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**INSTALLATION RESTORATION PROGRAM  
PRELIMINARY ASSESSMENT**

**254th COMBAT COMMUNICATIONS GROUP  
221st COMBAT COMMUNICATIONS SQUADRON  
GARLAND AIR NATIONAL GUARD STATION  
TEXAS AIR NATIONAL GUARD  
GARLAND, TEXAS**

Prepared for

**National Guard Bureau  
Andrews Air Force Base, Maryland 20331-6008**

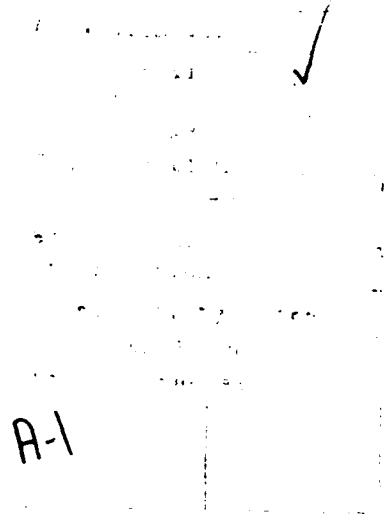


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Submitted to

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December 1990

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## ACRONYM LIST

AGE	Aerospace Ground Equipment
CCGP	Combat Communications Group
CCSQ	Combat Communications Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
EO	Executive Order
EPA	Environmental Protection Agency
FR	Federal Register
FS	Feasibility Study
HARM	Hazard Assessment Rating Methodology
HAS	Hazard Assessment Score
HAZWRAP	Hazardous Waste Remedial Actions Program
IRP	Installation Restoration Program
MOGAS	Automotive Gasoline
NGB	National Guard Bureau
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyl
PL	Public Law
POC	Point of Contact
RCRA	Resource Conservation and Recovery Act of 1976
R&D	Research and Development
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act of 1986
SciTek	Science & Technology, Inc.
SI	Site Investigation
USAF	United States Air Force
USC	United States Code
UTA	Unit Training Assembly

## EXECUTIVE SUMMARY

### A. INTRODUCTION

Science & Technology, Inc. (SciTek) was retained to conduct the Installation Restoration Program (IRP) Preliminary Assessment (PA) of the 254th Combat Communications Group (CCGP) and the 221st Combat Communications Squadron (CCSQ), Garland Air National Guard Station [hereinafter referred to as the Station] located at Garland, Texas. For the purpose of this document, the Station shall include the total area leased by the 254th CCGP and the 221st CCSQ at Garland, Texas.

The PA included the following activities:

- o an on-site visit, including interviews with a total of eight persons familiar with Station operations, and field surveys by SciTek representatives during June 18-22, 1990;
- o acquisition and analysis of information on past hazardous materials use, waste generation, and waste disposal at the Station;
- o acquisition and analysis of available geological, hydrological, meteorological, and environmental data from federal, state, and local agencies; and
- o the identification and assessment of sites on the Station that may have been contaminated with hazardous wastes.

### B. MAJOR FINDINGS

The 254th CCGP and the 221st CCSQ have used hazardous materials and generated small amounts of wastes in mission-oriented operations and maintenance at the Station since 1959.

Operations that have involved the use of hazardous materials and the disposal of hazardous wastes include vehicle maintenance and maintenance of aerospace ground equipment (AGE). The hazardous wastes disposed of through these operations include varying quantities of fuels, acids, paints, thinners, strippers, solvents, and oils.

The field surveys and interviews resulted in one site being identified that exhibits the potential for contaminant presence and migration.

### **C. CONCLUSIONS**

It has been concluded there is one site at the Station where a potential for contaminant presence exists. This site is as follows:

Site No. 1 - Station Drainage Area and Fence Line (HAS - 66)

### **D. RECOMMENDATIONS**

Further work under the IRP is recommended for the identified site to determine the presence or absence of contamination.

## I. INTRODUCTION

### A. Background

The 254th Combat Communications Group (CCGP) and the 221st Combat Communications Squadron (CCSQ), Garland Air National Guard Station [hereinafter referred to as the Station] is located at Garland, Texas. The 254th CCGP and the 221st CCSQ have been active at their present location since 1959. Both the past and current operations have involved the use of potentially hazardous materials and the disposal of wastes. Because of the use of these materials and the disposal of resultant wastes, the National Guard Bureau (NGB) has implemented the Installation Restoration Program (IRP).

The IRP is a comprehensive program designed to:

- o Identify and fully evaluate suspected problems associated with past hazardous waste disposal and/or spill sites on Department of Defense (DoD) installations and
- o Control hazards to human health, welfare, and the environment that may have resulted from these past practices.

During June 1980, DoD issued a Defense Environmental Quality Program Policy Memorandum (DEQPPM 80-6) requiring identification of past hazardous waste disposal sites on DoD installations. The policy was issued in response to the Resource Conservation and Recovery Act of 1976 (RCRA) and in anticipation of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, Public Law (PL) 96-510), commonly known as "Superfund." In August 1981, the President delegated certain authority specified under CERCLA to the Secretary of Defense via an Executive Order (EO 12316). As a result of EO 12316, DoD revised the IRP by issuing DEQPPM 81-5 (December 11, 1981), which reissued and amplified all previous directives and memoranda.

Although the DoD IRP and the Environmental Protection Agency (EPA) Superfund programs were essentially the same, differences in the definition of program activities and lines of authority resulted in some confusion between DoD and state/federal regulatory agencies. These difficulties were rectified via passage of the Superfund Amendments and Reauthorization Act (SARA, PL-99-499) of 1986. On January 23, 1987, Presidential Executive Order EO 12580 was issued. EO 12580 effectively revoked EO 12316 and implemented the changes promulgated by SARA.

The most important changes effected by SARA included the following:

- o Section 120 of SARA provides that federal facilities, including those in DoD, are subject to all provisions of CERCLA/SARA concerning site assessment, evaluation under the National Contingency Plan [40CFR300], listing on the National Priorities List, and removal/remedial actions. DoD must therefore comply with all the procedural and substantive requirements (guidelines, rules, regulations, and criteria) promulgated by the EPA under Superfund authority.
- o Section 211 of SARA also provides continuing statutory authority for DoD to conduct its IRP as part of the Defense Environmental Restoration Program (DERP). This was accomplished by adding Chapter 160, Sections 2701-2707 to Title 10 United States Code (10 USC 160).
- o SARA also stipulated that terminology used to describe or otherwise identify actions carried out under the IRP shall be substantially the same as the terminology of the regulations and guidelines issued by the EPA under their Superfund authority.

As a result of SARA, the operational activities of the IRP are currently defined and described as follows:

- o **Preliminary Assessment**

The Preliminary Assessment (PA) process consists of personnel interviews and a records search designed to identify and evaluate past disposal and/or spill sites that might pose a potential and/or actual hazard to public health, public welfare, or the environment. Previously undocumented information is obtained through the interviews. The records search focuses on obtaining useful information from aerial photographs; Station plans; facility inventory documents; lists of hazardous materials used at the Station; Station subcontractor reports; Station correspondence; Material Safety Data Sheets; federal/state agency scientific reports and statistics; federal administrative documents; federal/state records on endangered species, threatened species, and critical habitats; documents from local government offices; and numerous standard reference sources.

- o **Site Inspection/Remedial Investigation/Feasibility Study**

The Site Inspection consists of field activities designed to confirm the presence or absence of contamination at the potential sites identified in the PA. An expanded Site Inspection has been designed by the Air National Guard as a Site Investigation. The Site Investigation (SI) will include additional field tests and the installation of monitoring wells to

provide data from which site-specific decisions regarding remediation actions can be made. The activities undertaken during the SI fall into three distinct categories: screening activities, confirmation and delineation activities, and optional activities. Screening activities are conducted to gather preliminary data on each site. Confirmation and delineation activities include specific media sampling and laboratory analysis to confirm either the presence or the absence of contamination, levels of contamination, and the potential for contaminant migration. Optional activities will be used if additional data is needed to reach a decision point for a site. The general approach for the design of the SI activities is to sequence the field activities so that data are acquired and used as the field investigation progresses. This is done in order to determine the absence or presence of contamination in a relatively short period of time, optimize data collection and data quality, and to keep costs to a minimum.

The Remedial Investigation (RI) consists of field activities designed to quantify and identify the potential contaminant, the extent of the contaminant plume, and the pathways of contaminant migration.

If applicable, a public health evaluation is performed to analyze the collected data. Field tests, which may necessitate the installation of monitoring wells or the collection and analysis of water, soil, and/or sediment samples, are required. Careful documentation and quality control procedures in accordance with CERCLA/SARA guidelines ensure the validity of data. Hydrogeologic studies are conducted to determine the underlying strata, groundwater flow rates, and direction of contaminant migration. The findings from these studies result in the selection of one or more of the following options:

1. **No Further Action** - Investigations do not indicate harmful levels of contamination that pose a significant threat to human health or the environment. The site does not warrant further IRP action, and a Decision Document will be prepared to close out the site.
2. **Long-Term Monitoring** - Evaluations do not detect sufficient contamination to justify costly remedial actions. Long-term monitoring may be recommended to detect the possibility of future problems.
3. **Feasibility Study** - Investigation confirms the presence of contamination that may pose a threat to human health and/or the environment, and some sort of remedial action is indicated. The Feasibility Study (FS) is therefore designed and developed to identify and select the most appropriate remedial action. The FS may include individual sites, groups of sites, or all sites on an

installation. Remedial alternatives are chosen according to engineering and cost feasibility, state/federal regulatory requirements, public health effects, and environmental impacts. The end result of the FS is the selection of the most appropriate remedial action with concurrence by state and/or federal regulatory agencies.

o **Remedial Design/Remedial Action**

The Remedial Design involves formulation and approval of the engineering designs required to implement the selected remedial action. The Remedial Action is the actual implementation of the remedial alternative. It refers to the accomplishment of measures to eliminate the hazard or, at a minimum, reduce it to an acceptable limit. Covering a landfill with an impermeable cap, pumping and treating contaminated groundwater, installing a new water distribution system, and in situ biodegradation of contaminated soils are examples of remedial measures that might be selected. In some cases, after the remedial actions have been completed, a long-term monitoring system may be installed as a precautionary measure to detect any contaminant migration or to document the efficiency of remediation.

o **Research and Development**

Research and Development (R&D) activities are not always applicable for an IRP site but may be necessary if there is a requirement for additional research and development of control measures. R&D tasks may be initiated for sites that cannot be characterized or controlled through the application of currently available, proven technology. It can also, in some instances, be used for sites deemed suitable for evaluating new technologies.

o **Immediate Action Alternatives**

At any point, it may be determined that a former waste disposal site poses an immediate threat to public health or the environment, thus necessitating prompt removal of the contaminant. Immediate action, such as limiting access to the site, capping or removing contaminated soils, and/or providing an alternate water supply may suffice as effective control measures. Sites requiring immediate removal action maintain IRP status in order to determine the need for additional remedial planning or long-term monitoring. Removal measures or other appropriate remedial actions may be implemented during any phase of an IRP project.

## **B. Purpose**

The purpose of this IRP PA is to identify and evaluate suspected problems associated with past waste handling procedures, disposal sites, and spill sites on Station property.

The potential for migration of hazardous contaminants was evaluated by visiting the Station, reviewing existing environmental data, analyzing Station records concerning the use of hazardous materials and the generation of hazardous wastes, and conducting interviews with current Station personnel who had knowledge of past waste disposal techniques and handling methods. Pertinent information collected and analyzed as part of the PA included a records search of the history of the Station; the local geological, hydrological, and meteorological conditions that might influence migration of contaminants; and ecological settings that indicate environmentally sensitive conditions.

## **C. Scope**

The scope was limited to the identification of sites at or under primary control of the Station and evaluation of potential receptors. The PA included:

- o an on-site visit and field surveys during the period June 18-22, 1990;
- o acquisition of records and information on hazardous materials use and waste handling practices;
- o acquisition of available geological, hydrological, meteorological, land use and zoning, critical habitat, and related data from federal and state agencies;
- o a review and analysis of all information obtained; and
- o preparation of a summary report to include recommendations for further action.

The subcontractor effort was conducted by the following Science & Technology, Inc. (SciTek) personnel: Mr. Ray S. Clark, Civil/Environmental Engineer; and Mr. P. J. McMullen, Geologist/Hydrogeologist. Ms. Carol Ann Beda of the NGB is Project Officer for this Station and participated in the overall assessment during the Station visit. Mr. Larry Janssen of the Hazardous Waste Remedial Actions Program (HAZWRAP) also participated in the Station visit.

The point of contact (POC) at the Station was COL Dehnert, 254th CCGP Vice-Commander. In addition, 1LT Mark Byrd represented the Host Base, Hensley Field, Dallas, Texas.

