand and gravel deposits associated with river deposition. One 6-inch well reported to be 150 feet deep develops a small amount (10 gpm) of water at the base golf course. This well discharges to the pond on the course and is reported to have poor water quality, although no test data were available. This very limited resource is also developed just off base for agricultural use, again in very small quantities.

This shallow aquifer would probably be the only potential receiving zone for vertical contaminant migration. The water table at the base occurs at approximately 40 feet bls, and recharge to this zone is by direct percolation from the

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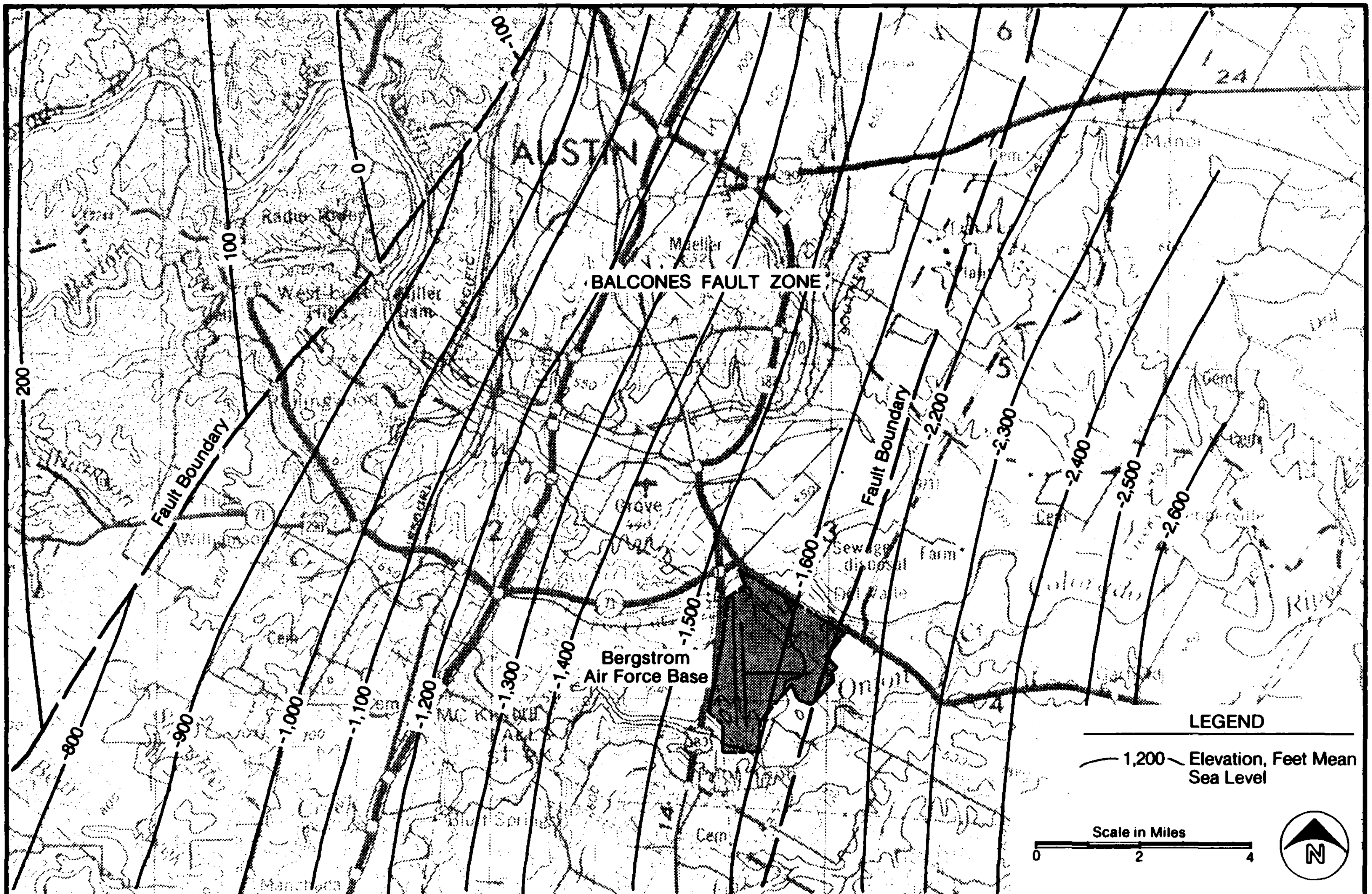

Source: University of Texas, Bureau of Economic Geology

FIGURE 14.
Structural Contour Map of the Top of the Trinity Aquifer, Austin Area, Texas.

surface through soils and along stream channels. Rates of vertical movement would be moderate (1×10^{-3} ft/min) given the clay-silt soil at the surface. Horizontal movement over any distance would also be quite slow since the deposits associated with river deposition tend to be lenticular, pinching out in either direction.

D. ECOLOGY

1. Habitat

Bergstrom AFB lies in the Blackland Prairie vegetation region of east-central Texas. Past and present agricultural practices, such as hay cropping and grazing, as well as Air Force activities, have influenced the ecosystems present on base. Although the entire base has received some disturbance, several significant areas still support diverse populations of plants and wildlife. These include the infrequently mowed grassland areas distant from runways and other facilities, the hay field and rangeland areas, and the wooded drainageways on the east, south, and southwest sides of the base.

There are 1,831 acres of semi-improved and unimproved grounds at Bergstrom AFB. The majority of this area is planted in a combination of grasses, including bluestem grass, Johnson grass, buffalograss, Bermudagrass, fescue, and Texas wintergrass. Spring wildflowers, including Texas bluebonnet and indian paintbrush, are also common in these areas. Forested areas along the drainageways leaving the base are dominated by riparian tree species including cottonwood, hackberry, black willow, and box elder. The 183-acre grazing outlease area is dominated by grasses and scattered mesquite trees.

Bird life and small mammals are abundant at Bergstrom AFB. Common bird species observed during the base visit included meadowlarks, killdeer, boat-tailed grackles, scissor-tailed flycatchers, and mourning doves. Unusual birds that were observed include the upland plover and the green kingfisher. The California jack rabbit is very common on the grassy areas of the base. Other mammals known to be present in the wooded ravines include oppossums, raccoons, and armadillos. No large wild mammals are known to occur on base.

A few aquatic habitats are present on Bergstrom AFB. These include three small ponds in the golf course area and the intermittent streams in the wooded drainageways. Some small fish such as mosquito fish and sunfish may occur in these habitats; however, no true fishery exists on base.

2. Threatened and Endangered Species

Table 4 lists the threatened and endangered species reported to occur in the vicinity of Bergstrom AFB, in Travis County, Texas. None of these species are known to occur on base. Suitable habitat for certain species may be present on base; however, no exhaustive surveys have been conducted.

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Table 4
FEDERAL AND STATE LISTED THREATENED OR ENDANGERED SPECIES
OCCURRING IN THE VICINITY OF BERGSTROM AFB, TRAVIS COUNTY, TEXAS

Common Name	Scientific Name	State[a]	Federal[a]	Habitat
Animals				
Whooping Crane	*Grus americana*	E	E	Migrant in fields
Interior Least Tern	*Sterna albifrons athalassos*	E		Migrant near ponds
Southern Bald Eagle	*Haliaeetus leucocephalus*	E	E	Near rivers and lakes
Peregrine Falcon	*Falco peregrinus*	E	E	Rare migrant
White-faced Ibis	*Plegodis chihi*	T		Near ponds
Osprey	*Pandion haliaetus carolinensis*	T		Near rivers and lakes
Wood Stork	*Mycteria americana*	T		Swamps and marshes
Golden-cheeked Warbler	*Dendroica chrysoparia*	T		Cedar/oak woodlands
Swallow-tailed Kite	*Elanoides forficatus*	T		Near river swamps
White-tailed Hawk	*Buteo albicaudatus hypospodius*	T		Grasslands
Zone-tailed Hawk	*Buteo albonotatus*	T		Wooded canyons and rivers
American Alligator	*Alligator mississipiensis*	E	E	Permanent waterways
Texas Horned Lizard	*Phrynosoma cornutum*	T		Brushlands, grasslands
Mexican Milk Snake	*Lampropeltis triangulum annulata*	T		Throughout
Blue Sucker	*Cycleptus elongatus*	T		Permanent waterways
Plants				
False Dragon-head	*Physostegia correllii*		C	Stream banks
Spiderwort	*Tradescantia edwardsiana*		C	Stream banks

Source: Texas Parks and Wildlife Department; USFWS.

[a] E = Endangered; T = Threatened; C = Candidate for listing.

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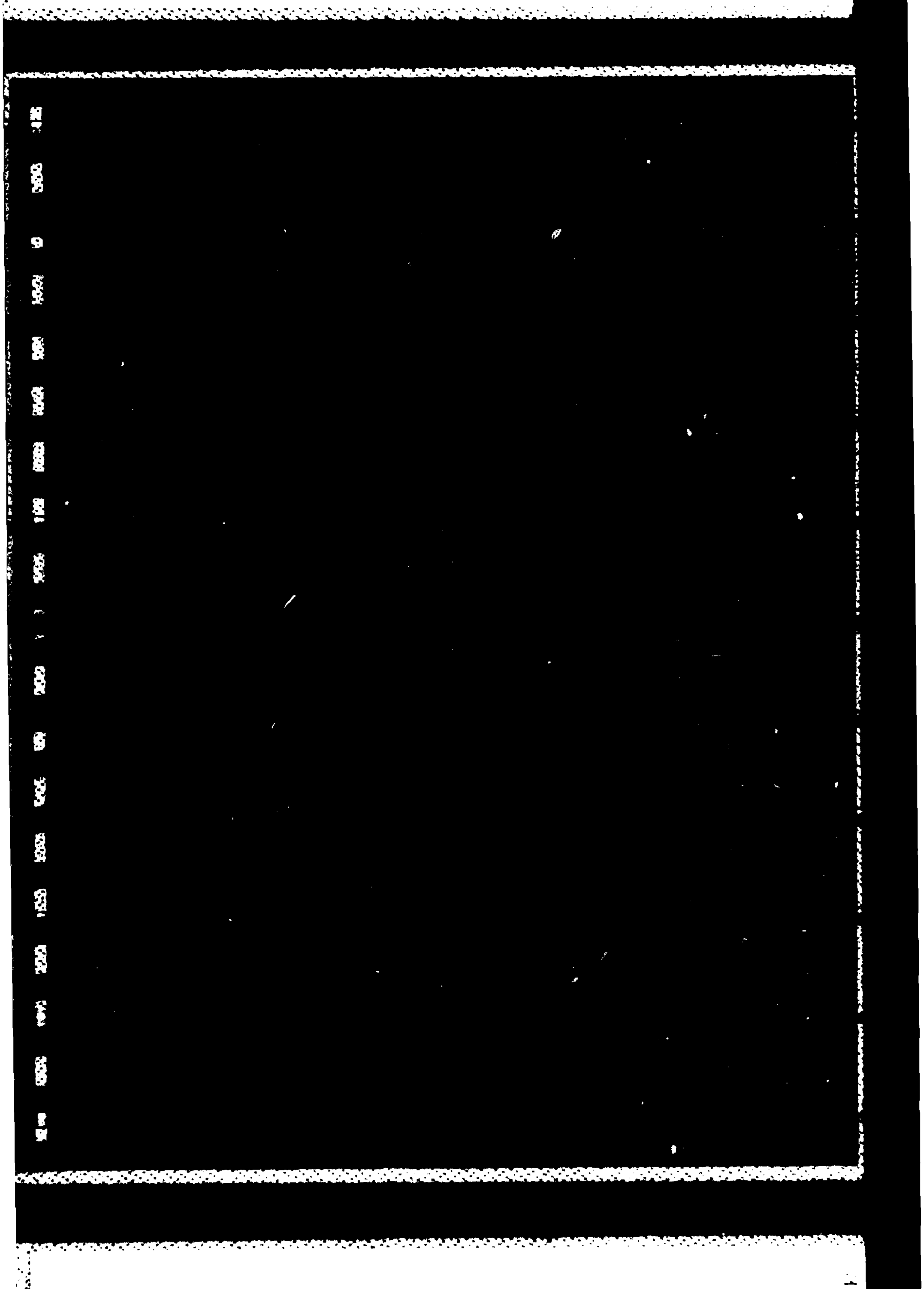

IV. FINDINGS

A. ACTIVITY REVIEW

1. Summary of Industrial Waste Disposal Practices

The majority of industrial operations at Bergstrom AFB have been in existence since the early 1950s. The initial construction of the installation began in 1942 and the base was in full operation by the end of 1943. Some industrial activities were conducted during the early years of operation. The major industrial operations include corrosion control shops, flightline maintenance shops, aerospace ground equipment (AGE) maintenance shops, non-destructive inspection (NDI) labs, photographic processing interpretation facilities (PPIF), and vehicle maintenance shops. These industrial operations generate varying quantities of waste oils, contaminated fuels, and spent solvents and cleaners.

The total quantity of waste oils, recovered fuels, and spent solvents and cleaners generated ranges from 50,000 to 75,000 gallons per year. The above range of total waste quantities is believed to be representative for the period from the mid-1960s, when the base was transferred from the Strategic Air Command to the Tactical Air Command, to present. Some aircraft maintenance activities were accelerated in 1976 with the transfer of the 924th Tactical Airlift Group to Bergstrom AFB.

Practices for past (based on information obtained from shop files and on the best recollection of interviewees) and present industrial waste disposal practices are as follows:

- 1943 to 1972: The majority of waste oils were burned during fire department training exercises. Waste engine oils, lube oils, hydraulic fluids, and transmission fluids were collected in 55-gallon drums and transported by shop personnel to the fire department training area (Site No. 23). The 55-gallon drums were stored at the training area until needed to ignite a practice burn during training exercises. Some waste oils were used for road oiling to control dust on unimproved roads (Site No. 14) from approximately 1955 to 1962. Waste oils generated by flightline maintenance shops were collected in a bowser. When the bowser was full, a spreader arm was attached and waste oils were sprayed over unimproved roads in the landfill area.

  The majority of recovered fuels were also burned during fire department training exercises. Recovered fuels were collected in bowsers and transported to the fire department training area. The bowsers were emptied into the training pit area and the empty bowser brought back to the shop.

  The majority of spent industrial solvents and cleaners were burned during fire department training exercises or discharged to the sanitary sewer. Since no program of waste segregation existed, most spent solvents were commingled with waste oils and disposed of in the same manner as the waste oils, as previously described. Aircraft cleaning compounds and solvents used at the aircraft washrack (Facility No. 4540) were drained to an oil/water separation system which discharged to the storm sewer system. Some waste paints and paint thinners were disposed of in the base sanitary landfills in operation during this period.

- 1972 to Present: In 1972, three of the twelve underground 25,000-gallon storage tanks located at Facility No. 590 were converted to the storage of waste materials. Since 1972, these three tanks have stored spent non-halogenated solvents (Tank No. 7), waste oils (Tank No. 9), and recovered aviation fuels (Tank No. 11). The non-halogenated solvent storage tank receives all the various types of solvents generated by the base. Waste oils, recovered fuels, and spent solvents are collected in 55-gallon drums and transported by shop personnel to Facility No. 590, where the materials are placed in the appropriate storage tank. The Defense Property Disposal Office (DPDO) accepts accountability for the waste materials, but not physical custody. DPDO assumes the responsibility for resale or contractor removal of the waste materials. In 1982, a program was initiated (currently in the process of being implemented) to designate waste accumulation points and waste accumulation point managers. Also in 1982, another storage tank at Facility No. 590 was converted to the storage of synthetic oils (Tank No. 5). The non-halogenated solvent storage tank is used for the storage of solvents, primarily PD-680. Other types of solvents are stored at the accumulation points until DPDO arranges for removal.

Aircraft cleaning compounds and solvents used at the aircraft washrack (Facility No. 4540) are discharged to the sanitary sewer system via an oil/water separator.

An inventory of the waste materials delivered to the Facility No. 590 waste storage tanks over a 1-year period (April 1, 1982 to March 31, 1983) indicated the following quantities: 3,325 gal/yr of waste synthetic oils, 465 gal/yr of spent non-halogenated solvents, 7,675 gal/yr of waste oils, and 17,000 gal/yr of recovered aviation fuels.

2. Industrial Operations

The industrial operations at Bergstrom AFB have been primarily involved in the routine maintenance of C-47, C-46, C-82, C-54, AT-6, T-24, F-84F, F-101, CB-29, B-52, CK-135, O-2, OV-10, C-130, RF-4C, CT-39A, and F-4D aircraft. Appendix F contains a master list of the industrial operations.

A review of base records and interviews with past and present base employees resulted in the identification of the industrial operations in which the majority of industrial chemicals are handled and hazardous wastes are generated. Table 5 summarizes the major industrial operations and includes the estimated quantities of wastes generated as well as the past and present disposal practices of these wastes, i.e., treatment, storage, and disposal. Information on estimated waste quantities and past disposal practices is based upon information obtained from shop files and interviews with shop personnel based upon their best recollection. Descriptions of the major industrial activities are included in the following paragraphs.

Table 5
MAJOR INDUSTRIAL OPERATIONS SUMMARY

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
67th Component Repair Squadron				
NDI Lab	1615	Penetrant Bulk Fluorescent Mag. Ins. Oil Methyl Isobutyl Ketone Emulsifier	70 gal/yr 100 gal/yr 24 gal/yr 70 gal/yr	Fire Dept. Training; Sanitary Sewer; Facility No. 590[a]
		Fixer Developer	95 gal/yr 95 gal/yr	Sanitary Sewer; Silver Recovery to Sanitary Sewer
		Activator Stabilizer	12 gal/yr 12 gal/yr	Sanitary Sewer
Electrical Systems	1610	Sulfuric Acid	120 gal/yr	Neutralization to Sanitary Sewer
		7808 Engine Oil Engine Oil	150 gal/yr 5 gal/yr	Fire Dept. Training; Facility No. 590
67th Transportation Squadron				
General Purpose Vehicle Maintenance	1801	Engine Oil Brake Fluid Hydraulic Fluid Wood Alcohol Ethylene Glycol	2,600 gal/yr 35 gal/yr 75 gal/yr 35 gal/yr 660 gal/yr	Fire Dept. Training; Facility No. 590

LEGEND

—— = Time frame confirmed by shop personnel.

---- = Time frame assumed by shop personnel.

[a]Facility No. 590, underground waste storage tanks, for disposition through DPDO.

Table 5--Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1940 / 1950 / 1960 / 1970 / 1980)
Heavy Equipment Maintenance	713	Motor Oils PD-680	2,300 gal/yr 340 gal/yr	Fire Dept. Training (assumed, ca. 1943 – ca. 1972); Facility No. 590[a] (ca. 1972 onward)
Special Purpose Vehicle Maintenance	1801	Brake Fluid Hydraulic Fluid Transmission Fluid Denatured Alcohol PD-680 Engine Oil	48 gal/yr 12 gal/yr 12 gal/yr 10 gal/yr 240 gal/yr 900 gal/yr	Fire Dept. Training (assumed, ca. 1943 – ca. 1972); Facility No. 590 (ca. 1972 onward)
67th Tactical Reconnaissance Wing				
Photo Processing	1400	Developer Fixer	2,350 gal/yr 2,600 gal/yr	Silver Recovery to Sanitary Sewer (ca. 1970 onward)
67th Equipment Maintenance Squadron				
ACE Maintenance Shop	4548	PD-680 Motor Oils	2,700 gal/yr 1,600 gal/yr	Fire Dept. Training (assumed, ca. 1943 – ca. 1972); Facility No. 590 (ca. 1972 onward)
Fuel Systems Repair	4533	JP-4	12,000 gal/yr	Oil/Water Separator to Storm Drain (1940 – ca. 1960); Oil/Water Separator to Storm Drain; Facility No. 590 (ca. 1960 – ca. 1972); Facility No. 590 (ca. 1972 onward)

LEGEND

—— = Time frame confirmed by shop personnel.

---- = Time frame assumed by shop personnel.

[a]Facility No. 590, underground waste storage tanks, for disposition through DPDO.

Table 5--Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods (1940–1980)
Wheel and Tire Shop	1610	PD-680 Hot Paint Stripper	1,000 gal/yr 225 gal/yr	Holding Tank, Contractor Removal
Corrosion Control	4540[a]	Aircraft Cleaning Compound PD-680	4,800 gal/yr 2,900 gal/yr	Oil/Water Separator to Storm Sewer; Oil/Water Separator to Sanitary Sewer
	1602	Paint Remover Methyl Ethyl Ketone Methyl Isobutyl Ketone Toluene Dope Thinner	660 gal/yr	Fire Dept. Training; Oil/Water Separator to Storm Sewer; Oil/Water Separator to Sanitary Sewer; Facility No. 590[b]
12th Tactical Reconnaissance Squadron				
PPIF	4531	Developer Fixer	5,750 gal/yr 5,750 gal/yr	Silver Recovery to Sanitary Sewer
91st Tactical Reconnaissance Squadron				
PPIF	320	Developer Fixer	5,750 gal/yr 5,750 gal/yr	Silver Recovery to Sanitary Sewer

LEGEND

——— = Time frame confirmed by shop personnel.

- - - - = Time frame assumed by shop personnel.

[a]Aircraft washrack.

[b]Facility No. 590, underground waste storage tanks, for disposition through DPDO.

Table 5--Continued

Shop Name	Location (Bldg. No.)	Waste Material	Estimated Waste Quantity	Treatment/Storage/Disposal Methods 1940 1950 1960 1970 1980
924th Tactical Fighter Group				
Flightline Maintenance	4540[a]	Aircraft Cleaning Compound PD-680	600 gal/yr 240 gal/yr	Oil/Water Separator to Sanitary Sewer (mid-1970s →)
	Flightline	Jet Engine Oil Hydraulic Fluid	120 gal/yr 60 gal/yr	Facility No. 590[b] (mid-1970s →)
Jet Engine/Propulsion Shop	4589	Corrosion Preventive Compound Aircraft Cleaning Compound	50 gal/yr 120 gal/yr	Oil/Water Separator to Sanitary Sewer (mid-1970s →)
		PD-680 Engine Oil	650 gal/yr 240 gal/yr	Facility No. 590 (mid-1970s →)

LEGEND

——— = Time frame confirmed by shop personnel.

- - - - = Time frame assumed by shop personnel.

[a]Aircraft washrack.

[b]Facility No. 590, underground waste storage tanks, for disposition through DPDO.

GNR111

a. 67th Component Repair Squadron

i. NDI Lab

The NDI Lab is located in Building No. 1615. Non-destructive testing methods, including x-ray, magnaflux, and ultrasound, are performed to determine material defects of aircraft structures, component parts, and related ground equipment. Wastes generated by the developing process include penetrant (70 gal/yr), emulsifier (70 gal/yr), fixer (95 gal/yr), developer (95 gal/yr), activator (12 gal/yr), and stabilizer (12 gal/yr). The penetrant and emulsifier are contained in dip tanks which are cleaned out once per year. Waste fluorescent oil (100 gal/yr) is generated by the periodic maintenance of the NDI equipment. Methyl isobutyl ketone (24 gal/yr) is used for rinsing a sample holding apparatus. Since 1972, the penetrant, emulsifier, waste fluorescent oil, and methyl isobutyl ketone have been brought to the underground waste storage tanks at Facility No. 590 for disposition through DPDO. Prior to 1972, these wastes were either burned during fire department training exercises or discharged to the sanitary sewer. Since 1958, the fixer and developer solutions have been processed for silver recovery prior to being discharged to the sanitary sewer. Prior to 1958, the fixer and developer were discharged to the sanitary sewer. The activator and stabilizer are discharged to the sanitary sewer, which was also common practice in the past.

ii. Electrical Systems Shop

The Electrical Systems Shop is located in Building No. 1610. Activities include the servicing of lead batteries and the testing of constant-speed drives and generators. Wastes generated include battery acid (sulfuric acid, 120 gal/yr), 7808 engine oil (150 gal/yr), and engine oil (5 gal/yr). The battery acid is neutralized with sodium bicarbonate in a neutralization sink and diluted with water prior to being discharged to the sanitary sewer. This was also common practice in the past. Nickel-cadmium batteries are also collected in this shop; however, the battery electrolyte is not drained and the batteries are turned in to DPDO full for disposition. Since 1972, the engine oils have been brought to Facility No. 590 for disposition through DPDO. Prior to 1972, the engine oils were burned during fire department training exercises.

b. <u>67th Transportation Squadron</u>

i. <u>General Purpose Vehicle Maintenance Shop</u>

The General Purpose Vehicle Maintenance Shop is located in Building No. 1801. Wastes generated during the repair and maintenance of light duty vehicles include engine oil (2,600 gal/yr), brake fluid (35 gal/yr), hydraulic fluid (75 gal/yr), wood alcohol (35 gal/yr), and ethylene glycol (660 gal/yr). Since 1972, these wastes have been brought to Facility No. 590 for disposition through DPDO. Prior to 1972, these wastes were burned during fire department training exercises.

ii. <u>Heavy Equipment Maintenance Shop</u>

The Heavy Equipment Maintenance Shop is located in Building No. 713. Wastes generated during the repair and maintenance of heavy purpose equipment and vehicles include motor oils (2,300 gal/yr) and PD-680 (340 gal/yr). Since 1972, these wastes have been brought to Facility No. 590 for disposition through DPDO. Prior to 1972, these wastes were burned during fire department training exercises.

iii. Special Purpose Vehicle Maintenance Shop

The Special Purpose Vehicle Maintenance Shop is located in Building No. 1801. Wastes generated during the repair and maintenance of special purpose vehicles include brake fluid (48 gal/yr), hydraulic fluid (12 gal/yr), transmission fluid (12 gal/yr), denatured alcohol (10 gal/yr), PD-680 (240 gal/yr), and engine oil (900 gal/yr). Since 1972, these wastes have been brought to Facility No. 590 for disposition through DPDO. Prior to 1972, these wastes were burned during fire department training exercises.

c. 67th Tactical Reconnaissance Wing

i. Photo Processing

The photo processing facility is located in Building No. 1400. Wastes generated during the processing of air reconnaissance photographs include developer (2,350 gal/yr) and fixer (2,600 gal/yr). The developer and fixer are processed for silver recovery prior to being discharged to the sanitary sewer. This was also common practice in the past.

d. 67th Equipment Maintenance Squadron

i. AGE Maintenance Shop

The AGE Maintenance Shop is located in Building No. 4548. The responsibility of this shop is to repair, maintain, and periodically inspect all aerospace ground equipment. Wastes generated include PD-680 (2,700 gal/yr) and motor oils (1,600 gal/yr). Since 1972, these wastes have been brought to Facility No. 590 for disposition through DPDO. Prior to 1972, these wastes were burned during fire department training exercises.

ii. Fuel Systems Repair Shop

The Fuel Systems Repair Shop is located in Building No. 4533. Activities include the draining and maintenance of both internal and external fuel tanks. The only waste generated is the recovered JP-4 fuel, which is drained from the fuel tanks prior to maintenance. PD-680 is used as a test medium in the fuel tanks to determine if the tanks are leaking. The PD-680 is transferred from one fuel tank to the next and no waste is generated. Currently, 750 gal/mo (9,000 gal/yr) of JP-4 is recovered and placed into a bowser located at the shop. The bowser is pumped out approximately twice per month by POL personnel, and the recovered fuel is transported to Facility No. 590 for disposition through DPDO. Prior to 1982, a larger quantity of recovered JP-4, approximately 1,000 to 1,250 gal/mo (12,000 gal/yr minimum), was generated by the shop. Between 1972 and 1982, the recovered JP-4 was either brought to Facility No. 590 for disposition through DPDO or drained into the floor drain which discharged to an oil/ water separator located outside the shop. Prior to 1972, the majority of recovered JP-4 was drained into the floor drain, which discharged to the oil/water separator. The oil/water separator is serviced on a monthly basis and the effluent is discharged to the storm drainage system. Prior to 1982, the monthly quantity of JP-4 drained to the oil/water separator greatly exceeded the separator capacity for JP-4 (approximately 350 gal/mo capacity). Therefore, a significant quantity of JP-4 was being discharged to the storm drainage system. The Fuel Systems Repair Shop is a suspected source of the fuel in the South Fork Drainage Ditch (Site No. 16).

iii. Wheel and Tire Shop

The Wheel and Tire Shop is located in Building No. 1610. Activities include the cleaning, stripping, and painting of aircraft wheel rims. Wastes generated include PD-680 (1,000 gal/yr) and hot paint stripper (225 gal/yr). The PD-680 is contained in two separate dip tanks (110-gallon and 55-gallon) which are cleaned about every 2 months. The hot paint stripper, which consists of 30 percent mono ethanol amine, 5 percent benzyl alcohol, 5 percent furyl alcohol, and 60 percent water, is contained in a 75-gallon dip tank which is cleaned about every 4 months. The PD-680 and hot paint stripper dip tanks are drained to an underground holding tank located outside the building. The tank is periodically pumped out by a contractor. This was also common practice in the past.

iv. Corrosion Control Shop

The Corrosion Control Shop is located in Building No. 1602. Corrosion control activities include cleaning, sanding, wiping, priming, repainting, and stenciling of aircraft. All aircraft washing is conducted at the aircraft washrack (Facility No. 4540). Wastes generated during washing operations include aircraft cleaning compound (4,800 gal/yr) and PD-680 (2,900 gal/yr). The aircraft cleaning compound is mixed one-to-one with water and applied with spray guns. Since 1972, the aircraft cleaning compound and PD-680 have been diluted with water during rinsing and washed down the washrack drain to an oil/water separator which discharges to the sanitary sewer. Prior to 1972, the aircraft washrack drained to an oil/water separation system which discharged to the storm drainage system during that period.

The corrosion control spray booth is located in Building No. 1602, and the majority of painting is conducted at this location. Building No. 4533, primarily used as the Fuel Systems Repair Shop, is used when an aircraft is to be painted. The corrosion control spray booth is a waterfall type facility. The water, which collects airborne paint particles, is continuously recycled during operation. The water-holding tank is purged to the sanitary sewer about once per month (approximately 1,000 gallons) and replenished with freshwater. Wastes generated during the painting operations include paint removers and paint thinners (660 gal/yr), such as methyl ethyl ketone, methyl isobutyl ketone, toluene, and dope thinner. Since 1972, these wastes have been either discharged to the oil/water separator which is connected to the sanitary sewer or placed in 55-gallon drums and brought to the Facility No. 590 underground waste tanks for disposition through DPDO. Between 1965 and 1972, the majority of these wastes were discharged to the oil/water separator which was connected to the storm drain during this period. Prior to 1965, these waste paint removers and thinners wre commingled with other waste oils and burned during fire department training exercises.

e. <u>12th Tactical Reconnaissance Squadron (TRS)</u>

i. <u>12th TRS PPIF</u>

The 12th TRS Photographic Processing Interpretation Facility (PPIF) is located at Facility No. 4531. Activities include the processing of air reconnaissance photographs at mobile processing facilities. The 12th TRS PPIF operates six mobile processing units. Wastes generated include developer (5,750 gal/yr) and fixer (5,750 gal/yr). The developer (20 gallons per week per unit) and fixer (20 gallons per week per unit) are processed through a mobile silver recovery unit prior being discharged to the sanitary sewer. This was also common practice in the past.

f. 91st Tactical Reconnaissance Squadron

i. 91st TRS PPIF

The 91st TRS PPIF is located at Facility No. 320. The 91st TRS PPIF also operates six mobile processing units, and the activities are identical to those of the 12th TRS PPIF. Wastes generated include developer (5,750 gal/yr) and fixer (5,750 gal/yr) and the wastes are processed for silver recovery prior to being discharged to the sanitary sewer. This has also been the common practice in the past.

g. 924th Tactical Fighter Group

i. Flightline Maintenance

The Flightline Maintenance activities, most of which are conducted on the flightline, include engine run-up and refueling, servicing, and washing of aircraft. Washing operations are conducted at the aircraft washrack (Facility No. 4540) and wastes generated include aircraft cleaning compound (600 gal/yr) and PD-680 (240 gal/yr). As previously described in the discussion of the Corrosion Control Shop, materials used on the washrack are discharged to the sanitary sewer via an oil/water separator. Other wastes generated include jet engine oil (120 gal/yr) and hydraulic fluid (60 gal/yr). These wastes are brought to Facility No. 590 for disposition through DPDO.

ii. Jet Engine/Prop Shop

The Jet Engine/Prop Shop is located in Building No. 4589. Wastes generated during the repair and maintenance of aircraft engines include corrosion preventive compound (50 gal/yr), aircraft cleaning compound (120 gal/yr), PD-680 (650 gal/yr), and engine oil (240 gal/yr). The corrosion preventive compound and aircraft cleaning compound are discharged to the sanitary sewer via an oil/water separator. The PD-680 and engine oil are brought to Facility No. 590 for disposition through DPDO.

3. Fuels

The major fuel storage area on Bergstrom AFB is the POL tank farm (Facilities No. 513 and 515). This POL bulk storage area houses two aboveground, floating-roof, diked tanks used for JP-4 storage. The capacities of the storage tanks are 20,000 barrels and 13,000 barrels (Facilities No. 513 and 515, respectively). Adjacent to these facilities is Facility No. 590, which houses 12 underground 25,000-gallon storage tanks. Four tanks store JP-4, two tanks store diesel, two tanks store MOGAS, and four tanks store waste materials. Other major storage areas are located at Pumphouses No. 1, 2, and 3 (Facilities No. 4553, 4554, and 4537, respectively). Pumphouse No. 1 houses six underground 50,000-gallon tanks; Pumphouse No. 2 houses six underground 50,000-gallon tanks; and Pumphouse No. 3 houses eight underground 50,000-gallon tanks. All of the tanks located at the pumphouses store JP-4. There are numerous other tanks on base which are used for the storage of MOGAS, AVGAS, diesel fuel, and heating fuel oil. A complete inventory and inspection schedule of the major existing POL storage tanks is included in Appendix G.

Appendix G indicates facility number, capacity, substance stored, type of tank, date of installation, date of last inspection, and tank condition for the major existing POL storage tanks.

Several fuel spills have occurred on Bergstrom AFB in the past. A total of 13 fuel spill related sites have been identified. These sites (Sites No. 8 through 20) are discussed in detail in Section IV-B, "Disposal Sites Identification and Evaluation," page IV-26.

The two major JP-4 storage tanks at the POL bulk storage area are cleaned every 6 years by a contractor. Other smaller-capacity fuel storage tanks are inspected every 3 years and cleaned out by base personnel if needed. The quantities of sludge generated per tank cleaning operation are small, and the sludge consists mainly of water, rust, dirt, and fuel. During the most recent tank cleaning operation (1982), the fuel tank sludge was placed in 55-gallon drums and sampled by Bioenvironmental Engineering. Results indicated that the drummed material contained approximately 99 percent water, 1 percent petroleum distillates floating on top, and small concentrations of heavy metals (lead--1.3 mg/l and nickel--1.2 mg/l). The floating portion was skimmed off the top and treated as contaminated fuel, the water layer was flushed into the sanitary sewer, and the sludge residuals in the bottom of the drums were consolidated into one drum for proper disposal. Prior to 1962, sludge was reportedly weathered at the sludge weathering pit (Site No. 22). Since AVGAS fuel was used during that time period, the potential exists that leaded AVGAS sludge may have been weathered at the site. The disposal method for fuel tank sludge between 1962 and 1976 is unknown.

Several inactive storage tanks have been identified at Bergstrom AFB. There are 12 inactive underground 25,000-gallon tanks located to the southeast of the POL bulk storage area between Facilities No. 504 and 503. These tanks have reportedly been filled with dirt and there were no records or evidence indicating that these tanks once leaked. There is an inactive underground 3,000-gallon tank previously used to store anhydrous ammonia located at Facility No. 4583. This tank is also reportedly filled with dirt. Other underground inactive tanks include a 1,000-gallon diesel tank at Facility No. 217, a 1,000-gallon diesel tank at the Communications Transmitter Site (Facility No. 6000), and a MOGAS tank of unknown capacity adjacent to Facility No. 1613. It is not known if these tanks have been filled with dirt.

4. Fire Department Training Exercises

Fire department training activities have been common since the activation of the base. Based on available information, training activities have always been conducted at the present fire department training area (Site No. 23). No other fire department training areas were identified during the records search. Past and present fire department training activities at Bergstrom AFB are as follows:

- Prior to 1972: Recovered fuels and commingled waste oils and spent solvents were burned during training exercises. The commingled waste oils and spent solvents were transported to the training area in 55-gallon drums. The waste drums were stored at the training area until needed to ignite a practice burn. Interviewees reported that up to 50 waste drums were stored at the training area at any particular time. Recovered fuels were transported to the training area in bowsers, which were emptied directly into the training pit area. The training activities were conducted on a simulated aircraft located in an unlined, circular pit area surrounded by a dirt berm. Waste materials were poured into the pit area, ignited, preburned for 30 seconds, and then extinguished. Most of the POL waste would have been consumed in the fire, but some minor percolation into the ground probably occurred. The quantity of waste POL used per training exercise is unknown. The frequency of exercises is believed to have been approximately once per month.

- <u>1972 to 1982</u>: During this period, only clean JP-4 was used during training exercises. In 1975, a 1,175-gallon aboveground storage tank for JP-4 was installed at the training area. The JP-4 would flow by gravity from the storage tank to the training pit area and be distributed by a nozzle system. Procedures were to presaturate the ground with water, apply the clean JP-4, ignite, preburn for 30 seconds, and extinguish with Aqueous Film-Forming Foam (AFFF). Approximately 200 gallons of JP-4 were used per exercise. Exercises were conducted a minimum of two to three times per quarter.

- <u>1982 to present</u>: Major construction was conducted at the fire department training area during the summer of 1982. The revamping of the training area included the following: a pump was installed to transmit the JP-4 from the storage tank to the pit area; the training pit area was regraded, enlarged, and a new limestone base put down; a water drafting pit was installed; and an oil/water separator was installed to receive the runoff after a training exercise. The procedures used since 1972 for igniting a burn have been followed. The current frequency of exercises is approximately twice per month and a maximum of 300 gallons of JP-4 is used per exercise.

5. Polychlorinated Biphenyls (PCBs)

Typical sources of PCB at Bergstrom AFB are electrical transformers and capacitors. Presently, there are 20 out-of-service transformers stored on base. All 20 transformers have been tested, and three were found to contain PCB transformer oil with concentrations ranging from 490,000 to 790,000 parts per million (ppm). These three transformers are currently stored in Building No. 217 within a sandbag berm to retain any possible spills which may occur. The remaining 17 transformers were found to contain transformer oil with PCB concentrations less than 5 ppm. These transformers are stored at the civil engineering storage yard behind Building No. 723. There are also eight out-of-service PCB capacitors stored at the civil engineering storage yard in closed 55-gallon drums.

There are 598 in-service transformers at Bergstrom AFB. A program is to be initiated during fiscal year 1983 to sample all in-service transformers for PCB. In addition, a concrete vault, located in the DPDO storage yard, to be used for the temporary storage of PCB transformers will soon be put into operation. DPDO assumes responsibility for the contractor removal of all PCB transformers and capacitors. Prior to becoming regulated in 1979, PCB transformers and capacitors were turned in to Base Supply for salvage.

There were no reports or evidence of any major PCB spills from leaking or blown transformers. There was also no indication that any out-of-service transformers were disposed of in base landfills.

6. Pesticides

Pesticides have commonly been used at Bergstrom AFB. The Entomology Shop controls the use and handling of all pesticides, which are used to control mosquitoes, cockroaches, ants, and mice, as well as undesirable weeds, algae, and overgrowth.

The major pesticides currently used and the 1982 quantities used are Baygon (11 lb/yr), Anticoagulant Bait (58 lb/yr), Chlordane (48 lb/yr), Sevin (20 lb/yr), Diazinon (9 lb/yr), Dibrom (10 lb/yr), and the herbicide Duncmherb (200 lb/yr).

Proper preparation and application procedures are followed. All empty pesticide containers are triple rinsed and placed in the dumpster for contractor removal. Rinsate is collected and reused as dilution water during batch preparation. Prior to moving to the present location (Building No. 722) in 1973, the Entomology Shop was located in Building No. 724. Pesticide application equipment and empty containers were rinsed outside of Building No. 724 and the rinsate was drained to the local ground surface (Site No. 21).

Two small pesticide-related spills have occurred on Bergstrom AFB in the past. Both spills resulted when the trailer used during mosquito fogging operations overturned. In each case, the spill consisted of less than 50 gallons of diesel fuel containing approximately 1.5 quarts of Dibrom.

One spill occurred near the main gate entrance (Site No. 11) and the other occurred on a bridge crossing a small creek on the golf course (Site No. 12). The spills are discussed in further detail in Section IV-B, "Disposal Sites Identification and Evaluation," page IV-26.

There were no reports or evidence of banned or restricted pesticides or herbicides currently used on base. DDT was used extensively in the past until approximately 1971. During the early 1970s, seven drums of DDT were found abandoned at Landfill No. 6. One of the drums was corroded and had leaked its contents onto the ground. The corroded drum was buried at the landfill and the remaining six drums were removed from the site.

7. Wastewater Treatment

The Bergstrom AFB sanitary sewer system is connected to the City of Austin municipal system. Bergstrom AFB has never had a central on-base sanitary wastewater treatment plant. All sanitary and industrial wastewater is treated at the City of Austin's Hornsby Bend Wastewater Treatment Plant. The flow from Bergstrom AFB accounts for approximately 65 to 75 percent of the influent flow to the plant. The average daily flow at Bergstrom AFB is estimated to be 0.40 million gallons per day (mgd) from sanitary sources and 0.15 mgd from industrial sources. All base sewage flows to the lift station near the center of the base housing area and is pumped off base through a 10-inch cast iron force main. The lift station is one of 11 water pollution monitoring locations (sample location K), which are sampled on a quarterly basis. The water pollution monitoring program is discussed in further detail in the next section, "Available Water Quality Data." The City of

Austin samples the Bergstrom AFB wastewater as it leaves the base and uses the annual sampling results as a means of determining the surcharge for industrial waste discharges. The average sampling results obtained during 1981 indicated a pH of 7.1, a biochemical oxygen demand (BOD) of 196 million gallons per liter (mg/l), a chemical oxygen demand (COD) of 549 mg/l, and a suspended solids concentration of 155 mg/l.

There are 26 oil/water separators located at various industrial shops and washracks to provide pretreatment of the industrial wastewater. By the early 1970s, the majority of the oil/water separators were connected to the sanitary sewer system. Four known exceptions are the oil/water separators located at Buildings No. 4533, 4534, 4576, and 8024, which discharge to the storm drainage system. Three oil/water separators were installed on major storm drainage ditches in 1981 to catch any potential POL spills prior to leaving the base. An inventory of all oil/water separators, including location (building number), date of installation, and approximate capacity, is included in Appendix H. The oil/water separators are serviced periodically by a contractor, and waste oils are transported off base.

8. Available Water Quality Data

All potable water for Bergstrom AFB is purchased from the City of Austin. Austin draws its raw water from two surface sources, Lake Austin and Town Lake, both of which are impoundments on the Colorado River. The potable water is delivered to the base, after treatment, through one 8-inch main and one 12-inch main. The water usage averaged 0.916 mgd between 1973 and 1976. The quality of the potable water supplied by the City of Austin is good. A typical potable water supply chemical analysis report is included in Appendix E, "Water Quality," Table E-2.

The storm drainage system at Bergstrom AFB is composed of man-made ditches, natural drainageways, and storm sewers. The aircraft parking apron is drained by a subsurface concrete storm system, which discharges to the South Fork Drainage Ditch. The cantonment area is drained by open grass ditches with intermediate concrete culverts. The southerly portion of the base drains into Onion Creek, and the northerly portion drains into the Colorado River. Onion Creek receives the majority of the base storm drainage and is monitored for water pollution by the Texas Department of Water Resources. Appendix E, Table E-1, presents water quality data collected from sampling stations on Onion Creek directly upstream (State Station No. K) and downstream (State Station No. L) from Bergstrom AFB. The major storm drainage ditches and creeks leaving Bergstrom AFB are also monitored for water pollution. Eleven water pollution monitoring locations, which include 10 storm drainage ditches and creeks and one main sanitary sewage lift station, are sampled by Bioenvironmental Engineering personnel. Water quality is determined by collection and analysis of quarterly grab samples. Appendix E, Table E-3, presents the 1981 yearly average values for all 11 sampling locations. Appendix E, Table E-4, presents the probabilities of exceedance (percent chance that the standard will be exceeded when a quarterly grab sample is taken) for all 11 sampling locations. The locations of the 11 water pollution monitoring points are shown on Figure 15. During the onsite base visit, an oil sheen (potential fuel contamination) was observed in the South Fork Drainage Ditch near sampling point D (Site No. 17). This site is discussed in further detail in Section IV-B, "Disposal Sites Identification and Evaluation," page IV-26.

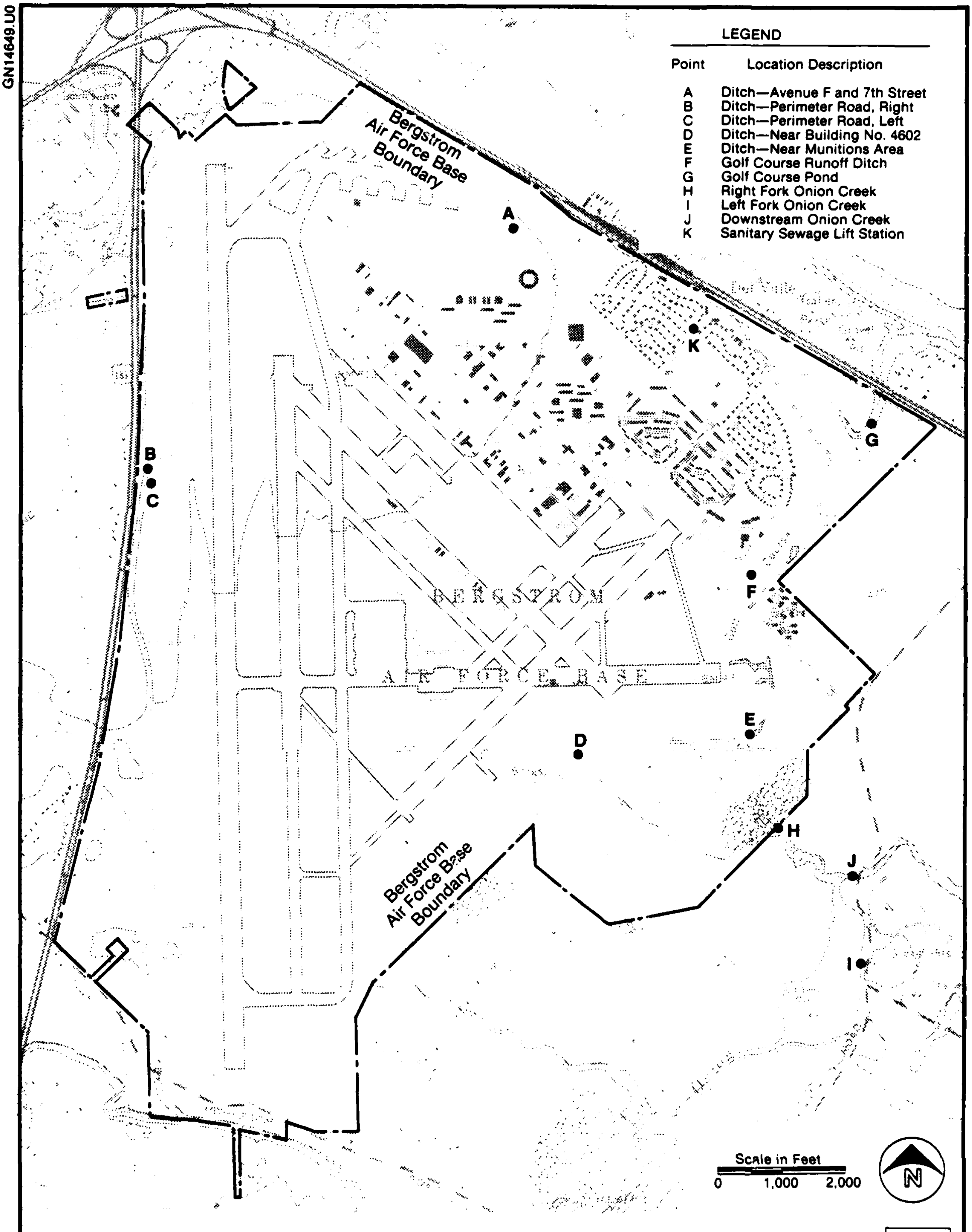

FIGURE 15.
Location Map of Bergstrom AFB Water Pollution Monitoring Points.

The only water quality related environmental stress was the reported fishkill/snakekill which occurred at the base golf course pond in January 1976. Numerous water and sediment samples were collected by Bioenvironmental Engineering personnel and analyzed for suspected pesticides. Examinations of the fish and static bioassays were also conducted. However, the cause of the fishkill/snakekill was not determined through the analytical and biological work conducted. Therefore, the base golf course pond was not identified as a potential disposal or spill site.

9. Other Activities

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

All explosive ordnance disposal (EOD) activities are conducted at the EOD area located on the southwestern portion of the base. This site has always been used for EOD activities and the records search did not identify any other past EOD areas. The EOD area is used for training operations only. The training operations are conducted about once per month. There is a 5-pound explosive limit, and any other larger munitions are sent to Fort Hood or Lackland AFB for proper disposal.

B. DISPOSAL SITES IDENTIFICATION AND EVALUATION

Interviews were conducted with past and present base personnel (Appendix C) to identify disposal and spill sites at Bergstrom AFB. A preliminary screening was performed on all the identified sites based on the information obtained from the interviews and available records from the base and outside agencies. Using the decision tree process described in the "Methodology" section, a determination was made whether a potential exists for hazardous material contamination in any of the identified sites. For those sites where hazardous material contamination was considered significant, a determination was made whether significant potential exists for contaminant migration from these sites. These sites were then rated using the U.S. Air Force Hazard Assessment Rating Methodology (HARM), which was developed jointly by the Air Force, CH2M HILL, and Engineering-Science for specific application to the Air Force Installation Restoration Program. The HARM system considers four aspects of the hazard posed by a specific site: (1) the receptors of the contamination, (2) the waste and its characteristics, (3) potential pathways for waste contaminant migration, and (4) any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating. A more detailed description of the HARM system is included in Appendix I.

A total of 26 disposal and spill sites were identified at Bergstrom AFB. Of these, a total of 24 were rated using the HARM rating system. A complete listing of all of the sites, indicating potential hazards, is given in Table 6. Copies of the completed rating forms are included in Appendix J, and a summary of the hazard ratings for the sites is given in Table 7.

Descriptions of each site, including a brief discussion of the rating results, are presented below. Approximate locations of the sites are shown on Figure 16. Approximate operating dates for the identified landfills are shown on Figure 17. Figure 17 also includes operating dates for the fire department training site and approximate dates that correspond to continuous or intermittent spills.

Table 6
DISPOSAL SITE SUMMARY

Site No.	Site Description	Potential Hazard Contamination	Potential Hazard Migration	Rating
1	Landfill No. 1	Yes	Yes	Yes
2	Landfill No. 2	Yes	Yes	Yes
3	Landfill No. 3	Yes	Yes	Yes
4	Landfill No. 4	Yes	Yes	Yes
5	Landfill No. 5	Yes	Yes	Yes
6	Landfill No. 6	Yes	Yes	Yes
7	Landfill No. 7	Yes	Yes	Yes
8	JP-4 Spill/Overtopped Tank	Yes	Yes	Yes
9	JP-4 Spill/Open Pipeline	Yes	Yes	Yes
10	JP-4 Spill/Faulty Valve	Yes	Yes	Yes
11	Dibrom/Diesel Spill at Entrance Gate	No	NA	No
12	Dibrom/Diesel Spill at Golf Course	Yes	Yes	Yes
13	MOGAS Spill at Motor Pool Area	Yes	Yes	Yes
14	Road Oiling Area	Yes	Yes	Yes
15	JP-4 Spill/Apron Excavation	Yes	Yes	Yes
16	JP-4 Spill/Refueling Truck	Yes	Yes	Yes
17	South Fork Drainage Ditch	Yes	Yes	Yes
18	JP-4 Spill at Fuel Systems Repair Shop	Yes	Yes	Yes
19	JP-4 Spill from A/C Fuel Tank	Yes	Yes	Yes
20	Fuel Tank Jettison Area	Yes	Yes	Yes
21	Old Entomology Rinse Area	Yes	Yes	Yes
22	Sludge Weathering Pit	Yes	Yes	Yes
23	Fire Department Training Area	Yes	Yes	Yes
24	Radioactive Waste Disposal Site	Yes	No	No
25	Asphalt Primer Spill/Avenue F	Yes	Yes	Yes
26	Asphalt Primer Spill/Star Drive	Yes	Yes	Yes

Note: NA = not applicable.

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Table 7
SUMMARY OF DISPOSAL SITE RATINGS

Site No.	Site Description	Subscore (% of Maximum Possible Score in Each Category) Receptors	Characteristics	Pathways	Factor for Waste Management Practices	Overall Score	Page Reference of Site Rating Form
1	Landfill No. 1	43	40	56	1.0	46	J-1
2	Landfill No. 2	43	40	56	1.0	46	J-3
3	Landfill No. 3	54	40	56	1.0	50	J-5
4	Landfill No. 4	54	40	56	1.0	50	J-7
5	Landfill No. 5	52	40	56	1.0	49	J-9
6	Landfill No. 6	52	60	56	1.0	56	J-11
7	Landfill No. 7	52	40	56	1.0	49	J-13
8	JP-4 Spill/Overtopped Tank	46	64	56	.95	53	J-15
9	JP-4 Spill/Open Pipeline	46	40	56	.95	45	J-17
10	JP-4 Spill/Faulty Valve	46	40	56	.95	45	J-19
12	Dibrom/Diesel Fuel Spill at Golf Course	58	32	56	.95	46	J-21
13	MOGAS Spill at Motor Pool Area	53	64	56	1.0	58	J-23
14	Road Oiling Area	54	50	56	1.0	53	J-25
15	JP-4 Spill/Apron Excavation	51	40	56	.95	47	J-27
16	JP-4 Spill/Refueling Truck	49	40	56	1.0	48	J-29
17	South Fork Drainage Ditch	52	64	80	1.0	65	J-31
18	JP-4 Spill at Fuel Systems Repair Shop	43	48	56	1.0	49	J-33
19	JP-4 Spill from A/C Fuel Tank	43	40	56	.95	44	J-35
20	Fuel Tank Jettison Area	50	40	56	1.0	49	J-37
21	Old Entomology Rinse Area	46	60	48	1.0	51	J-39
22	Sludge Weathering Pit	47	40	56	1.0	48	J-41
23	Fire Department Training Area	43	80	48	1.0	57	J-43
25	Asphalt Primer Spill/Avenue F	51	40	56	1.0	49	J-45
26	Asphalt Primer Spill/Star Drive	53	40	56	1.0	50	J-47

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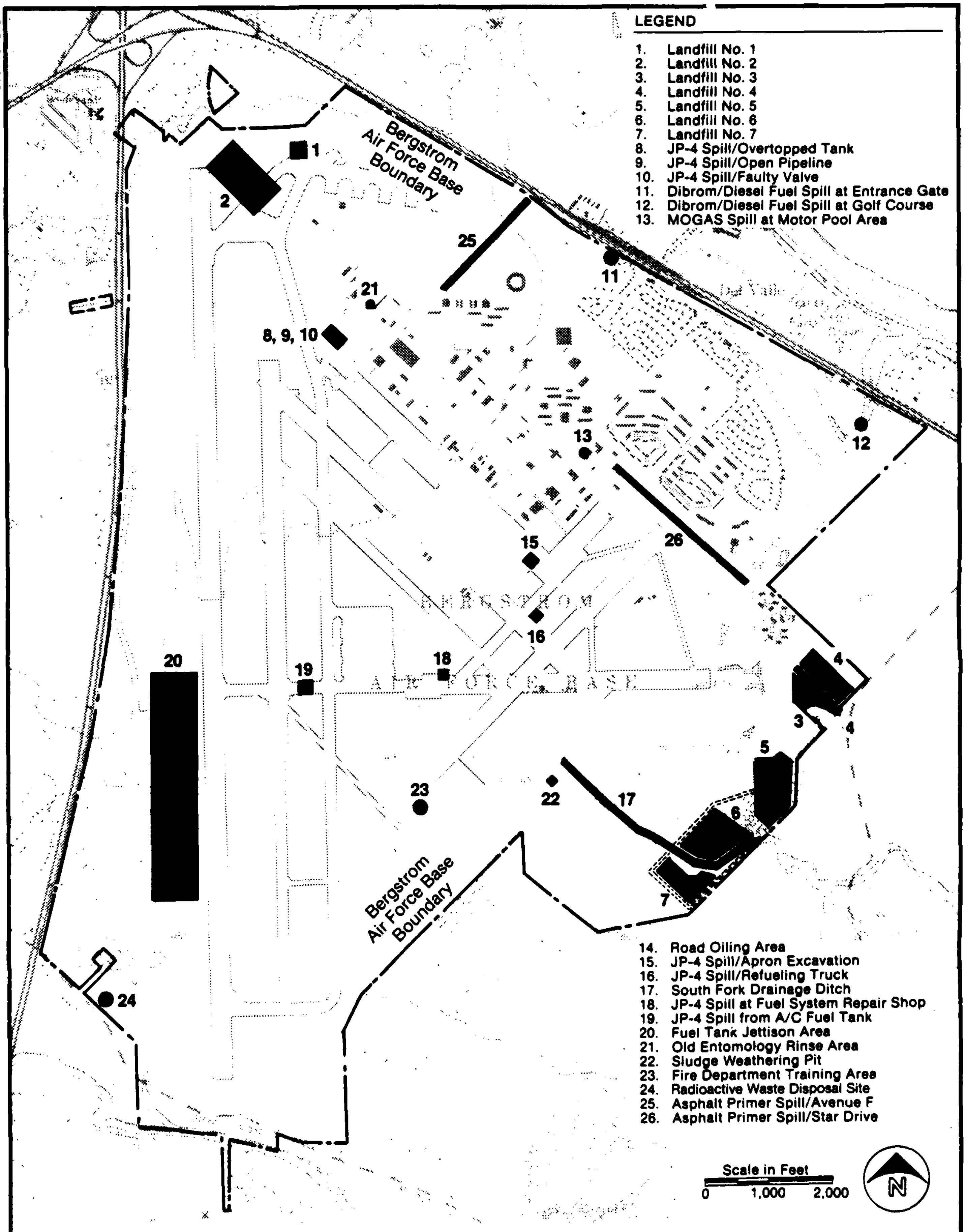

FIGURE 16.
Location Map of Identified Disposal and Spill Sites at Bergstrom AFB.