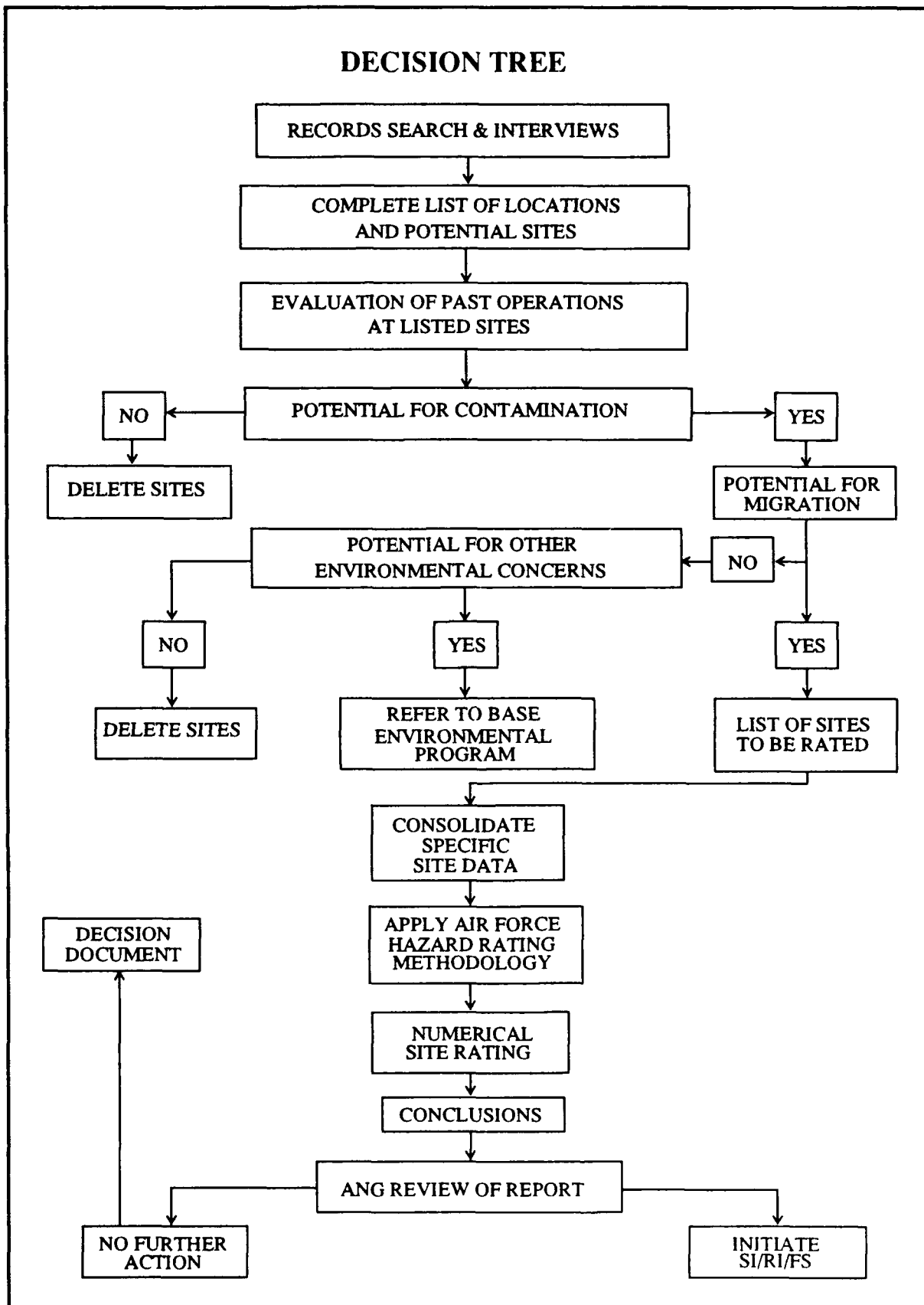
## **D. Methodology**

The PA began with a visit to the Station to identify all operations that may have used hazardous materials or may have generated hazardous wastes. Figure I.1 is a flow chart of the PA methodology.

A total of eight current and past Station employees familiar with the various operating procedures were interviewed. These interviews were conducted to determine those areas where waste materials (hazardous or nonhazardous) were used, spilled, stored, disposed of, or released into the environment. The interviewees' knowledge and experience with Station operations averaged 17 years and ranged from 8 to 26 years. Records contained in the Station files were collected and reviewed to supplement the information obtained from the interviews.

Detailed geological, hydrological, meteorological, and environmental data for the area were obtained from the appropriate federal and state agencies. A listing of federal and state agency contacts is included as Appendix A.

After a detailed analysis of all the information obtained, one potential site was identified to be potentially contaminated with hazardous wastes. Under the IRP program, when sufficient information is available, sites are numerically scored and assigned a Hazard Assessment Score (HAS) using the Air Force Hazard Assessment Rating Methodology (HARM). However, the absence of a HAS does not necessarily negate a recommendation for further IRP investigation, but rather, may indicate a lack of data. A description of HARM is presented in Appendix B.



**Figure I.1**  
**Preliminary Assessment Methodology Flow Chart**

## II. INSTALLATION DESCRIPTION

### A. Location

The Station is located approximately 13 miles northeast of downtown Dallas and is adjacent to Garland City Park. The major route to the Station is Garland Avenue (Hwy 78).

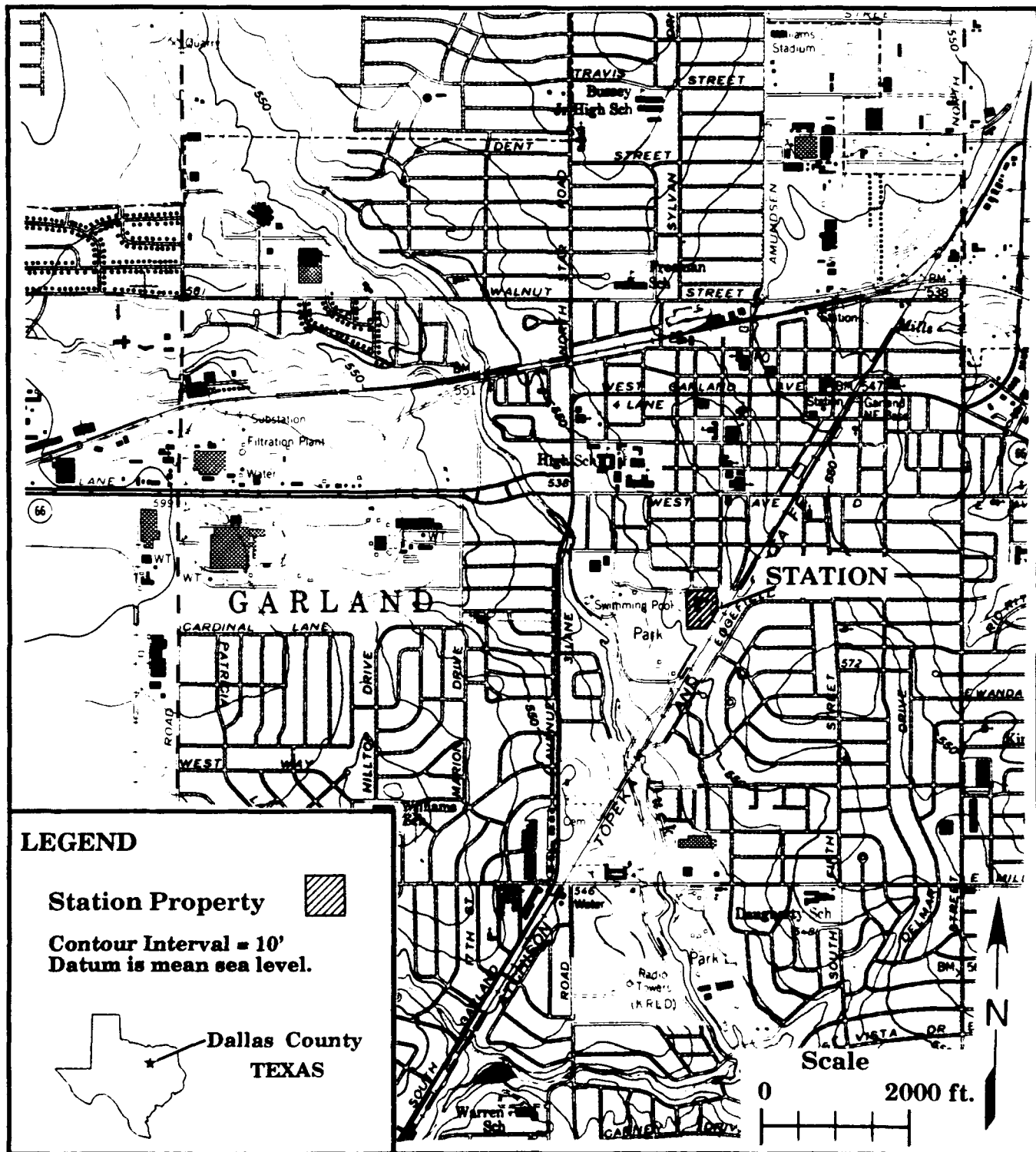
The Station occupies approximately six acres along Glenbrook Drive. Figure II.1 illustrates the location and boundaries of the Station. On weekdays, the population at the Station is approximately 34. Unit Training Assembly (UTA) occurs one weekend per month. The Station population during this weekend is approximately 225. The Station is completely fenced with controlled access. The unimproved acreage is used to conduct training and for parking of equipment.

### B. Organization and History

The Station was first occupied by the 254th CCGP and the 221st CCSQ during the late 1950s. The land at the Station had previously been used for a park. The land surrounding the Station is currently a city park and includes baseball fields and other areas for recreation. The first building at the Garland Station, Headquarters (Building 1), was constructed in 1959. The east wing of this building was used for vehicle maintenance until a new vehicle maintenance shop was built in 1977. Vehicle maintenance has been combined with AGE maintenance in the new Auto/AGE Shop (Building 5). This facility has an oil/water separator which collects waste oils. This separator is connected to the sanitary sewer system and is equipped with an alarm which indicates the waste oil tank is full. It is pumped by a contractor who disposes of the waste liquids.

A new fuel island was also installed in 1977. The original fuel tank at Building 1 was abandoned, and a new facility was constructed east of the Auto/AGE Shop (Building 5). The new fuel island included three new underground storage tanks for diesel and automotive gasoline (MOGAS).

The mission of the 254th CCGP and the 221st CCSQ is to install, operate, and maintain mobile communication facilities providing interbase and intrabase communications in support of tactical air forces and state emergencies and has remained essentially the same over the years. Maintenance operations required the use and disposal of hazardous materials such as waste oils, fuels, solvents, thinners, and paints. Such materials are largely generated in vehicle maintenance. AGE maintenance occurs within the Auto/AGE shop when needed.



SOURCE: Garland Quad N3252.5-W9637.5/7.5 1959 (photorevised 1967, 1973)

**Figure II.1**  
**Location Map of**  
**the Garland Air National Guard Station**

Washrack activity and the routine maintenance of vehicles, generators, and other equipment results in varying quantities of hazardous materials. The Station does not have a washrack facility. Washing operations take place on the southwest side of the Supply Building (Building 4). Water from these operations drains west.

Through the years, waste materials have been disposed of on the ground and then by a contractor. In addition to waste disposal, small spills and other releases of liquid wastes have periodically occurred at the Station. Presently, wastes generated by the Station are collected and disposed of by a contractor.

### III. ENVIRONMENTAL SETTING

#### A. Meteorology

The following climatological data is taken from Climatology of the United States No. 81 - Texas (United States Department of Commerce, National Climatic Center, Asheville, N.C., 1982) and Climatic Atlas of the United States (United States Department of Commerce, National Climatic Center, Asheville, N.C., 1979).

Data from Dallas-Fort Worth Regional Weather Station Office (41-2242), Dallas Federal Aviation Administration (41-2244) and Richardson (41-7588) indicate that Garland experiences wide annual temperature extremes. Average annual temperature during the 29-year period of 1951-1980 was 66.2°F. The temperature ranged from a low of 44.5°F in January to a high of 86.3°F in July.

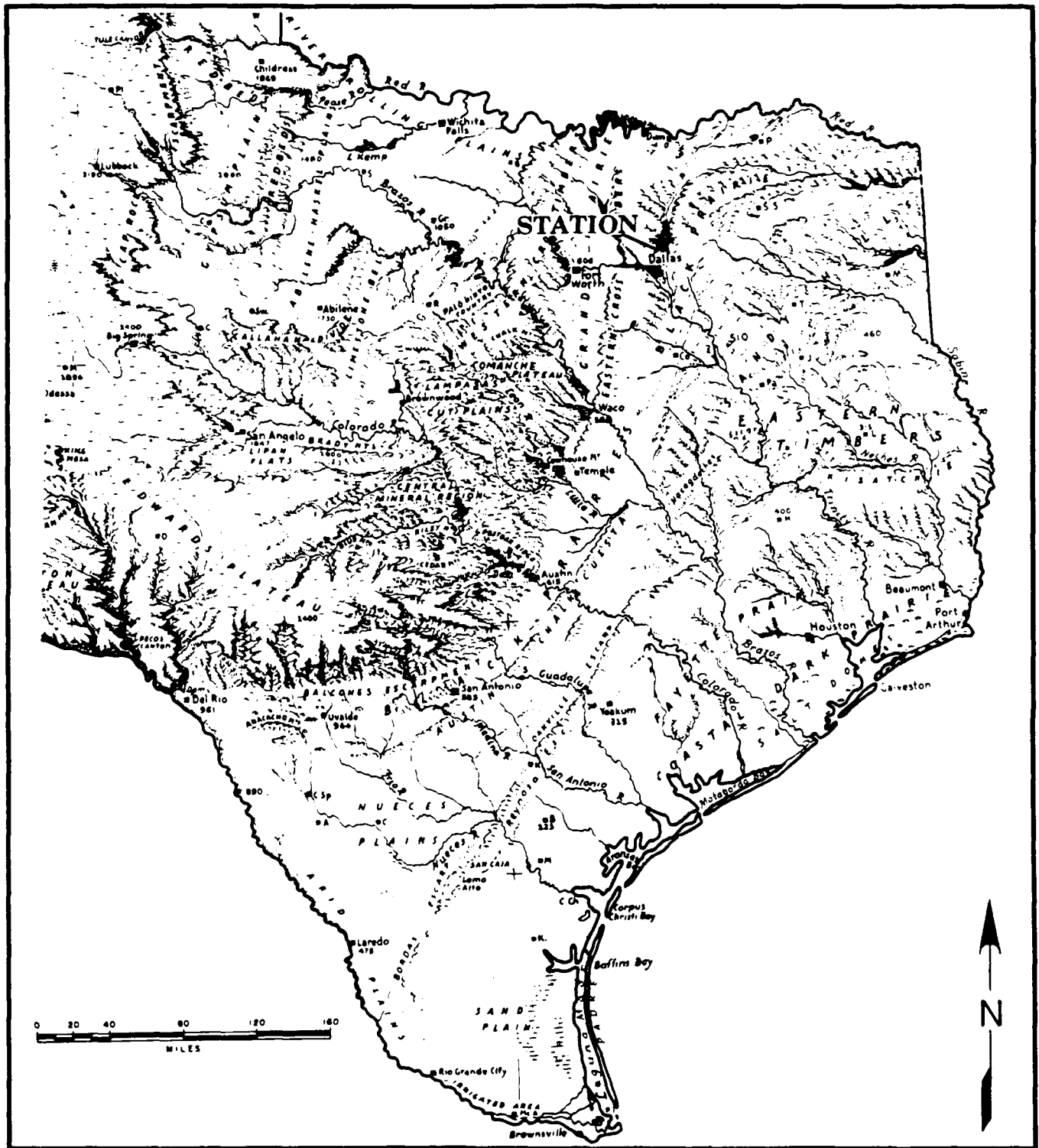
A large portion of the annual precipitation results from thunderstorm activity, especially during April and May. The average annual precipitation, based on data from the 1951-1980 period, was 35 inches. Mean annual lake evaporation is 56 inches. Net precipitation, which is the difference between mean annual lake evaporation and average annual precipitation, is minus 21 inches per year. Maximum rainfall intensity, based on a 1-year, 24-hour rainfall, is 3.5 inches.