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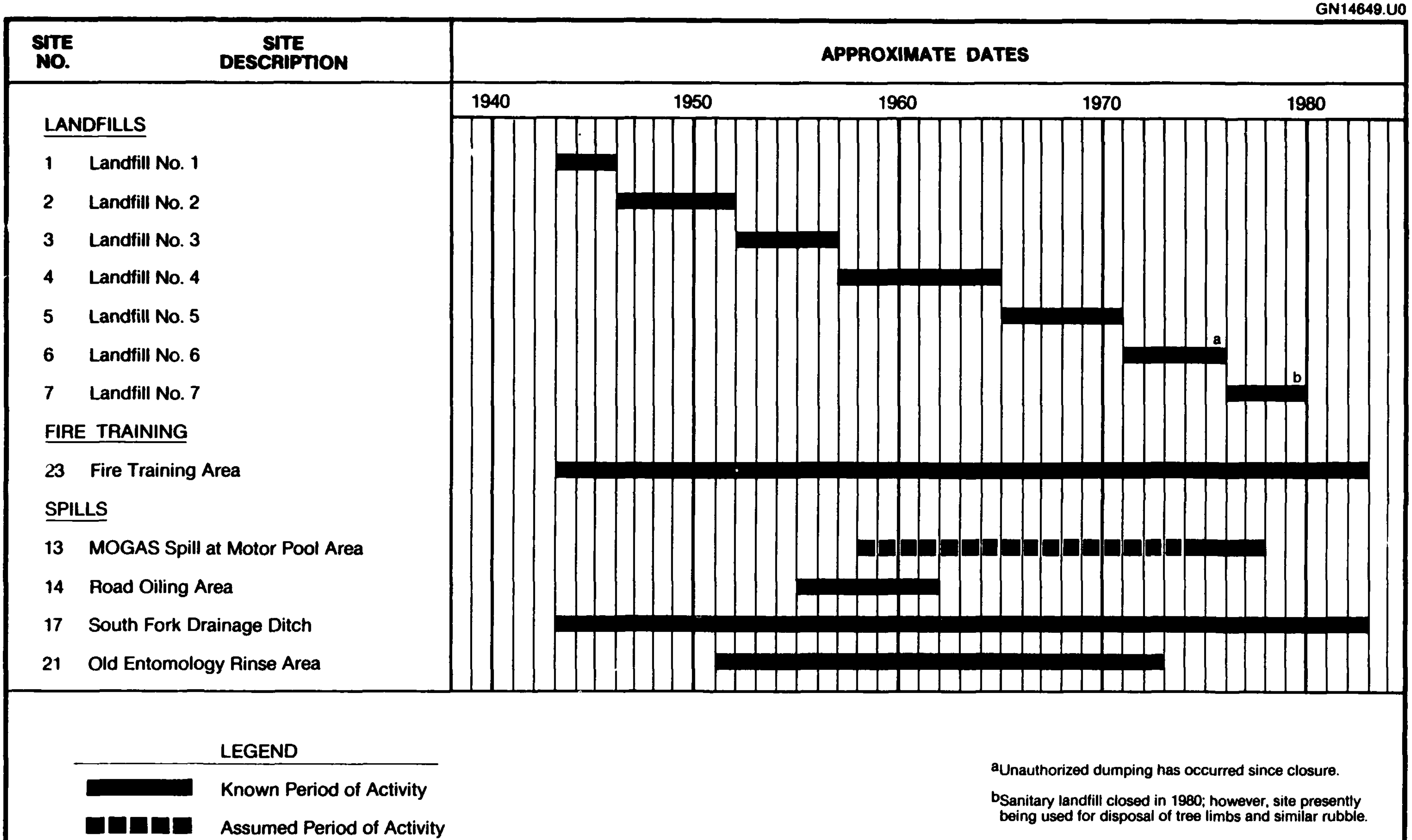

FIGURE 17.
Historical Summary of Activities at Major Disposal and Spill Sites at Bergstrom AFB.

1. Landfills

Base solid waste was disposed of in seven base landfills from 1943 to 1980. Since 1980, off-base contract disposal has been used. The seven landfill sites are described below.

a. Site No. 1--Landfill No. 1

Landfill No. 1 (overall score of 46), the original base landfill, was operated from 1943 to 1946. The landfill, located at the north end of the base, covered approximately 2 acres in the area of the present Apron E (Facility No. 8071).

Landfill No. 1 received primarily domestic solid waste. However, other materials that may have been disposed of include empty pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents from the industrial shop areas.

Burning or incineration followed by burying in trenches was apparently the mode of operation at this landfill. Some buried materials were uncovered in 1959 during the construction of Apron E. These materials were excavated to satisfy compaction requirements. The nature and disposition of the excavated materials is not known.

Landfill No. 1 received an overall HARM rating score of 46. Low subscores in the receptors (43) and waste characteristics (40) categories were offset by a pathways subscore of 56. The low receptors subscore is due primarily to the lack of water wells and critical environments within 1 mile of the site. The low waste characteristics subscore resulted from the suspected disposal of small quantities of hazardous wastes. The high pathways subscore resulted from the site's proximity to a nearby drainage ditch.

b. Site No. 2--Landfill No. 2

Landfill No. 2 (overall score of 46) was operated from 1946 to 1952. The landfill, approximately 16 acres in size, is located at the north end of the base, between the end of the main runway and the site of Landfill No. 1. The site now appears as an open area covered with grass.

Landfill No. 2 received primarily domestic solid waste. However, other materials that may have been disposed of at the site include empty pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents from the industrial shop areas.

Burning or incineration, followed by burial in trenches, was apparently the mode of operation at Landfill No. 2. Some buried materials from Landfills No. 2 and No. 1 were uncovered in 1959 during the construction of Apron E. These materials were excavated to satisfy compaction requirements. The nature and disposition of the excavated materials is not known.

Landfill No. 2 received an overall HARM rating score of 46. Because this site is in the same approximate location as Landfill No. 1 and because the same types of materials were disposed of, the overall rating and the rationale for the rating categories are identical to those of Landfill No. 1.

c. Site No. 3--Landfill No. 3

Landfill No. 3 (overall score of 50) was operated from 1952 to 1957. This site, of approximately 10 acres, is located on the east side of the base along the south side of Third Street just southeast of the senior officers' Military Family Housing (Facilities No. 4402 through 4428). The site now appears as a cleared field covered with grass; no evidence of recent use or unauthorized dumping exists. Landfill No. 3 received primarily domestic solid waste. Construction rubble was also disposed of at the site. Other materials that may have been disposed of include empty pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents from the industrial shop areas.

The mode of operation at Landfill No. 3 was to burn and bury in trenches. Historical aerial photographs show evidence of at least two covered trenches at the site. An asphalt emulsion tank had been located at this landfill until 1975. No environmental problems were known to be associated with this tank; nevertheless, it was removed in 1975.

Landfill No. 3 received an overall HARM rating score of 50. A low subscore in the waste characteristics (40) category was offset by receptors and pathways category subscores of 54 and 56, respectively. The low waste characteristics subscore resulted from the suspected disposal of small quantities of hazardous waste. The higher subscores in receptors and pathways were due primarily to: (1) the distance from the site to the nearest water well (golf course well 3,700 feet to the north), (2) the distance from the site to the reservation boundary

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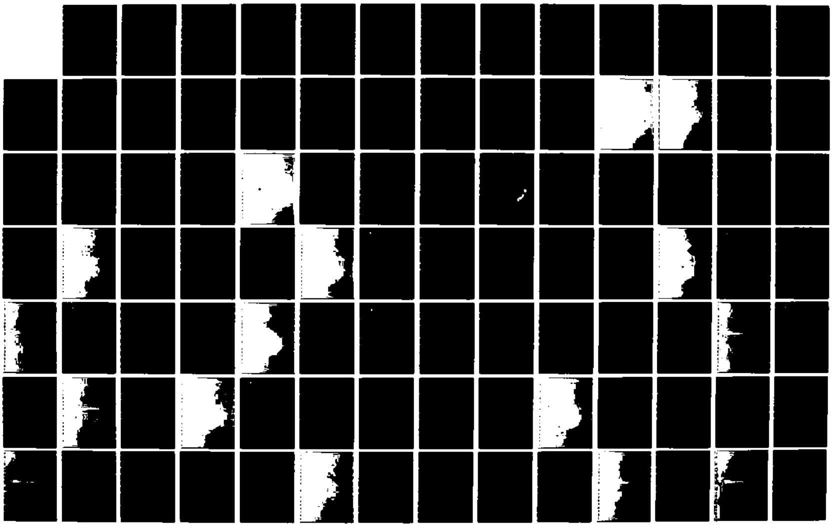

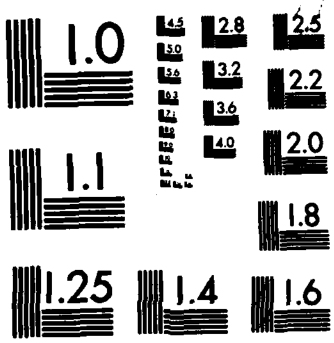

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c. Site No. 3--Landfill No. 3

Landfill No. 3 (overall score of 50) was operated from 1952 to 1957. This site, of approximately 10 acres, is located on the east side of the base along the south side of Third Street just southeast of the senior officers' Military Family Housing (Facilities No. 4402 through 4428). The site now appears as a cleared field covered with grass; no evidence of recent use or unauthorized dumping exists. Landfill No. 3 received primarily domestic solid waste. Construction rubble was also disposed of at the site. Other materials that may have been disposed of include empty pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents from the industrial shop areas.

The mode of operation at Landfill No. 3 was to burn and bury in trenches. Historical aerial photographs show evidence of at least two covered trenches at the site. An asphalt emulsion tank had been located at this landfill until 1975. No environmental problems were known to be associated with this tank; nevertheless, it was removed in 1975.

Landfill No. 3 received an overall HARM rating score of 50. A low subscore in the waste characteristics (40) category was offset by receptors and pathways category subscores of 54 and 56, respectively. The low waste characteristics subscore resulted from the suspected disposal of small quantities of hazardous waste. The higher subscores in receptors and pathways were due primarily to: (1) the distance from the site to the nearest water well (golf course well 3,700 feet to the north), (2) the distance from the site to the reservation boundary (less than 100 feet), and (3) the distance from the site to the nearest surface-water body (drainage ditch less than 100 feet from the site).

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

Landfill No. 4 (overall score of 50) was operated from 1957 to 1965. This site, approximately 10 acres in area, is located on the east side of the base, southeast of the senior officers' Military Family Housing and across Third Street from Landfill No. 3. The site now appears as a cleared field, covered with grass; no evidence of recent use or unauthorized dumping was found.

Landfill No. 4 received primarily domestic solid waste. Construction rubble was likely buried at the site. Rinsed and punctured pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents are also suspected of having been buried at the site.

Normal operation at this landfill was to burn and bury in 12-foot-deep trenches. The practice was to burn in one trench while covering the previously burned waste in the other trench. Historical aerial photographs show evidence of at least three covered trenches running the length of the site. Landfill No. 4 was the last landfill at which routine burning was practiced.

Landfill No. 4 received an overall HARM rating score of 50. Because this site is in the same approximate location as Landfill No. 3 and because the same types of materials were disposed of, the overall rating and rationale for the rating categories are identical to those of Landfill No. 3.

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

Landfill No. 5 (overall score of 49) was operated from 1965 to 1971. This landfill, approximately 12 acres in size, is located in the southeast corner of the base. It is bordered on the east and southeast by the reservation boundary and on the west and southwest by a deep drainage ditch that flows off base. The site is bordered on the northwest by an area access road.

Domestic solid waste and construction rubble were disposed of at this landfill. Rinsed and punctured pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents are also suspected of having been buried at the site.

The site now appears as an open field, partially covered by grass. Two asphalt storage tanks (approximately 6,000 gallons each) are located near the center of the site and are believed to have been installed here when the emulsion tank at Landfill No. 3 was removed. Asphalt emulsion, covering a small area of ground beneath the tank nozzles, was observed during the records search team's base visit. The suspected cause is accidental spillage of asphalt by workers drawing asphalt from the tank. No evidence of tank or nozzle leakage was reported or observed during the base visit.

Miscellaneous rubble including broken concrete, an old television set, and an empty 55-gallon drum were observed on the slopes of the drainage ditch that borders the site. No evidence of hazardous wastes or vegetation stress was observed during the base visit.

The site also serves as the storage point for three solid waste collection bins located on the west side of the site. A man was observed scavenging the bins during the records search team's site visit.

The method of operation at this landfill was the same as at the landfills discussed previously, i.e., trenching; however, burning of refuse prior to burying was not practiced.

Landfill No. 5 received an overall HARM rating of 49. Moderate receptor and pathways category subscores of 52 and 56, respectively, were offset by a low waste characteristics subscore of 40. Higher receptors and pathways subscore were due to: (1) the distance from the site to the nearest water well (golf course well 5,000 feet to the north), (2) the distance from the site to the reservation boundary (the site borders on the boundary), and (3) the distance from the site to the nearest surface-water body (drainage ditch borders the site). The low waste characteristics subscore resulted from the suspected disposal of small quantities of hazardous waste.

f. Site No. 6--Landfill No. 6

Landfill No. 6 (overall score of 56) was operated from 1971 to 1976. This landfill, of approximately 12 acres, is located in the southeast corner of the base between Landfills No. 5 and No. 7. The site is bordered on the southwest, south, and southeast by a deep drainage ditch (South Fork Drainage Ditch). The munitions storage area borders the site on the northwest side, while the northeast side borders the drainage ditch separating this landfill from Landfill No. 5.

The types of materials received at this landfill included domestic solid waste and construction rubble. Other materials suspected of having been disposed of at this site include rinsed and punctured pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents. In the early 1970s, seven 55-gallon drums of DDT were found abandoned at this landfill. One of the drums was corroded and had leaked its contents into the ground. It was not known whether or not the drum was full prior to leaking. The remaining six drums were given to the City of Austin.

The site now appears as an open field, scarred with roads and partially covered with grass. Solid waste materials are pushed up to the edge of the South Fork Drainage Ditch. The records search team observed construction debris (e.g., broken concrete) and several empty 5-gallon paint containers near the ditch. Four 55-gallon drums were also observed. One of the drums was marked PD-680 and had been leaking because of a loose bung cap. It appeared to be about 20 percent full, while the other three drums appeared to be empty. Whether the PD-680 drum had been full prior to leaking is not known. Based on the physical appearance of the four drums, they were probably placed there after 1976 when the landfill was closed. These drums were subsequently removed by base personnel.

Operation of this landfill has been described as open trench. Trenches may have been as deep as 30 feet. No burning was practiced at this landfill.

Landfill No. 6 received an overall HARM rating score of 56. Moderate receptors and pathways subscores of 52 and 56, respectively, were offset by a high waste characteristics subscore of 60. Receptors and pathways subscores were identical to those for Landfill No. 5 and for the same reasons: (1) the distance from the site to the nearest water well (4,300 feet to golf course well), (2) the distance from the site to the reservation boundary (200 feet), and (3) the distance from the site to the nearest surface-water body (borders South Fork Drainage Ditch). The high waste characteristics subscore (60) resulted from the reported discovery of the seven DDT drums at the landfill.

g. Site No. 7--Landfill No. 7

Landfill No. 7 (overall score of 49) was operated from 1976 to 1980. This landfill, of approximately 7 acres, is located in the southeast corner of the base, south of Landfill No. 6. The southeast side of the site borders the reservation property line.

Materials received at this landfill included domestic solid waste and construction rubble. Other materials suspected of being present at the site include empty pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents. One interviewee reported that approximately 5 years ago, a small quantity of antifreeze was poured into the landfill. More specific data were not available.

The landfill now appears as an open field with sparse grass coverage. Two open trenches are currently in use at the site for disposal of tree limbs and similar rubbish. One trench extends nearly the entire length of the southwest side of the site while the other runs a short distance along the southeast boundary. No evidence of hazardous waste dumping was noted in either of these trenches. The open trench method of operation was utilized at this landfill. Burning was not practiced.

Landfill No. 7 received an overall HARM rating score of 49. Moderate receptors and pathways subscores of 52 and 56, respectively, were offset by a low waste characteristics subscore of 40. The receptors and pathways subscores were identical to those for Landfills No. 5 and No. 6 and for the same reasons: (1) the distance from the site to the nearest water well (3,800 feet to golf course well), (2) the distance from the site to the reservation boundary (site borders the boundary), and (3) the distance from the site to the nearest surface-water body (less than 100 feet to South Fork Drainage Ditch). The low waste characteristics subscore (40) was based on the reported disposal of a small quantity of antifreeze in the landfill. The antifreeze, assumed to be ethylene glycol, was assigned a medium hazard for rating purposes.

2. POL Spills

a. Site No. 8--JP-4 Spill/Overtopped Tank

Site No. 8 (overall score of 53), at the POL bulk storage area (Facility No. 513), was the site of a tank filling accident that resulted in the loss of 2,000 to 8,000 gallons of JP-4 fuel in 1975. The tank being filled was the larger of two vertical storage tanks at the facility. The spill occurred when the floating top was allowed to exceed its normal maximum height, permitting JP-4 to escape and overtop the tank walls. The lost fuel soaked into the gravel base of the POL storage area. No attempts to recover the spilled fuel were reported.

The site received an overall HARM rating score of 53. The receptor subscore (46) was low; however, the waste characteristics and pathways subscores, 64 and 56, respectively, were high due to: (1) the large confirmed spill of a medium hazard material (JP-4) and (2) the proximity of the site to surface water (less than 100 feet to drainage ditch).

b. <u>Site No. 9--JP-4 Spill/Open Pipeline</u>

Site No. 9 (overall score of 45), located at fuel pumping stations No. 506 and 507 within the POL bulk storage area, was the site of a JP-4 pipeline spill in March 1982. A contractor had been working on an 8-inch pipeline and had removed a section of the pipe. Due to lack of communication, POL personnel turned on fuel system pumps in another area of the base, causing pressure in the line to build up and resulting in a spill from the open section of pipe.

It was estimated that 200 to 300 gallons of JP-4 spilled onto the ground. Most of the fuel was contained in a trap near Facility No. 507; however, a small amount went into an adjacent drainage ditch and was contained within an oil/water separator that was under construction. According to documentation in Air Force files, POL personnel pumped all of the spilled fuel from the trap and separator and deployed a sorbent boom to clean up the surface slick. Though most of the fuel was collected, a small amount soaked into the ground near the open pipe. POL personnel were instructed to excavate this area and replace the surface gravel. The recovered (approximately 75 percent) fuel was taken to the waste POL tanks at Facility No. 590.

This site received an overall HARM rating score of 45. Low receptors (46) and waste characteristics (40) subscores were offset slightly by a pathways subscore of 56. The higher pathways subscore was due primarily to the proximity of the site to the adjacent drainage ditch.

c. Site No. 10--JP-4 Spill/Faulty Valve

Site No. 10 (overall score of 45), located at the waste POL tank storage area (Facility No. 590), was the site of a 950-gallon spill of JP-4 in September 1982. The cause of the spill was a defective shut-off float valve in an underground JP-4 storage tank (Tank No. 8) at Facility No. 590. Fuel being transferred via gravity from the JP-4 bulk storage tank to the underground tank overflowed the tank when an automatic high-level shut-off valve failed to close. The total amount of fuel was estimated to be 950 gallons. Approximately 500 gallons of the fuel was recovered and pumped into an adjacent tank used for storage of waste fuels. The remaining fuel either soaked into the surrounding ground, which is topped with 12 inches of gravel, or was lost through evaporation.

Site No. 10 received an overall HARM rating score of 45. The receptors, waste characteristics, and pathways subscores and the respective rationales were the same as those for Site No. 9.

d. Site No. 11--Dibrom/Diesel Fuel Spill at Entrance Gate

Site No. 11 (no score determined), located at the main entrance on Presidential Boulevard, was the site of a spill of diesel fuel containing Dibrom, an insecticide used for killing adult mosquitoes. The spill resulted when a vehicle fogging for mosquitoes turned over making a turn at the entrance gate. The spill, which occurred in the early 1970s, consisted of less than 50 gallons of diesel fuel containing approximately 1.5 quarts of Dibrom. The spill was onto pavement and was covered and soaked up with sand. Disposition of the sand was not known; however, it may have been disposed of in the landfill in operation at that time, Landfill No. 6 (Site No. 6). Because the spill occurred on pavement and was reportedly cleaned up, the site was not rated.

e. Site No. 12--Dibrom/Diesel Fuel Spill at Golf Course

Site No. 12 (overall score of 46), located at the base golf course, was the site of a second spill of a mixture of diesel fuel and Dibrom. The spill resulted when a vehicle fogging for mosquitoes turned over on a bridge crossing a small creek on the golf course. The creek is an unnamed tributary to the Colorado River.

The spill, which occurred about 1975, consisted of less than 50 gallons of diesel fuel containing about 1.5 quarts of Dibrom. The spill onto the concrete surface of the bridge was covered with sand and cleaned up. However, because the bridge is narrow and does not have curbing or sides to prevent liquid from running off the sides into the creek, it is assumed that some portion of the spill entered the creek; for this reason the site was rated. Disposition of the sand used to absorb the spill was not known; however, it may have been disposed of at the landfill in operation at that time, Landfill No. 6 (Site No. 6).

Site No. 12 received an overall HARM rating score of 55. Moderately high subscores in all three categories (receptors, 58; waste characteristics, 32; pathways, 56) were due primary to: (1) the distance to the nearest water well (600 feet from the golf course well), (2) distance to reservation boundary (400 feet), (3) small suspected quantity of a high hazard material (Dibrom), and (4) distance to nearest surface water (creek below bridge).

f. Site No. 13--MOGAS Spill at Motor Pool Area

Site No. 13 (overall score of 58), located at the Motor Pool area between vehicle fueling stands 1803 and 1804, is the site of repeated spills occurring from 1974 to 1978. The spills were periodic and occurred during filling of two underground MOGAS storage tanks. Approximately 25 to 50 gallons of MOGAS were spilled onto the surrounding gravel-covered ground each time a tank was filled. At a reported rate of 8 fillings per tank per year, the spills totaled 400 to 800 gallons per year. Over the 4-year period from 1974 to 1978, the total spillage was estimated to be 1,600 to 3,200 gallons. According to an interviewee, the cause of the spills was a poorly designed adapter used to connect the MOGAS fill lines with the storage tank filler pipes. Each time a tank was filled, fuel would be lost through the connection. All spills soaked into the gravel-covered ground. No attempts to recover spills were reported. The spills ceased in 1978 when a proper connection was established between the fill lines and filler pipes.

Site No. 13 received an overall HARM rating score of 58. Moderate scores in the receptors and pathways categories, 53 and 56, respectively, were offset by a high waste characteristics subscore of 64. The high waste characteristics subscore was the result of a moderate and confirmed quantity of a high hazard material (MOGAS).

g. <u>Site No. 14--Road Oiling Area</u>

Site No. 14 (overall score of 53), located at the southern extremity of Third Street, was the site of road oiling for dust control. The site extends for about 1/2 mile, covering the length of Third Street between Landfills No. 3 and No. 4 and the 90° extension of Third Street around the southeast side of Landfill No. 3, between the fill and the base property line. The activity occurred from the mid-1950s to 1962. Sources of the waste oils were the industrial shops located along the flightline areas. Oil was dispensed from a spreader bar on the back of a 250-to 500-gallon bowser. It has been estimated that approximately two times per year up to 300 gallons of waste oil may have been spread onto the road. Over an approximately 7-year period, 4,200 gallons would have been spread over the unimproved road.

Site No. 14 received an overall HARM rating of 53. All subscores were in the moderate range, with receptors and pathways having the highest subscores at 54 and 56, respectively. Significant elements that contributed to the receptors and pathways subscores were: (1) distance to the nearest water well (3,700 feet to golf course well), (2) distance to reservation boundary (less than 100 feet), and (3) the distance to the nearest surface water (less than 100 feet to drainage ditch).

h. <u>Site No. 15--JP-4 Spill/Apron Excavation</u>

Site No. 15 (overall score of 47), located at the southeast end of Apron A, is the site of a JP-4 fuel accumulation below the original apron. The source is unknown but is suspected of being the accumulation of small spills on the apron area that seeped through concrete cracks and joints and migrated beneath the concrete to the site. An estimated 500 to 600 gallons of JP-4 were discovered in 1955 during the excavation of concrete in the area which now forms part of Apron A. An area of approximately 900 square feet was reported to have an estimated 1-inch-thick layer of JP-4 above a layer of water. The fuel was pumped off by fire department personnel and used in fire department training exercises.

Site No. 15 received an overall HARM rating score of 47. Moderate receptors and pathways subscores, 51 and 56, respectively, were offset by a low waste characteristics subscore of 40. The low waste characteristics subscore was assigned because the quantity of the spill was small and the spill involved a medium hazard substance (JP-4).

i. Site No. 16--JP-4 Spill/Refueling Truck

Site No. 16 (overall score of 48), located at the intersection of taxiways 12 and 14, is the site of a JP-4 fuel spill. The accident occurred in 1974 when a JP-4 refueling truck turned over while making a turn at the taxiway intersection. The fuel spilled onto a grassy area (about 30 feet by 30 feet) and soaked into the ground. Although the quantity spilled was unknown, it was reported to be small. No information was obtained through interviews or review of base files indicating that any remedial actions were taken at the site to remove fuel-contaminated soil.

Site No. 16 received an overall HARM rating score of 48. Moderate receptors and pathways subscores of 49 and 56, respectively, were offset by a low waste characteristics subscore of 40. The low subscore was assigned because the quantity of the spill was judged small and the spill involved a medium hazard substance (JP-4).

j. Site No. 18--JP-4 Spill at Fuel Systems Repair Shop

Site No. 18 (overall score of 49), located at the Fuel Systems Repair Shop (Facility No. 4533), is the site of a JP-4 spill. In 1982, a fuel tank was accidentally drained onto the ground near the southeast corner of the maintenance facility. The quantity was not known but was less than the capacity of the fuel tank, which was assumed to be about 2,000 gallons. The spill soaked into the ground. No information was obtained through interviews or review of base files indicating that any remedial efforts were made to remove the contaminated soil.

The site received an overall HARM rating score of 49. A waste characteristics subscore of 48 was balanced by a low receptors subscore of 43 and a moderate pathways subscore of 56. The waste characteristics subscore (48) resulted from the confirmed moderate quantity of a medium hazard material (JP-4). Receptors subscore (43) was low, due primarily to low population in the area of the spill and the distance to the nearest water well (7,300 feet). The pathways subscore (56) resulted from the proximity of the site to surface water (approximately 200 feet to a drainage ditch).

k. Site No. 19--JP-4 Spill from A/C Fuel Tank

Site No. 19 (overall score of 44), located on the mid-field taxiway (T/W8) between the primary and secondary runways, is the site of a JP-4 spill. The incident occurred in January 1981, when the left wing tank of a C-130 was discovered leaking. The fuel was flushed from beneath the aircraft by fire department personnel. Absorbent pads and sand were placed along the edge of the spill to soak up fuel being flushed from the area. The total quantity of the spill was estimated to be 200 gallons. No fuel was allowed to enter the storm drain system in the area; however, it is likely that some fuel, flushed from the spill area prior to placement of the absorbent pads and sand, soaked into the ground at the edge of the taxiway.

Site No. 19 received an overall HARM rating score of 44. A low receptors subscore of 43 was balanced by a lower waste characteristics subscore of 40 and a moderate pathways subscore of 56. The receptors subscore (43) was low, due primarily to the low population in the area of the spill and the distance to the nearest water well (7,200 feet). The waste characteristics subscore (40) was based on a small confirmed quantity of a medium hazard material (JP-4). The pathways subscore (56) resulted from the proximity of the site to surface water (400 feet to nearest drainage ditch).

1. Site No. 20--Fuel Tank Jettison Area

Site No. 20 (overall score of 49), located at the south end of the base between runway 17R and the perimeter road, is the area officially designated for the emergency jettison of fuel tanks. This is an area of approximately 75 acres and is currently covered with grass. It is not known how often or how many tanks have been dropped in the area since it was first designated for that use in the late 1950s; however, one interviewee reported that tanks were dropped on at least two occasions within the past several years. The quantity of fuel contained in the dropped tanks was not known; however, it is believed to have been small. No analytical data were available for this site; however, data were developed for another area, which has soil conditions similar to those at Bergstrom AFB, that was the site of an emergency fuel tank jettison. The incident involved an estimated 1,400 gallons of JP-4. Soil samples collected at the site indicated contamination with JP-4 down to at least 12 inches. It is possible that similar contamination exists in the designated Fuel Tank Jettison Area.

This site received an overall HARM rating score of 49, due primarily to the disposal of a small amount of JP-4 with a moderate potential for surface-water migration of contaminants.

m. Site No. 23--Fire Department Training Area

Site No. 23 (overall score of 57) is located at the south end of the base adjacent to taxiway 9. It is the only identified site of fire department training activities and has been in use since the base was activated.

The training site is an unlined circular pit area of approximately 120 feet in diameter surrounded by a dirt berm. Improvements made over the years included enlargement, regrading, and the installation of a new limestone base in 1982. A drain and an oil/water separator were also connected to the sanitary sewer in 1982 to collect and pretreat the runoff. Prior to this time, runoff percolated into the ground within the pit area.

Prior to 1972, recovered fuels, waste oils, and spent solvents were burned at the site. These were poured directly onto the unlined pit surface prior to a burn. Since 1972 (to present) only clean JP-4 fuel has been burned at the site and presaturation of the ground with water is routinely practiced.

Most of the materials would have been consumed in the fires; however, some minor percolation into the ground is assumed to have occurred, especially in the pre-1972 years before presaturation of the ground was practiced. It is not known what quantity of fuels, waste oils, and spent solvents have percolated into the ground.

Site No. 23 received an overall HARM rating score of 57, due primarily to the known disposal of fuels, waste oils, and spent solvents at the site and a moderate potential for surface-water migration of contaminants.

n. <u>Site No. 25--Asphalt Primer Spill/Avenue F</u>

Site No. 25 (overall score of 49), located near the intersection of Avenue F and Third Street, is the site of an asphalt primer runoff. In 1981, shortly after the application of asphalt primer to a parking lot, rain and ensuing runoff washed an unknown quantity of the primer into the drainage ditch that parallels Avenue F. The primer was washed away with the ditch flow; however, some primer may have soaked into the ground.

To prevent such occurrences in the future, personnel have been advised to take into account weather conditions when planning paving operations. In addition, they have been advised to use floating booms in ditches or bales of hay lining slopes of paving areas to prevent contamination of surface waters due to storm runoff.

This site received an overall HARM rating score of 49, due primarily to the known release of a small quantity of asphalt primer and the moderate potential for surface-water migration of contaminants.

o. Site No. 26--Asphalt Primer Spill/Star Drive

Site No. 26 (overall score of 50), located on the east side of the base between Star Drive and McWhirk Boulevard, is the site of a second asphalt primer spill. In about 1981, asphalt primer applied to Star Drive was washed by stormwater into the drainage ditch that runs parallel to the road. The primer was washed away with the ditch flow; however, it is probable that some primer soaked into the ground in the ditch and between the road and the ditch. The quantity of primer washed away and the quantity that may have soaked into the ground are not known; however, they are assumed to be small.

This site received an overall HARM rating score of 50, due primarily to the release of a small quantity of asphalt primer and a moderate potential for surface-water migration of contaminants. This site had a higher overall rating (50 vs. 49) than the other asphalt primer spill site (Site No. 25) because of the closer proximity to the golf course water well.

3. Other Sites

a. Site No. 17--South Fork Drainage Ditch

Site No. 17 (overall score of 65), located at the south end of the base, is a drainage ditch that begins near Facility No. 4602, runs between Landfills No. 6 and 7, and extends beyond the reservation boundary. The ditch is the open portion of a storm drainage system that drains Apron A and the fuel hydrant area of Apron B and some of the major industrial shop areas. This ditch has provided major drainage since construction of the base in 1942.

Because of the nature of the areas being drained, fuels and oils are probably the major contaminants that have entered this drainage ditch. Prior to the installation of an oil/water separator near the head of the ditch in 1981, waste materials could have (1) flowed through the ditch and off the reservation property, (2) soaked into the ground along the route of the ditch, or (3) evaporated. It is probable that a combination of all three occurred. Installation of the oil/water separator in 1981 had the effect of capturing fuel and oil layers, preventing their escape from base property, and reducing the potential area of contamination to the section of ditch ending at the oil/water separator.

Of major significance to this site is information provided by interviewees indicating that as much as 650 to 900 gallons/month of JP-4 was routinely, but inadvertently, released to the South Fork Drainage Ditch for a period of years, ending in 1982. The source of the JP-4 was an overloaded oil/water separator located at the Fuel Systems Repair Shop. (For more information see the discussion of the Fuel Systems Repair Shop presented in Section IV-A, Activity Review, page IV-1.)

Two signs of contamination in the South Fork Drainage Ditch were observed during the records search team's inspection of the site. One was a small patch of a red oily substance noted downstream of the oil/water separator approximately between Landfills No. 6 and No. 7. It is suspected that this material is a red dye used in the Fuel Systems Repair Shop for leak detection. It is not suspected to be leachate from the landfills.

The other sign was a second patch of red oily material observed floating upstream of the oil/water separator. This material was similar in appearance to the substance found downstream of the separator.

Bioenvironmental Engineering personnel routinely collect and analyze water samples from Onion Creek. To date, the data have indicated that no significant contamination exists in Onion Creek downstream of the South Fork Drainage Ditch. (A discussion of water quality results is presented in Section IV-A, Activity Review, page IV-1).

Site No. 17 received an overall HARM rating score of 65, due primarily to (1) the known disposal of a large quantity of JP-4 fuel and (2) the indirect evidence of contaminant migration, supported by the discovery of two patches of oily materials floating in the ditch.

b. Site No. 21--Old Entomology Rinse Area

Site No. 21 (overall score of 51), located behind Facility No. 724, was a rinse area for used pesticide containers. From 1951 to 1973, at which time the Entomology Shop was moved to Facility No. 722, pesticide containers were rinsed onto the ground behind Facility No. 724. The rinse water soaked into the ground. The quantity of pesticide residual that entered the ground is not known; however, it is assumed to have been small.

The site received an overall HARM rating score of 51, due primarily to the known disposal of small quantities of pesticides and a moderate potential for surface-water migration of contaminants.

c. Site No. 22--Sludge Weathering Pit

Site No. 22 (overall score of 48), located at the south end of the base, approximately 1,000 feet east of Facility No. 4580, is a former sludge weathering pit. The pit is thought to have been used for sludge weathering until 1962, when it was converted to an oxidation pond to serve Facilities No. 4580 and 4582. It was abandoned in 1975 when sanitary sewers were connected to Facilities No. 4580 and 4582.

Materials weathered at the site are assumed to have included AVGAS and JP-4 tank sludges. The frequency of weathering and quantity of weathered sludges is not known; however, the quantities are assumed to be small. Disposition of weathered sludge is not known; however, it may have been disposed of in the landfills operated prior to 1962 (Landfills No. 1 to No. 4).

The site received an overall HARM rating score of 48, due primarily to the suspected weathering of small quantities of AVGAS and JP-4 sludges and a moderate potential for surface-water migration of contaminants.

d. Site No. 24--Radioactive Waste Disposal Site

Site No. 24 (no score determined), located in the southwest corner of the base adjacent to the Small Arms Range, is the site of three closed radioactive waste disposal cells. Two of the cells consist of 18-inch-diameter cast iron pipe; the third consists of 12-inch-diameter cast iron pipe. All three extend vertically approximately 20 feet into the ground. Each has been covered with a 4-inch-thick concrete slab. The cells were installed in the mid-1950s and were closed in 1971.

The cells were used for the disposal of low-level radioactive materials much as luminous watch dials and electron tubes. Reportedly, concrete was poured into the cells with each batch of radioactive materials. Data on the frequency of use or the quantity of materials in the cells was not available.

A radiological survey was conducted at the surface of the site and no activity above background levels was found. Due to the containment provided by the cast iron pipes in conjunction with the concrete poured into the cells, it is considered that there is no potential for contaminant migration from the disposal site; as a result, this site was not rated.

C. ENVIRONMENTAL STRESS

During the base visit in April 1983, major known former or present disposal areas were examined for signs of vegetative stress possibly related to the presence or migration of hazardous wastes. No signs of stress were detected during this investigation. All former landfill areas are populated with diverse assemblages of plant and animal species. Forested creek bottoms and ravines downgradient from landfill areas also appear healthy and unstressed. Live fish were observed to be present in the drainageways leaving the base property. Past environmental stress reported at the base includes a fishkill and a snakekill at the golf course pond noted in January 1976; a frogkill in the South Fork Drainage Ditch, possibly related to wastes coming from the flightline area; and patches of dead grass resulting from fuel spills in the flightline area. No evidence of lingering environmental stress was reported at any of these sites, and no further recommendations are made.

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B. OTHER ENVIRONMENTAL RECOMMENDATIONS

1. The golf course water well should be sampled and analyzed for the primary drinking water parameters (heavy metals and pesticides). This is the only well located on base and has been in use for about 10 years. This well can also be used as an additional upgradient monitoring well for the zone monitoring of the Southeast Landfill Area. Analyses of this well would also be useful in characterizing the quality of ground water beneath Bergstrom AFB and determining if a long-term contaminant migration potential exists.

2. The oil/ water separator located at Facility No. 4533 should be connected to the sanitary sewer.

V. CONCLUSIONS

A. No direct evidence was found to indicate that migration of hazardous contaminants exists within or beyond Bergstrom AFB boundaries. Indirect evidence of contamination was found at Site No. 17, South Fork Drainage Ditch in the form of two small patches of a red oily material, suspected of being a red dye used in the Fuel Systems Repair Shop, which were observed on the surface of the ditch.

B. No evidence of environmental stress due to past disposal of hazardous wastes was observed at Bergstrom AFB.

C. Information obtained through interviews with 43 past and present base personnel, base records, shop folders, and field observations indicates that hazardous wastes have been disposed of on Bergstrom AFB property in the past.

D. The potential for contaminant migration exists at Bergstrom AFB. A shallow ground-water zone, not used as a potable water source, is located approximately 40 feet below the surface. Assuming the existence of a hydraulic driving force, vertical percolation to this zone would be moderate (1×10^{-3} ft/min) due to a clay-silt soil at the surface; movement of contaminants horizontally through the lenticular river deposits would be slow. The moderate vertical percolation through the clay-silt soils reduces the potential for ground-water migration of contaminants but increases the potential for surface-water runoff and migration of contaminants.

E. Table 8 presents a priority listing of the rated sites and their overall scores. The following sites were designated as areas showing the most significant potential (relative to other Bergstrom AFB sites) for environmental impact.

Table 8
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
17	South Fork Drainage Ditch	65
13	MOGAS Spill at Motor Pool Area	58
23	Fire Department Training Area	57
6	Landfill No. 6	56
8	JP-4 Spill/Overtopped Tank	53
14	Road Oiling Area	53
21	Old Entomology Rinse Area	51
3	Landfill No. 3	50
4	Landfill No. 4	50
26	Asphalt Primer Spill/Star Drive	50
5	Landfill No. 5	49
7	Landfill No. 7	49
18	JP-4 Spill at Fuel Systems Repair Shop	49
20	Fuel Tank Jettison Area	49
25	Asphalt Primer Spill/Avenue F	49
16	JP-4 Spill/Refueling Truck	48
22	Sludge Weathering Pit	48
15	JP-4 Spill/Apron Excavation	47
1	Landfill No. 1	46
2	Landfill No. 2	46
12	Dibrom/Diesel Fuel Spill at Golf Course	46
9	JP-4 Spill/Open Pipeline	45
10	JP-4 Spill/Faulty Valve	45
19	JP-4 Spill from A/C Fuel Tank	44

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1. <u>Site No. 17--South Fork Drainage Ditch</u>

This ditch is the open portion of a storm drainage system that drains Apron A, the fuel hydrant area of Apron B, and some of the major industrial shop areas. Fuels and oils are probably the major contaminants that have entered this drainage ditch. Prior to installation of an oil/water separator near the head of the ditch in 1981, waste materials could have: (1) flowed through the ditch and off the reservation property, (2) soaked into the ground along the route of the ditch, or (3) evaporated. It is probable that a combination of all three occurred. This site received the highest rating of all of the Bergstrom sites (65) due primarily to: (1) a report of 650 to 900 gallons/month of JP-4 that was inadvertently released to the ditch for a period of years ending in 1982 and (2) the indirect evidence of contaminant migration observed both upstream and downstream of the oil/water separator (patches of red oily material).

Quarterly grab samples collected by Bioenvironmental Engineering from a point downstream of the South Fork Drainage Ditch have indicated that no significant contamination exists. However, the potential for surface-water migration of contaminants is high during intensive rainfall when runoff is greatest.

2. <u>Site No. 13--MOGAS Spill at Motor Pool Area</u>

Site No. 13, located at the Motor Pool area, is the site of repeated MOGAS spills occurring from 1974 to 1978. It is estimated that 1,600 to

3,200 gallons of MOGAS were spilled at this site. Fuel that did not evaporate would have soaked into the ground. The spills were the direct result of a poorly designed adapter used to connect tanker fuel lines with the storage tank filler pipes. The problem was corrected in 1978. The site received a HARM rating score of 58, due primarily to the reported quantity of MOGAS believed to have soaked into the ground. Although the potential for surface-water or ground-water migration of contaminants is moderate, the nature and quantity of the spill poses a potential environmental impact.

3. Site No. 23--Fire Department Training Area

Site No. 23 is the only identified site of fire department training activities and has been in use since the base was activated. Prior to 1972, recovered fuels, waste oils, and spent solvents were poured directly onto the unlined pit surface prior to being burned during a training exercise. Since 1972, only clean JP-4 fuel has been burned at the site and presaturation of the ground water has been routinely practiced. Materials which did not evaporate or were not consumed in the fires would have percolated into the soil. This site received a HARM rating score of 57, due primarily to the known disposal of fuels, waste oils, and spent solvents. The persistent components, such as chlorinated solvents, and organic aromatic components of fuel such as benzene and toluene, may be present below the ground surface in this area and pose a concern for potential contaminant migration.

2. <u>Sites No. 6, 14, 3, 4, 5, and 7--The Southeast Landfill Area</u>

Sites No. 6, 14, 3, 4, 5, and 7 (listed in order of priority) are located in close proximity to one another along the southeastern base boundary (see Figure 16, page IV-30). For the purpose of recommending any Phase II monitoring, these sites can be grouped together and treated as one identified disposal area.

Sites No. 3, 4, 5, 6, and 7 are Landfills No. 3, 4, 5, 6, and 7, respectively. The Southeast Landfill Area was used for all base landfilling operations from 1952 to 1980. These landfills primarily received domestic solid waste and construction rubble. Other materials suspected of being disposed of in the landfills include pesticide containers, paint cans, and incidental quantities of waste paints, thinners, strippers, oils, and solvents.

Site No. 14, Road Oiling Area, is the area along the southeastern base boundary where road oiling for dust control on unimproved roads in the landfill area was conducted. Road oiling activities occurred from the mid-1950s to 1962. Waste oils collected from shops along the flightline were dispensed from a spreader bar on the back of a bowser.

Sites No. 3, 4, 5, 6, 7, and 14 received HARM rating scores of 50, 50, 49, 56, 49, and 53, respectively. Site No. 6 received the higher score of 56 primarily due to the reported discovery of seven DDT drums abandoned at the site. One of the drums had corroded and leaked its contents and the remaining six drums were removed. The potential for contaminant migration is moderate. The South Fork and North Fork Drainage Ditches run through the Southeast Landfill Area, which increases the concern for potential surface-water migration of contaminants. Quarterly grab samples collected by Bioenvironmental Engineering from Onion Creek at a point downstream of the South Fork and North Fork Drainage Ditches have indicated that no significant contamination exists.

5. Site No. 8--JP-4 Spill/Overtopped Tank

Site No. 8, located at the POL bulk storage area (Facility No. 513), was the site of a tank overtopping accident in 1975. Approximately 2,000 to 8,000 gallons of JP-4 fuel overtopped the tank walls and soaked into the gravel base inside the dike at the POL bulk storage area. This site received a HARM rating score of 53. The potential for contaminant migration is moderate.

F. The remaining rated sites (No. 1, 2, 9, 10, 12, 15, 16, 18-22, 25, and 26), as well as the sites that were not rated, are not considered to present significant environmental concerns.

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VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A limited Phase II monitoring program is suggested to confirm or rule out the presence and/or migration of hazardous contaminants. The priority for monitoring at Bergstrom AFB is considered low to moderate; no imminent hazard has been identified.

Tables 9 and 10 present a summary of recommended monitoring sites, parameters to be measured, and the rationale for the analyses, while Figure 18 shows the sites where monitoring is recommended. Specifically, monitoring is recommended for Site No. 17--South Fork Drainage Ditch, Site No. 13--MOGAS Spill at Motor Pool Area, Site No. 23--Fire Department Training Area, Sites No. 3, 4, 5, 6, 7, and 14--Southeast Landfill Area, and Site No. 8--JP-4 Spill/Overtopped Tank. The approximate monitoring locations are shown on Figures 20, 21, 22, 23, and 24 in Appendix K.

1. Site No. 17--South Fork Drainage Ditch

It is recommended that two backhoe test trenches be dug at this site to allow visual examination of the subsurface below the ditch. The trenches should be located as shown on Figure 20 (Appendix K). The trenches should cut across the ditch and to a depth of approximately 10 feet below the stream bed. A certified geologist should be present to examine the soil profile and characteristics and to inspect for signs of contamination such as abnormal odor (e.g., POL, solvent odors) or discoloration. Soil samples should be collected and analyzed in accordance with Table 9. The number of samples collected should be at the

Table 9
RECOMMENDED PHASE II ANALYSES

Sample Type	TOX[a] or VOC[b]	Heavy Metals	Phenols	Pesticides	COD, TOC and Oil and Grease
Soil Sampling					
Site No. 17--South Fork Drainage Ditch	X	X[c]			X
Site No. 13--MOGAS Spill at Motor Pool Area	X	X[c]			X
Site No. 23--Fire Department Training Area	X	X			X
Site No. 8--JP-4 Spill/ Overtopped Tank	X				X
Monitoring Wells					
Sites No. 3, 4, 5, 6, 7, and 14--Southeast Landfill Area	X	X	X	X	X

[a]TOX--Total Organic Halogens.

[b]VOC--Volatile Organic Compounds.

[c]Lead only.

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Table 10
RATIONALE FOR RECOMMENDED ANALYSES

Parameter	Rationale
Total Organic Halogens (TOX) or Volatile Organic Compounds (VOC)	Organic solvents used on-base (past and present); persistent components of fuels and other POL products, e.g., benzene and toluene.
Heavy Metals (lead, nickel, chromium, cadmium, and silver)	Potential sources identified (leaded fuel, battery acid and electrolyte, paint wastes, photographic chemicals).
Phenols	Phenolic cleaners and paint strippers used in the past.
Pesticides	Commonly used at Bergstrom AFB.[a]
COD, TOC, and Oil and Grease	Fuel spill indicators and indicators of non-specific contamination.

[a]Pesticide analysis should include aldrin, DDD, DDE, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, DDT, methoxychlor, Chlordane, alpha-BHC, beta-BHC, delta-BHC, toxaphene, and Dibrom.

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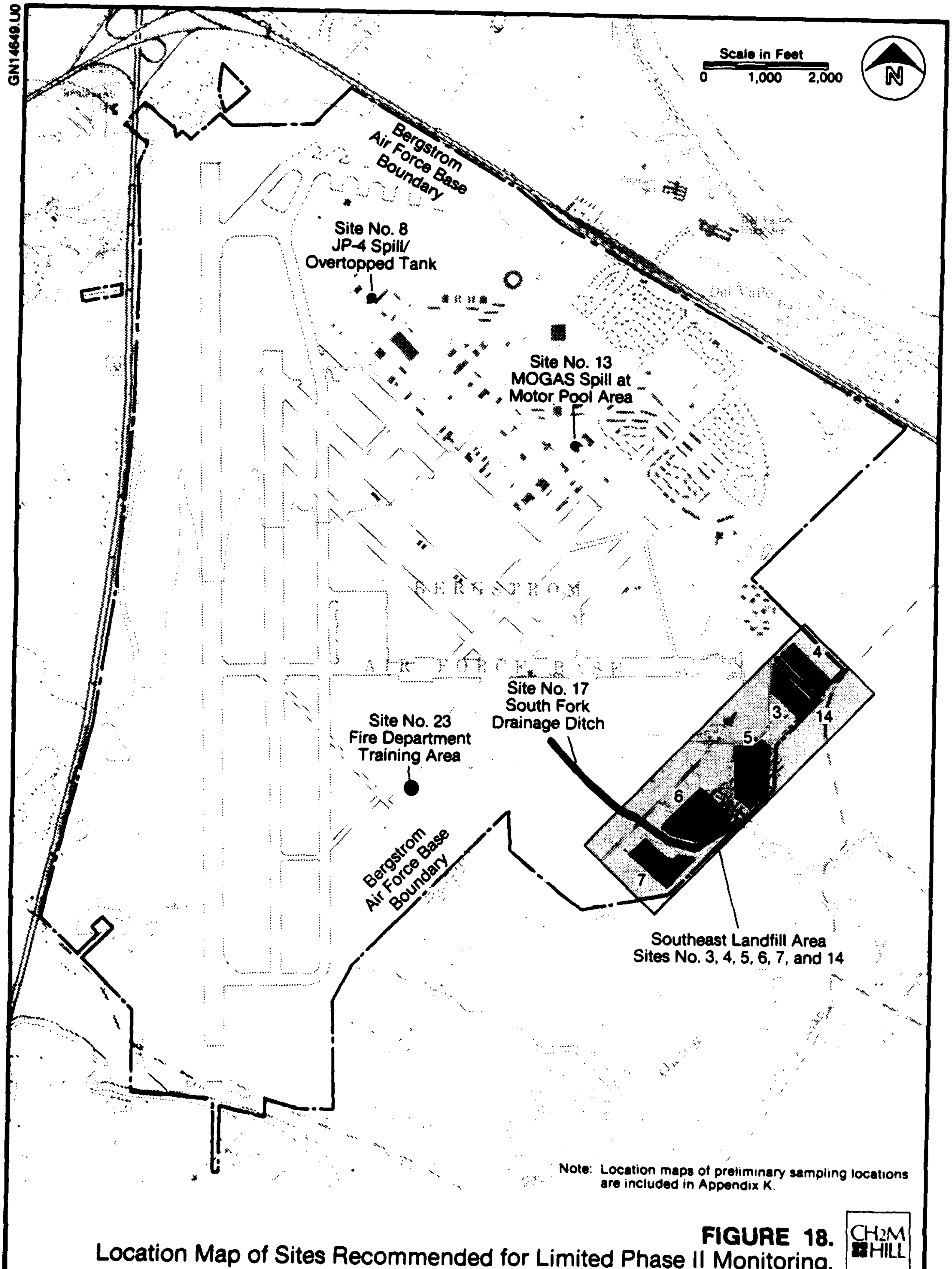

FIGURE 18.
Location Map of Sites Recommended for Limited Phase II Monitoring.

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discretion of the geologist; however, it is anticipated that 1 to 5 samples per trench will be adequate.

An alternative (Option B) to backhoe test trenches is the performance of four hand auger borings. The requirement and role of a certified geologist, the depth of the borings, the number of samples required (1 to 5 per boring), and the recommended analyses are the same as recommended for Option A, the backhoe test trenches. The recommended locations for the borings are shown on Figure 20 in Appendix K.

2. Site No. 13--MOGAS Spill at Motor Pool Area

It is recommended that one hand auger boring be completed at this site. The boring should be located as shown on Figure 21 (Appendix K) and should be completed to a depth of approximately 10 feet. A certified geologist should be present to examine the soil profile and characteristics and to inspect for signs of fuel saturation. Soil samples should be collected and analyzed in accordance with Table 9. The number of samples collected should be at the discretion of the geologist.

3. Site No. 23--Fire Department Training Area

It is recommended that one hand auger boring be completed at this site. The boring should be located at the southeastern end of the training area as shown on Figure 22 (Appendix K) and should be completed to a depth of approximately 10 feet.

The procedures described above for Site No. 13 should be followed. Soil samples should be collected and analyzed in accordance with Table 9.

4. <u>Sites No. 3, 4, 5, 6, 7, and 14--Southeast Landfill Area</u>

Due to the close proximity of these sites to one another, it is recommended that these sites be grouped together and monitored under an areawide plan. It is recommended that six monitoring wells, four downgradient and two upgradient, be installed to determine if hazardous contaminants are present in the ground water. The monitoring well locations are shown on Figure 23 (Appendix K). Each well should be drilled to approximately 50 feet (10 feet below the ground-water table) and screened in the ground-water zone. Each well should be analyzed for the parameters given in Table 9 and should be sampled on two occasions, at least 30 days apart.

5. <u>Site No. 8--JP-4 Spill/Overtopped Tank</u>

It is recommended that one hand auger boring be completed at this site. The boring should be located inside the dike, in the corner with the lowest elevation (to be determined), as shown on Figure 24 (Appendix K). The boring should be completed to a depth of approximately 10 feet. The procedures described for Site No. 13 should be followed. Soil samples should be collected and analyzed in accordance with Table 9.

B. OTHER ENVIRONMENTAL RECOMMENDATIONS

1. The golf course water well should be sampled and analyzed for the primary drinking water parameters (heavy metals and pesticides). This is the only well located on base and has been in use for about 10 years. This well can also be used as an additional upgradient monitoring well for the zone monitoring of the Southeast Landfill Area. Analyses of this well would also be useful in characterizing the quality of ground water beneath Bergstrom AFB and determining if a long-term contaminant migration potential exists.

2. The oil/water separator located at Facility No. 4533 should be connected to the sanitary sewer.

C. LAND USE RESTRICTIONS FOR IDENTIFIED SITES

It is recommended that land use restrictions at the identified disposal and spill sites at Bergstrom AFB be considered. The purpose of such land use restrictions would be (1) to provide for the continued protection of human health, welfare, and the environment; (2) to ensure that the migration of potential contaminants is not promoted through improper land uses; (3) to facilitate the compatible development of future USAF facilities; and (4) to allow for identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions at each of the identified disposal and spill sites at Bergstrom AFB are presented in Table 11. A description of the land use restriction guidelines is presented in Table 12. Land

Table 11
RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

Site No.	Site Description	Recreational Use	Well Construction On or Near the Site	Housing On or Near the Site	Agricultural Use	Surface-Water Impoundments (Lagoons, Irrigation)	Disposal Operations	Construction	Excavation	Burning Operations or Ignition Sources	Material Storage	Silvicultural Use	Vehicular Traffic	Site Access
1	Landfill No. 1	X	X	X	X	X	X	X	X					
2	Landfill No. 2	X	X	X	X	X	X	X	X					
3	Landfill No. 3	X	X	X	X	X	X	X	X					
4	Landfill No. 4	X	X	X	X	X	X	X	X					
5	Landfill No. 5	X	X	X	X	X	X	X	X					
6	Landfill No. 6	X	X	X	X	X	X	X	X					
7	Landfill No. 7	X	X	X	X	X	X	X	X					
8	JP-4 Spill/Overtopped Tank	X	X	X	X	X	X			X				
9	JP-4 Spill/Open Pipeline	X	X	X	X	X	X			X				
10	JP-4 SPill/Faulty Valve	X	X	X	X	X	X			X				
11	Dibrom/Diesel Spill at Entrance Gate	X	X		X	X	X							
12	Dibrom/Diesel Spill at Golf Course	X	X		X	NA	X							
13	MOGAS Spill at Motor Pool Area	X	X	X	X	X	X			X				
14	Road Oiling Area	X	X	X	X	X	X							
15	JP-4 Spill/Apron Excavation	X	X	X	X	X	X			X				
16	JP-4 Spill/Refueling Truck	X	X	X	X	X	X			X				
17	South Fork Drainage Ditch	X	X	X	X	NA	X			X				
18	JP-4 Spill at Fuel Systems Repair Shop	X	X	X	X	X	X			X				
19	JP-4 Spill from A/C Fuel Tank	X	X	X	X	X	X			X				
20	Fuel Tank Jettison Area	X	X	X	X	X	X							
21	Old Entomology Rinse Area	X	X	X	X	X	X							
22	Sludge Weathering Pit	X	X	X	X	X	X							
23	Fire Department Training Area	X	X	X	X	X	X	X	X		X			
24	Radioactive Waste Disposal Site	X	X	X	X	X	X	X	X					
25	Asphalt Primer Spill/Avenue F	X	X		X	NA	X							
26	Asphalt Primer Spill/Star Drive	X	X		X	NA	X							

Note: NA = Not Applicable.

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Table 12
DESCRIPTION OF LAND USE RESTRICTION GUIDELINES

Guideline	Description
Recreational use	Restrict the use of the site for recreational purposes.
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 be site-specific based on hydrogeologic conditions.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Surface-water impoundments (lagoons, irrigation)	Restrict the use of the site for surface-water impoundments, lagoons, or irrigation. Water infiltration could provide a driving force and promote contaminant migration.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Construction	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.
Burning operations or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials)
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.
Site Access	Restrict access to the site to prevent unknowing or accidental direct contact with potentially hazardous substances.

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use restrictions at sites recommended for Phase II monitoring should be re-evaluated upon the completion of the Phase II monitoring program and changes made where appropriate.

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4. Base Sanitary Landfill Operations Plan, 67th Civil Engineering Squadron, Bergstrom AFB, Texas, September 1976.