#### B. Geology

The Station elevation is 560 feet above mean sea level with surface slopes of 25 to 50 feet per mile to the south-southwest into Duck Creek (Figure II.1).

Garland is located northeast of Dallas, Texas near the junction of the Central Plains area and the more flat lying Prairies, which comprise most of eastern and southern Texas (Figure III.1). This junction is marked by an escarpment that also reflects that the Station is located near the northwest flank of the East Texas Embayment which is a major structural subbasin within the much larger Gulf Coast Basin of the southern United States (Figure III.2).

According to Foster, 1965, the East Texas Embayment originated during the Triassic Period as a separate rift basin from the major rift that ultimately formed the Gulf of Mexico. Prior to the rifting, the Paleozoic Ouachita Mountains, which were located north and west of the Station, were uplifted and eroded. Following this uplifting and erosion, collapse and infill began to form the basin by mid-Jurassic time. By early Cretaceous, subsidences of the divergent continental margin of the basin allowed for the seaward deposition



SOURCE: Geological Highway Map of TEXAS - by the American Association of Petroleum Geologists.

Figure III.1

Physiographic Map of Texas



of large volumes of sediments derived from the erosion of the older Paleozoic Ouachita Mountains (clastics). In addition, it was at this point in geological time, that the present day Gulf of Mexico was completely formed.

The Station is underlain by a wedge of shallow marine post-Paleozoic strata, mainly terrigenous sediments of Upper and Lower Cretaceous age. These sediments expand gulfward from a thin section northwest of Garland townsite to 10,000 feet or more in the center of the embayment. With expansion, these sediments become more porous, shelf limestone deposits. These Cretaceous formations, like other formations located along the basin margin, are gradational to one another depending upon their relative depositional position within the tectonic basin framework (Figure III.3).

The Lower Cretaceous Trinity Group is composed of three formations in a basinward position (Caughey, 1977). From oldest to youngest, they are the Twin Mountains, Glen Rose, and Paluxy Formations, which have a total thickness in excess of 3000 feet. At or near the outcrop position, west of the Station, these units coalesce into one single formation referred to as the Antlers Formation which has a thickness of approximately 900 feet.

The Twin Mountains, Paluxy, and Antlers Formations are recognized as having five principal facies: Channel-fill and floodbasin, Meanderbelt, Coastal barrier, Lagoon, and Strandplain. The facies distinction is made on the basis of lithic composition, fossil content, and regional trends of sandstone distribution.

Figure III.4 shows the subparallel outcrop patterns of the various geologic units. The Trinity, Woodbine, and Navarro Groups are highlighted because they are the major north-central Texas aquifers. The Station rests upon the Upper Cretaceous Austin Chalk Formation that outcrops in a 12 to 15 mile wide band that trends north-south in this area. Within the Austin Chalk, the unit is mostly a light gray microgranular, massive calcite, with some calcareous clay partings in the upper and lower parts. Generally, the formation has very poor porosity (0 to 20 percent) and very slow permeability (less than  $4.24 \times 10^{-5}$  cm/sec), but because of local structure, fracturing will increase permeability in some localized areas.

The younger Upper Cretaceous Taylor (Ozan Formation) Group outcrops immediately east of Garland townsite and west of Lake Ray Hubbard. This sequence is approximately six miles wide and is parallel to the Austin Chalk outcrop. The sequence consists of 500 feet of medium gray, calcareous, montmorillonite clay.

The soil series that underlies the Station has been assigned to the Houston Black-Urban land complex which is composed of deep, moderately well drained, nearly level and gently sloping soils (0 to 4 percent slopes). Typically, the surface layer of the Houston Black soil is a moderately alkaline, dark gray

System	Series	Group	Stratigraphic units	Approximate maximum thickness (feet)	Character of rocks	Water-bearing characteristics*	
Quaternary	Holocene		Alluvium	75	Sand, silt, clay and gravel.	Yields small to large amounts of fresh water to wells along the Red River	
	Pleistocene		Fluvial terrace deposits				
Cretaceous	Gulf	Navarro	Keokuk Clay Cretaceous Marl Nacatoch Sand	800	Fossiliferous clay and hard limy marl, fine sand, fossiliferous	Upper members are not known to yield water to wells in area, lower member yields small to moderate quantities of fresh to slightly saline water near the outcrop	
		Taylor	Marlbrook Marl Pecan Gap Chalk Wolfe City Ozan Formations	1,500	Clay, marl, mudstone, and chalk	Yields small quantities of water to shallow wells	
		Austin	Gober Chalk Brownstown Marl Blissum Sand Bonham Formation	700	Chalk, limestone and marl, fine to medium sand, fossiliferous	Yields small to moderate quantities of fresh to moderately saline water to wells in the northeastern part of the area, very limited as an aquifer	
		Eagle Ford		650	Shale with thin beds of sandstone and limestone	Yields small quantities of water to shallow wells	
		Woodbine		700	Medium to coarse iron sand, sandstone, clay and some lignite	Yields moderate to large quantities of fresh to slightly saline water to municipal, industrial and irrigation wells	
	Cumanche	Washita		1,000	Fossiliferous limestone, marl and clay, some sand near top	Yields small quantities of water to shallow wells	
		Fredericksburg		250	Limestone, clay, marl, shale, and shell conglomerates	Yields small quantities of water to shallow wells	
		Trinity	Antlers Formation	Paluxy Formation	400	Fine sand, sandy shale, and shale	Yields small to moderate quantities of fresh to slightly saline water to wells
				Glen Rose Formation	1,500	Limestone, marl, shale, and anhydrite	Yields small quantities of water in localized areas
				Twiss Mountain Formation	1,000	Fine to coarse sand, shale, clay, basal gravel, and conglomerate	Yields moderate to large quantities of fresh to slightly saline water to wells
		Paleozoic rocks undifferentiated		Sandstone, limestone, shale and conglomerate	Yields small quantities of water in the western part of the area		

SOURCE: Baker, B. et al. Evaluation of Water Resources in Part of North-Central Texas, Texas Water Development Board, 1990.

Figure III.3  
Generalized Stratigraphic Column of the Area



clay that is 6 inches thick. To a depth of 38 inches, the soil is a moderately alkaline, black clay, and to a depth of 52 inches, it is a moderately alkaline, dark clay. To a depth of 70 inches, the soil is a moderately alkaline, dark grayish brown clay that has light olive brown mottles. Permeability is very slow (less than  $4.24 \times 10^{-5}$  cm/sec), runoff is medium, and the hazard of erosion is moderate.

Immediately adjoining the Houston Black sequence along the west-southwestern boundary of the Station is the Lewisville-Urban soil complex. This sequence differs from the Houston Black in that it is more of a silty clay which gives it a moderate permeability ( $4.45 \times 10^{-4}$  cm/sec to  $1.41 \times 10^{-3}$  cm/sec). The information pertaining to soils contained in the text was derived from the Soil Survey of Dallas County, Texas (United States Department of Agriculture, Soil Conservation Service, February 1980). Soil borings are available for the Station and are included in Appendix D.

## C. Hydrology

### 1. Surface Water

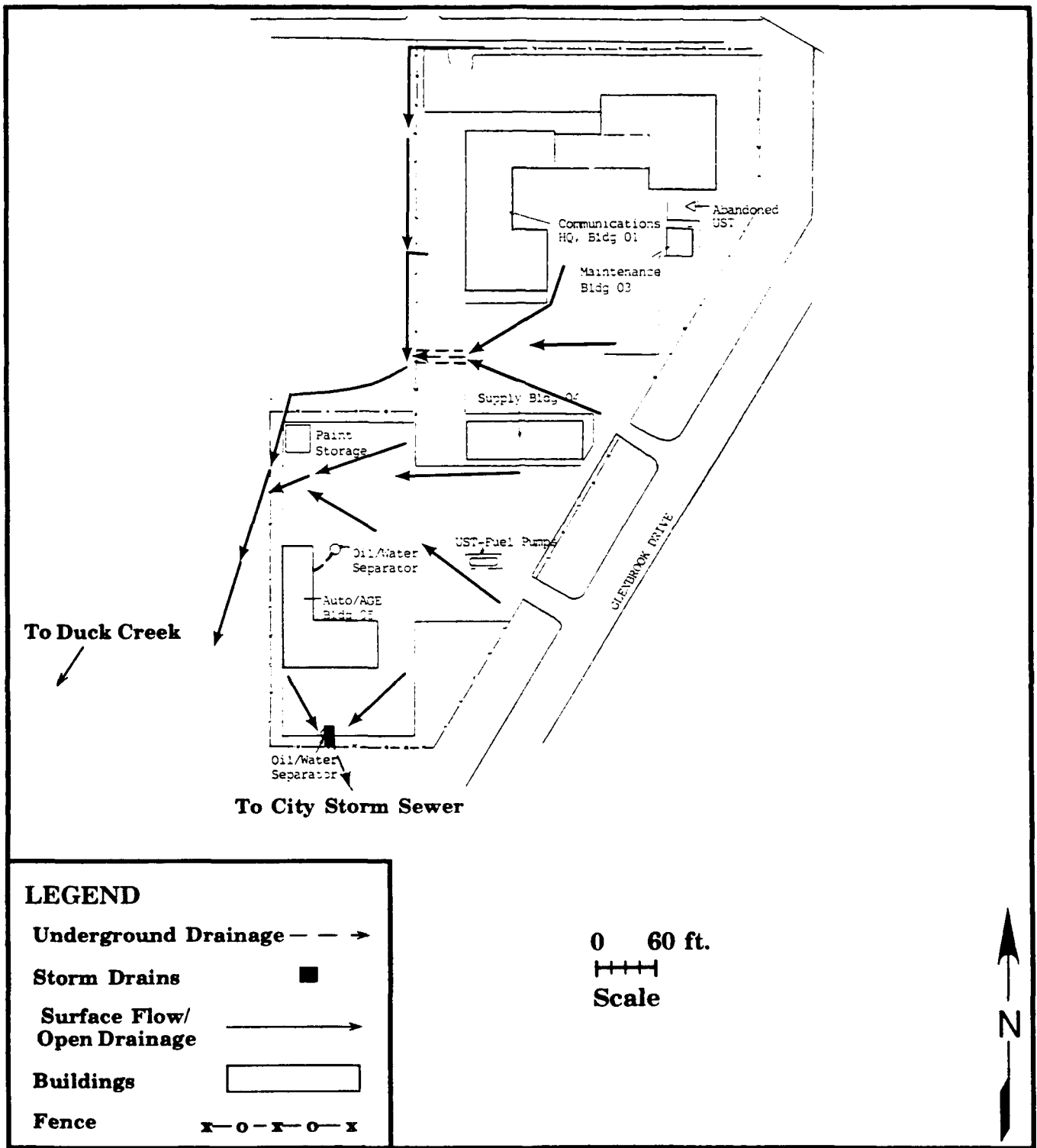
The Station is located in the Duck Creek drainage basin of the East Fork Trinity River watershed. Surface runoff is through storm drains and/or directly off the pavement into open ditches that ultimately flow into Duck Creek (Figure III.5). The Station has been classified as being outside the 100-year flood plain.

### 2. Groundwater

Leggat, 1957, and Morgan, 1965, state that the principal groundwater aquifers are within the Trinity Group (Twin Mountains, Paluxy, and Antlers) of Lower Cretaceous age (Figures III.6, III.7). The Lower Cretaceous units, as a whole, are discordant with and overlap the beveled edge of the arcuate Ouachita front that forms the East Texas Embayment boundaries in northeast Texas, southeast Oklahoma, and southwest Arkansas. In some sections, recharge of the deeper aquifers is effected by this discordant surface. Additional groundwater reservoirs are found within the Upper Cretaceous Woodbine Group.