5. Case files from the Office of Bioenvironmental Engineering, USAF Hospital, Bergstrom AFB, Texas.

VII. OFF-BASE INSTALLATIONS

A. INTRODUCTION

Three off-base installations were included in the Bergstrom AFB records search. The Lake Travis Recreation Site, the Middle Marker Site, and the Communications Transmitter Site. The locations of these installations are shown on Figure 1. Ground tours of these sites and interviews of personnel knowledgeable about the sites were conducted during the week of April 4 through 8, 1983.

B. MIDDLE MARKER SITE

The Middle Marker Site is located on 0.23 acres of fee purchase land, immediately south of the main runway at Bergstrom AFB. The site has been operable since about 1958, when it was part of the runway navigation system. The site is still maintained in operable condition, although it is not generally used. Two fuel storage tanks are present at the site, including a 275-gallon aboveground fuel oil tank and a 1,000-gallon underground MOGAS tank used to operate an emergency generator. No hazardous wastes are known to have been disposed of at the Middle Marker Site.

C. COMMUNICATIONS TRANSMITTER SITE

The Communications Transmitter Site is located south of Burleson Road, approximately 7,200 feet west of Bergstrom AFB, and includes 27.5 acres of fee purchase land. The site was aquired in 1953 and operated until 1982 when it was taken out of operation. Two tanks were formerly present at the site, including a 550-gallon aboveground fuel oil tank no longer at the site, and a 1,000-gallon underground diesel fuel tank still present at the site. During the site visit, three transformers were also noted to be present at the site. The land around the site is grassland/mesquite rangeland and is used for cattle grazing. No disposal of hazardous materials is known to have occurred at the Communications Transmitter Site.

D. LAKE TRAVIS RECREATION SITE

The Lake Travis Recreation Site is located approximately 40 road miles northwest of Bergstrom AFB and is accessible via State Highway 71 and FM 2322. This site occupies 64.4 acres of land leased in 1969 from the Lower Colorado River Authority and is operated as an off-base recreational annex for military personnel and their families. The site is bordered on one side by Lake Travis, a large impoundment created by Lake Travis Dam on the Colorado River.

Biologically, the Lake Travis Site is part of the Edwards Plateau, with a vegetative assemblage of live oak, mesquite, and juniper. The land appears arid and rocky; however, many air plants are found in the trees adjacent to the lake shore. Parts of the site are mowed and fertilized, and other areas are left in a semi-natural condition.

The Lake Travis Recreation Site has 13 permanent trailers, a recreation center, a boathouse facility, and a boat ramp. Also, travel trailers can be set up temporarily at special campsite areas. Potable water is supplied by a 280-foot-deep, 6-inch well, installed in 1970. Sanitary wastes are disposed of in four septic tanks with drainage field systems. Solid wastes have been removed to the county landfill or by a contractor since opening of the site in 1970. A 2,000-gallon aboveground leaded MOGAS tank is located in a bermed area near the boathouse and supplies fuel for pleasure boating. Also, one 55-gallon drum of engine oil is kept at the site. No hazardous wastes are known to have been spilled or disposed of at the Lake Travis Recreation Site.

E. CONCLUSIONS

The records search did not identify any past disposal or spill sites at any of the off-base installations.

F. RECOMMENDATIONS

Phase II monitoring is not recommended at any of the off-base installations.

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DAVID M. MOCCIA

Education

B.S., Chemical Engineering, University of Florida, 1971

Experience

Mr. Moccia joined CH2M HILL in 1971 and is currently the Manager of the Chemical Processes Department. He is responsible for projects involving water treatment in the power industry, energy production, and industrial in-plant reuse/recycle processes. Since joining the firm, Mr. Moccia has participated in a wide variety of projects, including facility evaluations, pilot studies, and conceptual and engineering design for municipal and industrial wastewater treatment facilities.

Examples of Mr. Moccia's project-related experience include the following:

- Project management for design of three poultry process wastewater treatment facilities for Perdue, Inc.
- Project management for design of a biological-chemical wastewater treatment system for a tank car cleaning and maintenance facility for General American Transportation Corporation in Waycross, Georgia.

GLOSSARY OF TERMS

1. ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semisorted sediment in the bed of the stream or on its flood plain or delta.

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

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

4. CONFINING STRATUM - A stratum of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

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

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

7. EVAPOTRANSPIRATION - Evaporation from the ground surface plus transpiration through vegetation.

8. FLOOD PLAIN - The relatively smooth valley floors adjacent to and formed by alluviating rivers which are subject to overflow.

9. FRIABLE - Condition of a rock or mineral that crumbles naturally or is easily broken, pulverized, or reduced to powder.

10. GROUND WATER - All subsurface water, especially that part in the zone of saturation.

11. HAZARDOUS WASTE - A solid waste which because of its quantity, concentration, or physical, chemical or infectious characteristics may -

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

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

12. LEACHING - The separation or dissolving out of soluble constituents from a rock or ore body by percolation of water.

13. MIGRATION (Contaminant) - The movement of contaminants through pathways (ground water, surface water, soil, and air).

14. NET PRECIPITATION - Mean annual precipitation minus mean annual evapotranspiration.

15. OUTWASH PLAIN - A broad, outspread, flat or gently sloping, alluvial sheet of outwash deposited by meltwater streams flowing in front of or beyond the terminal moraine of a glacier.

16. PD-680 (Type I and Type II) - A military specification for petroleum distillate used as a safety cleaning solvent. The primary difference between PD-680 Type I and Type II is the flash point of the material. The flash points are 100°F and 140°F for PD-680 Types I and II, respectively.

17. PERMEABILITY - The capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure.

18. POTENTIOMETRIC SURFACE - An imaginary surface that represents the static head of ground water and is defined by the level to which water will rise in a cased well.

19. SOIL HORIZONS:

(A) A-HORIZON - The uppermost mineral horizon of a soil; zone of leaching.

(B) B-HORIZON - Occurs below the A-Horizon; the mineral horizon of a soil or the zone of accumulation.

(C) C-Horizon - Occurs below the B-Horizon; a mineral horizon of a soil consisting of unconsolidated rock material that is transitional in nature between the parent material below and the more developed horizons above.

20. SOLUM - Upper part of a soil profile, in which soil-forming processes occur; A and B horizons.

21. STRATA - Plural of stratum.

22. STRATUM - A single and distinct layer of homogeneous or gradational sedimentary material (consolidated rock or unconsolidated earth) of any thickness, visually separable from other layers above and below by a discrete change in the character of the material deposited or by a sharp physical break in deposition, or by both.

23. TERRACE - Any long, narrow, relatively level or gently inclined surface, generally less broad than a plain, bounded along one edge by a steeper descending slope and along the other by a steeper ascending slope; a large bench or step-like ledge breaking the continuity of a slope.

24. UNSATURATED ZONE (Zone of Aeration) - A subsurface zone containing water under pressure less than that of the atmosphere, including water held by capillarity; and containing air or gases generally under atmospheric pressure. This zone is limited above the land surface and below the surface of the zone of saturation.

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

26. WATER TABLE - The upper limit of the portion of the ground wholly saturated with water.

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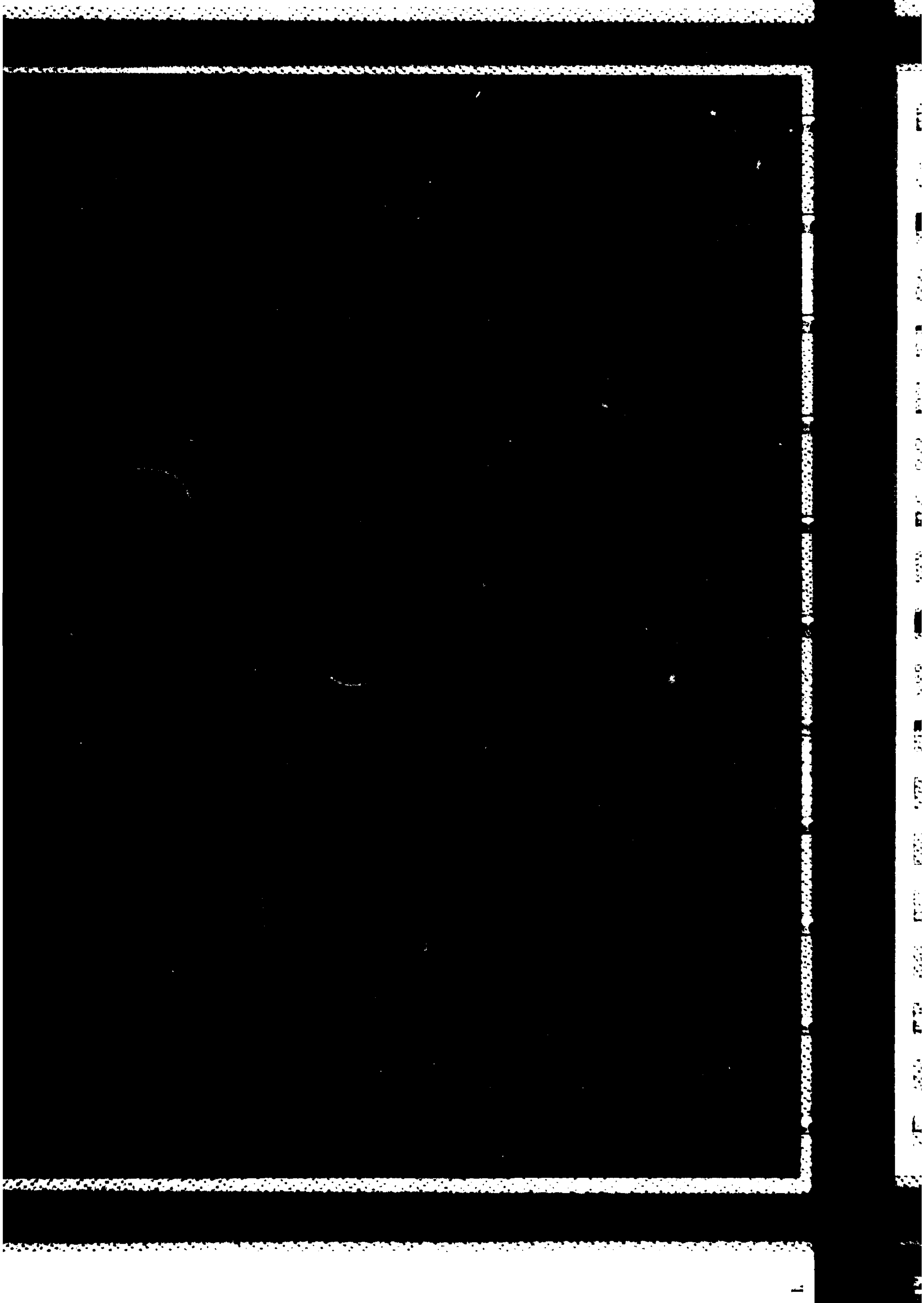

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS USED IN THE TEXT

A/C	Aircraft
AFB	Air Force Base
AFESC	Air Force Engineering and Services Center
AFRES	Air Force Reserve
AG	Aboveground
AGE	Aerospace Ground Equipment
AVGAS	Aviation Gasoline
Bldg.	Building
bls	Below Land Surface
BOD_5	Biochemical Oxygen Demand (5-day)
BX	Base Exchange
°C	Degrees Celsius (Centigrade)
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
cm/s	Centimeters per Second
COD	Chemical Oxygen Demand
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DPDO	Defense Property Disposal Office
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
ft/min	Feet per Minute
gal/yr	Gallons per Year
gpd	Gallons per Day
gpm	Gallons per Minute
HARM	Hazard Assessment Rating Methodology
IRP	Installation Restoration Program
JP	Jet Petroleum
lb	Pounds
lb/yr	Pound(s) per Year
mg/l	Milligram(s) per Liter
mgd	Million Gallons per Day

ml	Milliliter
mo.	Month
MOGAS	Motor Gasoline
mph	Miles per Hour
msl	Mean Sea Level
NDI	Non-Destructive Inspection
No.	Number
NPDES	National Pollutant Discharge Elimination System
OEHL	Occupational and Environmental Health Laboratory
PCB	Polychlorinated Biphenyls
POL	Petroleum, Oil, and Lubricants
PPIF	Photographic Processing Interpretation Facility
ppm	Parts per Million
RCRA	Resource Conservation and Recovery Act
SAC	Strategic Air Command
SCS	Soil Conservation Service
TAC	Tactical Air Command
TCG	Tactical Control Group
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOX	Total Organic Halogen
TRW	Tactical Reconnaissance Wing
TSS	Total Suspended Solids
UG	Underground
USAF	United States Air Force
USDA	United States Department of Agriculture
VOC	Volatile Organic Compound

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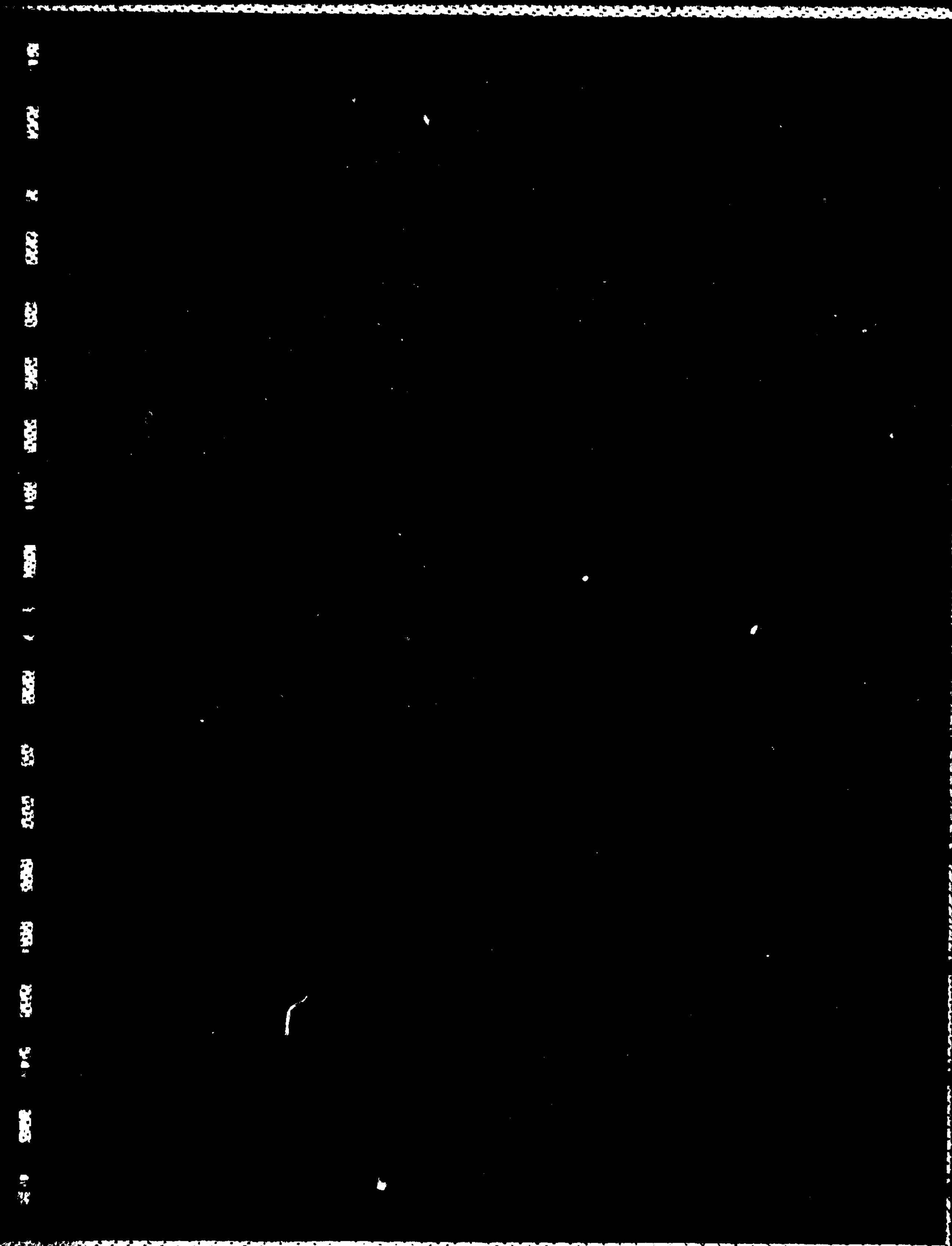

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Appendix D
INSTALLATION HISTORY

The information regarding the history of Bergstrom AFB was obtained from the Base Level Resource Statement, September 1982.

On March 3, 1943, Bergstrom Army Air Field was named in memory of Captain John August Earl Bergstrom.

Captain Bergstrom was believed to be the first casualty of the war from Austin, Texas. He was assigned to the 19th Bombardment Group in the Philippines, stationed at Clark Field at the time of his death.

The field, which was activated as Del Valle Army Air Base on September 19, 1942, was renamed Bergstrom Army Air Field at the suggestion of former President (then Congressman)

DAVID M. MOCCIA

Education

B.S., Chemical Engineering, University of Florida, 1971

Experience

Mr. Moccia joined CH2M HILL in 1971 and is currently the Manager of the Chemical Processes Department. He is responsible for projects involving water treatment in the power industry, energy production, and industrial in-plant reuse/recycle processes. Since joining the firm, Mr. Moccia has participated in a wide variety of projects, including facility evaluations, pilot studies, and conceptual and engineering design for municipal and industrial wastewater treatment facilities.

Examples of Mr. Moccia's project-related experience include the following:

- Project management for design of three poultry process wastewater treatment facilities for Perdue, Inc.
- Project management for design of a biological-chemical wastewater treatment system for a tank car cleaning and maintenance facility for General American Transportation Corporation in Waycross, Georgia.
- Preliminary engineering for a 3.0-mgd reverse-osmosis water treatment plant for the Englewood Water District, Englewood, Florida.
- Process responsibilities for design of a 9.5-mgd activated sludge treatment plant, including sludge thickening and dewatering, for the City of Alexander City, Alabama.
- Preliminary design for a sludge drying and pelletizing facility for the City of Naples, Florida.

Professional Engineer Registration

Florida, Georgia, North Carolina

Membership in Organizations

Florida Engineering Society
Florida Pollution Control Association
National Society of Professional Engineers
Water Pollution Control Federation
Tau Beta Pi

GREGORY T. MCINTYRE
Environmental Engineer

Education

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

Experience

Mr. McIntyre is a project engineer in CH2M HILL's Industrial Processes Division, the Department of Solid and Hazardous Waste. His responsibilities involve projects dealing with hazardous waste management, industrial waste treatment processes, and laboratory and pilot plant treatability studies.

Mr. McIntyre participated in the wastewater characterization, laboratory bench-scale treatability study, evaluation of existing pretreatment facilities, and conceptual design for the equalization and aerobic biological treatment of industrial wastewater for Hercules, Inc. (6/82)

Mr. McIntyre has participated in hazardous materials disposal site records searches for 5 U.S. Air Force installations throughout the United States. The purpose of the records searches is to assess the potential for hazardous contaminant migration from past disposal practices and to recommend follow-up actions. (12/82)

Mr. McIntyre participated in the physical, chemical, and biological monitoring study of the effluent discharge mixing zone and the evaluation of the wastewater treatment system performance for Air Products and Chemicals, Inc., Escambia Plant. (6/82)

Mr. McIntyre participated in the compilation and evaluation of existing ground-water data for Phase I of the Biscayne Aquifer/Dade County Superfund hazardous waste study. (6/82)

Before joining CH2M HILL in September 1981, Mr. McIntyre worked as a research assistant in graduate school and one of his activities included researching the removal of heavy metals, including copper, zinc and trivalent chromium, using a large-scale adsorbing colloid foam flotation pilot plant.

Professional Registration

Engineer-In-Training, Florida

GREGORY T. MCINTYRE

Membership in Organizations

American Society of Civil Engineers
American Water Works Association
Water Pollution Control Federation
Florida Pollution Control Federation
Tau Beta Pi

Publications

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

"Copper Removal by an Adsorbing Colliod Foam Flotation Pilot Plant." (Coauthors E. L. Thackston, J.J. Rodriguez, and D.J. Wilson). Separation Science and Technology, 17(2), 1982.

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

GARY E. EICHLER
Hydrogeologist

Education

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

Experience

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

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

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

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

GARY E. EICHLER

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

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

- Geophysics. Well logging and interpretation.

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

Membership in Organizations

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

Publications

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

Certifications

Certified Professional Geologist
Certificate No. 4544

■ **ROBERT L. KNIGHT**
Ecologist

Education

B.A., Zoology, University of North Carolina, 1970
M.S.P.H., Environmental Chemistry and Biology, University of North Carolina, 1973
Ph.D., Systems Ecology, University of Florida, 1980

Experience

Dr. Knight's responsibilities at CH2M HILL involve all aspects of environmental study, including design and implementation of field studies, data analysis and interpretation, project management, environmental systems overview analysis, impact analysis, prediction, and assessment. His experience has covered a wide range of applied research problems in aquatic and terrestrial environments, including computer simulation analyses. Representative experience includes the following:

- Crystal River Power Plant Study—Managed and participated in field study of the effects of nuclear power plant operation on Crystal River estuarine metabolism.

- Heavy Metal Toxicity Studies—Participated in design and implementation of long-term studies of fate and effects of cadmium and mercury at low levels in stream microcosms. Prepared toxicity simulation model for cadmium and developed general quantification techniques of toxicity in biological systems.

- Environmental Systems Overview Analysis—Prepared and simulated quantitative overview models for Coosa River EIS and for Indian River Power Plant impacts.

- Silver Springs Study—Performed extensive field work at Silver Springs, Florida, to investigate the relationship between plant productivity and consumer organisms. Developed new microcosm design for study of flowing aquatic systems.

- Wetland Waste Assimilation Studies—Conducted feasibility and research studies on the use of natural and artificial wetlands for assimilation of domestic wastewaters. Wetland systems include *Spartina* salt marshes in North Carolina, hardwood swamp and prairie wetlands in Florida, and pocosin systems in South Carolina.

- Hazardous Waste Studies--Assessed environmental impacts of hazardous waste disposal at a number of Air Force bases, nationwide.

- Phytoplankton Research—Performed field verification studies of Algal Assay Procedure. Studied effects of power plant entrainment on phytoplankton numbers and diversity. Provided enumeration and taxonomy of Suwannee River phytoplankton.

ROBERT L. KNIGHT

Publications

Dr. Knight has authored several technical papers on ecosystem metabolism, phytoplankton ecology, and heavy metal dynamics in aquatic systems. Representative papers include:

"In Defense of Ecosystems," (Coauthor D. Swaney). *American Naturalist*, 117:991-992, 1981.

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Appendix B
AGENCY CONTACT LIST

1. U.S. Fish and Wildlife Service
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   505/766-3972

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   Wildlife Biologist
   Austin, Texas
   Mr. Floyd Potter
   512/479-4979

3. Texas Parks and Wildlife Department
   Fishkills and Toxic Spills
   Austin, Texas
   Mr. Dennis Palafox
   512/479-4864

4. City of Austin
   Environmental Resource Management
   Austin, Texas
   512/477-6511

5. State of Texas
   Agricultural Department
   Agricultural and Environmental
   Sciences Division
   Austin, Texas
   Mr. Ted Fisher
   512/473-9600

6. Texas Department of Water Resources
   Austin, Texas
   Mr. Kieth Alexander
   512/475-5633

7. Travis County
   County Hydrologist
   Austin, Texas
   Mr. David Prebble
   512/472-9122

8. U.S. Geological Survey
   Austin, Texas
   Mr. Raymond Slade
   512/482-5686

9. Texas Health Department
   Solid Waste Management
   Austin, Texas
   Mr. Doug McArthur
   512/458-7271

10. Texas Department of Water Resources
Wastewater Section
Austin, Texas
Mr. Rex McDonald
512/475-7896

11. Texas Department of Water Resources
Permits Division, Solid Waste Section
Austin, Texas
Mr. Ray Austin
512/475-2041

12. Texas Department of Water Resources
Solid Waste and Spill Response Section
Austin, Texas
Mr. David Barker
512/475-6371

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Appendix C
BERGSTROM AFB RECORDS SEARCH INTERVIEW LIST

Interviewee	Area of Knowledge	Years at Installation
1	Environmental/Civil Engineering	8
2	Bioenvironmental Engineering	2
3	Real Estate	3
4	Resources/Planning	20
5	Entomology	17
6	Liquid Fuels	3
7	Liquid Fuels	3
8	Roads and Grounds	6
9	Roads and Grounds	29
10	Roads and Grounds	20
11	Fire Department Training	9
12	Fire Department Training	11
13	Water and Wastewater	4
14	Lake Travis Recreation Site	10
15	Lake Travis Recreation Site	1
16	Electrician	12
17	Exterior Electric	5
18	Heavy Equipment Maintenance	25
19	Heavy Equipment Maintenance	20
20	Refueling Vehicle Maintenance	20
21	Auto Hobby Shop	4
22	Fire Department Training	10
23	Explosive Ordnance Disposal	1
24	USAF Hospital and Medical Lab	24
25	BX Service Station	1
26	Defense Property Disposal Office	8
27	Fuels Management	1
28	Fuels Management	9
29	Civil Engineering	30
30	Civil Engineering	30
31	Communications	3
32	Photo Reconnaissance	1
33	Photo Reconnaissance	2
34	Component Repair Squadron	2
35	Component Repair Squadron	2
36	Component Repair squadron	1
37	Transportation	2
38	Transportation	2
39	Equipment Maintenance Squadron	2
40	Equipment Maintenance Squadron	2
41	Equipment Maintenance Squadron	2
42	Equipment Maintenance Squadron	1
43	Photographic Processing Interpretation Facility	1

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Appendix D
INSTALLATION HISTORY

The information regarding the history of Bergstrom AFB was obtained from the Base Level Resource Statement, September 1982.

On March 3, 1943, Bergstrom Army Air Field was named in memory of Captain John August Earl Bergstrom.

Captain Bergstrom was believed to be the first casualty of the war from Austin, Texas. He was assigned to the 19th Bombardment Group in the Philippines, stationed at Clark Field at the time of his death.

The field, which was activated as Del Valle Army Air Base on September 19, 1942, was renamed Bergstrom Army Air Field at the suggestion of former President (then Congressman) Lyndon B. Johnson. It became Bergstrom Field on November 11, 1943, followed by the current official designation in December 1948 after the creation of the Air Force as a separate armed force.

After activation, Bergstrom Air Force Base became the home of troop carrier units, some of which took part in the historic Berlin Airlift in 1948-1949.

The transfer of the base to Strategic Air Command (SAC) in 1949 was followed by the arrival of the 27th Fighter Wing in March 1949.

The 12th Fighter Escort Wing moved to the base in December 1950. With the arrival of the 42nd Air Division in 1951, Bergstrom became a very important station of SAC.

On July 1, 1957, Bergstrom Air Force Base transferred from SAC to Tactical Air Command (TAC) and in January 1958, the base was assigned to 12th Air Force.

On October 1, 1958, the base once again was transferred to SAC and became the home of the 4130th Strategic Wing. It became a unit of the 2nd Air Force operating B-52 "Stratofortresses" and KC-135 jet tankers. On September 1, 1963, the 4130th became the 340th Bombardment Wing, Heavy.

On July 1, 1966, Bergstrom Air Force Base again came under the jurisdiction of TAC. With the transfer, the base became a unit of 12th Air Force and home of the 75th Tactical Reconnaissance Wing (TRW).

The 602nd Tactical Control Group (TCG) moved to Bergstrom AFB on April 15, 1966, from James Connally AFB, Texas, where it had been activated as the 4460th TCG in August 1965. As a part of 12th Air Force, the 602nd operates a complete tactical aircraft control and warning sub-system in support of contingencies throughout the world.

On August 31, 1968, the parent command to Bergstrom's tactical activities, Headquarters 12th Air Force, moved to the base. At that time, Twelfth Air Force was responsible for all TAC reconnaissance, fighter, and airlift operations based west of the Mississippi River.

On July 15, 1971, the host 75th TRW was deactivated and replaced by the 67th TRW, making Bergstrom the only tactical reconnaissance base.

The 71st Tactical Air Support Group was officially formed on the base January 15, 1970, through redesignation of the 602nd Direct Air Support Squadron. On July 1, 1974, it was deactivated, and its assets, personnel and headquarters functions were combined with those of the 602nd TCG to form the 602nd Tactical Air Control Group, redesignated a wing in October 1976.

Two organizations of the Air Force Reserve moved from Ellington AFB, Texas to Bergstrom on March 10, 1976. They were Central Air Force Reserve Region Headquarters (redesignated 10th Air Force (Reserve) on October 8, 1976) and the 924th Tactical Airlift Group (redesignated Tactical Fighter Group). The Tenth Air Force is the headquarters of SAC and TAC gained reserve units in the United States. It supervises the training of more than 13,000 Air Force reservists in 17 flying and 68 non-flying units.

With the addition of two tactical reconnaissance training squadrons (the 45th and the 62nd) and an academic tactical training squadron (the 67th) in 1982, Bergstrom began training pilots and weapon systems officers in the RF-4C. The training provided by the 67th TRW ranges from initial RF-4C transition training to RF-4C refresher courses. As such, Bergstrom AFB is the United States Air Force center for tactical reconnaissance training.