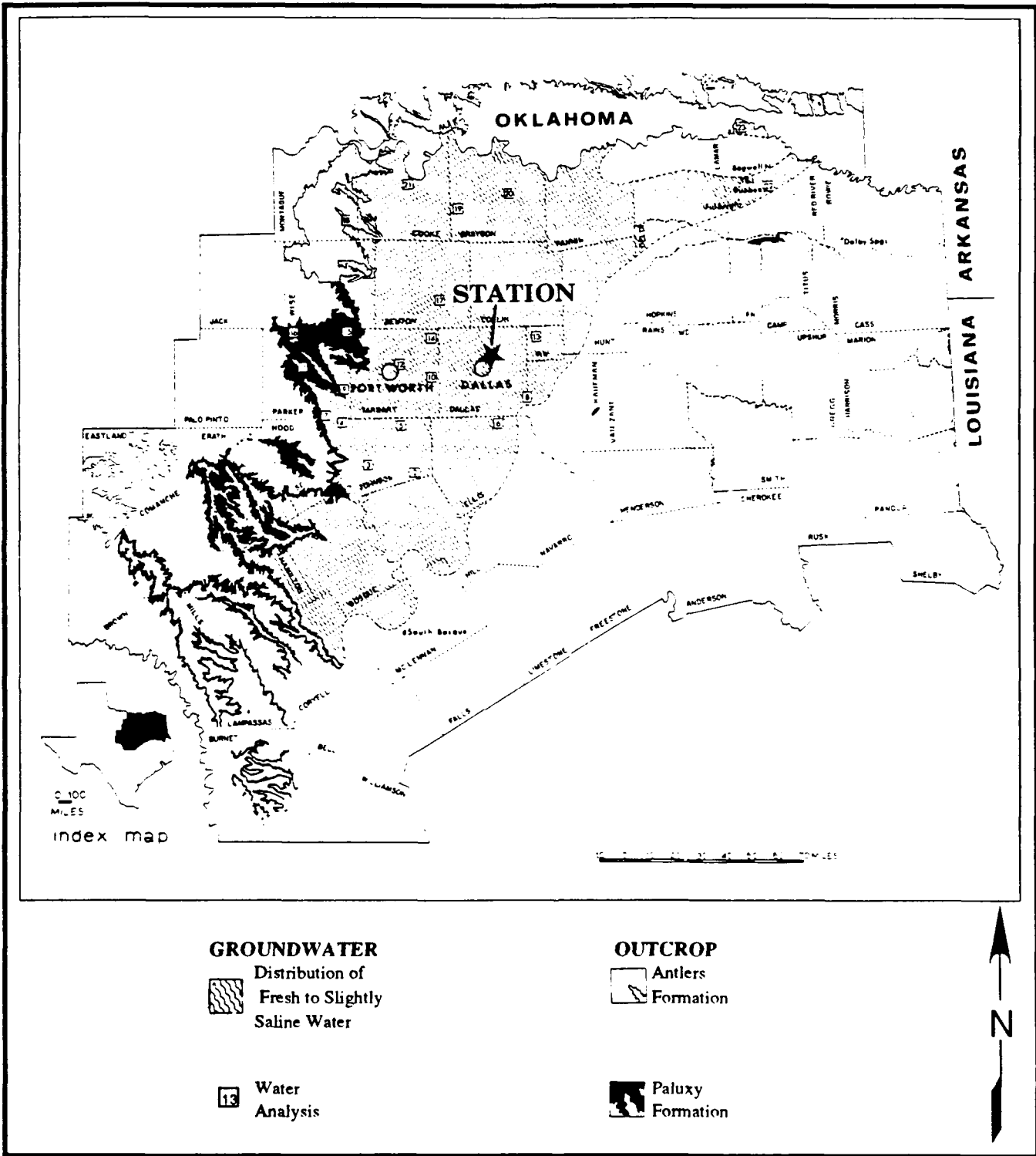
The majority of the aquifers are located within the Strandplain facies because the sands are more porous, fine to very fine granulated quartz deposits. Thickness of individual sand units ranges up to 90 feet.

To the east of the Station, on the Dallas/Rockwall/Kaufman County lines, the depth to these sands ranges from 2860 feet to 3342 feet. West of the Station, on the Dallas/Tarrant County line, the depth ranges from 700 to 1074 feet.



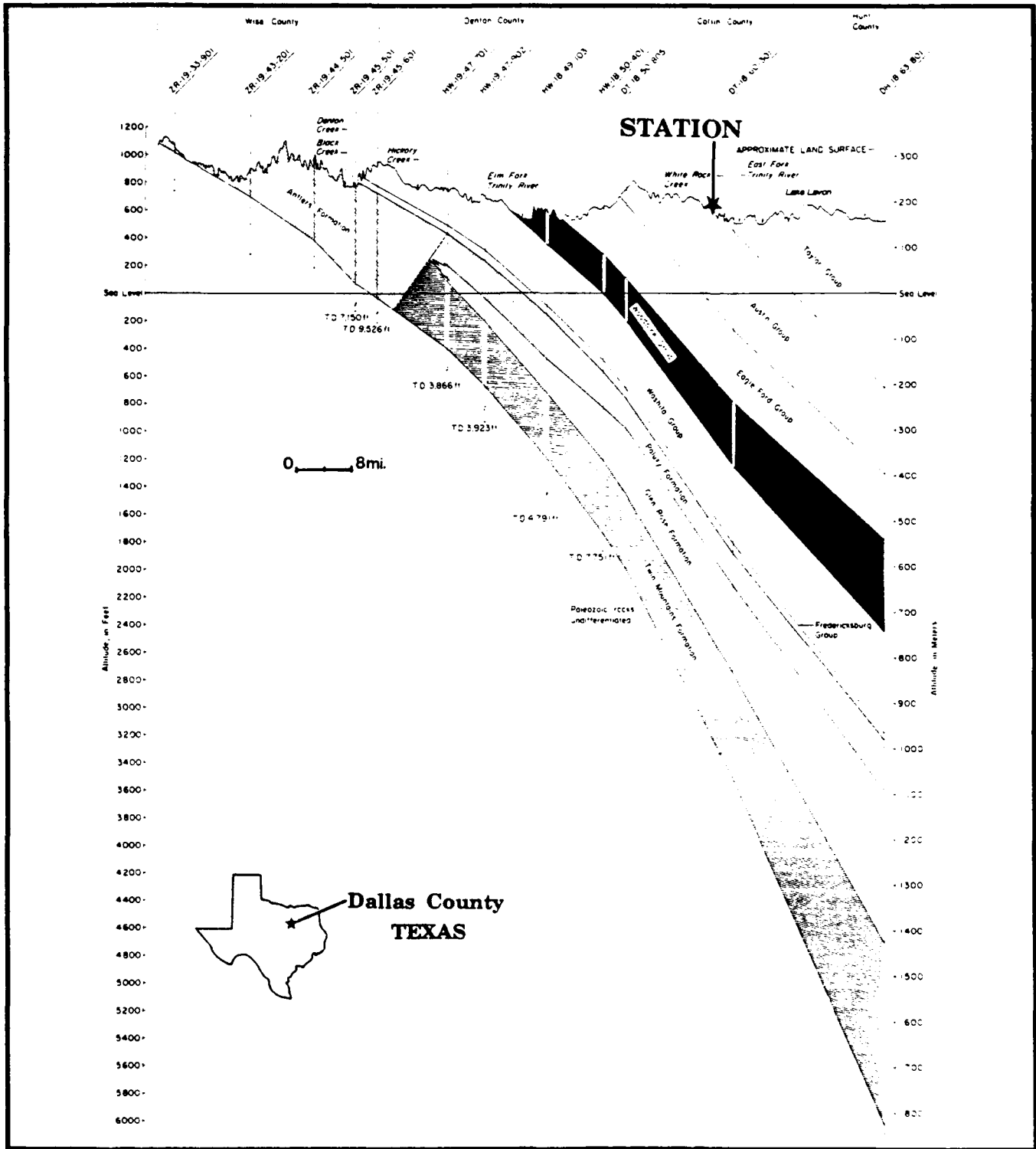
SOURCE: Garland ANG Station Site Plan.

**Figure III.5**  
**Drainage Map of**  
**the Garland Air National Guard Station**



SOURCE: Caughey, C. A., Depositional Systems in the Paluxy Formation. Bureau of Economic Geology, The University of Texas at Austin, Geological Circular 77-8, 1977.

**Figure III.6**  
**Paluxy Resources in Northeast Texas**



SOURCE: Baker, B. et al.

Figure III.7  
Hydrogeologic Section of Part of North-Central Texas

Well test data reported by the Texas Department of Water Resources indicates that the coefficient of transmissivity for the Twin Mountains Formation aquifer ranges from 2890 to 20,130 ft<sup>2</sup>/day<sup>-1</sup>; for the Paluxy aquifer, the range is 1263 to 13,808 ft<sup>2</sup>/day<sup>-1</sup>.

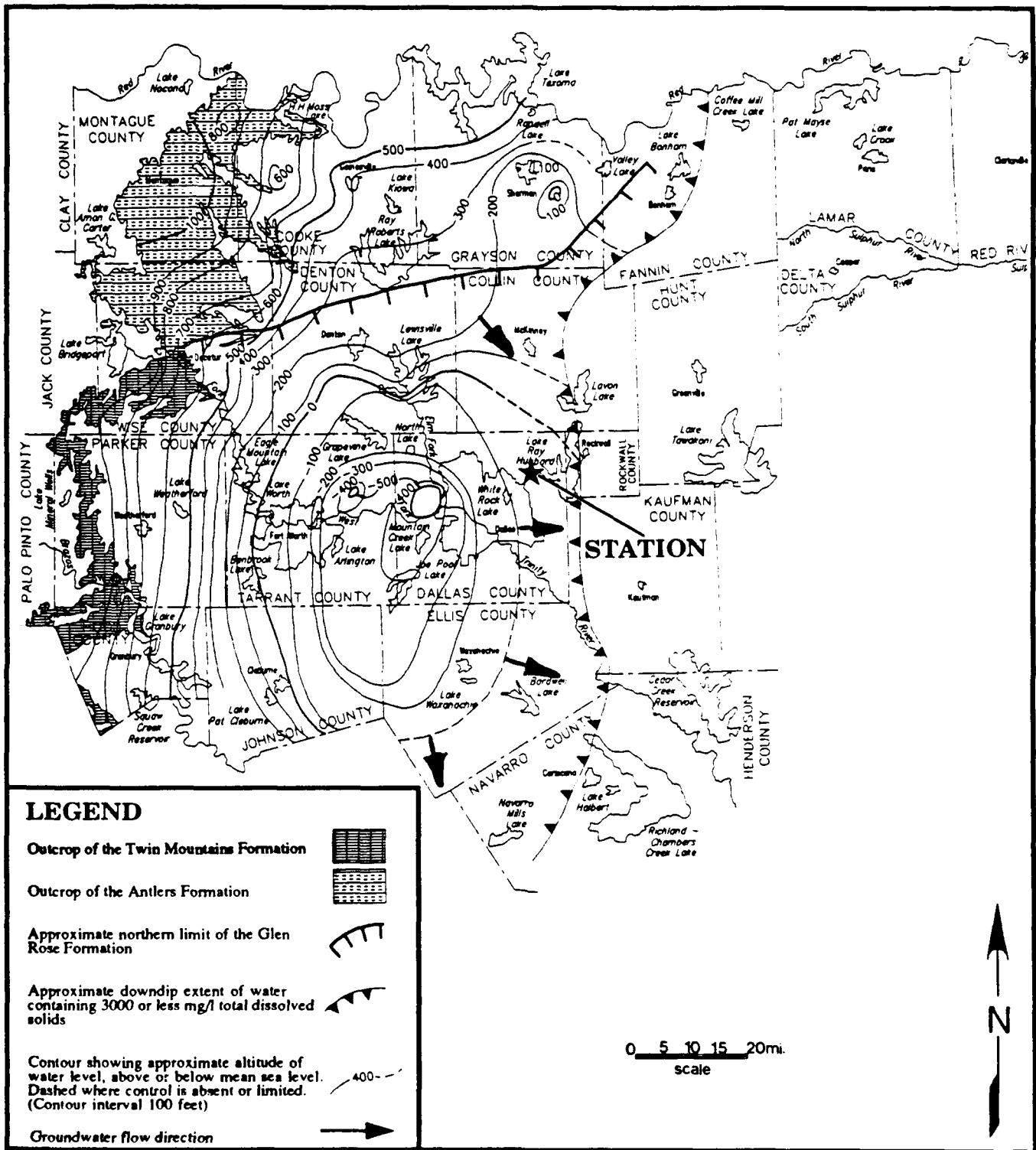
All of these units have a rather uniform north and south strike that is accompanied by an equally uniform east dip of 50 to 100 feet per mile in the subsurface.

Measurements by Baker, 1990, reflect that the approximate altitude of water levels in 1989 for the Twin Mountains, Paluxy, and Antlers Formations ranged from 50 feet below mean sea level for the Twin Mountains to 150 feet above mean sea level for the Antlers aquifer (Figures III.8, III.9). The Woodbine Group had a water level altitude of approximately 100 feet above mean sea level in 1989 (Figure III.10).

The cities of Garland and Dallas, as well as other major north-central Texas population centers, are dependent upon surface water sources for public supply.

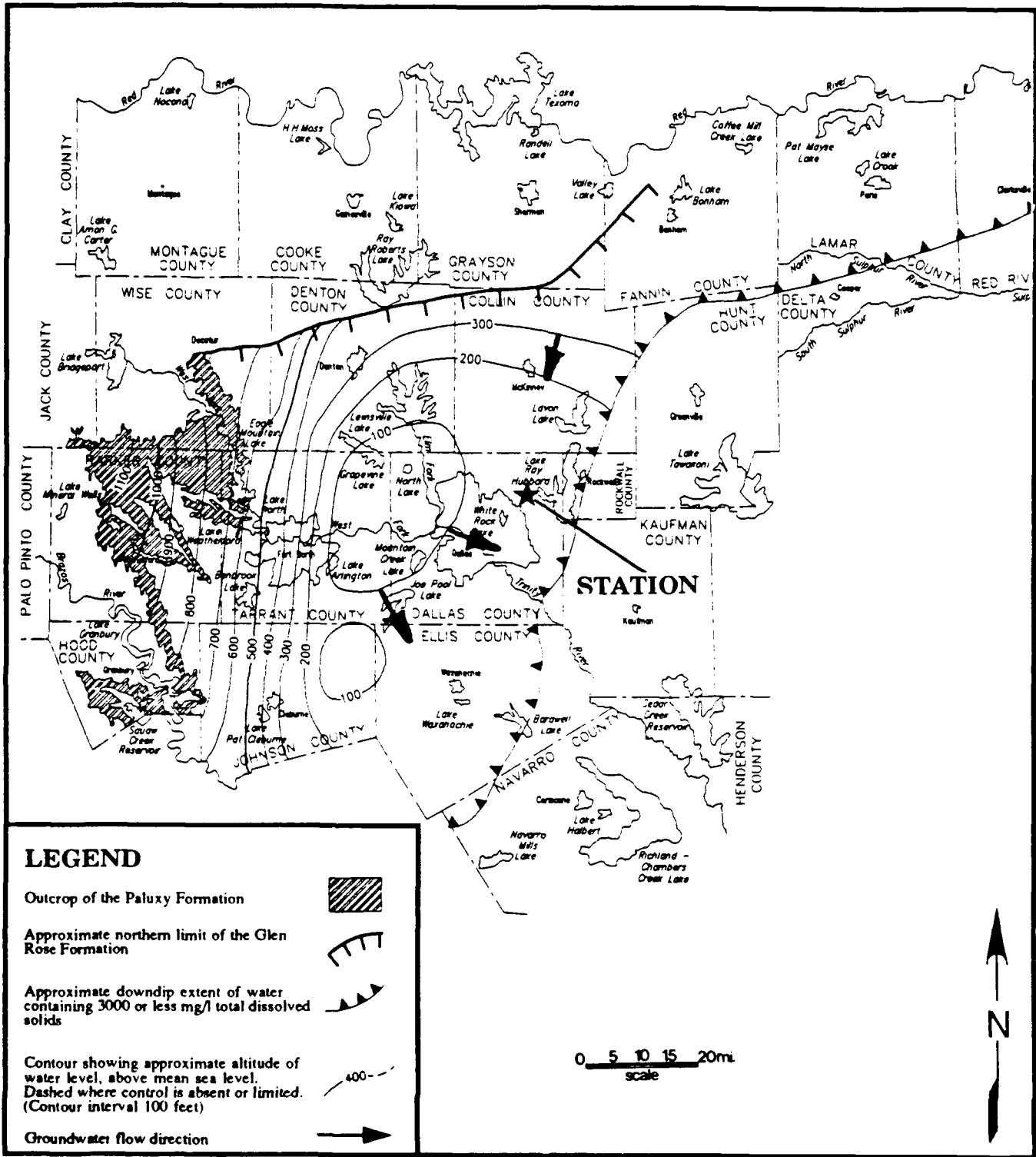
#### **D. Critical Habitats/Endangered or Threatened Species**

According to records maintained by the Texas Parks and Wildlife Department, no endangered or threatened species of flora or fauna have been identified within a 1-mile radius of the Station.



SOURCE: Baker, B. et al.

**Figure III.8**  
**Approximate Altitude of Water Levels in**  
**the Antlers and Twin Mountains Formations, 1989**



SOURCE: Baker, B. et al.

Figure III.9  
 Approximate Altitude of Water  
 Levels in the Paluxy Formation, 1989



## IV. SITE EVALUATION

### A. Activity Review

A review of Station records and interviews with personnel were used to identify specific operations in which the majority of hazardous materials and/or hazardous wastes are used, stored, disposed of, and processed. Table IV.1 provides a history of waste generation and disposal for operations conducted in the Auto/AGE Shop at the Station. Maintenance of AGE equipment is performed within this building when necessary. If an item is not listed on the table on a best-estimated basis, that activity or operation produces negligible (less than 1 gallon/year) waste requiring disposal.

Fresh product gasoline and diesel fuel are stored in underground tanks located at the fuel island just east of the Auto/AGE Shop (Building 5). These tanks were installed in 1977. The original fuel island was removed during construction of the new one. However, the original fuel tank is still in its original location between Headquarters (Building 1) and the Maintenance Shop (Building 3).

The 221st CCSQ generates hazardous wastes primarily through vehicle and AGE maintenance operations. Over the years, wastes have been disposed of on the ground and released into the environment through spills. Since 1980, the wastes have been collected and stored until disposed of by a contractor.

The Station has always been connected to city water and sanitary sewer. These utilities are provided by the city of Garland.

Drains in the Auto/AGE Shop (Building 5) are connected to an oil/water separator which is attached to the sanitary sewer. Another oil/water separator is located on the south side of Building 5. This separator receives all of the surface drainage on the south side of this shop. It is connected to the storm sewer. A contractor pumps out the holding tanks and disposes of the liquids when needed.

### B. Disposal/Spill Site Information, Evaluation, and Hazard Assessment

Eight persons were interviewed to identify and locate potential sites that may have been contaminated by hazardous wastes as a result of past Station operations. One potentially contaminated site was identified through the interviews. The site identification was followed by a visual field examination of the site. The site was rated by application of the United States Air Force (USAF) HARM, and since the potential for contaminant migration exists, it is recommended for further investigation under the IRP program.

Table IV.1

Hazardous Materials/Hazardous Wastes Disposal Summary: Carland Air  
National Guard Station, Carland, Texas.

Shop Name and Location	Possible Hazardous Wastes	Estimated Quantities (Gallons/Year)	1959	1970	1980	1985	1990
Vehicle Maintenance (Bldg. 5)	Engine Oil	200		GRND/CONTR		CONTR	
	Battery Acid	50		NSAN		CONTR	
	Ethylene Glycol	20		GRND/SAN		CONTR	
	Hydraulic Oil	20		GRND/CONTR		CONTR	
	Transmission Fluid	10		GRND/CONTR		CONTR	
	Paint Thinner	20		TRASH		TRASH/CONTR	
	Brake Fluid	10		GRND/CONTR		CONTR	
	Lubricating Oil	20		GRND/CONTR		CONTR	
	Diesel Fuel	100		GRND/CONTR		CONTR	
	Lacquer	10		TRASH		TRASH/CONTR	

KEY:

- CONTR - Disposed of through a Contractor.
- GRND - Material disposed of on the ground.
- NSAN - Neutralized and disposed of down drains leading to the sanitary sewer.
- NU - Material not in use at this time.
- OWS - Disposed of in drains leading into an oil/water separator through washing operations. Liquids in the oil/water separator are pumped out of the tank and disposed of by a contractor.
- TRASH - Disposed of in trash (i.e. rags, residual in containers, etc.)

Table IV.1

Hazardous Materials/Hazardous Wastes Disposal Summary: Garland Air National Guard Station, Garland, Texas (continued).

Shop Name and Location	Possible Hazardous Wastes	Estimated Quantities (Gallons/Year)	1959	1970	1980	1985	1990	Method of Disposal
Aerospace Ground Equipment (AGE) Maintenance (Bldg. 5)	Engine Oil	75		GRND/CONTR		CONTR		CONTR
	Strippers/Thinners	15		TRASH		TRASH/CONTR		TRASH/CONTR
	Battery Acid	50		SAN		CONTR		CONTR
	Cleaning Compound	5		TRASH/GRND		OWS		OWS
	Parts Cleaner	20		NU		SAN		OWS/CONTR
	Gasoline	25		GRND/CONTR		CONTR		CONTR
-----								
Electronic Maintenance Shop (Building 3)	Trichloroethane	2				TRASH		TRASH
	Battery Acid	10		GRND/NSAN		CONTR		CONTR
	Parts Cleaner	55		GRND		OWS/CONTR		OWS/CONTR
	Lacquer	10		TRASH		TRASH/CONTR		TRASH/CONTR

KEY:

- CONTR - Disposed of through a Contractor.
- GRND - Material disposed of on the ground.
- NSAN - Neutralized and disposed of down drains leading to the sanitary sewer.
- NU - Material not in use at this time.
- OWS - Disposed of in drains leading into an oil/water separator through washing operations. Liquids in the oil/water separator are pumped out of the tank and disposed of by a contractor.
- TRASH - Disposed of in trash (i.e. rags, residual in containers, etc.)

A copy of the completed HARM form and an explanation of the factor rating criteria used for site scoring is contained in Appendix C.

The potential exists for contaminant migration at the rated site. Contaminants that may have been released have the potential to be transported by groundwater and surface water. The water table is less than 10 feet below the ground surface at the Station. If the shallow groundwater becomes contaminated by hazardous wastes, then, under certain circumstances, the deeper aquifers may also be contaminated by groundwater migration. Released contaminants that are exposed on the ground surface have the potential to be transported by surface waste migration into Duck Creek.

The location of the identified site is shown on Figure IV.1. A description of the potential site at the Station follows.

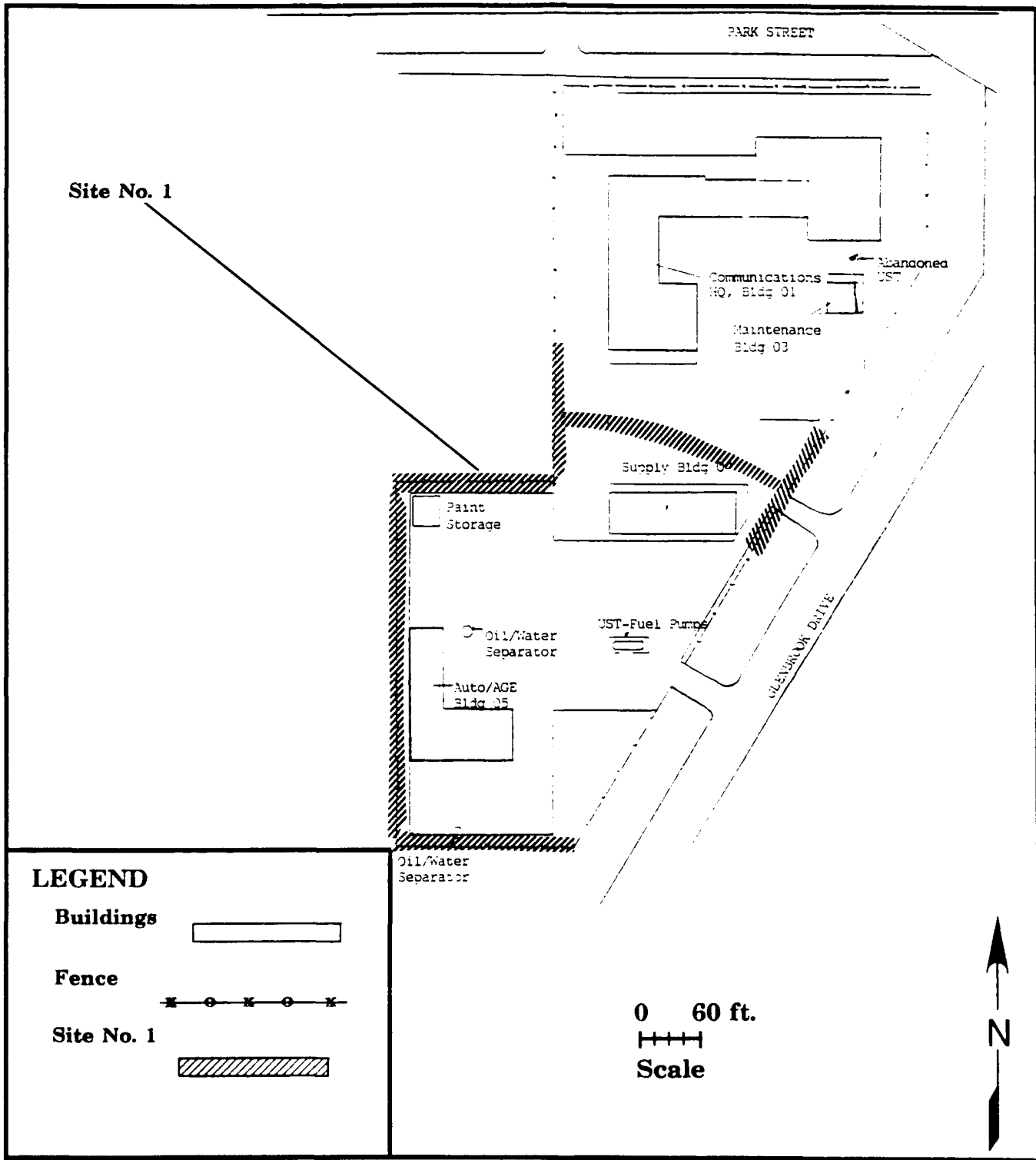
#### Site No. 1 - Station Drainage Area and Fence Line (HAS - 66)

Interviewees reported that the fence line east of Supply (Building 4) was occasionally used to dispose of small amounts of waste oils, solvents, paints, and thinners. These materials were periodically poured along the boundary fence during the late 1950s through the middle 1970s. In addition, similar waste materials were poured along the fence on the west side of the Station.

Several small (less than 40 gallons) spills involving diesel and MOGAS have occurred in the area south of the Auto/AGE Shop (Building 5). Through the years, such fuel spills were a result of ruptured fuel tanks on generators and other AGE equipment. These tanks would sometimes rupture as a result of high temperatures during the summer. The vegetation in the immediate vicinity was killed as a result of the fuel spills in the area. Presently, the tanks are made of fiberglass and are less likely to burst because of their ability to expand.

The soils in this area were removed and disposed of by a contractor (Coronado Builders) during December of 1985. Afterwards, the area was filled with new soil, compacted, and covered with concrete. However, as a result of the fuel spills, the vegetation kill, and the possibility of contaminant migration, the southern and western fence line outside the Auto/AGE Shop (Building 5) was included as part of this potential site.

Also included as a part of this site is the Station's drainage area. Nearly all surface water on the Station property drains across the asphalt and into an area along the fence line on the west side of the Station. The majority of spills or releases of hazardous materials would drain to this general drainage area and then seep into the soil. During the late 1960s, vandals released approximately 55 gallons of diesel and 55 gallons of oil onto the asphalt on the north side of Supply (Building 4). After draining to the western fence line, the



SOURCE: Garland ANG Station Site Plan.

Figure IV.1  
 Potential Sites  
 at the Garland Air National Guard Station

liquids were washed down by the Fire Department where they seeped into the soils along the drainage area.

Exact quantities disposed of along the fence lines and dumped upon the ground are not known. However, assuming the Station disposed of 100 gallons of waste materials per year and wastes were disposed of on the ground for at least 15 years, it is possible that at least 1500 gallons of wastes were disposed of on Station grounds. Spills and other releases would increase this amount. As a result, a medium quantity is assigned to this potential site. A medium quantity according to HARM is 21 to 85 drums (1155 to 4675 gallons) of material. In addition, a high hazard rating is assigned to this site because of the toxicity of some of the solvents that were reported to have been disposed of in this area.

### C. Other Pertinent Facts

- o Trash and nonhazardous solid wastes are disposed of by the city of Garland.
- o There are no Polychlorinated Biphenyl (PCB) transformers at the Station.
- o The Station does not have a National Pollutant Discharge Elimination System (NPDES) permit.
- o An abandoned underground storage tank (UST) is located approximately 20 feet north of Maintenance Building 3. It is located between Building 3 and the east wing of Building 1. This is the site of the original fuel island. The island was removed when the present fuel island was constructed in 1977. This 5000-gallon steel tank was installed in the late 1950s and contained MOGAS until it was abandoned in 1977 when it was pumped dry and filled with sand. There are no records indicating that the tank ever leaked.