A. PRIMARY MISSION

The 67th Tactical Reconnaissance Wing is the current host unit at Bergstrom AFB. The primary mission is to maintain and operate combat ready forces capable of rapidly deploying to anywhere in the world with men and equipment to conduct reconnaissance missions; to train pilots and weapons systems operators for the RF-4C from initial transition training to RF-4C refresher courses; to provide operational tactical reconnaissance through an integrated system of aerial data collection using visual, optical, and other sensory devices, and subsequent processing, interpretation, storage, retrieval, and distribution of derived reconnaissance information/intelligence concerning the disposition, movement, and activity of friendly or hostile forces; to provide supervision to assigned squadrons and provide assistance to reserve forces assigned to the base; and to provide resources for logistic and administrative support for tenant units located on-base.

B. TENANT MISSION

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

1. Headquarters 12th Air Force (TAC)

The mission is to command, administer, and supervise unit training of assigned and attached active forces, and ensure the operational readiness of designated TAC gained units of the Air Force Reserve prior to mobilization; to assist in program planning and provide program management for a significant change in force structure, weapon systems, personnel, facilities, or material within assigned active units and for aircraft conversions in designated TAC gained Air National Guard and Air Force Reserve units; to develop and publish joint and unilateral readiness exercises and contingency employment operations orders and plans as directed by TAC, deploy the nucleus of a Mobile Air Force Component Headquarters as directed, and conduct required employment air operations with designated forces in support of exercises or contingency operation orders or plans.

2. Headquarters 10th Air Force Reserve (AFRES)

The mission is to command, supervise and manage all TAC, SAC, and AFLC gained Air Force Reserve units throughout the United States. AFRES encompasses approximately 13,000 reservists, 17 flying, and 68 non-flying units.

3. <u>924th Tactical Fighter Group (AFRES)</u>

The mission is to establish a training program to achieve the capability of worldwide deployment and to be prepared upon direction to deploy and to destroy enemy forces and facilities through delivery of all types of tactical weapons, compatible with weapons systems possessed, in support of tactical aviation roles of counter air, interdiction, and close air support.

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Table E-1
WATER QUALITY OF ONION CREEK

Parameter	Concentration: Station No. K[a] (Upstream)	Concentration: Station No. L[b] (Downstream)
Dissolved Oxygen	8.9	7.3
pH (standard units)	8.6	8.6
Conductivity (μmhos/cm)	536	556
BOD_5	0.5	0.5
TSS	<10	<10
Organic Nitrogen (as N)	0.38	0.37
Ammonia Nitrogen (as N)	<0.02	0.03
Nitrite Plus Nitrate Nitrogen (as N)	0.05	0.17
Total Nitrogen (as N)	0.45	0.57
Total Phorphorus (as P)	0.01	0.02
Chloride	35	35
Sulfate	32	34
TDS	294	324
Fecal Coliforms (Number per 100 ml)	100	32

Note: 1. All values expressed in mg/l except as noted otherwise.
2. Stations monitored by the Texas Department of Water Resources.

[a]Station No. K on Onion Creek at Lower Falls in McKinney Falls State Park.

[b]Station No. L on Onion Creek at Farm to Market 973.

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Table E-2
TYPICAL POTABLE WATER SUPPLY CHEMICAL ANALYSIS REPORT

Parameter	Concentration
Calcium	17
Magnesium	16
Sodium	24
Carbonate	10
Bicarbonate	52
Sulfate	38
Chloride	47
Fluoride	0.6
Nitrate (as N)	0.36
TDS	180
Total Alkalinity (as $CaCO_3$)	59
Total Alkalinity (as $CaCO_3$)	108
pH (standard units)	9.5
Conductance (μmhos/cm)	368
Arsenic	<0.01
Barium	<0.5
Cadmium	<0.005
Chromium	<0.02
Copper	<0.02
Iron	0.02
Lead	<0.02
Manganese	<0.02
Mercury	<0.0002
Selenium	<0.002
Silver	<0.01
Zinc	0.05
Endrin	<0.0002
Lindane	<0.00003
Methoxychlor	<0.0005
Toxaphene	<0.005
2,4-D	<0.02
2,4,5-TP	<0.0005

Source: Texas Department of Health, Division of Water Hygiene, Supply Source: Town Lake, Distribution Sample, March 1981.

Note: All values expressed in mg/l except as noted otherwise.

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Table E-3
WATER POLLUTION MONITORING SUMMARY[a]

Parameter	Detection Limit	Water Quality Standard	1981 Annual Average Values A	B	C	D	E	F	G	H	I	J	K (Lift Station)	Industrial Waste Standard[b]
Temperature (°C)	--	35[c]	Dry	17.8	18.5	18.2	17.4	18.2	16.1	20.0	17.6	--	--	49
pH (standard units)	--	6.5-9.5[c]		7.5	7.3	7.8	8.0	8.4	7.5	8.0	8.0	--	--	6.0-10.5
Dissolved Oxygen	--	5.0[c]		2.1	2.3	4.1	5.3	3.6	2.7	7.8	6.7	--	--	--
COD	--	45[d]		11	16	22	15	10	17	13	10	11	266	450
TOC	--	--		2	6	6	10	5	4	4	3	6	68	--
Oil and Grease	0.3	No Sheen[e]		ND	ND	1.7	0.8	ND	ND	ND	ND	ND	26.3	20
Ammonia (as N)	0.2	No Odor[c]		0.3	ND	0.3	ND	4.7	0.5	ND	ND	ND	30.0	--
Nitrate (as N)	0.1	--		1.2	0.2	0.2	ND	ND	0.2	0.5	0.4	1.7	0.3	--
Nitrite (as N)	0.02	--		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	--
Phosphorus (as P)	0.1	--		0.12	0.12	0.15	0.13	--	0.20	0.15	0.15	0.15	5.08	15
Cyanide	0.01	0.02[d]		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03	2
Phenols	0.01	No Odor[c]		ND	ND	0.02	ND	ND	ND	ND	ND	ND	0.02	No Odor
Cadmium	0.01	0.02[d]		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
Chromium	0.05	0.5[e]		ND	ND	ND	ND	ND	0.13	ND	ND	ND	0.23	5.0
Copper	0.02	0.5[e]		8.77	0.11	0.08	0.03	ND	0.03	0.03	0.03	ND	0.08	1.0
Lead	0.05	0.1[d]		ND	ND	ND	ND	ND	0.16	ND	ND	ND	ND	0.1
Manganese	0.05	1.0[c]		14.60	0.10	ND	0.08	ND	0.15	0.14	ND	0.07	ND	1.0
Mercury	0.005	0.005[c]		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Silver	0.01	0.05[e]		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	0.1
Zinc	0.05	1.0[e]		ND	ND	ND	ND	ND	ND	ND	ND	ND	1.57	5.0
Chloride	--	100[c]		23.0	5.5	39.0	23.3	49.7	21.0	29.0	34.0	28.0	49.0	--
Color (color units)	--	--		7.5	36	19	39	18	20	10	5	4	25	--
TDS	--	400[d]		405	204	187	185	218	174	326	362	379	419	--
Sulfate	--	75[c]		36.5	17.8	31.5	22.0	27.0	16.0	36.5	46.3	46.3	91.8	250
Surfactants	--	No Foaming[c]		0.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	7.6	--
Turbidity (JTU)	--	--		31.5	5.3	3.3	1.3	7.3	4.3	2.3	1.8	2.0	59.0	--

Source: Water Pollution Emission Inventory and Monitoring Summary, Bergstrom AFB, August 1982.

Note: 1. ND = Not detected at specified detection limit.
2. All values expressed as mg/l except as noted otherwise.

[a]Water pollution monitoring locations shown on Figure 15, page IV-24.

[b]City of Austin Industrial Waste Ordinance 780406-B.

[c]1976 Texas Water Quality Standards.

[d]City of Austin Ordinance No. 771229-H.

[e]Texas Water Development Board General Regulations Section 156.19.15.002.

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Table E-4
PROBABILITIES OF EXCEEDANCE[a]

Parameter	Water Quality Standard	1981 Annual Average Values										K (Lift Station)	Industrial[b] Waste Standard
		A	B	C	D	E	F	G	H	I	J		
Temperature (°C)	35[c]	0.09	0.03	0.01	0.03	0.03	0.34	0.10	0.20	0.20	0.19	0.00	49
pH (standard units)	6.5-9.5[c]	68.1/12.9	57.4/1.8	69.8/1.3	82.1/3.4	77.6/4.1	73.2/8.7	66.8/8.7	76.4/3.1	88.5/2.9	67.0/8.5	72.6/0.0	6.0-10.5
Dissolved Oxygen	5.0[c]	76.42	76.73	61.41	58.32	74.86	68.79	46.02	66.64	68.08	91.47	--	--
COD	45[d]	23.89	1.92	0.17	71.23	48.41	0.16	5.7	0.03	0.00	0.19	4.85	450
TOC	--	--	--	--	--	--	--	--	--	--	--	7.64	--
Oil and Grease	No Sheen[e]	--	--	--	--	--	--	--	--	--	--	77.64	20
Ammonia (as N)	No Odor[c]	27.43	0.00	0.00	56.75	0.00	0.00	0.00	0.00	0.00	0.00	--	--
Nitrate (as N)	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite (as N)	--	--	--	--	--	--	--	--	--	--	--	--	--
Phosphorus (as P)	--	--	--	--	--	--	--	--	--	--	--	19.22	15
Cyanide	0.02[d]	0.00	51.20	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	2.0
Phenols	No Odor[c]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.50	No Odor
Cadmium	0.02[d]	0.00	0.00	0.00	2.28	4.00	0.00	0.00	0.00	0.00	9.85	2.28	0.02
Chromium	0.5[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.0
Copper	0.5[e]	18.94	53.59	0.00	31.56	0.00	0.00	0.00	0.00	2.17	0.00	0.00	1.0
Lead	0.1[d]	0.00	0.00	0.00	0.00	0.00	0.00	34.83	0.00	0.00	0.00	76.11	0.1
Manganese	1.0[c]	0.08	20.09	0.00	0.36	0.06	0.00	0.00	0.00	0.00	0.00	0.00	1.0
Mercury	0.005[c]	0.00	0.00	57.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.005
Silver	0.05[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.59	0.1
Zinc	1.0[e]	0.00	0.00	0.00	0.00	16.11	0.00	0.00	0.00	0.00	0.00	0.10	5.0
Chloride	100[c]	5.70	0.00	0.00	0.04	0.00	7.49	0.00	0.00	0.00	0.00	--	--
Color (color units)	--	--	--	0.00	--	--	--	--	--	--	--	--	--
TDS	400[d]	2.07	34.46	6.68	102	1.83	3.92	31.56	9.51	6.30	20.05	--	--
Sulfate	75[c]	0.10	0.00	0.00	3.84	0.00	0.00	0.00	0.39	0.04	0.6	0.00	250
Surfactants	No Foaming[c]	--	--	--	--	--	--	--	--	--	--	--	--
Turbidity (JTU)	--	--	--	--	--	--	--	--	--	--	--	--	--

Source: Water Pollution Emission Inventory and Monitoring Summary, Bergstrom AFB, August 1982.

Note: 1. ND = Not detected at specified detection limit.
2. All values expressed as mg/l except as noted otherwise.
3. Data base: 1977-1981.

[a]Probability of exceedance = percent chance that the standard will be exceeded when a quarterly grab sample is taken.

[b]City of Austin Industrial Waste Ordinance 780406-B.

[c]1976 Texas Water Quality Standards.

[d]City of Austin Ordinance No. 771229-H.

[e]Texas Water Development Board General Regulations Section 156.19.15.002.

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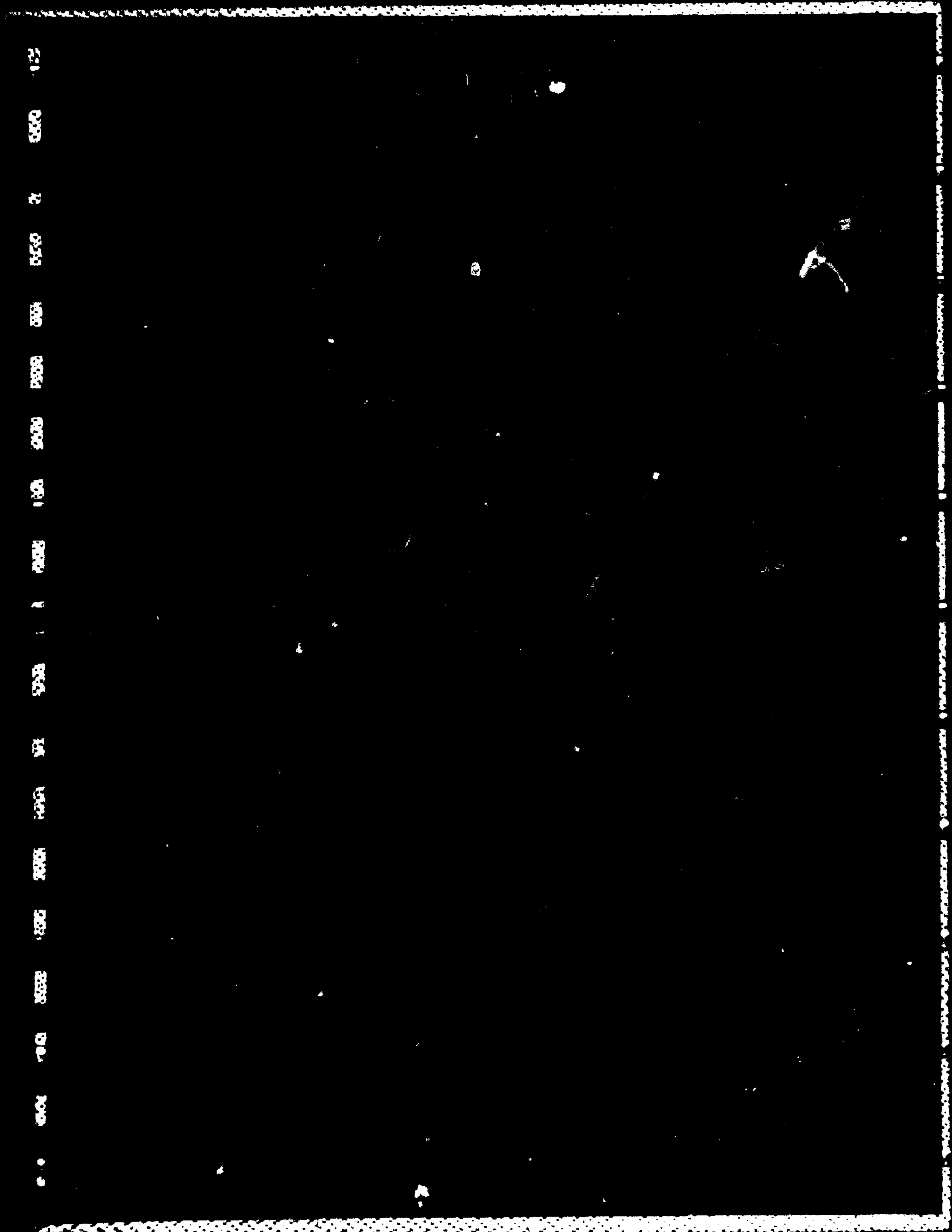

Appendix F

MASTER LIST OF INDUSTRIAL OPERATIONS

Shop Name	Present Location and Dates (Building No.)		Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Methods
67th Combat Support Group						
Graphics	2003	1953-Pres.				
Photo Lab	2003	1953-Pres.		--	--	
Reproduction	1101	1952-Pres.		X	X	Silver recovery to sanitary sewer
Wood Hobby Shop	600	1964-Pres.		--	--	
Auto Hobby Shop	600	1964-Pres.		--	--	
Small Arms Range	4505	1967-Pres.		X	X	Facility No. 590[a]
67th Component Repair Squadron						
Machine	1602	1953-Pres.		--	--	
Structural Repair	1602	1953-Pres.		X	--	Consumed in use
Metal Processing	1610	1955-Pres.		--	--	
Pneudraulics	1610	1955-Pres.		X	X	Facility No. 590
NDI Lab	1615	1971-Pres.		X	X	Facility No. 590; silver recovery to sanitary sewer
Electrical Systems	1610	1955-Pres.		X	X	Neutralization to sanitary sewer
Propulsion Shop	1612	1971-Pres.		X	X	Facility No. 590
Test Cell	4576	1958-Pres.		X	--	Consumed in use
Infrared Sensors	1611	1955-Pres.		X	--	Consumed in use
PMEL	1611	1955-Pres.		X	X	DPDO
COMM/NAV FLR	1611	1955-Pres.		X	--	Consumed in use
Instruments	1611	1955-Pres.		--	--	
Internal Navigation Systems	1611	1955-Pres.		--	--	
ECM/EWS	1643	1960-Pres.		X	--	Consumed in use
Pavetack	401	1975-Pres.		X	--	Consumed in use
Parachute Shop	4532	1960-Pres.		X	--	Consumed in use
67th Transportation Squadron						
Welding/Body Shop	1806	1960-Pres.		--	--	
Protective Coating	1801	1958-Pres.		X	--	Consumed in use
General Purpose Vehicle Maintenance	1801	1958-Pres.		X	X	Facility No. 590
Heavy Equipment	713	1962-Pres.		X	X	Facility No. 590
Special Purpose Vehicle Maintenance	1801	1958-Pres.		X	X	Facility No. 590
Refueling Maintenance	635	1969-Pres.		X	X	Facility No. 590
67th Supply Squadron/POL	532	1968-Pres.		X	--	
67th Tactical Reconnaissance Wing						
Photo Processing	1400	1968-Pres.		X	X	Silver recovery to sanitary sewer

[a] Facility No. 590, underground waste storage tanks, for disposition through DPDO.

Appendix F--Continued

Shop Name	Present Location and Dates (Building No.)		Past Location and Dates (Building No.)		Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Methods
67th Civil Engineering Squadron							
Pavements and Grounds	713	1962-Pres.			--	--	
Entomology	722	1973-Pres.	724	1951-1973	X	--	Consumed in use
Power Production	723	1975-Pres.			X	X	Facility No. 590[a]
Protective Coating	734	1955-Pres.			X	X	Facility No. 590
Welding/Sheet Metal	713	1962-Pres.			--	--	
Golf Course Maintenance	--	--			X	--	Consumed in use
Refrigeration	734	1955-Pres.			X	X	Facility No. 590, neutralization to sanitary sewer
Heating	734	1955-Pres.			X	--	Consumed in use
Fire Extinguisher Refill	201	1955-Pres.			X	--	Consumed in use
67th Equipment Maintenance Squadron							
AGE	4548	1956-Pres.			X	X	Facility No. 590
Fuel System Repair	4533	1959-Pres.			X	X	Facility No. 590
Wheel and Tire	1610	1955-Pres.			X	X	Holding tank, contractor removal
Corrosion Control	1602	1953-Pres.			X	X	Oil/water separator to sanitary sewer; contractor removal
Egress	1610	1955-Pres.			X	--	Consumed in use
Phase Dock	1610	1955-Pres.			X	X	Facility No. 590
67th Aircraft Generation Squadron							
Flightline Maintenance	Flightline	1950-Pres.			X	X	Facility No. 590
USAF Hospital							
Medical X-ray	2700	1970-Pres.	3901	1952-1970	X	X	Silver recovery to sanitary sewer
Dental Lab	2700	1970-Pres.	3901	1952-1970	X	--	Consumed in use
Dental Clinic	2700	1970-Pres.	3901	1952-1970	X	X	Silver recovery to sanitary sewer
Surgery	2700	1970-Pres.	3901	1952-1970	--	--	
Medical Lab	2700	1970-Pres.	3901	1952-1970	X	--	Consumed in use
12th Tactical Reconnaissance Squadron							
PPIF	4531	1974-Pres.			X	X	Silver recovery to sanitary sewer
91st Tactical Reconnaissance Squadron							
PPIF	320	1967-Pres.			X	X	Silver recovery to sanitary sewer

[a] Facility No. 590, underground waste storage tanks, for disposition through DPDO.

Appendix F--Continued

Shop Name	Present Location and Dates (Building No.)		Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Methods
924th Tactical Fighter Group[a]						
Repair and Reclamation	4534	1976-Pres.		X	X	Consumed in use, Facility No. 590[b]
Survival Equipment	4532	1976-Pres.				
NDI Lab	4535	1976-Pres.		X	X	Facility No. 590
Jet Engine/Prop Shop	4589	1976-Pres.		X	X	Oil/water separator to sanitary sewer; Facility No. 590
Welding	4535	1976-Pres.		--	--	
Machine/Sheet Metal	4535	1976-Pres.		X	--	Consumed in use
Fuel Systems Repair	4534	1976-Pres.		X	X	Consumed in use, Facility No. 590
Instrumentation and Auto Pilot/ Communication and Navigation Shops	4527	1976-Pres.		X	--	Consumed in use
Phase Dock	4535	1976-Pres.		X	X	Oil/water separator to sanitary sewer; Facility No. 590
Corrosion Control	4535	1976-Pres.		X	X	Oil/water separator to sanitary sewer; Facility No. 590
AGE	4562	1976-Pres.		X	X	Oil/water separator to sanitary sewer; Facility No. 590
Electric/Battery Shop	4535	1976-Pres.		X	X	Sanitary sewer
Pneudraulics	4535	1976-Pres.		X	X	Consumed in use; Facility No. 590
Environmental Systems	3658	1976-Pres.		X	--	Consumed in use
Flightline Maintenance	Flightline	1976-Pres.		X	X	Oil/water separator to sanitary sewer; Facility No. 590
712th Air Support Operations Center Squadron						
Ground Radio	1643	1960-Pres.		--	--	
Radio Relay	402	1953-Pres.		--	--	
Vehicle Maintenance	402	1953-Pres.		X	X	Facility No. 590
AGE	402	1953-Pres.		X	X	Facility No. 590
602nd Tactical Air Control Center						
Ground Radio	4580	1962-Pres.		--	--	
Radio Relay	4580	1962-Pres.		--	--	
Vehicle Maintenance	4580	1962-Pres.		X	X	Neutralization to sanitary sewer; Facility No. 590
AGE	4500	1968-Pres.		X	X	Facility No. 590

[a]The 924th Tactical Fighter Group moved from Ellington AFB to Bergstrom AFB in 1976.

[b]Facility No. 590, underground waste storage tanks, for disposition through DPDO.

Appendix F--Continued

Shop Name	Present Location and Dates (Building No.)		Past Location and Dates (Building No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Methods
1882nd Communications Squadron						
Communications Maintenance	255	1955-Pres.		X	--	Consumed in use
Detachment 2, 17th Military Intelligence Company (Army)						
PPIF	PB-62	--		X	X	Silver recovery to sanitary sewer

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STORAGE TANK INSPECTION SCHEDULE

FAC NO/ LOCATION	SIZE OF TANK(GALLONS)	SUBSTANCE STORED	UNDERGROUND (UG) OR ABOVEGROUND (AB)	DATE INSTALLED	TANK CUSTODIAN	DATE OF LAST IN-SPECTION	TANK CONDITION	SCHEDULED DATE OF INSPECTION
135	575	Diesel	UG	1958	DEMEP	Jun82	Good	Jun85
201	250	Gasoline	UG	1970	DEMEP	Jun82	Good	Jun85
207	600	Diesel	UG	1970	DEMEP	Jun82	Good	Jun 85
208	250	Gasoline	UG	1973	DEMEP	Jun82	Good	Jun85
210	1000	Diesel	UG	1970	DEMEP	Jun82	Good	Jun85
217	1000	Diesel	UG	1955	DEMEP	Jun82	Good	Jun85
406	1000	Avgas	AG	1955	Aero Club	Jun82	Good	Jun85
504	9500	Avgas	AG	1943	LGSF	Jun82	Good	Jun85
509	8760	PD-680	AG	1943	LGSF	Jun82	Good	Jun82
513	840000	JP-4	AG	1952	LGSF	Mar78	Good	Mar84
515	546000	JP-4	AG	1955	LGSF	Sep78	Good	Sep84
590	4@25000	JP-4	UG	1953	LGSF	Oct81	Good	Oct84
590	2@25000	Mogas	UG	1953	LGSF	Aug81	Good	Aug84
590	2@25000	Diesel	UG	1953	LGSF	Aug81	Good	Aug84
590	4@25000	POL Waste	UG	1953	LGSF	Jun82	Good	Jun85
1101	1000	Diesel	UG	1956	DEMEP	Jun82	Good	Jun85
1520	4@10000	Gasoline	UG	1970	AAFES(BX)	Jun82	Good	Jun85
1603	250	Gasoline	UG	1959	DEMEP	Jun82	Good	Jun85

AF FORM SEP 77 3132 GENERAL PURPOSE (10½" X 8")

STORAGE TANK INSPECTION SCHEDULE

FAC NO/ LOCATION	SIZE OF TANK(GALLONS)	SUBSTANCE STORED	UNDERGROUND (UG) OR ABOVEGROUND (AG)	DATE INSTALLED	TANK CUSTODIAN	DATE OF LAST IN-SPECTION	TANK CONDITION	SCHEDULED DATE OF INSPECTION
1604	600	JP-4	AG	1976	602TACC	Jun82	Good	Jun85
1610	275	Diesel	UG	1961	DEMEP	Jun82	Good	Jun85
1612	300	Diesel	AG	1980	MACP	Jun82	Good	Jun85
1613	4@275	Diesel	AG	1978	DEMEP	Jun82	Good	Jun85
1630	2@5000	Liquid Oxygen	AG	1963	LGS	Jun82	Good	Jun85
1704	500	JP-4	AG	1976	602TACC	Jun82	Good	Jun85
1803	6000	Diesel	UG	1958	LGSF	May81	Good	May84
1804	2@10000	Mogas	UG	1958	LGSF	May81	Good	May84
2700	9500	Fuel Oil	UG	1970	DEMMH	Jun82	Good	Jun85
2700	3250	Diesel	UG	1970	DEMEP	Jun82	Good	Jun85
2900	35000	Diesel	UG	1968	DEMEP	Jun82	Good	Jun85
4202	1000	Gasoline	UG	1958	DEMEP	Jun82	Good	Jun85
4514	275	Gasoline	UG	1961	DEMEP	Jun82	Good	Jun85
4517	285	Diesel	UG	1977	DEMEP	Jun82	Good	Jun85
4518	10000	Asphalt	AG	1975	DEMG	Jun82	Good	Jun85
4523	10000	Asphalt	AG	1975	DEMG	Jun82	Good	Jun85
4533	2@2000	Fuel Oil	AG	1959	DEMMH	Jun82	Good	Jun85
4535	2@2000	Fuel Oil	AG	1959	DEMMH	Jun82	Good	Jun85

AF FORM SEP 77 3132 GENERAL PURPOSE (10½" X 8")

STORAGE TANK INSPECTION SCHEDULE

FAC NO/ LOCATION	SIZE OF TANK(GALLONS)	SUBSTANCE STORED	UNDERGROUND (UG) OR ABOVEGROUND (AG)	DATE INSTALLED	TANK CUSTODIAN	DATE OF LAST IN-SPECTION	TANK CONDITION	SCHEDULED DATE OF INSPECTION
4537	8@50000	JP-4	UG	1959	LGSF	Mar81	Good	Mar84
4544	500	Diesel	UG	1972	DEMEP	Jun82	Good	Jun85
4551	575	Diesel	UG	1959	DEMEP	Jun82	Good	Jun85
4552	475	Diesel	UG	1962	DEMEP	Jun82	Good	Jun85
4553	6@50000	JP-4	UG	1956	LGSF	May81	Good	May84
4554	6@50000	JP-4	UG	1956	LGSF	Sep81	Good.	Sep84
4559	2@2000	JP-4	UG	1964	MAEA	Jun82	Good	Jun85
4559	2000	Mogas	UG	1964	MAEA	Jun82	Good	Jun85
4562	1000	Mogas	UG	1977	924 MAEA	Jun82	Good	Jun85
4564	285	Diesel	UG	1977	DEMEP	Jun82	Good	Jun85
4570	550	Gasoline	UG	1956	DEMEP	Jun82	Good	Jun85
4570	550	Fuel Oil	AG	1956	DEMMH	Jun82	Good	Jun85
4574	250	Diesel	UG	1970	DEMEP	Jun82	Good	Jun85
4575	250	Diesel	UG	1970	DEMEP	Jun82	Good	Jun85
4576	5000	JP-4	AG	1970	MACP	Jun82	Good	Jun85
4576	2500	Oil	AG	1970	MACP	Jun82	Good	Jun85
4576	1000	JP-4	AG	1970	MACP	Jun82	Good	Jun85
4577	500	Fuel Oil	UG	1958	DEMMH	Jun82	Good	Jun85

AF FORM SEP 77 3132 GENERAL PURPOSE (10½" X 8")