## V. CONCLUSIONS

Information obtained through interviews with eight present and past Station personnel, reviews of Station records, and field observations resulted in the identification of one potentially contaminated disposal and/or spill site on Station property. This potential site is as follows:

Site No. 1 - Station Drainage Area and Fence Line (HAS - 66)

This site exhibits the potential for contaminant migration through surface water, soil, and/or groundwater.

## **VI. RECOMMENDATIONS**

The PA identified one potentially contaminated site at the Station. As a result, additional investigation under the IRP is recommended for this site to confirm the presence or absence of contamination.

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## GLOSSARY OF TERMS

**ALLUVIAL** - Pertaining to or composed of alluvium or deposited by a stream or running water.

**ALLUVIAL FAN** - An outspread, gently sloping mass of alluvium deposited by a stream, especially in an arid or semiarid region where a stream issues from a narrow canyon onto a plain or valley floor.

**ANNUAL PRECIPITATION** - The total amount of rainfall and snowfall for the year.

**AQUIFER** - A water-bearing layer of rock that will yield water in a usable quantity to a well or spring.

**AQUITARD** - A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer.

**ARGILLACEOUS** - Like or containing clay.

**BASIN** - (a) A depressed area with no surface outlet; (b) A drainage basin or river basin; (c) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated.

**BAY** - A wide, curving open indentation, recess, or inlet of a sea or lake into the land or between two capes or headlands, larger than a cove, and usually smaller than, but of the same general character as a gulf.

**BED** [stratig] - The smallest formal unit in the hierarchy of lithostratigraphic units. In a stratified sequence of rocks it is distinguishable from layers above and below. A bed commonly ranges in thickness from a centimeter to a few meters.

**BEDDING** [stratig] - The arrangement of sedimentary rock in beds or layers of varying thickness and character.

**BEDROCK** - A general term for the consolidated (solid) rock that underlies soil or other unconsolidated superficial material. See **HORIZON** [soil] - *R layer*.

**CLASTIC** - Rock or sediment composed principally of fragments derived from pre-existing rocks or minerals and transported some distance from their place of origin.

**CLAY [soil]** - A rock or mineral particle in the soil having a diameter less than 0.002 mm (2 microns).

**CLAY [geol]** - A rock or mineral fragment or a detrital particle of any composition smaller than a fine silt grain, having a diameter less than 1/256 mm (4 microns).

**COARSE-TEXTURED (light textured) SOIL** - Sand or loamy sand.

**COMPRESSIBILITY** - The change of volume and density under hydrostatic pressure.

**CONE OF DEPRESSION** - The depression of heads around a pumping well caused by the withdrawal of water.

**CONGLOMERATE** - A coarse-grained sedimentary rock, composed of rounded pebbles, cobbles, and boulders, set in a fine-grained matrix of sand or silt, and commonly cemented by calcium carbonate, iron oxide, silica, or hardened clay.

**CONSOLIDATION** - Any process whereby loosely aggregated, soft, or liquid earth materials become firm and coherent rock; specif. the solidification of a magma to form an igneous rock, or the lithification of loose sediments to form a sedimentary rock.

**CONTAMINANT** - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) 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; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

- (a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,
- (b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,
- (c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under

the Solid Waste Disposal Act has been suspended by Act of Congress),

- (d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,
- (e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and
- (f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

**CONTEMPORANEOUS FAULT** - See GROWTH FAULT.

**CREEK** - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

**CRITICAL HABITAT** - The specific areas within the geographical area occupied by the species on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection.

**DEPOSITS** - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

**DRAINAGE CLASS (natural)** - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained* - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

*Somewhat excessively drained* - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

*Well-drained* - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does

not inhibit growth of roots for significant periods during most growing seasons. Well-drained soils are commonly medium textured. They are mainly free of mottling.

*Moderately well drained* - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

*Somewhat poorly drained* - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

*Poorly drained* - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough periods during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

*Very poorly drained* - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

**DRAINAGEWAY** - A channel or course along which water moves in draining an area.

**DRAWDOWN** - The reduction in head at a point caused by the withdrawal of water from an aquifer.

**EMBAYMENT** - A downwarped region of stratified rocks that extends into a region of other rocks.

**ENDANGERED SPECIES** - Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the Class Insecta determined by the secretary to constitute a pest whose protection would present an overwhelming and overriding risk to man.

**EROSION** - The general process or the group of processes whereby the materials of the Earth's crust are loosened, dissolved, or worn away, and simultaneously moved from one place to another by natural agencies, but usually exclude mass wasting.

**FAULT** - A fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture.

**FINE-GRAINED** - Said of a soil in which silt and/or clay predominate.

**FINE-TEXTURED (heavy textured) SOIL** - Sandy clay, silty clay, and clay.

**FLOOD PLAIN** - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

**FOLD [geol struc]** - A curve or bend of a planar structure such as rock strata, bedding planes, foliation or cleavage.

**FORMATION** - A lithologically distinctive, mappable body of rock.

**FRACTURE [struc geol]** - A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints, and faults.

**GEOLOGIC TIME** - See Figure G1.1.

**GRANITE** - Broadly applied, any crystalline, quartz-bearing plutonic rock; also commonly contains feldspar, mica, hornblende, or pyroxene.

**GRAVEL** - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

**GROUNDWATER** - Water in the saturated zone that is under a pressure equal to or greater than atmospheric pressure.

**GROWTH FAULT** - A fault in sedimentary rock that forms contemporaneously and continuously with deposition, so that the displacement (throw) increases with depth and the strata of the downthrown side are thicker than the correlative strata of the upthrown side.

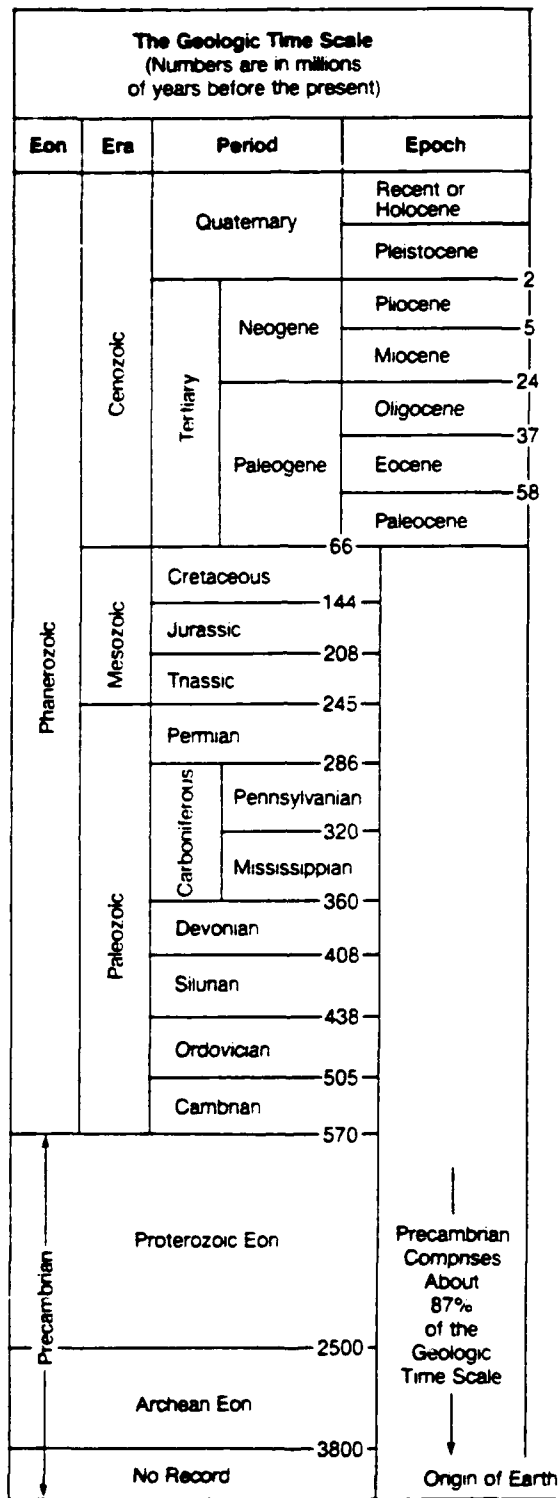


Figure G1.1

The Geologic Time Scale

**HARM - Hazard Assessment Rating Methodology** - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, December 11, 1981.)

**HAS - Hazard Assessment Score** - The score developed by using the Hazard Assessment Rating Methodology (HARM).

**HAZARDOUS MATERIAL** - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

**HAZARDOUS WASTE** - A solid or liquid waste that, 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 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.

**HEAD** - See TOTAL HEAD.

**HERBICIDE** - A weed killer.

**HIGHLAND** - A general term for a relatively large area of elevated or mountainous land standing prominently above adjacent low areas; and mountainous region.

**HILL** - A natural elevation of the land surface, rising rather prominently above the surrounding land, usually of limited extent and having a well-defined outline (rounded) and generally considered to be less than 1000 feet from base to summit.

**HORIZON [soil]** - A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

*O horizon* - An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

*A horizon* - The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral

material. Also, a plowed surface horizon most of which was originally part of a B horizon.

*A2 horizon* - A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

*B horizon* - The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon* - The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

*R layer* - Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

**HYDRAULIC CONDUCTIVITY** - The rate of flow of water in gallons per day through a cross section of one square foot under a unit hydraulic gradient, at the prevailing temperature or adjusted for a temperature of 60°F

**IGNEOUS ROCKS** - Rock or mineral that has solidified from molten or partially molten material, i.e. from magma.

**INTERBEDDED** - Beds lying between or alternating with others of different character; especially rock material laid down in sequence between other beds.

**LOAM** - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

**LOWLAND** - A general term for low-lying land or an extensive region of low land, esp. near the coast and including the extended plains or country lying not far above tide level.

**MEANDERBELT** - The zone along a valley floor across which a meandering stream shifts its channel from time to time.

**MEAN LAKE EVAPORATION** - The total evaporation amount for a particular area; amount based on precipitation and climate (humidity).

**MEAN SEA LEVEL** - The average height of the surface of the sea for all stages of the tide over a 19-year period.

**METAMORPHIC ROCK** - Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment, generally at depth in the Earth's crust.

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

**MINERAL** - A naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal form and physical properties.

**MONTMORILLONITE** - A clay mineral of the smectite group comprising expanding-lattice clay minerals when wetted.

**MOTTLED [soil]** - a soil that is irregularly marked with spots or patches of different colors, usually indicating poor aeration or seasonal wetness.

**NET PRECIPITATION** - Precipitation minus evaporation.

**OUTCROP** - That part of a geologic formation or structure that appears at the surface of the Earth; also, bedrock that is covered only by surficial deposits such as alluvium.

**OVERTURNED** - Said of a fold or the limb of a fold, that has tilted beyond the perpendicular. Sequence of strata thus appears reversed.

**PD-680** - A cleaning solvent composed predominately of mineral spirits; Stoddard solvent.

**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 - see **SOIL PERMEABILITY**.

**POND** - A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool.

**POROSITY** - The voids or openings in a rock. Porosity may be expressed quantitatively as the ratio of the volume of openings in a rock to the total volume of the rock.

**POTENTIOMETRIC SURFACE** - A surface that represents the total head in an aquifer; that is, it represents the height above a datum plane at which the water level stands in tightly cased wells that penetrate the aquifer.

**PROGRADE** - To build outward towards the sea by deposition of sediment.

**QUARTZ** - A crystalline silica, an important rock forming mineral:  $\text{SiO}_2$ . Occurs either in transparent hexagonal crystals (colorless or colored by impurities) or in crystalline or cryptocrystalline masses. Forms the major proportion of most sands and has a widespread distribution in igneous, metamorphic and sedimentary rocks.

**RIFT** - A long, narrow continental trough bounded by normal faults.

**RIVER** - A general term for a natural freshwater surface stream of considerable volume and a permanent or seasonal flow, moving in a definite channel toward a sea, lake, or another river.

**SALINE** [adj] - Salty; containing dissolved sodium chloride.

**SAND** - A rock or mineral particle in the soil, having a diameter in the range 0.52 - 2 mm.

**SANDSTONE** - A medium-grained fragmented sedimentary rock composed of abundant round or angular fragments of sand, size set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material (commonly silica, iron oxide, or calcium carbonate).

**SANDY LOAM** - A soil containing 43 - 85% sand, 0 - 50% silt, and 0 - 20% clay, or containing at least 52% sand and no more than 20% clay and having the percentage of silt plus twice the percentage of clay exceeding 30% or containing 43 - 52% sand, less than 50% silt, and less than 7% clay.

**SATURATED ZONE** - The subsurface zone in which all openings are full of water.

**SEDIMENT** - Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

**SEDIMENTARY ROCK** - A rock resulting in the consolidation of loose sediment that has accumulated in layers; e.g., a clastic rock (such as conglomerate or tillite) consisting of mechanically formed fragments of older rock transported from its source and deposited in water or from air or ice; or a chemical rock (such as rock salt or gypsum) formed by precipitation from solution; or an organic rock (such as certain limestones) consisting of the remains or secretions of plants and animals.

**SHALE** - A fine-grained detrital sedimentary rock, formed by the consolidation (especially by compression) of clay, silt, or mud.

**SILT [soil]** - (a) A rock or mineral particle in the soil, having a diameter in the range 0.002-0.005 mm; (b) A soil containing more than 80% silt-size particles, less than 12% clay, and less than 20% sand.

**SILT LOAM** - A soil containing 50 - 88% silt, 0 - 27% clay and 0 - 50% sand.

**SLICKENSIDE** - A polished and striated rock surface that results from friction along a fault plane.

**SOIL** - The layer of material at the land surface that supports plant growth.

**SOIL PERMEABILITY** - The characteristic of the soil that enables water to move downward through the profile. Permeability is measured as the distance per unit time that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow	-	less than 0.06 inches per hour (less than $4.24 \times 10^{-5}$ cm/sec)
Slow	-	0.06 to 0.20 inches per hour ( $4.24 \times 10^{-5}$ to $1.41 \times 10^{-4}$ cm/sec)
Moderately Slow	-	0.20 to 0.63 inches per hour ( $1.41 \times 10^{-4}$ to $4.45 \times 10^{-4}$ cm/sec)
Moderate	-	0.63 to 2.00 inches per hour ( $4.45 \times 10^{-4}$ to $1.41 \times 10^{-3}$ cm/sec)
Moderately Rapid	-	2.00 to 6.00 inches per hour ( $1.41 \times 10^{-3}$ to $4.24 \times 10^{-3}$ cm/sec)
Rapid	-	6.00 to 20.00 inches per hour ( $4.24 \times 10^{-3}$ to $1.41 \times 10^{-2}$ cm/sec)

Very Rapid - more than 20.00 inches per hour (more than 1.41 x 10<sup>-2</sup> cm/sec)

(Reference: United States Department of Agriculture, Soil Conservation Service)

**SOIL REACTION** - The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests at pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	<u>pH</u>
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

**SOIL STRUCTURE** - See STRUCTURE [soil].

**SOLUM** - The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum. See HORIZON [soil].

**SOLVENT** - A substance, generally a liquid, capable of dissolving other substances.

**STRAND PLAIN** - A prograded shore built seaward by waves and currents, and continuous for some distance along the coast.

**STRATIFIED** - Formed, arranged, or laid down in layers or strata; especially said of any layered sedimentary rock or deposit.

**STRIKE - SLIP FAULT** - A fault on which the movement is parallel to the fault's strike. See TRANSCURRENT FAULT.

**STRUCTURE [soil]** - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are - platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

**SUBSOIL** - Technically, the B horizon; roughly, the part of the solum below plow depth.

**SUBSTRATUM** - The part of the soil below the solum.

**SURFACE WATER** - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

**SYNCLINORIUM** - A composite synclinal structure of regional extent composed of lesser folds.

**TERRACE [geomorph]** - 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.

**TERRACE [soil]** - A horizontal or gently sloping ridge or embankment of earth built along the contours of a hillside for the purpose of conserving moisture, reducing erosion, or controlling runoff.

**TERRIGENOUS DEPOSITS** - Shallow marine sediment consisting of material eroded from the land surface.

**THREATENED SPECIES** - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**TIME [geol]** - See Figure G1.1.

**TOPOGRAPHY** - The general conformation of a land surface, including its relief and the position of its natural and man-made features.

**TOTAL HEAD** - The height above a datum plane of a column of water. In a groundwater system, it is composed of elevation head, pressure head, and velocity head.

**TRANSCURRENT FAULT** - A large scale strike - slip fault in which the fault surface is steeply inclined.

**UNCONSOLIDATED** - (a) Sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth. (b) Soil material that is in a loosely aggregated form.

**VALLEY** - Any low-lying land bordered by higher ground, especially an elongate, relatively large, gently sloping depression of the earth's surface, commonly situated between two mountains or between ranges of hills and mountains, and often containing a stream or river with an outlet. It is usually developed by stream or river erosion, but can be formed by faulting.

**WATER TABLE** - The level in the saturated zone at which the pressure is equal to the atmospheric pressure.

**WETLANDS** - Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

**WILDERNESS AREA** - An area unaffected by anthropogenic activities and deemed worthy of special attention to maintain its natural condition.

**Appendix A**

**Outside Agency Contact List**

## OUTSIDE AGENCY CONTACT LIST

- 1) Bureau of Economic Geology  
University of Texas at Austin  
University Station, Box X  
Austin, TX 78713  
(512) 471-1534
- 2) Houston-Galveston Subsidence District  
1660 West Bay Area Boulevard  
Friendswood, TX 77546  
Ron Neighbors  
Bud Holschuh  
(713) 486-1105
- 3) 136 TAW/CES  
8150 West Jefferson  
Hensley Field  
Dallas, TX 75211-9570  
LT Mark G. Byrd  
MAJ Carl Gustafson  
(214) 269-3388
- 4) Texas Parks and Wildlife  
Resources Protection Division  
4200 Smith School Road  
Austin, TX 78744  
Robert Spain  
Dorinda Sullivan  
(512) 448-4311
- 5) Texas Water Commission  
P.O. Box 13087  
Austin, TX 78711-3087  
(512) 463-8028
- 6) Texas Water Development Board  
611 South Congress  
Austin, TX 78704  
Bernie Baker  
(512) 445-1425  
Richard Preston  
(512) 445-1439

## OUTSIDE AGENCY CONTACT LIST (continued)

- 7) United States Department of Agriculture  
Soil Conservation Service  
1132A North Dallas Avenue  
Lancaster, TX 75146-1620
- 8) United States Department of Agriculture  
Soil Conservation Service  
8245 Gladys, Suite 201  
Beaumont, TX 77706
- 9) United States Department of Commerce  
National Oceanic and Atmospheric Administration  
National Climatic Data Center  
Federal Building  
Asheville, NC 28801  
(704) 259-0871
- 10) United States Geological Survey  
2320 La Branch Street  
Room 1112  
Houston, TX 77004  
Bob Gabrysch  
(713) 750-1656
- 11) United States Geological Survey  
Water Resources Division  
8011 Cameron Road, Building 1  
Austin, TX 78753

## **Appendix B**

# **USAF Hazard Assessment Rating Methodology**

## **USAF HAZARD ASSESSMENT RATING METHODOLOGY**

The DoD has developed a comprehensive program to identify, evaluate, and control hazardous waste disposal practices associated with past waste disposal techniques 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, December 11, 1981).

Accordingly, the USAF has sought to establish a system to set priorities for taking further action at sites based upon information gathered during the PA phase of the IRP.

### **PURPOSE**

The purpose of the site rating model is to assign a ranking to each site where there is suspected contamination from hazardous substances. This model will assist the Air National Guard in setting priorities for follow-up site investigations.

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

### **DESCRIPTION OF THE MODEL**

Like the other hazardous waste site ranking models, the USAF'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 needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment 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 worst hazards at the site. Sites are given low scores only if there are clearly no hazards. 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 presented in this appendix. The site rating form and the rating factor guidelines are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: (1) possible receptors of the contamination, (2) the waste and its characteristics, (3) the potential pathways for contaminant migration, and (4) any effort that was made to contain the waste resulting from a spill.

The receptors category rating is based on four rating factors: (1) the potential for human exposure to the site, (2) the potential for human ingestion of contaminants should underlying aquifers be polluted, (3) the current and anticipated use of the surrounding area, and (4) the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1000 feet of the site, and the distance between the site and the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows: receptors subscore = (100 X factor subtotal/maximum score subtotal).

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 solids are reduced.

The pathways category rating is based on evidence of contaminant migration along one of three pathways: surface water migration, flooding, and groundwater migration. 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 the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with 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 score for the other three categories.

## HAZARD 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 1000 ft. of site		4		12
B. Distance to nearest well		10		30
C. Land use-zoning within 1-mile radius		3		9
D. Distance to installation boundary		6		18
E. Critical environments within 1-mile radius of site		10		30
F. Water quality of nearest surface water body		6		18
G. Groundwater use of uppermost aquifer		9		27
H. Population served by surface water supply within 3 miles downstream of site		6		18
I. Population served by groundwater supply within 3 miles of site		6		18

Subtotals \_\_\_\_\_ 180

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	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
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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 groundwater migration. Select the highest rating, and proceed to C.

1. Surface water migration

Distance to nearest surface water		8		24
Net precipitation		6		18
Surface erosion		8		24
Surface permeability		6		18
Rainfall intensity		8		24

Subtotals \_\_\_\_\_ 108

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

2. Flooding

		1		3
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Subscore (100 x factor score/3)

3. Groundwater migration

Depth to groundwater		8		24
Net precipitation		6		18
Soil permeability		8		24
Subsurface flows		8		24
Direct access to groundwater		8		24

Subtotals \_\_\_\_\_ 114

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

C. Highest pathway score

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 \_\_\_\_\_ =

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

1. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels			Multiplier
	0	1	2	
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	10
C. Land use/zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	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	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	6
G. Groundwater use of uppermost aquifer	Not used, other sources readily available	Commercial Industrial, or Irrigation, very limited other water sources	Drinking water, municipal water available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	6

11. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

- C = Confirmed confidence level (minimum criteria below)
- S = Suspected confidence level
- o Verbal reports from interviewer (at least 2) or written information from the records
- o No verbal reports or conflicting verbal reports and no written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels		
	0	1	2
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°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

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

11. WASTE CHARACTERISTICS - Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
	L	C	H
80	H	C	H
70	L	S	H
	S	C	H
60	H	C	H
	L	S	H
	L	C	L
50	H	S	H
	S	C	H
	S	S	H
	H	S	H
	H	C	L
40	L	S	L
	S	C	L
30	H	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., MCH + SCH = LCH if the total quantity is greater than 20 tons.

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

8. Persistence Multiplier for Point Rating

Multiply Point Rating Persistence Criteria

Metals, polycyclic compounds, and halogenated hydrocarbons substituted and other ring compounds  
Straight chain hydrocarbons  
Easily biodegradable compounds

From Part A by the following

- 1.0
- 0.9
- 0.8
- 0.4

C. Physical State Multiplier

Physical state

Liquid  
Sludge  
Solid

Multiply Point Total From Parts A and B by the following

- 1.0
- 0.75
- 0.50

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, groundwater, 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.

8-1 Potential for Surface Water Contamination

Rating Factors	0			1			2			3			Multiplier	
	Greater than 1 mile	2,001 feet to a mile	501 feet to 2,000 feet	0 to 500 feet	Greater than +20 inches	Severe	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Moderate	Greater than 50% clay (<10 <sup>-6</sup> cm/sec)	>3.0 inches		>50 100
Distance to nearest surface water (includes drainage ditches and storm sewers)														8
Net precipitation														6
Surface erosion	None	Slight	Moderate	Severe										8
Surface permeability	0% to 15% clay (>10 <sup>-6</sup> cm/sec)	15% to 30% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	30% to 50% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	Greater than 50% clay (<10 <sup>-6</sup> cm/sec)										6
Rainfall intensity based on 1-year, 24 hour rainfall (thunderstorms)	<1.0 Inch	1.0 to 2.0 inches	2.1 to 3.0 inches	>3.0 inches										8
	0-5 0	6-35 30	36-49 60											

8-2 Potential for Flooding

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

8-3 Potential for Groundwater Contamination

Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	Multiplier
					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 <sup>-6</sup> cm/sec)	30% to 50% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	15% to 30% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	0% to 15% clay (>10 <sup>-2</sup> cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high groundwater level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean groundwater level	8
Direct access to groundwater (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):

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

Guidelines for fully contained:

Landfills:

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

Spills:

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

Surface Impairments:

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

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-B-3, then leave blank for calculation of factor score and maximum possible score.



## **Appendix C**

### **Site Hazard Assessment Rating Forms and Factor Rating Criteria**

## HAZARD ASSESSMENT RATING FORM

**NAME OF SITE** Site No. 1 - Station Drainage Area and Fence Line  
**LOCATION** Garland Air National Guard Station  
**DATE OF OPERATION OR OCCURRENCE** 1959 through the mid 1970s  
**OWNER/OPERATOR** 254th CCGP/221st CCSQ (Garland Air National Guard Station, Texas)  
**COMMENTS/DESCRIPTION** Waste oils, solvents, paints, and thinners were poured on the ground.  
**SITE RATED BY** Science & Technology, Inc.

**I. RECEPTORS**

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1000 ft. 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 installation boundary	3	6	18	18
E. Critical environments within 1-mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	3	6	18	18
G. Groundwater use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	3	6	18	18
I. Population served by groundwater supply within 3 miles of site	0	6	0	18

Subtotals 103 180

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

**II. WASTE CHARACTERISTICS**

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

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

$$\frac{80}{\quad} \times \frac{0.9}{\quad} = \frac{72}{\quad}$$

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

$$\frac{72}{\quad} \times \frac{1.0}{\quad} = \frac{72}{\quad}$$

**III. PATHWAYS**

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

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

Subscore 0

B. Rate the migration potential for 3 potential pathways: Surface water migration, flooding, and groundwater 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	2	8	16	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			76	108
Subscore (100 x factor score subtotal/maximum score subtotal)				70

2. Flooding

	0	1	0	3
Subscore (100 x factor score/3)				

3. Groundwater migration

				0
Depth to groundwater	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 groundwater	1	8	8	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway score

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

Pathways subscore 70

**IV. WASTE MANAGEMENT PRACTICES**

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

Receptors	57
Waste Characteristics	72
Pathways	70
Total 199	divided by 3 = 66
Gross Total Score	

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

Gross Total Score x Waste Management Practices Factor = Final Score

$$\frac{66}{1} \times 1.0 = 66$$

**Garland Air National Guard Station  
Garland, Texas**

**USAF Hazard Assessment Rating Methodology  
Factor Rating Criteria**

The following is an explanation of the HARM factor rating criteria for the potential site.

**I. Receptors**

**A. Population Within 1000 feet of Site.**

Factor Rating 3.

The population within 1000 feet of Site No. 1 is over 100. On UTA weekends, the Station population is approximately 225 persons.

**B. Distance to Nearest Water Well.**

Factor Rating 1.

The nearest water well is located approximately three miles northwest of the potential site. It is believed that this well is no longer being used.

**C. Land Use-Zoning (within 1-mile radius).**

Factor Rating 3.

The area within a 1-mile radius of the site is zoned commercial and residential. There is a city park adjacent to the Station, and residential neighborhoods are located nearby.

**D. Distance to Installation Boundary.**

Factor Rating 3.

Site No. 1 is adjacent to the Station's boundary. Site No. 1 includes portions of the west, south, and east perimeter fence.

**E. Critical Environments (within 1-mile radius).**

Factor Rating 0.

According to the Texas Parks and Wildlife Department, there are no endangered species or critical habitats within a 1-mile radius of the Station.