STORAGE TANK INSPECTION SCHEDULE

FAC NO/ LOCATION	SIZE OF TANK(GALLONS)	SUBSTANCE STORED	UNDERGROUND (UG) OR ABOVEGROUND (AG)	DATE INSTALLED	TANK CUSTODIAN	DATE OF LAST IN-SPECTION	TANK CONDITION	SCHEDULED DATE OF INSPECTION
4578	1175	JP-4	AG	1975	DEF	Jun82	Good	Jun85
4580	400	JP-4	AG	1976	602 TACC	Jun82	Good	Jun85
4580	6@5000	JP-4	AG	1976	602 TACC	Jun82	Good	Jun85
4589	1500	Fuel Oil	UG	1981	DEMMH	Jun82	Good	Jun85
6001	1000	Gasoline	AG	1958	DEMEP	Jun82	Good	Jun85
Lake Travis	2000	Gasoline	AG	1970	SSR	Jun82	Good	Jun85
			MOBILE SOURCES					
Refuel Trucks	12@5000	JP-4	N/A	N/A	LGSF	Jun82	Good	Jun85
"	1500	JP-4	N/A	N/A	LGSF	Jun82	Good	Jun85
"	2@5000	Mogas	N/A	N/A	LGSF	Jun82	Good	Jun85
"	1200	Diesel	N/A	N/A	LGSF	Jun82	Good	Jun85
Fire Trucks	2@200	Light Water	N/A	N/A	DEF	Jun82	Good	Jun85
"	100	Light Water	N/A	N/A	DEF	Jun82	Good	Jun85
"	250	Light Water	N/A	N/A	DEF	Jun82	Good	Jun85

AF FORM SEP 77 3132 GENERAL PURPOSE (10½" X 8")

Appendix H
INVENTORY OF OIL/WATER SEPARATORS

Location (Building No.)	Date of Installation	Approximate Total Volume (gal)
201	1978	400
320	1980	250
400	1972	450
507	1972	450
532	1968	320
600	1964	970
635	1972	420
725	1973	720
1520	1970	450
1602	1965	150
1610	1962	400
1612	1971	70
1618	1955	300
1801	1958	960
1807	1960	375
4533	1959	500
4534	1959	1,000
4535	1959	600
4540	1972	250
4548	1956	1,200
4562	1977	590
4576	1958	590
4577	1959	250
4586	1976	1,080
4589	1981	5,000
7105 A	1981	36,000
7105 B	1981	34,000
7105 C	1981	35,000
8024	1971	590

GNR111

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

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

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

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

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

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of

AD-A130 668 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR BERGSTROM AIR FORCE BASE TEXAS(U) CH2M HILL GAINESVILLE FL JUL 83 F08637-80-G-0010 3/3

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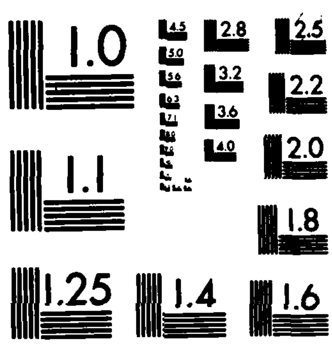

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

USAF OEHL, AFESC, various major commands, Engineering Science, and CH2M HILL met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

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

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

DESCRIPTION OF MODEL

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

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

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

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

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

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface-water migration, flooding, and 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. Scores for sites at which there is no containment are not reduced. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

GNR126

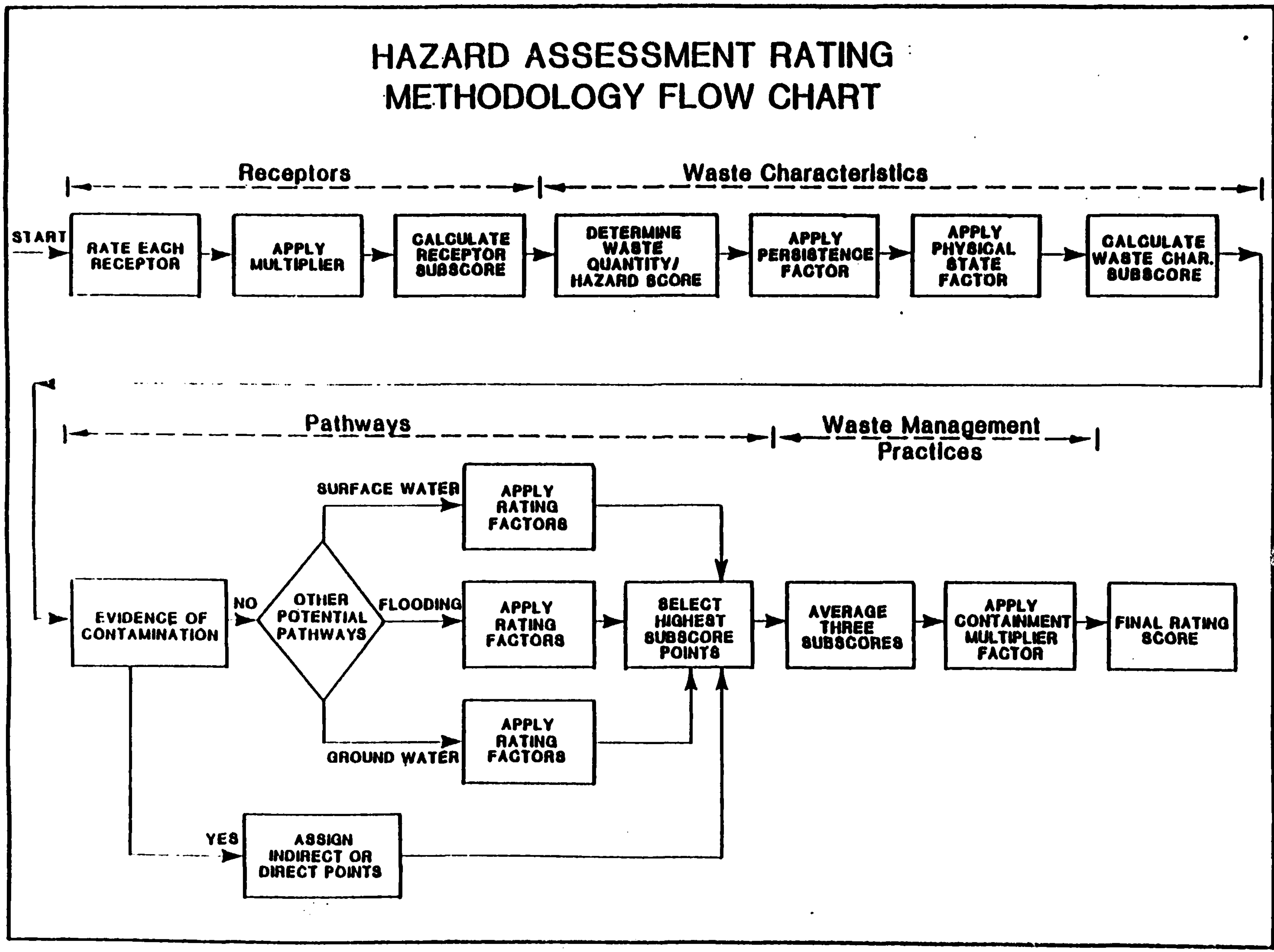
HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
Pathways
Waste Management Practices
EVIDENCE OF CONTAMINATION
NO
OTHER POTENTIAL PATHWAYS
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
YES
ASSIGN INDIRECT OR DIRECT POINTS

FIGURE 1

FIGURE 2

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE ____________________

LOCATION ____________________

DATE OF OPERATION OR OCCURRENCE ____________________

OWNER/OPERATOR ____________________

COMMENTS/DESCRIPTION ____________________

SITE RATED BY ____________________

I. RECEPTORS

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

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

II. WASTE CHARACTERISTICS

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

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

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

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

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

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.

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
Subtotals			______	______
Subscore (100 X factor score subtotal/maximum score subtotal)				______
2. Flooding		1		
Subscore (100 x factor score/3)				______
3. Ground-water migration				
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		
Subtotals			______	______
Subscore (100 x factor score subtotal/maximum score subtotal)				______

C. Highest pathway subscore.

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

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

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

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

Table 1
HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-15	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

Table 1--Continued

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- 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

S = Suspected confidence level

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

A-3 Hazard Rating

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

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

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

Table 1--Continued

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

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

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level
- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

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

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

B. Persistence Multiplier for Point Rating

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

III. PATHWAYS CATEGORY

A. Evidence of Contamination

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

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

B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($>10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall	<1.0 inch	1.0 to 2.0 inches	2.1 to 3.0 inches	>3.0 inches	8

B-2 Potential for Flooding

Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Ground-Water Contamination

Depth to ground water	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to + 20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8

Table 1--Continued

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

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

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

B. Waste Management Practices Factor

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

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

Guidelines for fully contained:

Landfills:

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

Surface Impoundments:

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

Spills:

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

Fire Protection Training Areas:

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

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III-6-3, then leave blank for calculation of factor score and maximum possible score.

GNR68A

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1943-1946

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	78	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 43

II. WASTE CHARACTERISTICS

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

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

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

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

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	43
Waste Characteristics	40
Pathways	56
Total 139 divided by 3 =	46.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

46.33 x 1.0 = 46

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1946-1952

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	78	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 43

II. WASTE CHARACTERISTICS

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

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

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

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

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore **56**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	43
Waste Characteristics	40
Pathways	56
Total 139 divided by 3 =	46.33
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

46.33 x 1.0 **46**

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1952-1957

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	98	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) S

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

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

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

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	40
Pathways	56
Total 150 divided by 3 =	50
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

50 x 1.0 = 50

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1957-1965

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	98	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 - 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	40
Pathways	56
Total 150 divided by 3 =	50
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

50 x 1.0 = 50

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1965-1971

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	94	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) S

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

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

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

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	52
Waste Characteristics	40
Pathways	56
Total 148 divided by 3 =	49.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

49.33 x 1.0 = 49

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1971-1976

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; DDT pesticide; other suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	94	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	52
Waste Characteristics	60
Pathways	56
Total 168 divided by 3 =	56
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

56 x 1.0 = 56

HAZARDOUS ASSESSMENT RATING FORM

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

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1976-1980

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Primarily domestic solid waste; suspected hazardous wastes

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	94	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) C

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	52
Waste Characteristics	40
Pathways	56
Total 148 divided by 3 =	49.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

49.33 x 1.0 = 49

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 8--JP-4 Spill/Overtopped Tank

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1975

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 spill within diked area of POL bulk storage

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	82	180

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

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

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

80 x 0.8 = 64

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x .10 = 64

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	46
Waste Characteristics	64
Pathways	56
Total 166 divided by 3 =	55.33
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

55.33 x .95 = 53

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 9--JP-4 Spill/Open Pipeline

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: March 1982

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	82	180

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	46
Waste Characteristics	40
Pathways	56
Total 142 divided by 3 =	47.33
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

47.33 x 0.95 = 45

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 10--JP-4 Spill/Faulty Valve

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: September 1982

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	82	180

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	46
Waste Characteristics	40
Pathways	56
Total 142 divided by 3 =	47.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

47.33 x 0.95 = 45

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 12--Dibrom/Diesel Fuel Spill

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1975

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Dibrom/Diesel Mixture

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	3	10	30	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	104	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

40 x 0.8 = 32

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

32 x 1.0 = 32

III. PATHWAYS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
				Subscore	--
B.	Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
	1. Surface-water migration				
	Distance to nearest surface water	3	8	24	24
	Net precipitation	0	6	0	18
	Surface erosion	0	8	0	24
	Surface permeability	2	6	12	18
	Rainfall intensity	3	8	24	24
			Subtotals	60	108
	Subscore (100 x factor score subtotal/maximum score subtotal)				56
	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	1	8	8	24
	Subsurface flows	0	8	0	24
	Direct access to ground water	NA	8	--	--
			Subtotals	24	90
	Subscore (100 x factor score subtotal/maximum score subtotal)				27
C.	Highest pathway subscore				
	Enter the highest subscore value from A, B-1, B-2, or B-3 above.				
			Pathways Subscore		56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	58
Waste Characteristics	32
Pathways	56
Total 146 divided by 3 =	48.67
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48.67 x 0.95 = 46

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 13--MOGAS Spill at Motor Pool Area

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1974-1978

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: MOGAS spill over 4-year period

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	96	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

80 x 0.8 = 64

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.0 = **64**

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	53
Waste Characteristics	64
Pathways	56
Total 173 divided by 3 =	57.67
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

57.67 x 1.0 = 58

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 14--Road Oiling Area

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: Mid-1950s to 1962

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Road dust control with waste oils, possibly contaminated with solvents

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	98	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) S

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

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

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

50 x 1.0 = 50

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

50 x 1.0 = 50

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54
Waste Characteristics	50
Pathways	56
Total 160 divided by 3 =	53.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

53.33 x 1.0 = 53

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 15--JP-4 Spill/Apron Excavation

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1955

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 accumulation beneath apron area

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	2	4	8	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	2	6	12	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	92	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore **56**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51
Waste Characteristics	40
Pathways	56
Total 147 divided by 3 =	49
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

49 x 0.95 **47**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 16--JP-4 Spill/Refueling Truck

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1974

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation 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	1	9	9	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	88	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	49
Waste Characteristics	40
Pathways	56
Total 145 divided by 3 =	48.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48.33 x 1.0 = 48

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 17--South Fork Drainage Ditch

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1943 to present

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: AVGAS, JP-4 oils

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface-water body	3	6	18	18
G. Ground-water use of uppermost aquifer	1	9	9	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	94	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

80 x 0.8 = 64

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.0 = 64

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	80
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore **80**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	52
Waste Characteristics	64
Pathways	80
Total 196 divided by 3 =	65.33
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

65.33 x 1.0 = **65**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 18--JP-4 Spill at Fuel Systems Maintenance Facility

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1982

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	78	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 43

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 0.8 = 48

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.0 = 48

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	43
Waste Characteristics	48
Pathways	56
Total 147 divided by 3 =	49
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

49 x 1.0 = 49

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 19--JP-4 Spill from Aircraft Fuel Tank

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: January 1981

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4 spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	78	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 43

II. WASTE CHARACTERISTICS

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

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	43
Waste Characteristics	40
Pathways	56
Total 139 divided by 3 =	46.33
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

46.33 x 0.95 = 44

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 20--Fuel Tank Jettison Area

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: Late 1950s to present

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: JP-4

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	0	4	0	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	90	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) C

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	50
Waste Characteristics	40
Pathways	56
Total 146 divided by 3 =	48.67
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48.67 x 1.0 = 49

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 21--Old Entomology Rinse Area

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1951-1973

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Pesticide contamination

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation 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	1	9	9	27
H. Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	82	180

Receptors subscore (100 x factor score subtotal/maximum 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 (S = small, M = medium, L = large) S

2. Confidence level (C = confirmed, S = suspected) C

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

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

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

60 x 1.0 = 60

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.0 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore **48**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	46
Waste Characteristics	60
Pathways	48
Total 154 divided by 3 =	51.33
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

51.33 x 1.0 = **51**

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 22--Sludge Weathering Pit

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: ? to 1962

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Weathering site for AVGAS sludge

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	84	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) S

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

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

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

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	47
Waste Characteristics	40
Pathways	56
Total 143 divided by 3 =	47.67
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

47.67 x 1.0 48

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 23--Fire Department Training Area

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1943 to present

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Fire department training area; waste oils, fuels, solvents

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	78	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 43

II. WASTE CHARACTERISTICS

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

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

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

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

80 x 1.0 = 80

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	52	108
Subscore (100 x factor score subtotal/maximum score subtotal)				48
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 48

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	43
Waste Characteristics	60
Pathways	48
Total 171 divided by 3 =	57.00
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

57.00 x 1.0 = 57

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 25--Asphalt Primer Spill/Avenue F

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1981

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Asphalt primer spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	3	6	18	18
G.	Ground-water use of uppermost aquifer	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	92	180

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

II. WASTE CHARACTERISTICS

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

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

2. Confidence level (C = confirmed, S = suspected) C

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

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

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

Subscore --

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51
Waste Characteristics	40
Pathways	56
Total 147 divided by 3 =	49
	Gross Total Scor

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

49 x 1.0 = 49

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Site No. 26--Asphalt Primer Spill/Star Drive

LOCATION: Bergstrom AFB

DATE OF OPERATION OR OCCURRENCE: 1981

OWNER/OPERATOR: Bergstrom AFB

COMMENTS/DESCRIPTION: Asphalt primer spill

SITE RATED BY: D. Moccia, G. McIntyre, B. Knight

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	3	4	12	12
B.	Distance to nearest well	2	10	20	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation 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	1	9	9	27
H.	Population served by surface-water supply within 3 miles downstream of site	0	6	0	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	96	180

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

II. WASTE CHARACTERISTICS

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

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

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

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

50 x 0.8 = 40

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.				
			Subscore	--
B. Rate the migration potential for three potential pathways: surface-water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.				
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
		Subtotals	60	108
Subscore (100 x factor score subtotal/maximum score subtotal,				56
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	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	NA	8	--	--
		Subtotals	24	90
Subscore (100 x factor score subtotal/maximum score subtotal)				27

C. Highest pathway subscore

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

Pathways Subscore **56**

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	53
Waste Characteristics	40
Pathways	56
Total 149 divided by 3 =	49.67
	Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

49.67 x 1.0 = **50**

Gross Total Score x Waste Management Practices Factor = Final Score

46.33 x 0.95 = 44

Appendix K
GUIDELINES FOR A LIMITED PHASE II MONITORING PROGRAM FOR BERGSTROM AFB

I. INTRODUCTION

The Phase II Installation Restoration Program will generate the field data needed to confirm or rule out the existence of hazardous contaminant migration at the indentified sites. If appropriate, these data will be used in developing conceptual engineering remedial action alternatives.

The field studies may consist of two subphases: the initial field confirmation investigation and the follow on investigation. The initial field investigation includes those minimal surveys considered necessary to define the nature of the problem and determine the presence of contamination or contaminant migration at the site. If the initial investigation determines that there is no evidence of contamination, the site will be dropped from further study or deferred to long-term monitoring. If the initial investigation determines that there is indeed contamination, a decision will be made whether or not to conduct a follow on investigation, based on considerations of the environmental setting, the reliability of the data, and the remedial action alternatives. Thus, remedial actions, if necessary, can be evaluated and costed at an appropriate IRP phase. In some cases conceptual engineering evaluations can be conducted following initial field investigations. In other cases, detailed information on contaminant extent, rates of migration, fluctuation, and concentration may be advisable before an appropriate evaluation of remedial actions can be undertaken. Remedial actions may include monitoring, containment, removal, or treatment.

II. SAMPLING LOCATIONS, ANALYSES, AND DATA EVALUATION

Sampling is recommended for the South Fork Drainge Ditch (Site No. 17), the MOGAS Spill at the Motor Pool Area (Site No. 13), the Fire Department Training Area (Site No. 23), the Southeast Landfill Area (Sites No. 3, 4, 5, 6, 7, and 14), and the JP-4 Spill/Overtopped Tank (Site No. 8). Figure 19 shows the locations of all sites recommended for limited Phase II monitoring. Preliminary sampling locations are shown on Figures 20 through 24. Final sampling point selection should be done by the Phase II contractor after a preliminary site visit. The purpose of the preliminary site visit will be to:

- o Establish base contact.
- o Observe and record site features.
- o Establish approximate areal limits of the sites and identify any obstructions.
- o Locate utilities present at sites, if any.
- o Identify any unusual or potentially hazardous conditions, if any, that could impact well installation or sampling programs.
- o Select the final sampling locations.

The analyses suggested for the limited Phase II program have been described previously in Section VI, "Recommendations," Table 9. Soil samples collected at Sites No. 17, 13, 23, and 8, should be collected once. Ground-water samples collected from monitoring wells at the Southeast Landfill Area should be collected on two occasions at least 30 days apart.

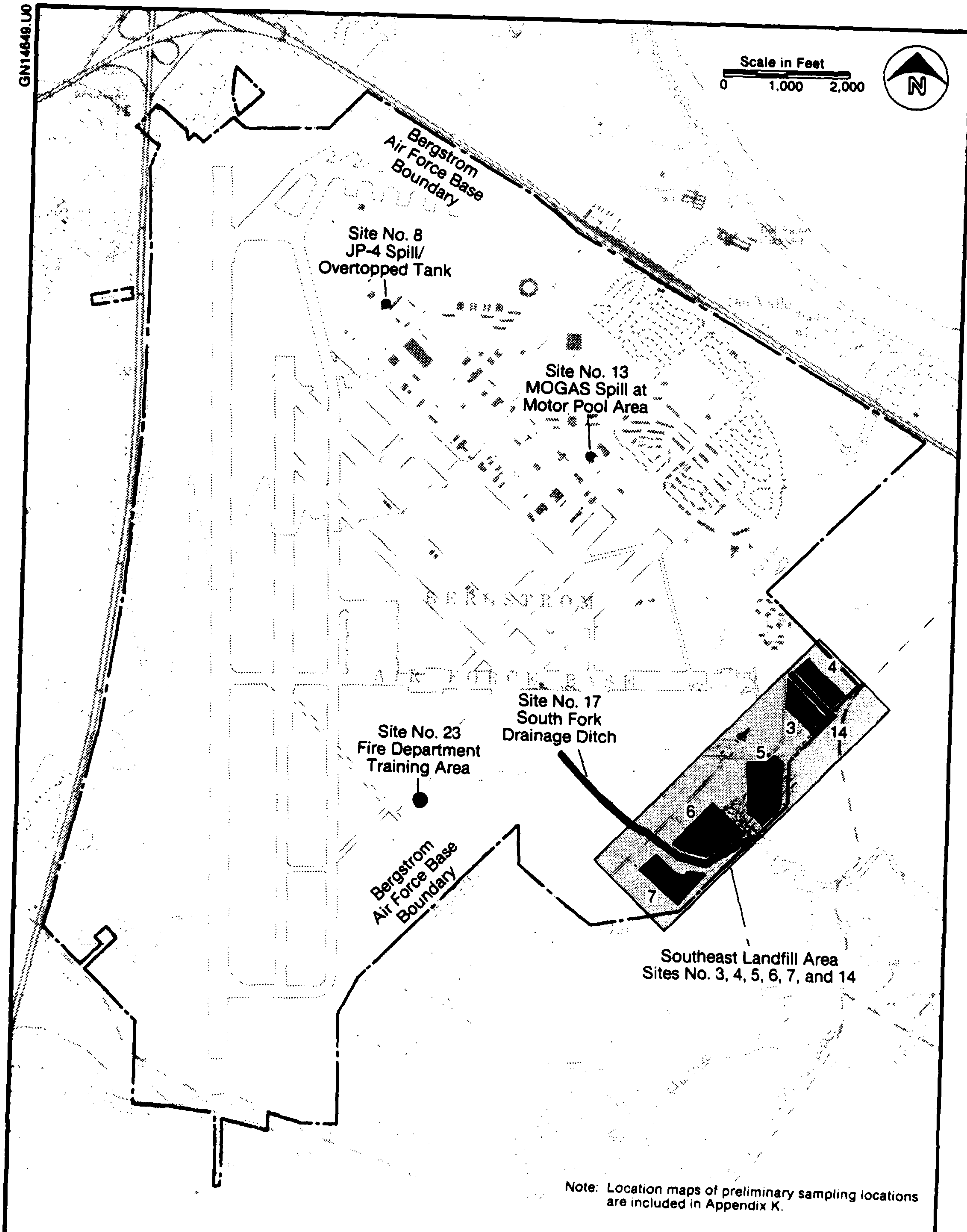

FIGURE 19.
Location Map of Sites Recommended for Limited Phase II Monitoring.

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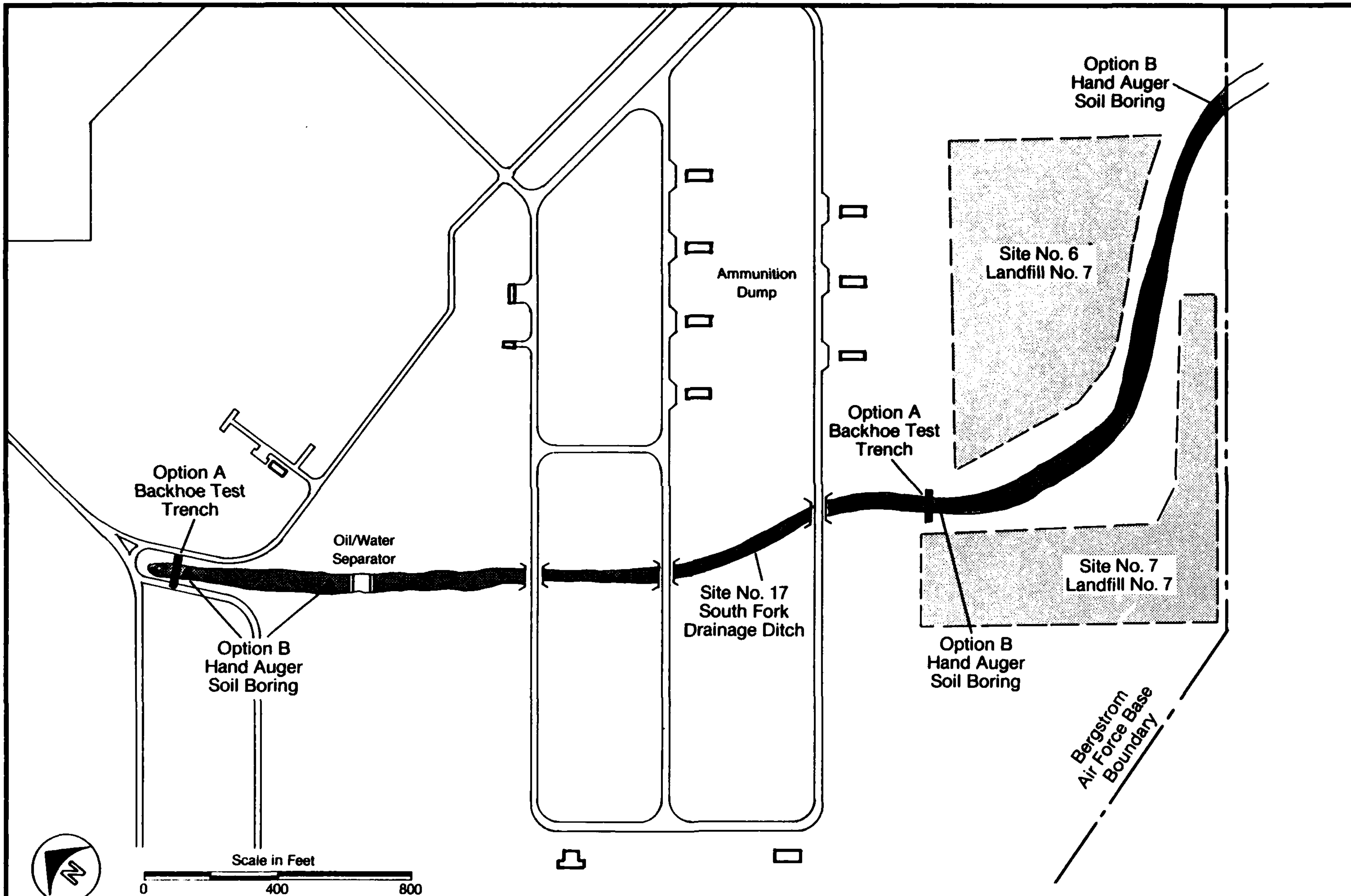

FIGURE 20.
Recommended Preliminary Sampling Locations for Site No. 17—
South Fork Drainage Ditch.

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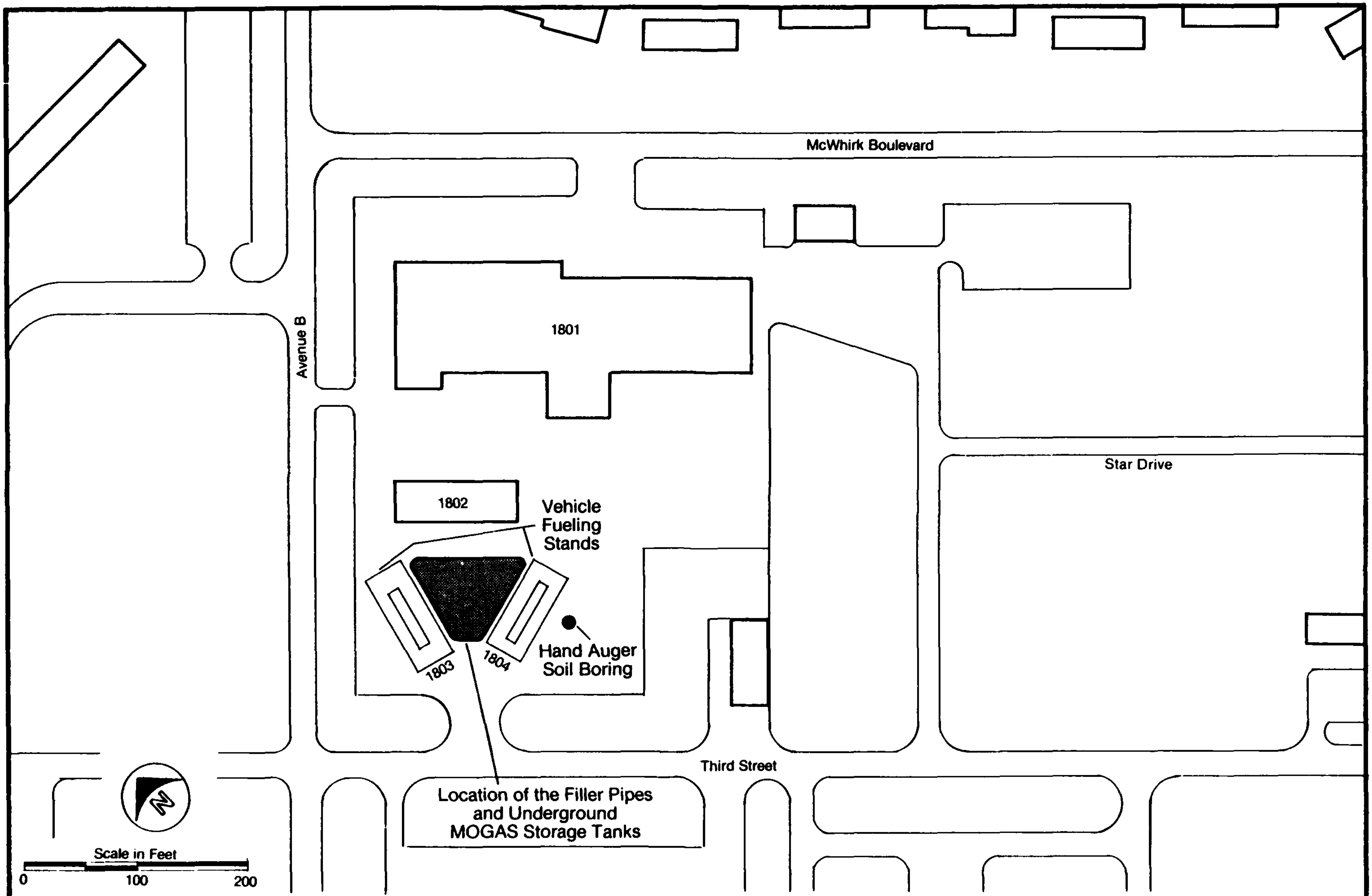

FIGURE 21.
Recommended Preliminary Sampling Locations for Site No. 13—MOGAS Spill at Motor Pool Area.