**F. Water Quality/Use Designation of Nearest Surface Water Body.**

Factor Rating 3.

Duck Creek is a tributary of the Trinity River which is largely used for the area's water supply.

**G. Groundwater Use of Uppermost Aquifer.**

Factor Rating 2.

Groundwater in Garland is not used for drinking water, but groundwater is used for drinking water near Garland. However, municipal water is available.

**H. Population Served by Surface Water Supplies Within 3 Miles Downstream of Site.**

Factor Rating 3.

The local population is supplied with water from surface water supplies.

**I. Population Served by Aquifer Supplies Within 3 Miles Downstream of Site.**

Factor Rating 0.

Municipalities in the Garland area obtain water from surface water supplies. Aquifers in the immediate area are not used for potable water supplies.

**II. Waste Characteristics**

**Site No. 1**

- A-1:** Hazardous Waste Quantity - Factor Rating M (Medium). It is estimated that a medium quantity (21 to 85 drums), of fuels, oils, solvents, paints, and thinners may have been released at this site.
- A-2:** Confidence Level - Factor Rating C (Confirmed). Several interviewees reported that wastes were disposed of upon the Station grounds until the middle 1970s.
- A-3:** Hazard Rating - Factor Rating H (High). A high hazard rating was assigned because of the high toxicity of the solvents released at this site.

**B. Persistence Multiplier for Point Rating.**

Site No. 1 was assigned a persistence multiplier of 0.9, based on the presence of waste products such as fuel and solvents. These wastes correspond primarily to the HARM category of "Substituted and Other Ring Compounds."

**C. Physical State Multiplier.**

A physical state multiplier of 1.0 was applied to the site because liquids were released into the environment.

**III. Pathways Category**

**A. Evidence of Contamination.**

Site No. 1 was given a score of 0 (no evidence) because there was no noticeable vegetation stress or soil staining, and the potential site is not greatly suspected of being a source of contamination.

**B-1 Potential for Surface Water Contamination.**

- o Distance to Nearest Surface Water: Factor Rating 3.  
Site No. 1 is located within 500 feet of drainage ditches and storm sewers.
- o Net Precipitation: Factor Rating 0.  
The average annual net precipitation at the Station is approximately minus 21 inches.
- o Surface Erosion: Factor Rating 2.  
According to the United States Department of Agriculture, the surface erosion at the Station is moderate.
- o Surface Permeability: Factor Rating 2.  
The surface permeability at the Station and Site No. 1 is in the range of  $10^{-6}$  to  $10^{-4}$  cm/sec. The soils are approximately 30 to 50 percent clay and the average permeability is  $4.2 \times 10^{-5}$  cm/sec.
- o Rainfall Intensity Based on 1-year, 24-hour Rainfall: Factor Rating 3.  
The rainfall intensity in the Station area is approximately 3.5 inches according to the Climatic Atlas of the U.S.

**B-2 Potential for Flooding.**

Factor Rating 0.

Site No. 1 is located beyond the 100-year flood plain of local streams.

**B-3 Potential for Groundwater Contamination.**

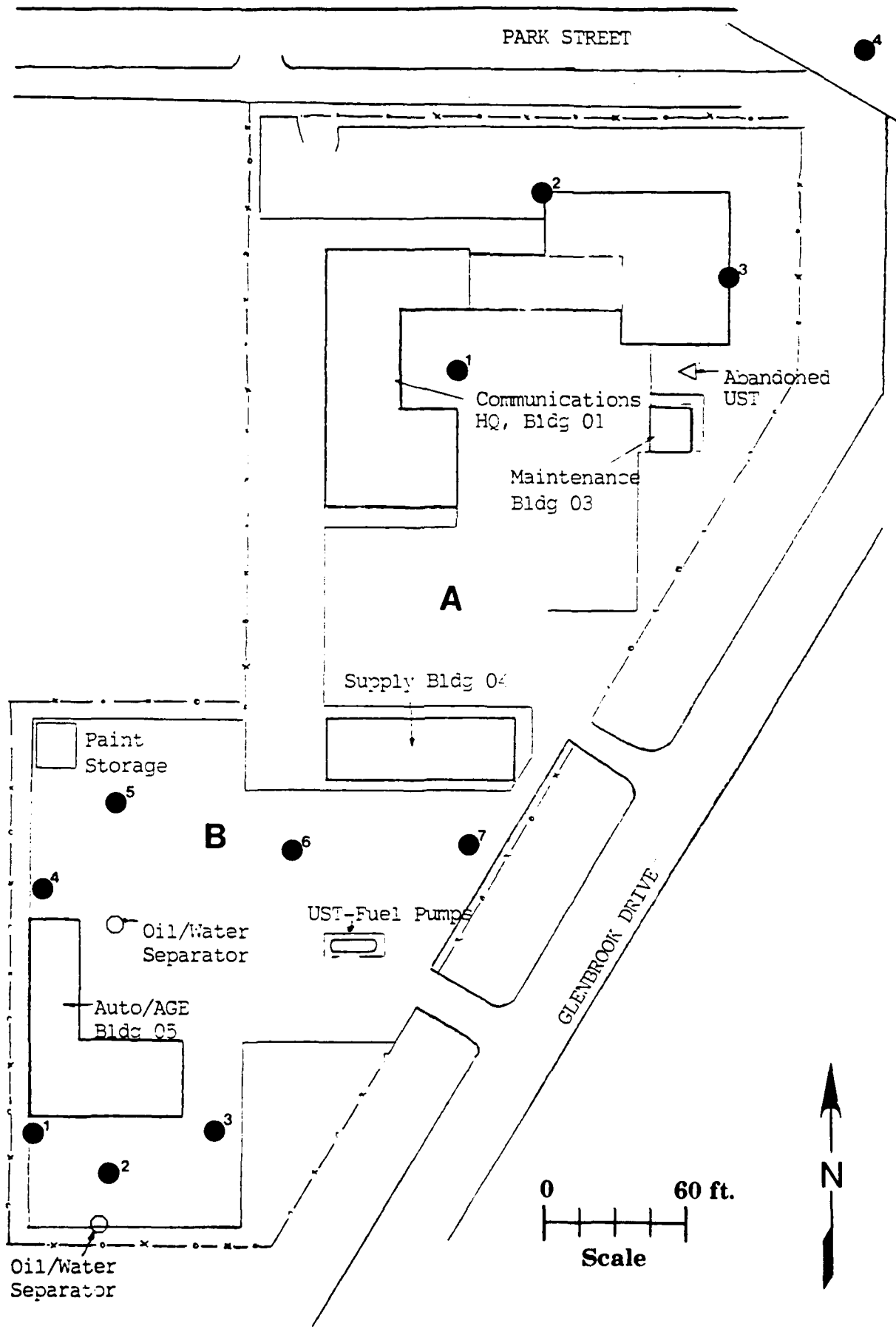
- o Depth to Groundwater: Factor Rating 2.  
The depth to groundwater at Site No. 1 is 11 to 50 feet.
- o Net Precipitation: Factor Rating 0.  
See B-1.
- o Soil Permeability: Factor Rating 1.  
The surface permeability at Site No. 1 is in the range of  $10^{-6}$  to  $10^{-4}$  cm/sec. The soils are approximately 30 to 50 percent clay and the average permeability is  $4.2 \times 10^{-5}$  cm/sec.
- o Subsurface Flows: Factor Rating 0.  
The bottom of Site No. 1 is greater than 5 feet above high groundwater level.
- o Direct Access to Groundwater: Factor Rating 1.  
Direct access to groundwater through faults, fractures, faulty well casings, subsidence, etc., is low risk for Site Nos. 1.

**IV. Waste Management Practices Factor**

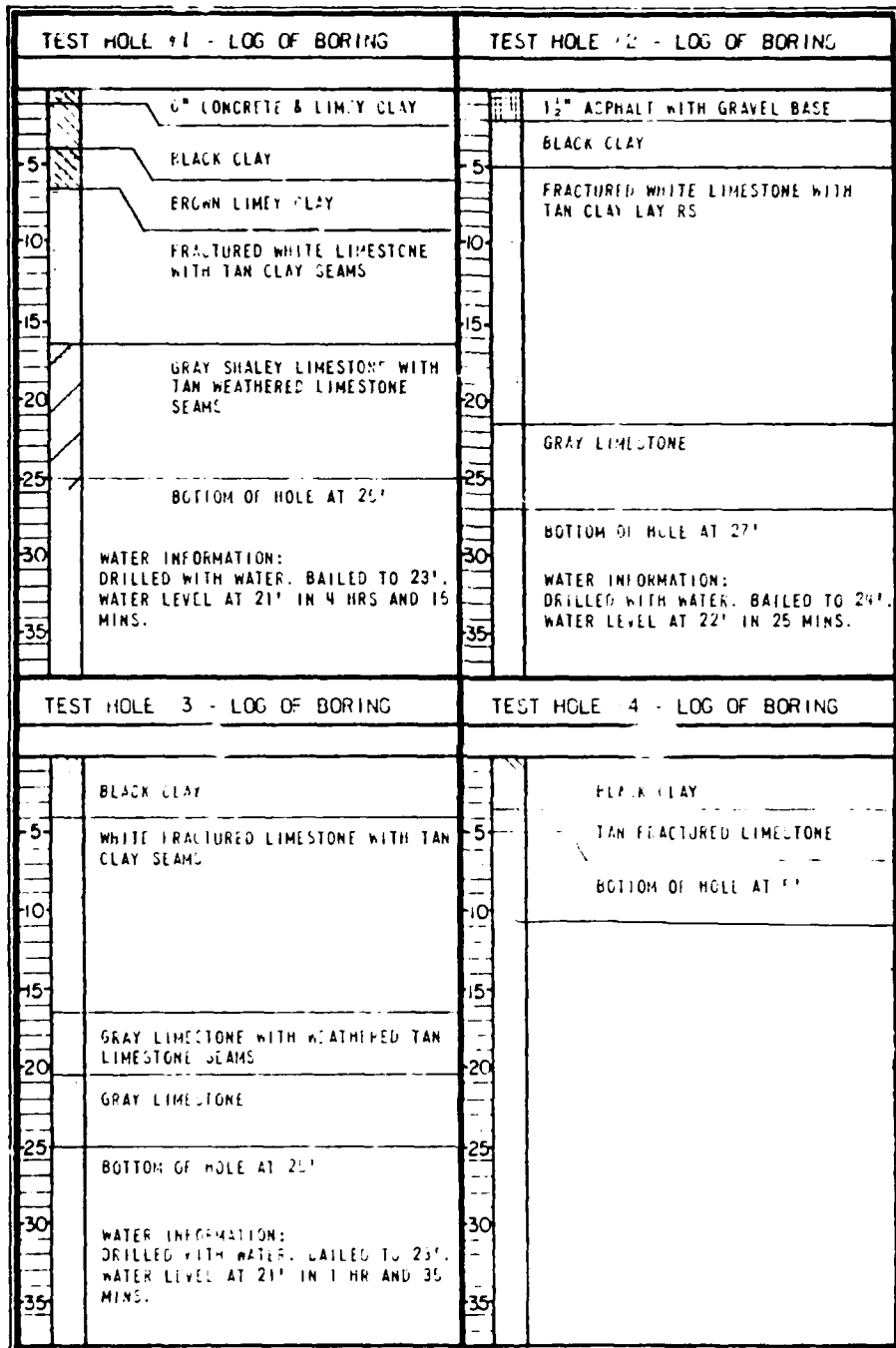
A multiplier of 1.0 is applied to Site No. 1 because it has no form of containment.

**Appendix D**

**Soil Borings  
at the Station**



Soil Borings -- Areas A and B



Area A

TEST HOLE #1 - LOG OF BORING	
ELEV. 546.77	
5	BROWN CLAY TAN LIMY CLAY
10	TAN AND GRAY LIMY CLAY
15	
20	TAN AND GRAY CLAY WITH GRAVEL SEAMS
25	WEATHERED LIMESTONE WHITE LIMESTONE
30	BOTTOM OF HOLE AT 25 FEET
35	

TEST HOLE #2 - LOG OF BORING	
ELEV. 546.39	
5	BROWN CLAY TAN LIMY CLAY TAN AND GRAY LIMY CLAY
10	
15	
20	
25	
30	BOTTOM OF HOLE AT 5 FEET
35	

TEST HOLE #3 - LOG OF BORING	
ELEV. 549.82	
5	BROWN CLAY TAN CLAY
10	
15	
20	TAN AND GRAY CLAY WITH PEBBLES
25	
30	TAN AND GRAY CLAY WITH GRAVEL SEAMS
35	WEATHERED LIMESTONE WHITE LIMESTONE BLUE LIMESTONE BOTTOM OF HOLE AT 32 FEET

TEST HOLE #4 - LOG OF BORING	
ELEV. 547.93	
5	BROWN CLAY TAN CLAY WITH PEBBLES
10	
15	TAN AND GRAY CLAY
20	
25	TAN AND GRAY CLAY WITH GRAVEL SEAMS
30	WEATHERED LIMESTONE WHITE LIMESTONE BLUE LIMESTONE
35	BOTTOM OF HOLE AT 29 FEET

TEST HOLE #5 - LOG OF BORING	
ELEV. 549.26	
5	BROWN CLAY TAN LIMY CLAY
10	
15	
20	
25	
30	
35	BOTTOM OF HOLE AT 5 FEET

TEST HOLE #6 - LOG OF BORING	
ELEV. 553.4	
5	1/2" ASPHALT AND 5" GRAVEL BASE (CRUSHED LIMESTONE) BROWN CLAY WITH PEBBLES TAN CLAY WITH EMBEDDED PEBBLES
10	
15	
20	
25	
30	
35	BOTTOM OF HOLE AT 6 FEET

TEST HOLE #7 - LOG OF BORING	
ELEV. 554.50	
5	1/2" ASPHALT AND 5" GRAVEL BASE (CRUSHED LIMESTONE) BROWN CLAY TAN CLAY WITH PEBBLES
10	
15	
20	
25	
30	
35	BOTTOM OF HOLE AT 6 FEET

Area B