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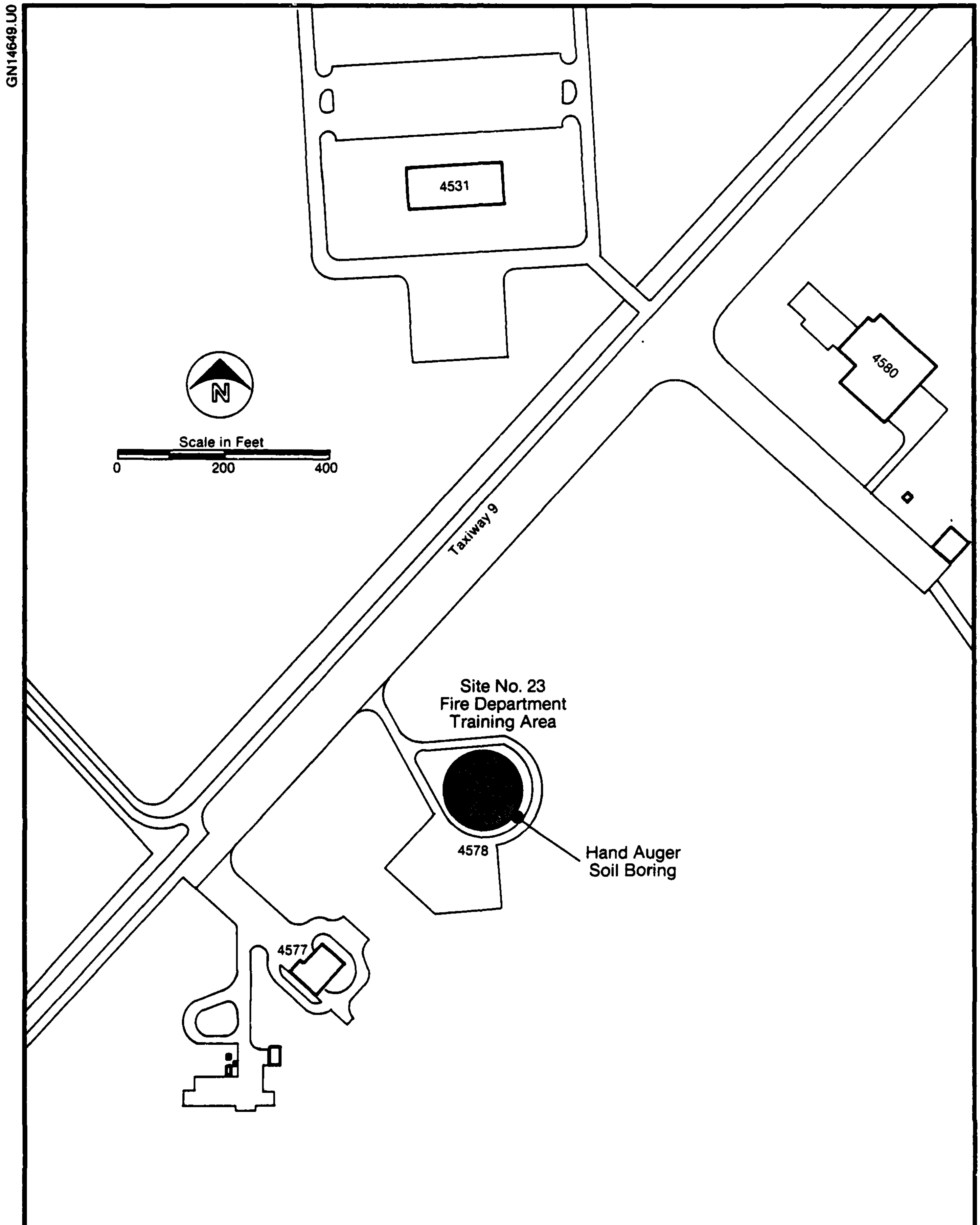

FIGURE 22.
Recommended Preliminary Sampling Locations for Site No. 23—
Fire Department Training Area.

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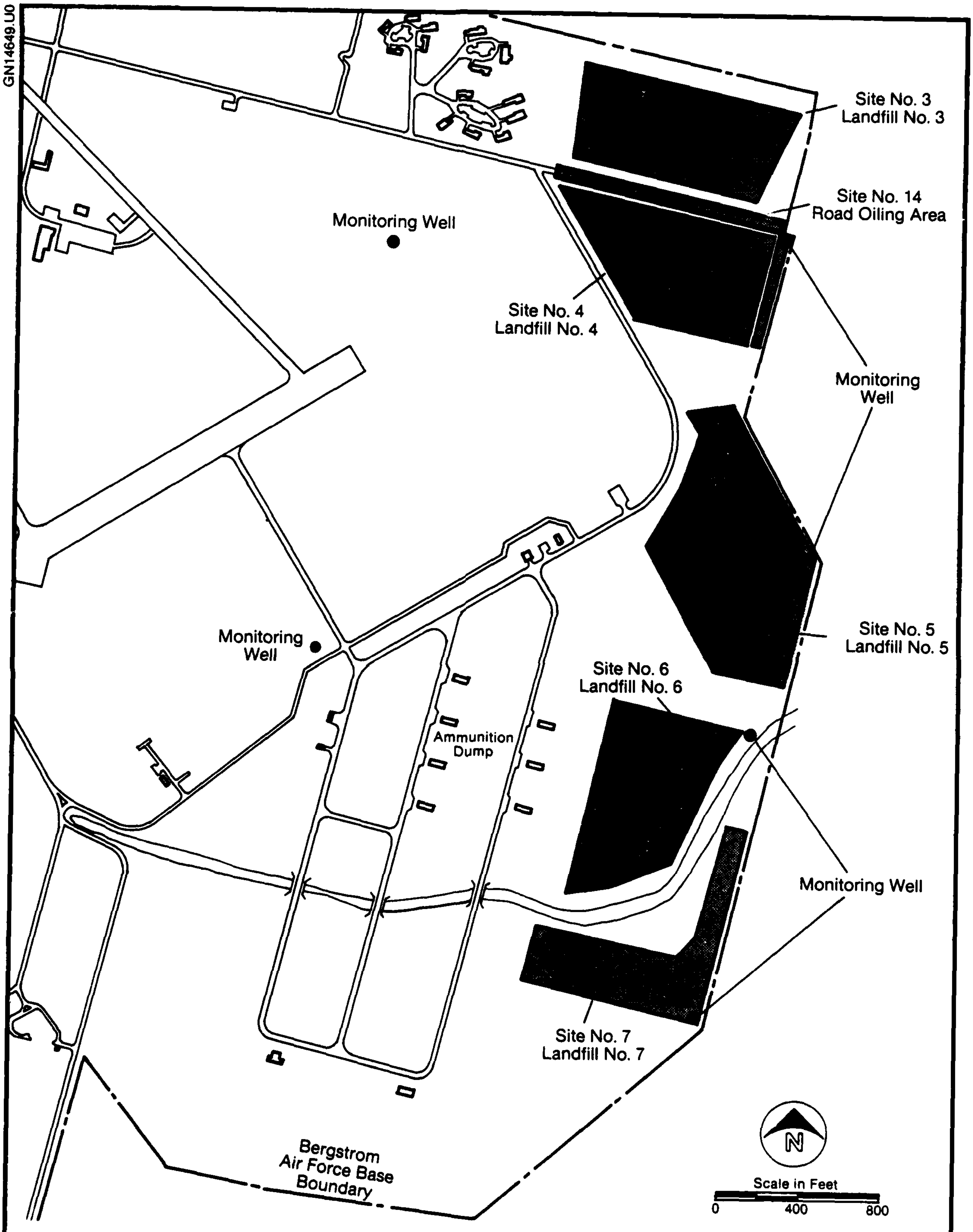

FIGURE 23.
Recommended Preliminary Sampling Locations for Areawide Sampling of the Southeast Landfill Area— Sites No. 3, 4, 5, 6, 7, and 14.

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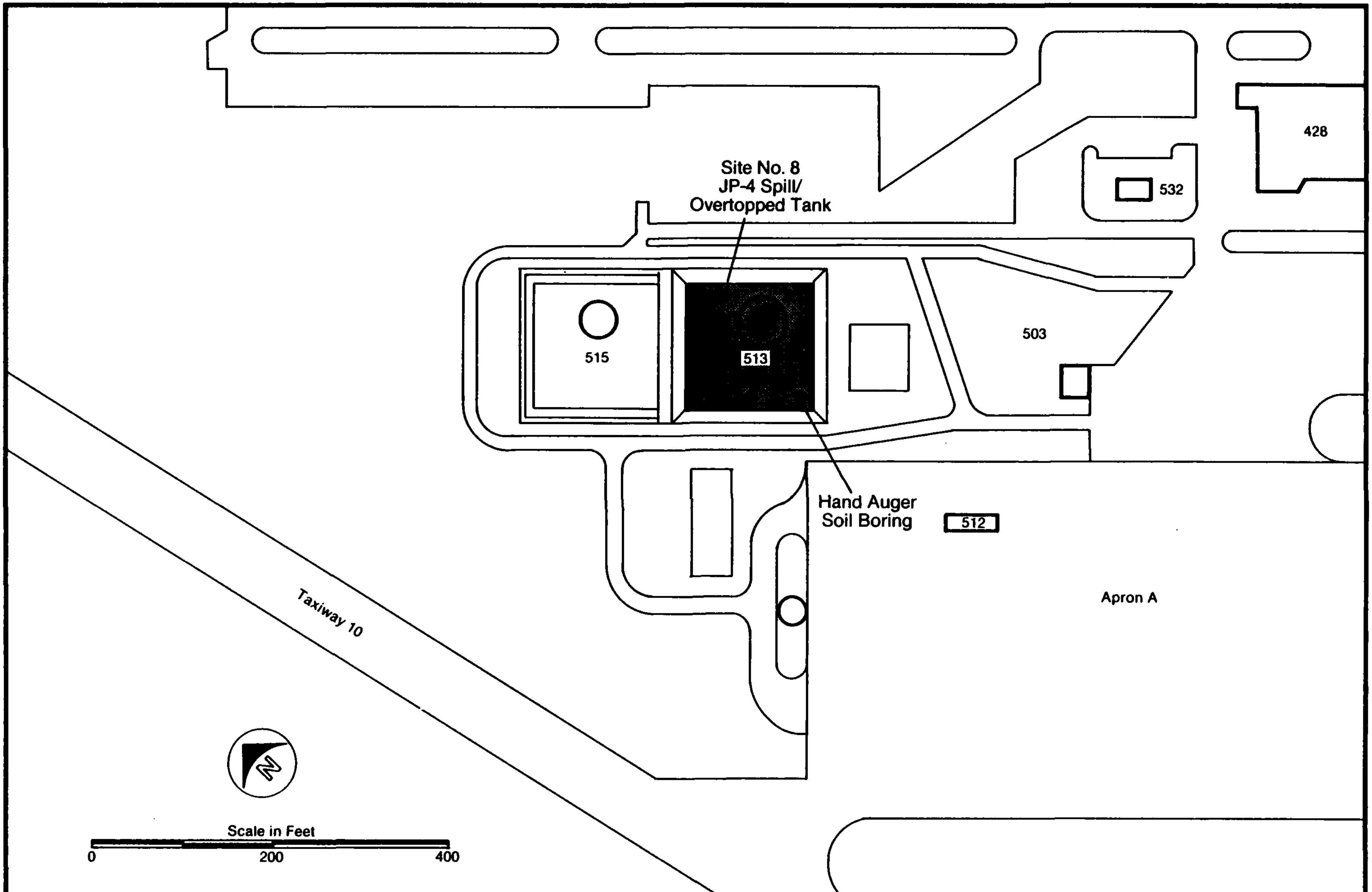

FIGURE 24.
Recommended Preliminary Sampling Locations for Site No. 8—
JP-4 Spill/Overtopped Tank.

The data collected should be evaluated in terms of applicable ground and surface water quality criteria. If water quality standards or criteria are not available for some of the parameters, then it is suggested that available toxicological information be used.

For the Southeast Landfill Area (Sites No. 3, 4, 5, 6, 7, and 14) (ground-water samples), three general cases are possible:

Case 1: Both samples indicate pollutants are not present or are present at levels below the recommended water quality standards or criteria or below recommended levels based on toxicological information.

Case 2: Both samples indicate pollutants are present and at levels higher than the recommended water quality standards or criteria or the recommended levels based on toxicological information.

Case 3: One of the two samples shows the presence of pollutants at levels higher than the recommended water quality standards or criteria or the recommended levels based on toxicological information.

Suggested actions for dealing with each case are given below:

Case 1 Action--If none of the analyzed pollutants are detected, delete the study site from further consideration. If one or more pollutants are detected but at levels lower than the recommended levels, then based upon an evaluation of the number, type, and concentrations of pollutants found, consideration should be given to continued monitoring or deleting the site from further action.

Case 2 Action--Develop a program to determine the extent of contaminant migration. As a minimum, the following would be applicable:

- o Confirm ground-water flow direction.
- o Establish background ground-water quality.
- o Define local extent of leachate plume.
- o Define the rock profile, soil material types, and distribution.
- o Obtain any additional information deemed necessary by the contractor to develop conceptual remedial action alternatives.

Case 3 Action--Collect a third sample at least 30 days after the second sample was collected. If the third sample shows the presence of contaminants in excess of the recommended levels, follow Case 2 action. If the sample shows no contaminants present or at levels below the recommended levels, follow Case 1 action.

For Sites No. 17, 13, 23, and 8 (soil samples), two general cases are possible:

Case 1: The samples indicate that pollutants are not present or are present at low levels.

Case 2: The samples indicate that pollutants are present at high levels.

Suggested actions for dealing with each case are given below:

Case 1 Action--If none of the analyzed pollutants are detected, delete the study site from further consideration. If one or more pollutants are detected but at low levels, then based upon an evaluation of the number, type, and concentration of pollutants found, consideration should be given to continued monitoring or deleting the site from further action.

Case 2 Action--Develop a program to determine the extent of contaminant migration. As a minimum, the following would be applicable at both study sites:

- Define vertical extent of contaminant migration, e.g., deeper soil borings.
- Define the areal extent of contaminant migration with more sampling locations.
- Define the necessity of monitoring well installation based on an evaluation of the data obtained from the additional soil borings.

III. MONITORING WELL INSTALLATION

Construction of monitoring wells during either the initial field confirmation investigation or the follow on investigation should follow the procedures described in this appendix. A qualified and experienced geologist should be present with each rig throughout the well drilling to direct progress of the work, log all soil samples, record all pertinent observations, and label all samples. This field representative should also direct the development of the wells and conduct the field permeability tests (aquifer tests).

Soil Sampling and Logging

A soil boring should be made at each proposed monitoring well location prior to installation of the well casing. The results of the soil boring will be used to confirm the anticipated soil stratification, permeabilities, bedrock depth and type, and ground-water table. Details of the monitoring well construction may be adjusted appropriately based on these findings, including screened interval, depth of well, gravel-pack gradation, screen slot size, or installation/development methodology. In addition, soil samples will be obtained which may be used to confirm anticipated soil properties such as gradation, plasticity, or permeability by performing appropriate laboratory tests. In addition, soil samples may be submitted for pollutant analysis based upon the discretion of the field representative and any observations of contamination made during the soil sample logging.

The soil borings should be made using a 4- to 6-inch nominal diameter hollow-stem auger. Disturbed soil samples are to be taken at 5-foot intervals and at other intermediate depths as may be required, in the judgment of the field representative, to adequately describe the subsurface conditions. Samples may be obtained by using either a 2-inch outside diameter split-spoon sampler or a 3-inch outside diameter thin-walled Shelby tube. After sampling has been completed, the soil borings should be properly sealed to prevent a pathway for contaminant migration.

The soils encountered should be classified by the field representative in accordance with the Unified Soil Classification System (ASTM D2488) and in accordance with any specific DoD requirements. The soil description should include the soil name, gradation or plasticity, estimated particle-size distribution, color, moisture content, relative density or consistency, soil structure or minerology, local or geologic name, and the USGS group symbol. Any abnormal behavior encountered during the drilling operations should be noted, such as changes in drilling rates or stratification.

Well Installation

The recommended construction of each well is shown schematically on Figure 25. In general, the wells at the Southeast Landfill Area should be installed so that the slotted section of the wells is located between a depth of 40 to 50 feet below the ground surface, within the terrace deposits of the Colorado River. Final depth of the wells is expected to be approximately 50 feet below the ground surface.

The wells should be drilled using a continuous hollow-stem auger at least 6 inches in diameter by reaming the borehole made during the soil boring. Well casings should consist of 2-inch-diameter Schedule 40 PVC pipe with threaded (screw-type) joints; no adhesive compounds should be used. The well screen will vary in length, depending on the total depth of the well. The screen should consist of factory-fabricated slots between .01 and .04 inches wide.

The well casing and screen should be positioned inside the hollow stem. A washed, medium-grained sand, similar to concrete sand (ASTM C33) should then be placed around the

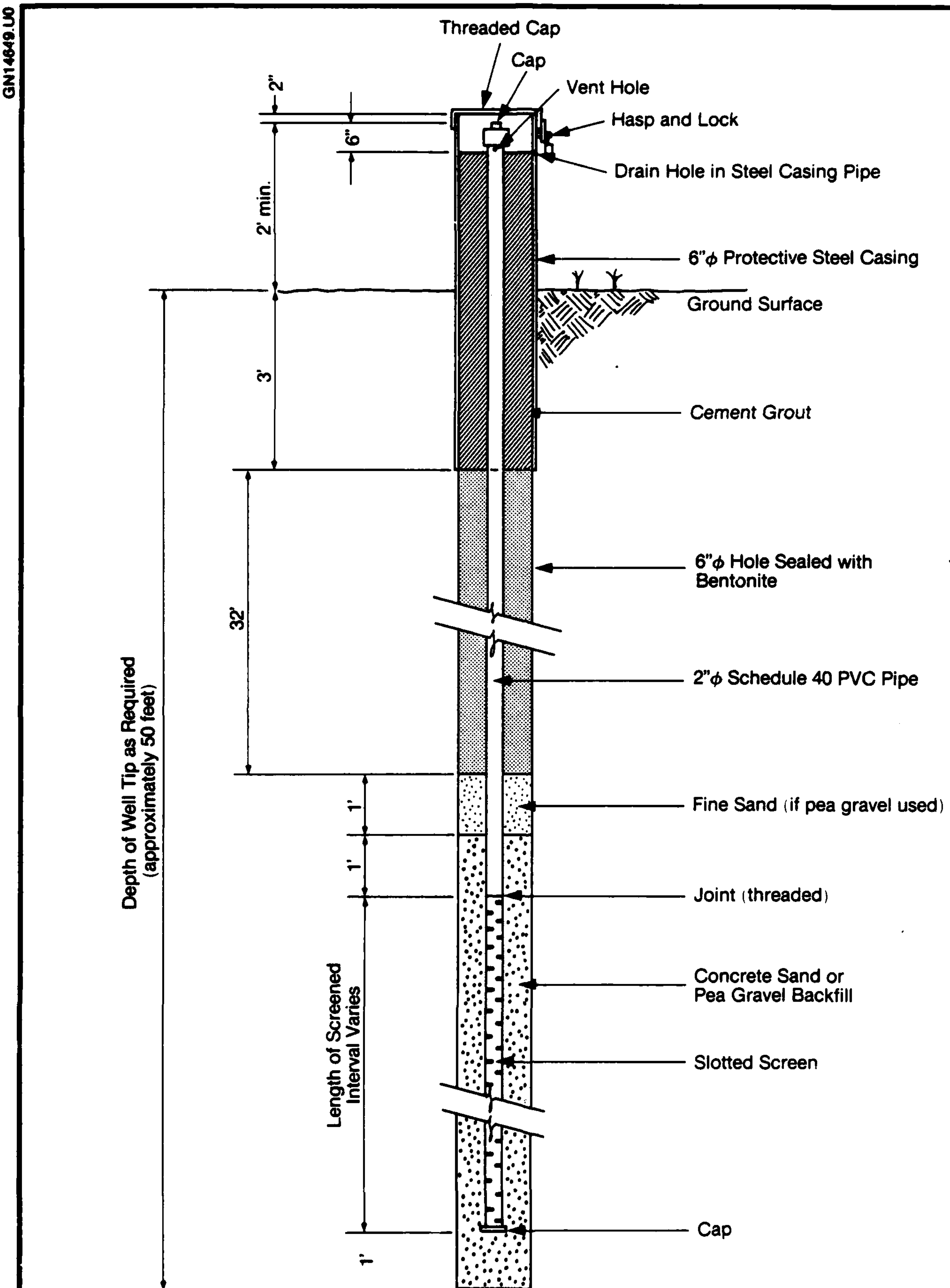

FIGURE 25.
Typical Monitoring Well Installation.

screen and the hole. The Phase II contractor should be responsible for selecting the exact slot size and backfill gradation for the well.

Above the sand or gravel backfill, a 3-foot interval of bentonite clay pellets should be used to seal the well. Neat cement grout, consisting of about 7 gallons of water per 94-pound bag of Portland cement, should be used to fill the annulus above the bentonite at the ground surface.

Each well casing should rise about 2 feet above the ground surface and should be capped with an unthreaded, removable PVC cap. A 6-inch-diameter steel pipe should be placed over the casing and embedded at least 3 feet. A threaded cap should be placed on top of the steel pipe, with a hasp and key-lock padlock to secure the well.

Well Development

Once a well has been completed, it should be developed by bailing the hole a minimum of 5 times its volume below the water table, or until the resulting water is, in the opinion of the field inspector, sufficiently clear to ensure proper functioning of the developed well. Methods of well development that cause reversals of flow, or surging, through the screen may be used. Static water levels should be measured and recorded both prior to and at least 24 hours following well development.

Aquifer tests consisting of rising head field permeability tests should be performed in each completed and developed well.

Well Survey

Each monitoring well should be surveyed to establish horizontal control within about 3 feet; these locations should be shown on existing installation maps. Vertical control should be established within about 0.1 foot with respect to USGS datum (mean sea level) for the ground surface and the top of each PVC well casing.

IV. SAMPLING PROTOCOL GUIDELINES

A sampling protocol is a plan that addresses the steps necessary to ensure the technical adequacy and validity of a sampling and analysis program. A sampling program should address the following items:

- Sample bottle preparation
- Sampling procedure
- Sample preservation and holding times
- Sample shipping
- Record keeping
- Analytical procedures
- Quality assurance

Sample Bottle Preparation

Sample bottle preparation includes selecting the type and size container and the proper cleaning procedure to protect against sample contamination. All three items are dependent upon the parameter to be tested for. EPA-recommended procedures for sample bottle preparation should be followed.

Sampling Procedure

Specific sampling procedures must be developed. These procedures are dependent on the nature of the sampling location (i.e., well, surface stream, etc.), the size of sample required, and any special techniques necessary due to the nature of the parameter or parameters to be tested.

Sample Preservation and Holding Times

Requirements for sample preservation and holding times are specific to the parameters being tested. Typical preservation techniques may include adding a chemical preservative to the sample and keeping the sample cooled to 4°C until time for analysis. Holding times are critical. When properly preserved, some samples can be stored for days while others should be analyzed as soon as possible. EPA-recommended sample preservation procedures and holding times should be adhered to.

Sample Shipping

Sample shipping should be planned to minimize in-transit times. Proper protection should be provided to minimize the possibility of breakage or sample spoilage.

Record Keeping

Record keeping should include tagging each sample with the pertinent information such as sample number, location, time of collection, required analyses, etc. Chain-of-custody records should be maintained to provide a record of the routing of each sample and the names of the personnel receiving and handling the samples.

Analytical Procedures

The analytical procedures to be used must be standard approved methods and should be properly referenced. Any deviations from standard approved procedures should be well documented and agreed to by the proper parties in advance.

Quality Assurance

Quality assurance of analytical results should be maintained throughout a sampling program. Elements of a quality assurance program may include the periodic analysis of blank samples to determine if sample contamination is occurring. To verify the accuracy of the laboratory, samples spiked with a known quantity of the constituent to be tested should occasionally be submitted for analysis. Another technique to verify laboratory accuracy involves splitting samples between the prime lab and one or more other labs.

V. HEALTH AND SAFETY PLAN

A. The Phase II contractor must take appropriate measures to ensure the health and safety of his employees. Each of the study sites was visited by the Phase I contractor and, based on his visits, the sites do not appear to pose a significant hazard to visiting personnel. The samples that will be collected at each site are environmental water, soil, and sediment samples as opposed to "hazardous waste" samples and no need for unusual levels of personal protection are anticipated. Nonetheless, the Phase II contractor will have the final responsibility for determining the necessary health and safety measures.

B. The Phase II contractor should have health and safety plans that address, as a minimum, the following items:

- Responsibility of employees with regard to safety
- Pathways of personal physical exposure
- Initial hazard assessment
- Emergency treatment
- Safety and protective equipment

1. Employee Safety

When visiting the sites, employees should use common sense, judgment, and experience. They should have reviewed in advance all existing data on the site to determine if any safety precautions are necessary.

2. Pathways of Physical Exposure

The Phase I study indicated that hazardous wastes may have been disposed of in the past at the identified sites. Because of the potential for exposure to these wastes, personnel should be aware of the pathways by which the materials can enter their body and how to prevent that entry. There are four (4) pathways:

- Inhalation
- Skin absorption
- Ingestion
- Eye contact

Inhalation is best prevented by not breathing in direct proximity to the waste or using a respirator appropriate for the type of hazardous material.

To prevent or minimize skin absorption, a combination of gloves, boots, hats, and coveralls should be worn. Although this clothing does not provide absolute protection, it should provide ample protection for personnel working at the identified sites.

To prevent ingestion, do not eat, drink, or smoke during visits to the identified sites.

To prevent eye contact, wear safety glasses, chemical goggles, or a face shield (without side perforations); do not rub eyes; and do not wear contact lenses. (Contact lenses cannot be worn with self-contained breathing apparatus or respirators.)

3. Initial Site Hazard Assessment

The Phase II contractor should conduct an initial site hazard assessment to determine the hazards that may exist at the site. He should review all available information on the sites to determine what protective clothing and equipment are required for the site visits.

4. Emergency Treatment

Before entering each site, the field team should know the locations and telephone numbers of the nearest emergency facilities (medical, fire, police, etc.). It is advisable that all field personnel have training in first aid and be prepared to provide emergency treatment for inhalation or ingestion of hazardous materials and skin exposure to or eye contact with hazardous materials.

5. Safety and Personnel Protective Equipment

For adequate protection against exposure to hazardous substances, should they be encountered at the identified sites, it is advisable that all employees have available first aid and safety equipment, protective clothing, and respiratory equipment. As a minimum, first aid equipment should include a first aid kit and a first aid handbook. Other first aid items include a supply of clean water, a potable eyewash unit, and oxygen bottles. Safety equipment might include an explosivity meter, radiation detector, organic vapor analyzer, and a list of emergency telephone numbers.

Protective clothing that might be needed in the field includes safety glasses, goggles and/or face shield, protective boots, protective gloves, spill-resistant coveralls, or plain coveralls with chemical protective apron worn over them.

Three kinds of respiratory protection devices are available:

- Self-contained breathing apparatus (SCBA)
- Supplied air or air line respirator

o Air-purifying respirator

Determination of the proper type to use and its use requires formal training. The self-contained breathing apparatus provides the most complete breathing protection for periods of time based on the amount of breathing air supplied and the breathing demand of the wearer. Normally, protection is provided for about 20 minutes.

The supplied air device delivers air through a supply hose and is generally used for long-term entry into a hazardous area.

The air-purifying device removes contaminants from the atmosphere to some degree and can be used only in atmospheres containing sufficient oxygen to sustain life.

Should it be determined that respiratory equipment is warranted at the identified study site, the air-purifying device would probably be the most applicable device.

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